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Critical Care Nurses' Role in Implementing the "ABCDE Bundle" into Practice

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Introduction

Growing evidence reveals the majority of critically ill patients are at risk for developing two common, dangerous, and potentially iatrogenic conditions-intensive care unit (ICU) delirium

and weakness. ICU-acquired delirium and weakness not only influence a patient's ability to survive critical illness,[1,2] but are also associated with poor long-term physical, functional, and cognitive outcomes.[3–6] The societal burden of these conditions is daunting. For example, the cost estimates of caring for delirious, mechanically ventilated patients in the United States alone ranges from $6.5–$20.4 billion dollars annually.[7,8] Strategies to prevent and/or treat ICU-acquired delirium and weakness are urgently needed to improve both ICU patient outcomes and the resulting societal burdens.

Recently, a novel, inter-professional, bundled approach to managing ICU–acquired delirium and weakness has been proposed. A "bundle", according to the Institute for Healthcare Improvement,[9] is a set of evidence-based practices — generally three to five — that, when performed collectively and reliably, improve patient outcomes. The **A**wakening and **B**reathing **C**oordination, **D**elirium Monitoring and Management, and **E**arly Mobility (**ABCDE**) bundle incorporates the best available evidence related to delirium, immobility, sedation/analgesia, and ventilator management in the ICU and tailors the pharmacologic and nonpharmacologic interventions used in prior clinical trials into a bundle that can be adopted into everyday clinical practice.[10–13] The foundation of the ABCDE bundle primarily depends upon three principles: 1) improving communication among members of the ICU team, 2) standardizing care processes, and 3) breaking the cycle of over-sedation and prolonged mechanical ventilation that can subsequently lead to delirium and weakness.[10]

The purpose of this paper is to summarize the evidence behind the ABCDE bundle. Additionally, we aim to explain the individual components of the ABCDE bundle and provide readers an example of an ABCDE policy. Finally, we discuss the registered nurses (RNs) unique role in implementing the ABCDE bundle into clinical practice.

Evidence Supporting Nursing-Implemented Sedation Protocols and Daily Awakening

The majority of critically ill patients require some form of analgesic or sedative therapy during their ICU stay; most often, various combinations of opioids, benzodiazepines, hypnotics, and antipychotics.[14] Nurses administer these medications to facilitate mechanical ventilation, improve tolerance of invasive procedures, protect the patient and staff from harm caused by aggressive or agitated patient behavior, and relieve pain and anxiety.[15,16] As with any procedure, there are adverse events associated with sedation and analgesia including respiratory depression, hypotension, renal failure, and deconditioning.[14] Moreover, several studies highlight the relationship between ICU-acquired delirium and the utilization of potent sedative and analgesic agents, with a notable increased risk of delirium with benzodiazepines.[17–19] These safety concerns have generated a surge of interest in broadly implementing strategies to decrease patients' exposure to sedative medications.

Nursing implemented, protocol-directed sedation is one strategy of reducing patients' exposure to potentially harmful medications. In a randomized, controlled trial, Brook and colleagues[20] found that protocol-directed sedation during mechanical ventilation reduced the duration of mechanical ventilation, decreased ICU and hospital length of stay (LOS), shortened the duration of continuous infusion of sedation, and lowered tracheostomy rates of patients' compared to those treated with non-protocol directed sedation. Since that time, many sedation protocols and algorithms have incorporated the evaluation and management of pain and agitation within a single algorithm,[16] with management intended to be under the direction of the bedside nurse. Beneficial outcomes linked to the use of nurse-managed sedation/analgesia algorithm(s) or protocol(s) in controlled studies include: more "on-target" sedation,[21] less pain and agitation,[22] reduced direct drug costs or medication use,[23] less patient ventilator asynchrony,[21] and decreased incidence of ventilator associated pneumonia.[24]

Another innovative way to reduce sedation in adult ICU patients is the practice of daily interruption of sedation. In 2001, Kress and colleagues[25] conducted a single-center, randomized controlled trial of 128 mechanically ventilated patients comparing usual care to a sedation strategy that involved daily interruption of sedative (midazolam or propofol) and analgesic (morphine) infusions, until the patient was awake, able to follow 3 or 4 simple commands, or was agitated. They found that daily interruption of sedation, now often referred to as **spontaneous awakening trials (SATs)**, led to a significant decrease in the duration of mechanical ventilation, a shorter ICU LOS, and use of fewer diagnostic tests for unexplained mental status changes. A retrospective analysis of this study found patients treated with SATs also experienced significantly fewer overall complications (e.g., ventilator associated pneumonia, upper gastrointestinal hemorrhage, bacteremia, barotrauma) than those treated with usual care.[26] To evaluate the impact of SATs on long-term psychological outcomes, Kress and colleagues also compared the development of post-traumatic stress disorder (PTSD) symptoms in each group.[27] Patients whose daily sedation was interrupted developed significantly fewer symptoms of PTSD following critical illness, suggesting that not only are SATs safe, but may have other beneficial effects on long-term outcomes of mechanically ventilated patients.[28]

