

Implementation of a Daily Spontaneous Breathing Trial Protocol

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DNP Quality Improvement Project

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Abstract

Patients in the intensive care unit who require endotracheal intubation are at higher risk of further complications and increased mortality. Inconsistent spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT), mechanical ventilation weaning strategies, and interdisciplinary rounding processes contribute to prolonged mechanical ventilation duration and length of stay in intensive care. The (Robertson et al., 2008) study found utilization of an evidence-based protocol for endotracheally intubated patients will decrease days that a patient requires mechanical ventilation. Daily spontaneous-breathing trials (SBTs) are proclaimed as the best method for assessing readiness for discontinuation of mechanical ventilation. SBT protocols have also been shown to improve overall outcomes. The overall aim of this quality improvement project is decreasing mechanical ventilator days to less than seven, provide standardized care, decrease setbacks, allow for patients to be moved out of the intensive care unit and increase bed/room availability for new admissions to the intensive care unit.

Introduction

Mechanical ventilation is the first-line treatment for patients with acute respiratory failure (Parate, et al., 2022). This lifesaving intervention is used to treat hundreds of thousands of critically ill patients each year. Patients require endotracheal intubation for a wide variety of reasons, including protecting the airway and respiratory failure owing to hypoxemia or hypercapnia. Airway protection may be required as a result of severe gastrointestinal bleeding with persistent hematemesis or conditions that decrease the level of consciousness, such as a cerebral vascular accident or overdose on medications/drugs that cause respiratory depression (Evidence-based guidelines for weaning and discontinuing ventilatory support, 2001). Safely weaning and extubating/liberating patients from mechanical ventilation is an important health care goal (Hooper & Girard, 2009). Critically ill patients who require mechanical ventilation are often given continuous intravenous infusions of sedative drugs to treat anxiety, keep patients comfortable and to facilitate their care (Hooper & Girard, 2009). Daily awakening trial protocol that includes a daily interruption of sedation, have previously been shown to predict reduced ventilatory support duration and shorter ICU and hospital stays and should be applied in conjunction with the weaning protocol (De Medeiros Silva et al., 2012). Reducing weaning time is necessary for minimizing potential sedation and mechanical ventilator complications, including ventilator induced lung injury, ventilator associated pneumonia (VAP), progressive muscle weakness such as ventilator induced diaphragmatic dysfunction, and death (Zein et al., 2017). Standardized weaning protocols have proven to reduce time spent on mechanical ventilation (Lancaster et al., 2022).

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A spontaneous awakening trial (SAT) is the initial step before proceeding to a spontaneous breathing trial (SBT). SAT involves slowly weaning the patient off sedation to prevent them from awaking startled or frightened. The registered nurse (RN) must remain at the patient's bedside to prevent self-extubation and resulting in vocal cord trauma. As individual patients metabolize sedatives and medications at different rates, the process requires patience and time. Weaning may take as little as minutes to as much as several days on patients with kidney disease. It is almost impossible to predict when a patient will awaken from sedation.

Once the patient begins to wake from sedation, mechanical ventilator changes can be made and SBT initiated. This includes changing ventilator from assist control or volume control modes to spontaneous mode with a pressure support of 0 – 12 depending on endotracheal tube size. An SBT assesses the patient's ability to breathe while receiving minimal mechanical ventilator support. If the patient passes SBT, then staff proceed with extubation/liberation from mechanical ventilator. Failing of SBT includes but not limited to apneic episodes for > 40 seconds, use of accessory muscles, nasal flaring, tachypnea with RR > 35 for > 5 minutes, rapid shallow breathing index > 100 and tachycardia. Upon failing of SBT, patient is placed on full mechanical ventilation support and sedation is started once again.

Local problem

As part of assessing and identifying areas of quality improvement in my practice, a 10-day practice improvement log (PAL) was obtained at The Hospitals of providence East Campus.

