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Improving Knowledge, Confidence, and Competency Among ICU Nurses Concerning the Benefits of Using the UK Ventilator Separation Protocol

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Improving Knowledge, Confidence, and Competency Among ICU Nurses Concerning the Benefits of Using the UK Ventilator Separation Protocol

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Abstract

Background: The trauma intensive care unit (ICU) at University of Kentucky (UK) Healthcare uses a ventilator separation protocol which provides specific guidelines on the successful weaning of patients from mechanical ventilation. However, many of the nurses are not aware of this protocol as formal education is not included in their orientation or training. This lack of knowledge can lead to risks such as increased patient morbidity, mortality, ICU length of stay, and healthcare-related costs. Research shows that using structured mechanical ventilator weaning tools in the ICU can shorten the duration of mechanical ventilation, which in turn, lowers these associated risks.

Purpose: The purpose of this DNP project was to improve the knowledge, confidence, utilization, and competency among trauma ICU nurses at UK Healthcare by examining the impact of an educational intervention concerning the benefits of using the UK Ventilator Separation Protocol and utilization of an in-room laminated assessment tool to increase use of the UK Ventilator Separation Protocol in order to improve patient outcomes such as decreasing mechanical ventilator days and ICU length of stays.

Methods: This was a single-center, multimodal project designed to examine the impact of an educational intervention using a pre- and post-survey and an in-room assessment tool, as well as fifteen patient chart audits as measurement to determine 1) if there was an improvement in baseline knowledge and confidence regarding use of the UK Ventilator Separation Protocol among the trauma ICU nurses, 2) how often did the trauma ICU nurses adhere to using the UK Ventilator Separation Protocol, and 3) if there was improvement in patient mechanical ventilator days and ICU length of stays. Descriptive statistics like means, standard deviations, medians, and interquartile ranges were used to compare nursing knowledge and confidence. Demographic

variables such as age, gender, body mass index (BMI), ethnicity, tobacco use, and comorbidities including chronic obstructive pulmonary disease (COPD), hypertension (HTN), hyperlipidemia (HLD), type 2 diabetes mellitus (T2DM), and heart failure with reduced ejection fraction (HFrEF) were used to compare mechanical ventilator days and ICU length of stays. Two-sample t-tests, chi-square tests, and Mann-Whitney U tests via SPSS software were used to analyze the data and interpret significance to clinical practice.

Results: A total of 21 trauma ICU nurses completed the pre-survey and 17 trauma ICU nurses completed the post-survey after an educational intervention and in-room assessment tool were implemented. There were no statistically significant differences seen in the demographic variables and prevalence of specific comorbidities. Most of the pre-intervention patients were over 65 years of age and most of the post-intervention patients were under 65 years of age. The post-intervention patients were nearly all male (93%), while over one-quarter of the pre-intervention patients were female (27%). Nearly half of the pre-intervention patients had a BMI >30 and were considered obese or morbidly obese (47%), while only 20% of the post-intervention patients had a BMI >30. Ethnicity was similar for the pre- and post-intervention patients with white being the most prevalent (86%), followed by black and Hispanic. Tobacco use was slightly higher in the pre-intervention patients (67%) compared to the post-intervention patients (60%). COPD was most prevalent in the pre-intervention patients (80%) compared to 47% of the post-intervention patients. The incidence of HTN was higher among the post-intervention patients (67%) compared to 60% of the pre-intervention patients. The prevalence of HLD was equal among both patient groups. The incidence of T2DM was higher in the pre-intervention patients (47%) compared to 27% in the post-intervention patients. HFrEF was more prevalent in the pre-intervention patients (27%) compared to only 7% in the post-intervention

patients. Statistically significant increases were observed in *I have heard of the protocol* (p = .008), *I feel comfortable using the protocol* (p = .003), *I feel confident speaking to the provider about the protocol* (p = .006), and *I know where to find information about the protocol* (p = .012). A statistically significant increase in protocol adherence was observed when comparing fifteen post-intervention chart audits to post-assessment tool chart audits (p = .010). Additionally, statistically significant decreases were observed in both mechanical ventilator days (p = .001) and ICU length of stays (p = <.001) from pre-intervention to the post-assessment tool chart audits of fifteen patients.