Evidence Supporting Respiratory Therapist Driven Protocolized Spontaneous Breathing Trials

Just as SATs are used to determine a patient's need for sedation, **spontaneous breathing trials (SBTs)** are used to determine if a mechanically ventilated patient is ready to breathe on her/his own.[28] Support for the use of SBTs was garnered over 10 years ago when a study by Esteban et al. found this strategy was associated with reduced time to successful weaning.[29] Subsequently, Ely and colleagues[30] reported that a respiratory care-driven weaning protocol including SBTs significantly shortened time to extubation compared to physician-driven weaning. The data generated by the aforementioned studies established the use of SBTs as an effective way of achieving early liberation from mechanical ventilation.[28]

Evidence Supporting the Pairing of SATs and SBTs: Awakening and Breathing Trial Coordination

The **Awakening and Breathing Controlled (ABC) Trial** conducted by Girard and colleagues[31] advanced the science of sedation and ventilator management by integrating the roles of nurses' sedation management with that of respiratory therapists' ventilator management by studying the pairing of SATs with SBTs. This randomized controlled trial included 336 patients at 5 medical centers in North America. The intervention group in the ABC trial was managed with the "wake up and breathe" protocol, consisting of protocolized coordination of nurse directed SATs and respiratory therapist directed SBTs, whereas the control group received patient-targeted sedation according to "usual care" combined with SBTs. The SBTs were accomplished by allowing the patient to breathe through either a T-tube circuit or a ventilator circuit with continuous positive airway pressure of 5 cm H_20 or pressure support ventilation of less than 7 cm H_20. Patients in the intervention arm spent significantly more days breathing without ventilator assistance, were discharged from the ICU and hospital earlier, had shorter duration of coma, and experienced a 14% absolute reduction in the risk of death up to 1 year after study enrollment. Although more patients in the intervention group self-extubated than in the control, the number of patients who required reintubation was similar. Few other differences were noted in in-hospital adverse events between groups[31] or long-term cognitive or psychological outcomes.[32]

Evidence Supporting Delirium Monitoring and Management

Research conducted over the last decade has consistently shown that delirium, often-referred to as acute brain dysfunction, is a significant problem in the ICU setting. The prevalence of delirium in mechanically ventilated adults is as high as 83%.[1] Delirium in the ICU setting is associated with multiple unfavorable outcomes including: higher ICU and hospital costs,[7] longer ICU admissions and overall LOS,[33,34] greater use of continuous sedation and physical restraints,[35] increased self-removal of catheters and self-extubation,[36] and higher ICU mortality.[2] Additionally, the impact of delirium extends to the post-discharge period. Post-discharge sequelae of delirium include: greater likelihood of discharge to a place other than home,[3] greater functional decline,[3] higher six month and 1-year mortality,[14] and long-term neurocognitive impairment.[5]

It is essential that providers routinely use valid and reliable sedation and delirium screening tools. Multiple studies report that without the use of these instruments clinicians miss the vast majority of ICU delirium cases.[37,38] One potential reason clinicians fail to notice delirium in critically ill patients is because the syndrome is frequently “invisible”. For example, the hypoactive form of delirium, characterized by a depressed level of consciousness and lack of psychomotor agitation, was found to be far more prevalent (64% and 60%) compared to the mixed (9% and 6%) or purely hyperactive (0% and 1%) forms in mechanically ventilated surgical and trauma intensive care unit patients.[18]

Fortunately, there are a number of valid and reliable tools available to screen for delirium in the ICU setting. Two of the most widely used tools[39] include the Confusion Assessment Method- ICU (CAM-ICU)[40] and the Intensive Care Delirium Screening Checklist (ICDSC).[41] Developed for use in critically ill, nonvocal patients, the CAM-ICU defines delirium in terms of four diagnostic features. Delirium is deemed present when a patient displays an acute change or fluctuating course of mental status (Feature 1), inattention (Feature 2), and either an altered level of consciousness (Feature 3), or disorganized thinking (Feature 4). The ICDSC contains eight items that are scored as either 1 (present) or 0 (absent). A total score of 4 or greater is considered a positive screen for delirium. Extensive information on how to successfully use these quick delirium-screening tools is available at www.icudelirium.org.[42]