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The PAL included documentation regarding patients' chief complaint, diagnosis, tools used to assess and follow-up time frame on every patient seen that day. I identified three patient-intervention-comparison-outcome-time (PICOT) questions.

PICOT # 1

P - Inpatient patients > 22 years of age who are endotracheally intubated

I - Daily Spontaneous Breathing Trial and Spontaneous Awakening Trial

C - Sedation with 1-4 sedatives (Fentanyl, Precedex, Propofol and/or Versed) and inconsistent sedation vacation

O - Being sedated with multiple sedatives, kept intubated for longer than necessary as a result of lack of sedation vacation

T - 14 days

PICOT #2

P - Inpatient patients > 50 years of age with moderate to large pleural effusion

I -Unknown

C -Undergo thoracentesis

O -Painful procedure that alleviates symptoms temporarily

T - 14 days

PICOT #3

P -Inpatient patients ages 55-80 with dysphagia

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I -Unknown

C -Aspiration precautions to include keeping head of the bed elevated > 30 degrees and diligent oral care at least every 4 hours

O -Aspiration pneumonia

T - 14 days

My PICOT questions were developed after the review of patients was completed. The PAL identified several patients who were being kept on mechanical ventilation without an SBT or SAT being attempted.

Weaning or liberation from mechanical ventilation is a common procedure in critical care areas. Weaning protocols were developed in early 2000s and initially used by cardio-thoracic surgery teams in cardiac critical care units to wean patients off mechanical ventilator after open heart surgical intervention (Chan et al., 2018). These were widely used and began to gain momentum in other fields of medicine such medical/surgical intensive care units (Serena et al.,2019). However, in 2020, most ICUS were unprepared for the arrival of the COVID-19 pandemic. Over time, I learned that patients with COVID-19 required mechanical ventilation for longer periods of time (3–4 weeks compared to 10–14 days prior to the pandemic) and more sedation/sedative drips (3–4 sedatives with the addition of a paralytic at times). As a result of the pandemic, ICUs focused more on survivorship and began to ignore standard SATs and SBTs. Many experienced RNs left the bedside and newly graduated RNs filled the gaps in the ICU. Nursing shifted drastically, with RNs constantly rotating and travel RNs (i.e., non-permanent staff) widely used to maintain ICU functioning. Routine protocols and consistency were no

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longer maintained. The pandemic caused confusion for bedside RNs, especially those on assignment from outside El Paso or Las Cruces. From my experience, as COVID-19 cases began to diminish, attempting to return to former standards of care, such as daily SAT and SBT routines, presented a challenge.

Intended Improvement

Based on the first PICOT question, arising from the 10-day PAL, I established the goal of standardizing daily SAT and SBT for patients on mechanical ventilation in ICU at The Hospitals of Providence East Campus. The aim/goal is to decrease days a patient spends on mechanical ventilation and in turn, reduce adverse events, number of days in the ICU and in the hospital setting.

Methods

Setting

The quality improvement project was conducted in The Hospitals of Providence East Campus is the only full-service hospital located in far east El Paso. It was established in 2008 in one of the most densely populated zip codes in the United States. In 2022, the hospital underwent a \$20 million expansion project to meet the growing needs of the East community by expanding its bed capacity from 108- beds to 218-beds. It houses a 24 bed ICU, however, most of the time, patients are held in the emergency department awaiting ICU beds. The ICU is fast-paced and diagnoses range from trauma to medical/surgical related admissions (The Hospitals of Providence - East Campus, 2023).

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Planning the intervention

As mentioned before, after the 10-day PAL was completed, a review of patients was performed. With those data, three PICOT questions were developed and a literature review was conducted. Word search keywords included adults on mechanical ventilation, hypercapnic respiratory failure, weaning/extubation of mechanical ventilation, spontaneous breathing trial protocol, sedation awakening trial, weaning of mechanical ventilation, sedation, and mechanical ventilation.