Evidence Supporting Early Mobility

A strategy for whole-body rehabilitation, accomplished by the use of SATs and **early exercise and mobilization**, was recently found to be safe and well tolerated by critically ill patients.[6] Schweickert and colleagues randomly assigned subjects to exercise and mobilization (with physical and occupational therapy, N=49) beginning on the day of enrollment (intervention) or to standard care (N=55) with physical therapy and occupational therapy delivered as ordered by the primary care team. Both groups were managed by goal-directed sedation and underwent daily interruption of sedatives. Patients in the intervention group were found to have significantly shorter duration of delirium and coma and more ventilator free days during the 28-day follow-up period than did controls. They also found intervention subjects were more likely to return to independent functional status at hospital discharge than controls. This liberation and animation strategy led to improvements in functional and cognitive outcomes even though only 33% of intubated patients moved from bed to chair and 15% ambulated. Active movements in bed, dangling and grooming were the most frequently performed animation activities with intubated patients,-tasks the nurse can incorporate into the patient’s bath.[43]

Significant improvement in patient outcomes were also found in a recent quality improvement project that involved the formation of a multidisciplinary team focused on

reducing heavy delivery of sedatives, conducting delirium screenings, and increasing the functional mobility of mechanically ventilated patients.[44] The major changes involved in this project included: 1) modifying the standardized MICU admission orders to change the default activity level from “bed rest” to “as tolerated”, 2) encouraging a change in sedation practice from using continuous IV infusions to “as needed” bolus doses, 3) establishing and disseminating simple guidelines for PT and OT consultation, 4) developing safety-related guidelines, 5) changing staffing to include a full-time PT and OT and a part-time rehabilitation assistant, 6) consulting a physiatrist for MICU patients receiving rehabilitation therapy, and 7) increasing consultations to neurologists for MICU patients with muscle weakness deemed severe or prolonged. When compared to the pre-intervention time period, the quality improvement project demonstrated benzodiazepine use decreased markedly, patients had improved sedation and delirium status, there were a greater median number of rehabilitation treatments per patient with a higher level of functional mobility (treatments involving sitting or greater mobility), and a decrease in ICU and hospital LOS. This project further demonstrates that a multicomponent, interdisciplinary approach, which includes early mobility, is an important consideration for any ICU.

Pulling the Evidence Together-The ABCDE Bundle

Despite the accumulating evidence of the benefits of SATs, SBTs, delirium monitoring and management, and early mobility protocols over the last decade, this evidence has not been widely applied in the ICU setting.[10] For example, a recent survey of 1,384 ICU physicians, nurses, respiratory therapists, and pharmacists found 40% of participants did not screen for delirium and almost one-third of the respondents did not use a sedation protocol.[45] Very few (22%) ICU healthcare providers in this survey reported using SATs on a daily basis; with the majority reporting SATs occurring on fewer than 75% of all ICU days.[45] Similarly, the use of SBTs among academic ICUs appears low, with rates ranging from 31–42%.[46] The use of exercise and early mobility protocols in the ICU is also lacking. For example, one study of critically ill patients found that 20% patients received no physical activity while another 15% received only passive range-of-motion exercises during their ICU stay.[47]

To address these deficiencies, leading critical care researchers have promulgated a unified approach to managing ICU-acquired delirium and weakness. First proposed as a model for preventing acute and chronic brain dysfunction in young and elderly ICU patients,[11] the overarching purpose of the ABCDE bundle is to reduce the frequency and magnitude of the negative outcomes associated with ICU-acquired delirium and weakness. There are several guiding principles behind the ABCDE bundle.[10]

In order for the ABCDE bundle to have its full impact,[10] we recommend healthcare providers consider using the bundle every day, in every adult patient admitted to an ICU. In the context of a hospital’s busy ICU care environment, there will be some patients on any given day that, for legitimate medical or even psychological reasons, may need to refrain or be excluded from participating in certain components of the ABCDE care bundle. Fortunately, the ABCDE bundle was developed in such a way that these patients can be safely identified. Bundle utilization should not depend on an individual physician’s order but rather structured as a daily part of care with clearly defined safety guidelines (e.g. an “opt-out” rather than “opt-in” approach to care delivery).[10] These safety guidelines should be based upon prior research while maintaining enough flexibility for institutions to adapt them to meet the needs of their special populations (e.g., neurosurgical or burn unit patients). When medically indicated, the prescriber can opt out of individual components of the ABCDE protocol. Documentation of the individual reasons will further enable the implementation team understand potential barriers to implementation, and allow for iterative modification of the protocol or training to meet the needs of the local environment. The

default must be delivery of the full ABCDE bundle, which puts a premium on coordinated, interdisciplinary care.

Successful implementation of the ABCDE bundle requires effective, frequent communication among a number of different ICU team members and an evolution in critical care team roles.[10] The evidence that nurse, respiratory therapist, and physical therapist-driven sedation, mechanical ventilation, and physical therapy protocols are safe and effective is compelling.[10,20,26,48] The contribution of a clinical pharmacist is essential in not only developing ICU sedation guidelines, but may also assist in monitoring and improving compliance with such guidelines.[49]

As stated previously, the ABCDE bundle is comprised of three distinct, yet highly interconnected, components including: 1) Awakening and Breathing trial Coordination, 2) Delirium monitoring and management, and 3) Early mobility. The interventions in the ABCDE bundle are operationalized. The bundle contains several essential elements that must be carried out for it to be effective. However, the bundle is flexible enough for adaptations needed to meet the needs of patients and staff. In the following section, we outline the essential elements of the ABCDE bundle and give examples of how one institution is currently implementing policies regarding the ABCDE bundle.

Procedure-Awakening and Breathing Trial Coordination

According to the ABCDE bundle, every mechanically ventilated patient should be evaluated with the ABC protocol (Table 1, Figure 1). This requires establishing a coordinated routine that relies on a number of team members making informed decisions. For example, a RN is primarily responsible for performing the SAT. A respiratory therapist (RT) is primarily responsible for performing the SBT. A licensed prescriber makes the decision to extubate the patient. Effective, frequent communication among professionals is necessary for successful implementation of the coordinated SAT and SBT.

There are four major steps in the Awakening and Breathing Trial Coordination process (Table 1). The evidence supporting the ABCs is mainly derived from the Awakening and Breathing Controlled Trial.[31] Step 1 is the SAT Safety Screen. In this step, a RN determines if it is safe to interrupt sedation by responding to a set of predefined safety questions (Table 1). If any of the SAT Safety Screen questions are answered YES, the RN should conclude it is NOT SAFE to shut off the patient's continuous sedative infusions. In the case it is determined to be unsafe, the RN should continue the patient's sedation regimen and reassess in 24 hours. The interdisciplinary team should also discuss the patient's condition during rounds. If all of the SAT Safety questions are answered NO, the RN will conclude it is SAFE to perform a SAT and proceed to step 2.

Step 2 involves the RN performing a SAT. A SAT involves the RN shutting off all continuous sedative infusions. Continuous analgesic infusions are maintained only if needed for active pain. During the SAT, the RN should also hold all sedative boluses. If the patient should complain or demonstrate signs/symptoms of pain while the continuous sedative infusion is shut off, the RN may administer bolus doses of analgesics as needed/ordered.

Next, the RN determines if the patient tolerated interruption of sedation by assessing if the patient demonstrates any of the SAT failure criteria described in Table 1. If the patient displays any of the SAT failure criteria, the RN should conclude the patient has failed the SAT. The RN should then restart the patient's sedation, if necessary, at ½ the previous dose, then titrate to the sedation target. The RN will repeat Step 1 in 24 hours. The interdisciplinary team will determine possible causes of the SAT failure during rounds.

At the point that the patient is able to open his/her eyes to verbal stimulation while tolerating the sedatives turned off (i.e. without failure criteria)-regardless of trial length- the RN will conclude the patient has passed the SAT and ask the RT to immediately perform a SBT Safety Screen. A SAT is also considered "successful" in those patients who after four hours do not respond to verbal stimulation, but do not display any of the failure criteria. In this case, the RN would also ask the RT to proceed to step 3.

Step 3 is the SBT Safety Screen. In this step, the respiratory therapist will determine if it is safe to perform a SBT by responding to a set of predefined safety questions (Table 1). If any of the SBT Safety Screen questions are answered YES, the RT will conclude it is NOT SAFE to perform a SBT. The RT will continue mechanical ventilation and repeat step 3 in 24 hours. The RT will ask the RN to restart sedatives at ½ the previous dose only if needed, and titrate to lowest necessary dose to maintain sedation target. The interdisciplinary team will discuss the patient's condition during rounds. If all of the above questions are answered NO, the RT will conclude it is SAFE to perform a SBT and proceed to step 4.