The first PICOT question had substantially more evidence and research to proceed with than PICOT questions two and three. The second and third PICOT questions seemingly were not supported by any research or evidence. It was evident that the first PICOT question regarding SBT and SAT would be the right choice to implement.

I was then able to create the practice improvement proposal (PIP), which was then submitted to the IRB. Within a few days, I received the “Not research-QI project” letter. I also obtained a work letter from El Paso Pulmonary Association, my workplace, giving me permission to move forward with quality improvement project. Once documentation was in place, the ‘knowledge to action’ framework and the Six Sigma Quality Improvement Model to create a plan to implement the quality improvement project. Education in the ICU regarding SBT protocol was initiated on 16 January 2023. Flyers containing the SBT protocol algorithm were printed and distributed to ICU staff (see attached table/algorithm; Harris et al., 2020).

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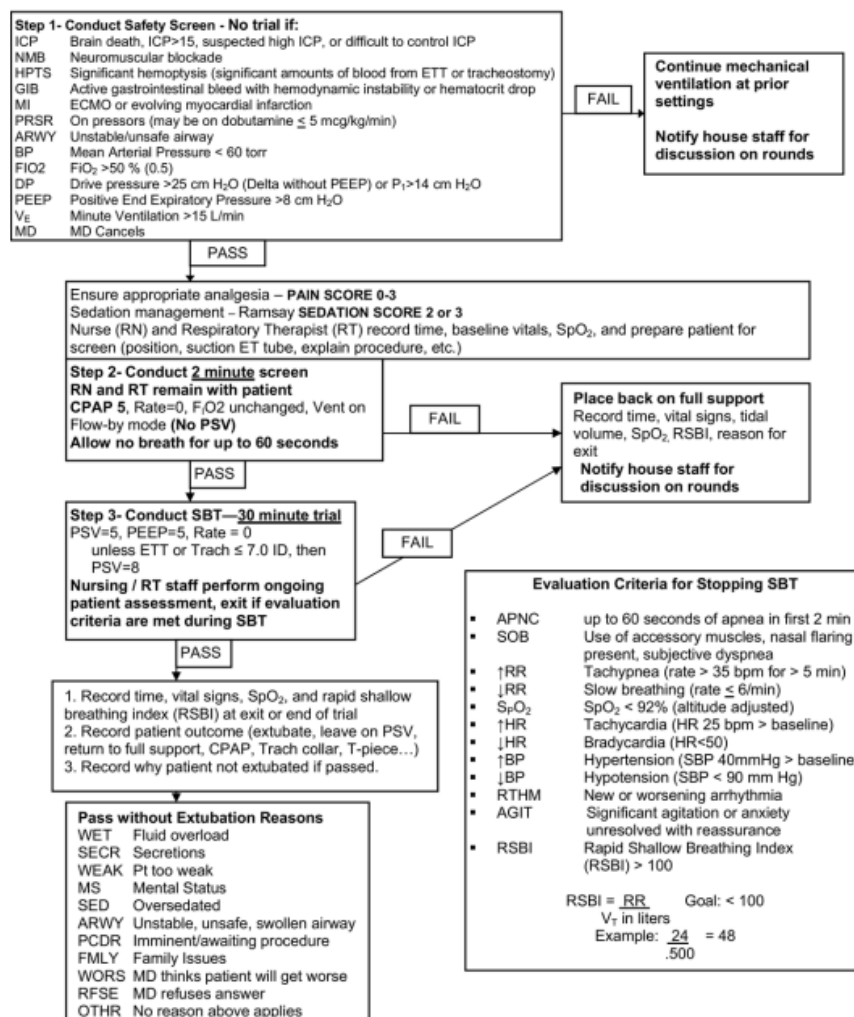


Figure 1. Common protocol for daily spontaneous-breathing trials (SBTs) agreed on by the Partnership for Excellence in Critical Care in Miami, FL, November 2005. bpm, breaths per minute; CPAP, continuous positive airway pressure; ETT, endotracheal tube; ICP, intracranial pressure; ID, internal diameter; PSV, pressure support ventilation.