Step 4 involves performing a SBT. In this step, the RT will place the patient on a SBT (e.g., change ventilator settings to CPAP pressure support 5, PEEP 5, use T-piece). The RT will determine if the patient tolerated the SBT by assessing if the patient demonstrates any of the spontaneous breathing trial failure criteria (Table 1). If the patient displays any of the SBT failure criteria, the RT will conclude the patient has failed the SBT and restart mechanical ventilation at previous settings. The RT will inform the nurse of the SBT failure and remind him/her to restart sedatives at ½ the previous dose only if needed. The RN and RT will evaluate the patient again in 24 hours starting with Step 1. The interdisciplinary team will determine possible causes of the spontaneous breathing trial failure during rounds. If the patient tolerates spontaneous breathing for 30–120 minutes without failure criteria, the RT will inform the RN and physician that the patient has passed their SBT. The ABC trial used the 2 hour time frame for establishing extubation readiness while Esteban and colleagues[11] found patients who were extubated after successfully completing a 30-min SBT had similar reintubation rates to those who were not extubated until they completed a 120-min trial. At this time, the physician should consider extubation.

Essential Elements of Delirium Monitoring and Management

According to the ABCDE bundle, every patient admitted to an adult ICU should undergo routine sedation/agitation and delirium assessment using standardized, validated assessment tools. We suggest the RN perform and record the results of a validated sedation scale every 2–4 hours with vital signs. We also suggest the RN perform and record the results of the delirium assessment (CAM-ICU or ICDSC) at least once per shift and whenever a patient experiences a change in mental status.

To facilitate communication among the interdisciplinary team, the ICU team should set a "target" sedation/agitation score at which the patient should be maintained for the following 24 hours. Each day during interdisciplinary rounds, the RN will inform the team of the patient's: 1) "target" sedation score, 2) actual sedation/agitation score, 3) delirium status, and 4) sedative and analgesic medication exposure (Figure 2). There are a number of valid and reliable tools that can be used to facilitate goal-directed titration of sedative medications including the Richmond Agitation Sedation Scale,[50] Sedation-Agitation Scale,[51] Adaption to the Intensive Care Enviornment,[52] Motor Activity Assessment Scale,[53] Vancouver Interaction and Calmness Scale[54] and others.

Because the management of delirium is focused on identifying and treating the actual cause of the syndrome, each day during interdisciplinary rounds, the team will also discuss possible causes of the patient's delirium. One useful acronym for the team is to "THINK"

when a patient is delirious (Table 2), a cognitive script meant to prompt the team to "think" of the underlying cause(s) contributing to the patients newly developed or ongoing delirium. Finally, while it is beyond the scope of this paper to address the nonpharmacologic management of delirium, there are a number of excellent references that specifically address this issue.[55,56] Though most nonpharmacologic delirium interventions have been studied in geriatric populations, they should still be considered in the routine care of all critically ill patients. We suggest the interdisciplinary team should always consider the use of nonpharmacologic strategies and **modification of risks first when caring for a patient with delirium.**

Essential Elements of Early Mobility

In the ABCDE bundle, patients are candidates for mobilization when they meet certain criteria (Table 3). These criteria were developed from some of the evidence supporting early mobility protocols.[44,47,57,58,58] We suggest exceptions to these criteria should only be permitted by specific written order by the prescriber (for example, skin integrity issues). The interdisciplinary care team assesses the patient's readiness for mobility. The team includes a physical therapist who assesses the patient's physical ability to participate; a nurse who assesses physiologic stability; and a respiratory therapist who is responsible for maintaining the patient's airway.[59] In addition, a critical care physician confirms that there are no clinical contraindications to physical activity.

There are a number of resources describing early mobility procedures found in the ICU literature.[6058,61,62] An example protocol, that incorporates the best of this evidence, is also provided by the Agency for Healthcare Research and Quality.[59] According to this protocol, each patient is assessed upon admission to the ICU, and those who qualify immediately begin the protocol. Those who are not eligible are reassessed during daily rounds. If activity has been halted due to an acute event (see examples Table 4) the patient is reevaluated each day until the protocol can be reinstated. Each eligible patient is encouraged to be mobile at least once a day, with the specific level of activity geared to his or her readiness. Patients progress through a three-step process, embarking on the highest level of physical activity they can tolerate, as outlined in Figure 3. The authors suggest that the use of the protocol ends when the patient is discharged from the ICU.

Conclusion-Nurses unique contribution

The successful implementation of a complex bundle requires: 1) high quality, timely, and reliable completion of independent tasks by trained individuals, 2) effective communication between individuals to ensure the proper order and sequence of the individual components, and 3) effective leadership that can mold and adapt implementation to meet the needs of the local culture/environment and provide ongoing support, resources, and training.

The ABCDE bundle is indeed complex, although successful implementation holds potential for tremendous benefit to our sickest patients. Nurses play a unique role in the implementation of ABCDE as they are critical to all requirements for successful implementation. Registered nurses lead protocol-guided sedation efforts that include daily spontaneous awakening trials and measurement of delirium and sedation/agitation using validated instruments. The nurse is also the communication link between each of the individual specialties. Decisions to advance to subsequent steps of the ABCDE bundle with SBT, early mobility, and extubation are dependent upon the RN's assessments of level of consciousness, pain, and other clinical parameters communicated to RTs, PTs, and MDs respectively. Finally, and equally important, RNs are well suited to the leadership roles required to individualize the ABCDE bundle to the institution. Meaning, RNs understand the

local context for implementation, and can provide critical insights into the resources and training required for implementation efforts.

In conclusion, the health of our patients depends upon the successful integration of many moving parts. The development or prevention of ICU-acquired delirium and weakness exemplifies the failure or success of a coordinated approach to care. Similarly, successful implementation of the ABCDE bundle will reflect effective coordination and leadership, a role that RNs are uniquely positioned to fill.

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Biography

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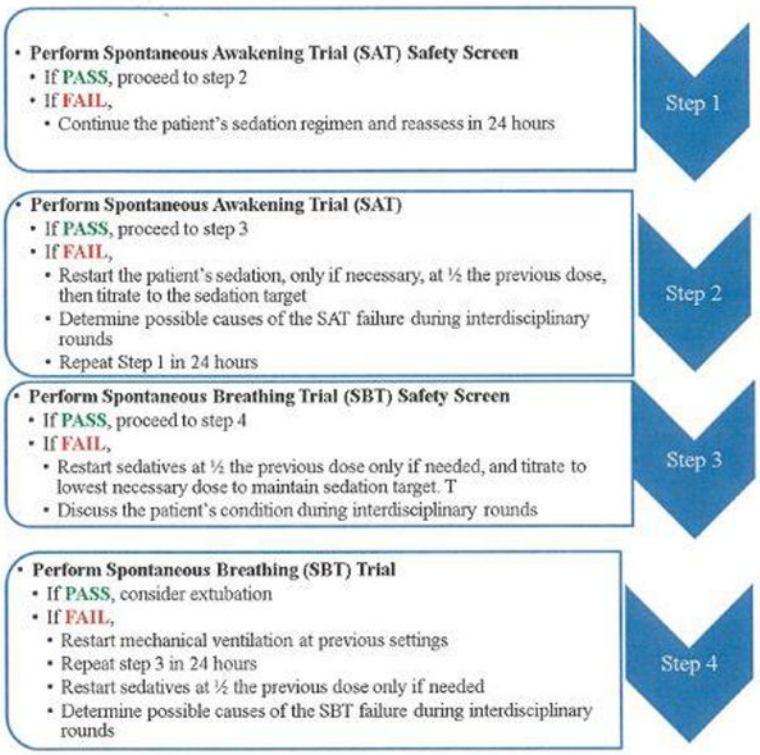

Figure 1.
Steps in Awakening and Breathing Trial Coordination

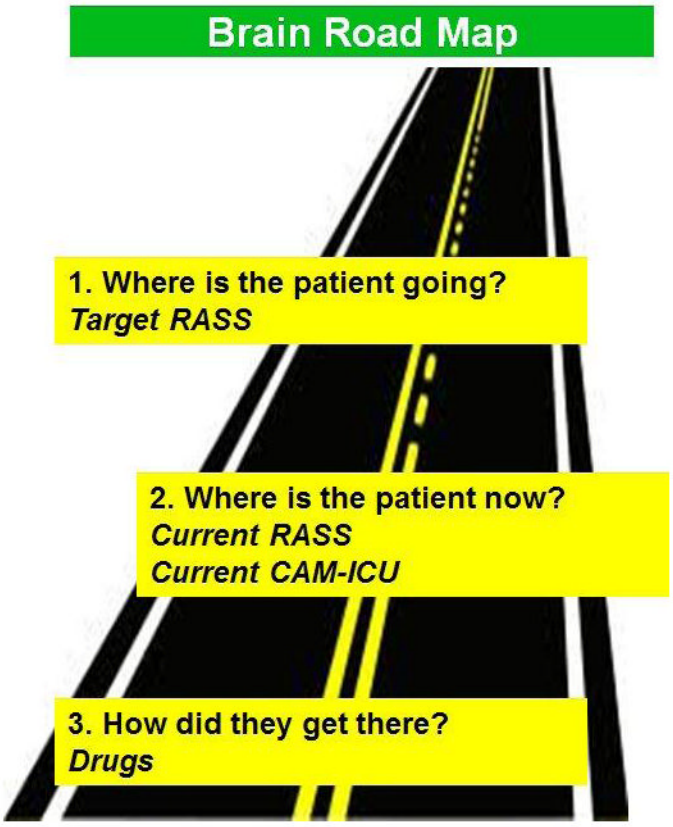

Figure 2.
Facilitating Inter-professional Communication during Intensive Care Unit Rounds-The Brain Road Map