Implementation of the protocol and collection of data were initiated on 16 January 2023.

I arrived to the ICU each morning and a safety screening was performed on each patient on mechanical ventilation in the service. When a patient passed a safety screen, I proceeded with SBT/SAT, decreasing the sedation myself or asking the RN to initiate SAT. Once the patient was

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awake, an SBT was initiated and, as per the algorithm, I decided to extubate or keep patient endotracheally intubated.

Ethical Issues

Adhering to ethical values was a key component of my quality improvement project and is a core element of care in the ICU. As a general overview, in the context of healthcare, there are four ethical principles. Autonomy, beneficence, justice, and non-maleficence guide how individuals and groups should behave (Haddad & Geiger, 2023). Ethical practice is a foundation for nurses, who face ethical dilemmas in their patient care daily. Nurses are advocates for patients and must find a balance while delivering patient care.

The critical care setting is entrenched with ethical issues and concerns. The ethical principle of non-maleficence is the obligation to do no harm; however, different healthcare providers may define this in different ways. Often, mechanical ventilation and end-of-life concerns go together. After multiple failed SBT trials, providers often then proceed to discuss withdrawal of care or code status to no longer prolong the end of life. Comfort measures are the withdrawal of care, this changing the goal of care to comfort rather than treatment. Such measures also include discontinuation of mechanical ventilator use. During my quality improvement project, we often had end-of-life discussions with family members. At times, patients were kept on mechanical ventilation as family members were pending to arrive to make further arrangements and other times they expired while on mechanical ventilation.

Another ethical dilemma that is encountered frequently while working in the ICU, is beneficence or treating every patient with compassion and respect (Haddad & Geiger, 2023). While one provider may believe that they are doing what is the best for the patient by continuing

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aggressive care measures, another may recommend withdrawal of care. Nurses and providers also disagree at times and are not always in agreement regarding what is the best treatment for the patient. An SAT may be ordered by the provider but if the nurse disagrees with the order, he or she may not follow through.

Methods of evaluation

Data collection was completed on 23 February 2023. Thereafter, I performed a collection review of every patient who met the SBT/SAT criteria, as well as those who were extubated. I documented number of days/length of mechanical ventilation. Data from mechanical ventilation days from January 2022 through March 2022 and January 2023 through March 2023 was also obtained and collected with the assistance of the respiratory therapy department.

Analysis

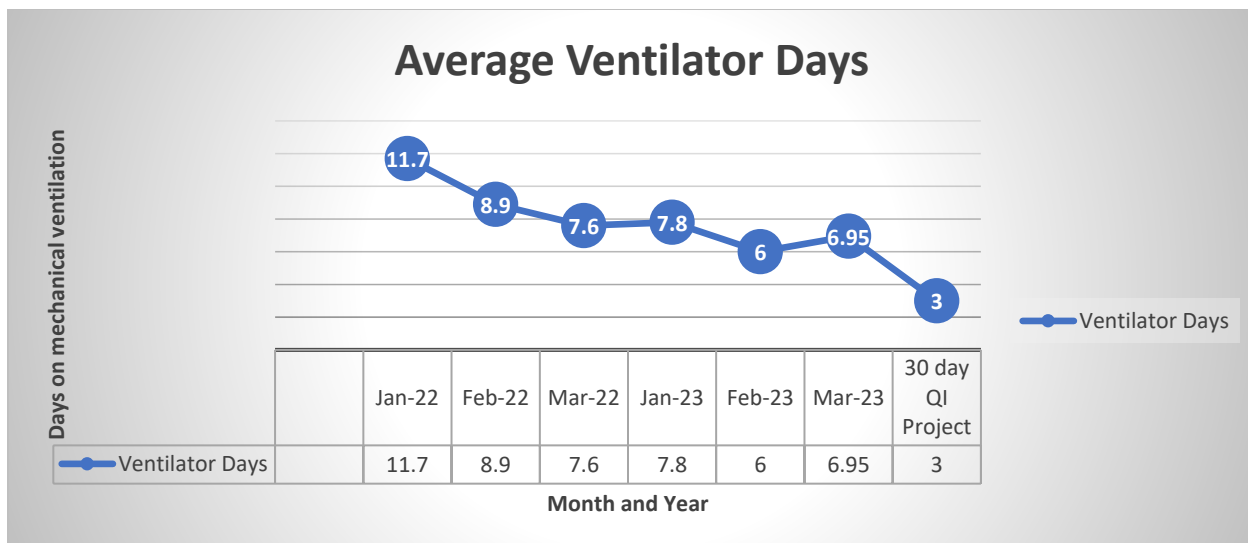
Data analysis required an extensive review of the 14 electronic charts of each patient who was extubated. Information regarding extubations was not easily attainable. Mechanical ventilation days are not recorded/documentated in a specific place in Cerner, the electronic medical record. I had to search the daily vital data for information on supplemental oxygen/ fiO_2 and/or provider notes that mentioned if the patient remained on mechanical ventilation or had been extubated. I opened every chart on every patient that had been extubated and tallied up the days on mechanical ventilation. Once I obtained ventilator days, I was able to get the average.