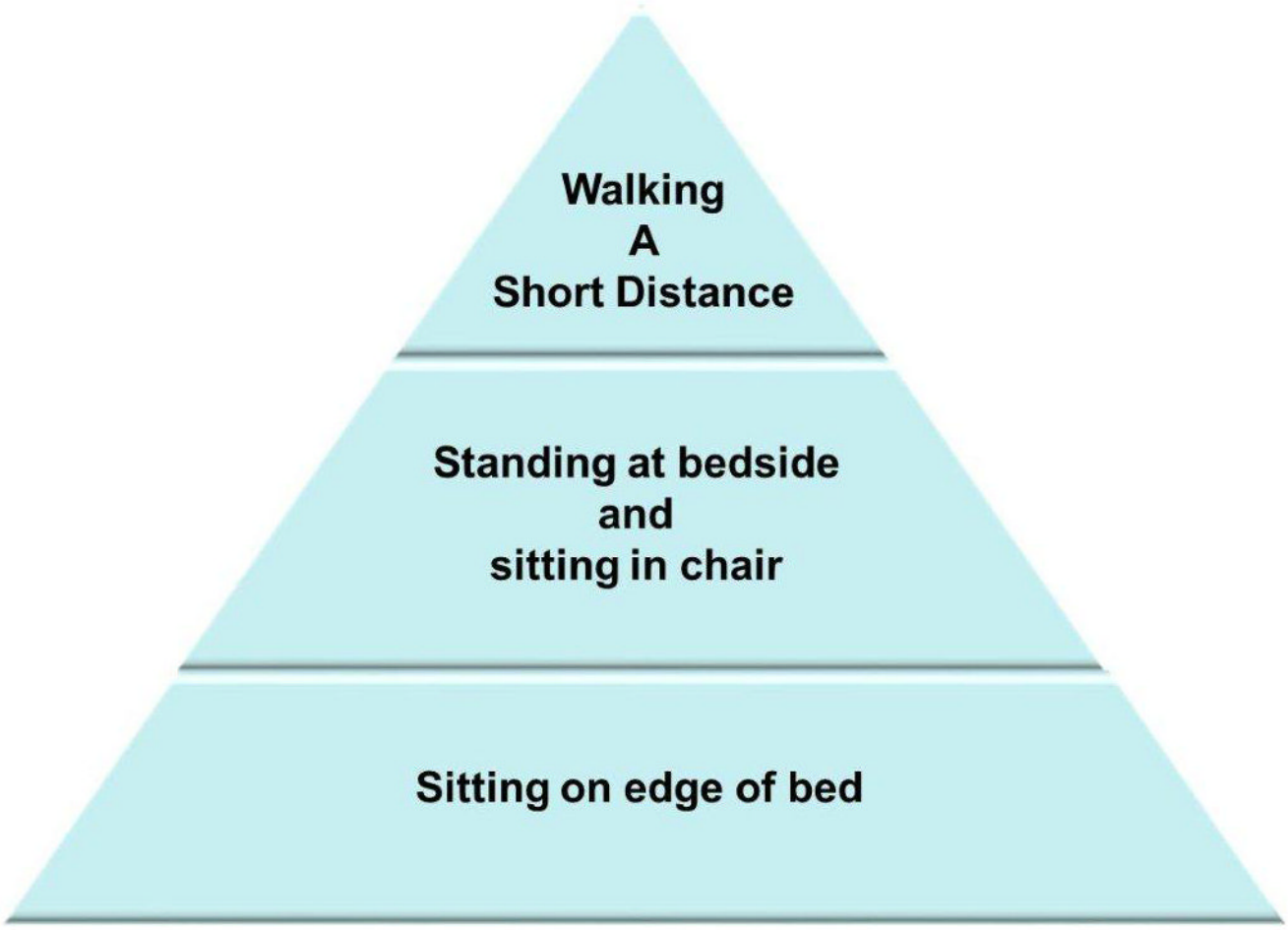

Figure 3.
Early Mobility Hierarchy

Table 1

Steps Involved in Awakening and Breathing Trial Coordination[*@]

Step 1 –SAT Safety Screen-RN Driven- The RN will determine if it is safe to interrupt sedation by responding to a set of predefined safety screen questions. For example,

1. Is patient receiving a sedative infusion for active seizures?[*]
2. Is patient receiving a sedative infusion for alcohol withdrawal?[*]
3. Is patient receiving a paralytic agent (neuromuscular blockade)?[*]
4. Is patient's Richmond Agitation Sedation (RASS) score >2?[*]
5. Is there documentation of myocardial ischemia in the past 24 hours?[*]
6. Is patient's intracranial pressure (ICP) > 20?[*]
7. Is patient receiving sedative medications in an attempt to control intracranial pressure?[@]
8. Is patient currently receiving Extracorporeal Membrane Oxygenation (ECMO)[@]

Step 2- Perform SAT-RN Driven- The RN will determine if the patient tolerated interruption of sedation by assessing if the patient demonstrates any predefined SAT failure criteria. For example,

1. RASS score > 2 for 5 minutes or longer[*]
2. Pulse oximetry reading of < 88 % for 5 minutes or longer[*]
3. Respirations >35 breaths per minute for 5 minutes or longer[*]
4. New Acute Cardiac Arrhythmia[*]
5. ICP >20[@]
6. 2 or more of the following symptoms of respiratory distress[*]
    - Heart rate increase 20 or more beats per minute, heart rate less than 55 beats per minute, use of accessory muscles, abdominal paradox, diaphoresis, dyspnea

Step 3- SBT Safety Screen- Respiratory Therapist (RT) Driven-The RT will determine if is safe to perform a SBT by responding to a set of predefined safety questions. For example,

1. Is patient a chronic/ventilator dependent patient?[#]
2. Is patient's pulse oximetry reading <88%?[*]
3. Is patient's fraction of inspired oxygen (FiO2) >50%?[*]
4. Is patient's set positive end expiratory pressure (PEEP) >7?[*#]
5. Is there documentation of myocardial ischemia in the past 24 hours?[*]
6. Is patient's ICP > 20?[*]
7. Is patient receiving mechanical ventilation in an attempt to control ICP?[#]
8. Is the patient currently on vasopressor medications?[*#]
9. Does the patient lack inspiratory effort?[*]

Step 4-Perform SBT-RT Driven- The RT will determine if the patient tolerated the SBT by assessing if the patient demonstrates any predefined SBT failure criteria. For example,

1. Respiratory rate >35 breaths per minute for 5 minutes or longer[*]
2. Respiratory rate <8[*]
3. Pulse oximetry reading of <88% for 5 minutes or longer[*]

4. ICP >20#
5. 2 or more of the following symptoms of respiratory distress *
   a. Use of accessory muscles
   b. Abdominal paradox
   c. Diaphoresis
   d. Dyspnea
6. Abrupt mental status changes *
7. Acute cardiac arrhythmia *

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*Criteria used in the Awakening and Breathing Controlled Trial (Evidence-based)[31]

#Criteria added by example institution based on interdisciplinary discussion

Table 2

What to "THINK" When Your Patient is Delirious

Toxic situations and medications: congestive heart failure, shock, dehydration, new organ failure (e.g., liver, kidney), deliriogenic medications
Examples of deliriogenic medications include benzodiazepines, anticholinergic medications, and steroids
Hypoxemia
Infection/sepsis (nosocomial), inflammation, immobilization
Non-pharmacological interventions
K+ or other electrolyte interventions

Table 3

Minimum Criteria for Early Mobility Protocol[*#]

N – Neurologic

- **a.** Patient responds to verbal stimulation (i.e. RASS > −3)[*]
  - **1.** Activity not started in comatose patients (RASS −4 or −5)[*]

R – Respiratory

- **a.** FIO2<0.6[*]
- **b.** PEEP<10 cm H2O[*]

C – Circulatory/Central lines/Contraindications

- **a.** No increase dose of any vasopressor infusion for at least 2 hours[*]
- **b.** No evidence of active myocardial ischemia[*]
- **c.** No arrthymia requiring the administration of a new antiarrythmic agent[*]
- **d.** Not receiving therapies that restrict mobility (extracorporeal membrane oxygenation, open-abdomen, intracranial monitoring/ drainage, femoral arterial line)[#]
- **e.** No injuries in which mobility is contraindicated (e.g., unstable fractures)[#]

[*] Criteria used in prior studies[44,47,57]

[#] Criteria added by institution based on interdisciplinary discussion

Table 4

Example Criteria for Halting Early Mobility*

Symptomatic drop in mean arterial pressure
Heart rate <50 or >130 beats per minute × 5 minutes
Respiratory rate <5 or >40 breaths per minute × 5 minutes
Systolic blood pressure >180 mmgHg × 5 minutes
Pulse oximetry reading of <88% × 5 minutes
Marked ventilator dysynchrony
Patient distress
New arrhythmia
Concern for myocardial ischemia
Concern for airway device integrity
Fall to knees
Endotracheal tube removal

*Developed from[44,57,58]