Results

Outcomes

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There were 184 opportunities to assess patients on mechanical ventilation to determine if they met criteria. Sixty-six patients met criteria for SBT and SAT. Of these, there were 14 successful extubations, with an average of three days on mechanical ventilation. A total of 21.21% of patients who met criteria were extubated and 92.85% of the patients were extubated in fewer than seven days.



Discussion

Summary

Spontaneous awakening and breathing trials have been associated with shorter durations of mechanical ventilation and intensive care unit lengths of stay (Cove et al., 2016). Harris et al. (2020) have found that inconsistent spontaneous awakening trials and spontaneous breathing trials, mechanical ventilation weaning strategies, and interdisciplinary rounding processes

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contributed to prolonged mechanical ventilation duration and length of stay. The need to standardize SBT is crucial in the ICU to reduce harm to patients, reduce mortality and adverse events.

While on mechanical ventilation, patients are sedated to minimize discomfort and anxiety, however, this makes them an extremely vulnerable population. Complications associated with sedation and in particular deep sedation are well established (Shehabi et al., 2013). Sedation management is a multidisciplinary process, but in most ICUs, nurses are primarily responsible for making the decisions about administration and titration of sedatives. Nurses adjust sedation according to a wide range of information (Grap et al., 2012). During my quality improvement project, I encountered push-back from nurses who did not wish to reduce sedation as asked to do so. This made it difficult to proceed with the quality improvement project at times. The reasons varied, from time constraints to simply disagreeing on what was best for the patient.

The quality improvement project aimed to reduce days on mechanical ventilator to less than seven days by having consistent SAT and SBT as per protocol. Over the five-week course, SAT/SBT protocol was proven to be effective in reducing days on mechanical ventilation. The quality improvement project supports the evidence-based effectiveness of consistent SAT and SBT.

Relation to other evidence

The quality improvement project found that the use of standardized weaning protocols with the use of daily SAT and SBT reduces duration of mechanical ventilation. The results of quality improvement were consistent with previous evidence.

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Limitations

The quality improvement project was performed over a 30-day period; further implementation and assessment are needed for longer periods of time in the future. Due to time constraints, I was unable to assess or evaluate the number of mechanical ventilation days among patients who were not extubated, length of stay in the ICU or length of hospitalization. Furthermore, I was unable to assess which patients eventually required tracheostomy or expired.

Interpretation

To conclude, my quality improvement project met the outcome to reduce mechanical ventilator days to less than 7 days was met.

References

- Chan, J. L., Miller, J. G., Murphy, M., Greenberg, A., Iraola, M., & Horvath, K. A. (2018). A multidisciplinary protocol-driven approach to improve extubation times after cardiac surgery. *The Annals of Thoracic Surgery*, *105*(6), 1684-1690.
doi:10.1016/j.athoracsur.2018.02.008
- Cove, M. E., MBChB, Ying, C., BS, Taculod, J. M., RRT-NPS, Oon, S. E., RN, Oh, P., RN, Kollengode, R., MBBS, . . . Tan, C. S., PhD. (2016). Multidisciplinary extubation protocol in cardiac surgical patients reduces ventilation time and length of stay in the intensive care unit. *The Annals of Thoracic Surgery*, *102*(1), 28-34. doi:10.1016/j.athoracsur.2016.02.071
- De Medeiros Silva, C. S., Timenetsky, K. T., Taniguchi, C., Calegario, S., Azevedo, C. S. A., Stus, R., . . . Barbas, C. S. V. (2012). *Low mechanical ventilation times and reintubation rates associated with a specific weaning protocol in an intensive care unit setting: A retrospective study* Elsevier BV. doi:10.6061/clinics/2012(09)02
- Evidence-based guidelines for weaning and discontinuing ventilatory support (2001)*
- Grap, M. J., Munro, C. L., Wetzell, P. A., Best, A. M., Ketchum, J. M., Hamilton, V. A., . . . Sessler, C. N. (2012). Sedation in adults receiving mechanical ventilation: Physiological and comfort outcomes. *American Journal of Critical Care*, *21*(3), e53-e64.
doi:10.4037/ajcc2012301
- Haddad, L., & Geiger, R. (2023). *StatPearls*. Treasure Island : StatPearls Publishing LLC.
- Harris, J., Roussel, L., Dearman, C., & Thomas, P. (2020). *Project Planning and Management* (Third edition ed.). Burlington: Jones & Barlett Learning.

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The Hospitals of Providence - East Campus. (2023, 04 09). Retrieved from <https://www.thehospitalsofprovidence.com/locations/detail/east-campus>

Hooper, M. H., MD, & Girard, Timothy D., MD, MSC. (2009). Sedation and weaning from mechanical ventilation: Linking spontaneous awakening trials and spontaneous breathing trials to improve patient outcomes. *Critical Care Clinics*, 25(3), 515-525.

doi:10.1016/j.ccc.2009.04.002

Lancaster, B., Shifrin, M. M., & Gast, S. (2022). Using a standardized rounding tool to improve the incidence of spontaneous awakening and breathing trials. *Critical Care Nurse*, 42(2), e1-e8. doi:10.4037/ccn2022854

Parate, T., Dhote, G., & Parate, R. (2022). Early predictors of success of non-invasive positive pressure ventilation in hypercapnic respiratory failure. *Vidarbha Journal of Internal*

Medicine, 32, 3-9. doi:10.25259/VJIM_23_2021

Serena, G., Corredor, C., Fletcher, N., & Sanfillippo, F. (2019). Implementation of a nurse-led protocol for early extubation after cardiac surgery: A pilot study. *World Journal of Critical Care Medicine*, 28-35.

Shehabi, Y., Chan, L., Kadiman, S., Alias, A., Ismail, W. N., Tan, M. A. T. I., . . . Bailey, M.

(2013). Sedation depth and long-term mortality in mechanically ventilated critically ill adults: A prospective longitudinal multicentre cohort study. *Intensive Care Medicine*, 39(5), 910-918. doi:10.1007/s00134-013-2830-2

Robertson, T., Mann, H., Hyzy, R., Rogers, A., Douglas, I., Waxman, A., . . . Buchman, T.

(2008). Multicenter implementation of a consensus-developed, evidence-based, spontaneous breathing trial protocol. *Critical Care Medicine*, 36(10), 2753-2762.

doi:10.1097/CCM.0b013e3181872833

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Zein, H., Baratloo, A., Negida, A., & Safari, S. (2017). *Review of leadership research in higher education* Springer International Publishing. doi:10.1007/978-3-319-54419-9_6