Conclusion: Results from this study suggest that web-based educational interventions and in-room assessment tools can be effective in improving the confidence, utilization, and competency among ICU nurses caring for mechanically ventilated patients, along with improving patient outcomes such as decreased mechanical ventilator days and ICU length of stays. The pre-intervention patients had demographic variables and comorbidities that made them more susceptible to requiring increased mechanical ventilator days and, therefore, increased ICU length of stays such as they were older, had higher BMIs, more tobacco use, and higher incidence of COPD, T2DM, and HFrEF compared to the post-intervention patients. Future research should focus on continued staff education, exploring unit-specific barriers to protocol use perceived by ICU nurses, utilization of eICU physicians for extubation support, and exploring patient variables and contributing factors that could have led to increased mechanical ventilator days and ICU length of stays.

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Background & Significance

Problem Statement

Many patients in the intensive care unit (ICU) require intubation and respiratory support by a mechanical ventilator. The goal of caring for intubated patients requiring mechanical ventilation is to obtain spontaneous breathing and successful weaning from the ventilator as soon as possible. Liberating a patient from mechanical ventilation involves gradual movement from dependence on the ventilator toward effectively breathing on their own. Reducing the amount of time a patient spends intubated on a mechanical ventilator leads to improved quality of life, increased motor function, and prevention of disability (Dehghani et al., 2016). Furthermore, expedited weaning from a mechanical ventilator reduces the incidence of ventilator-associated pneumonia (VAP) (Dehghani et al., 2016).

Context, Scope, and Consequences

Prolonged intubation and mechanical ventilation are associated with inadequate use of ICU and hospital resources compared to the number of days spent in an ICU, high in-hospital and post-discharge mortality, decreased functional capacity, poor quality of life after the ICU, and high healthcare costs compared with patients who have fewer intubation days and require mechanical ventilation for a shorter period of time (Hill et al., 2017). In the near future, it is anticipated that a significantly higher number of critically ill patients will require prolonged intubation and mechanical ventilation, with associated increases in mortality, morbidity, and healthcare costs (Hill et al., 2017). In the trauma ICU at UK Healthcare, there is an extubation tool known as the UK Ventilator Separation Protocol which includes guidelines on performing a spontaneous awakening trial (SAT) then a spontaneous breathing trial (SBT) on all intubated

patients every morning between 5-6 AM. There are several criteria that must be met before either intervention should be performed. These criteria include RASS -1 to +1, PEEP ≤ 6 cm H_2O, pH > 7.35, hemodynamically stable, no chest pain, $SaO_2 \geq 92\%$ at $FiO_2 \leq 0.5$, $SvO_2 > 60$ (if measured), no ongoing ICP monitoring, and Temp < 102.5 ºF. However, many of the ICU nurses are not aware of what these criteria are as formal education on this protocol is not included in their orientation or training. This lack of knowledge puts patients at risk for avoidable complications related to prolonged intubation and mechanical ventilation, including increased morbidity and/or mortality. This problem can potentially affect any patient who requires intubation and mechanical ventilation for any length of time.

Current Evidence-Based Interventions

To prevent the complications associated with prolonged intubation and mechanical ventilation, as well as to predict successful weaning from the ventilator, certain criteria and indicators are required. Some of these criteria include parameters related to pulmonary function, gas changes, and physiological and psychological conditions of patients. Currently, there are not any reliable tools available to predict which patients will require prolonged intubation and mechanical ventilation. However, there are numerous reliable tools available to measure patients' readiness to be successfully weaned from mechanical ventilation such as the acute physiology and chronic health evaluation (APACHE II) score, sequential organ failure assessment (SOFA) score, Burn's wean assessment program, and the Morganroth and Gluck index. Using structured weaning tools along with commonly performed practices in the ICU, such as daily SATs and SBTs, keeping the head of bed elevation between 30° and 45°, peptic ulcer prophylaxis, deep vein thrombosis prophylaxis, and use of chlorhexidine for oral care,

shortens the duration of mechanical ventilation, shortens the patient's ICU length of stay, and reduces costs along with fewer unsuccessful extubations (Dehghani et al., 2016).

Purpose

The purpose of this project was to improve the knowledge, confidence, utilization, and competency among trauma ICU nurses at UK Healthcare concerning the benefits of using the UK Ventilator Separation Protocol. This was accomplished by developing an educational intervention. In addition, a laminated assessment tool was placed in each trauma ICU patient room which consisted of criteria for an SBT and if met, a 30-to-60-minute SBT that included the following criteria: pressure support 6-10 cm H_2O, positive end-expiratory pressure (PEEP) 5-6 cm H_2O, $FiO_2 \leq 0.5$, trach collar appropriate if trach placed, and t-piece at MD discretion. If SBT criteria were not met, nurses would document why the patient was ineligible for an SBT and there would be no change in mechanical ventilator settings. During an SBT, nursing monitored the patient continuously for five minutes then every fifteen minutes for SBT termination criteria. SBT termination criteria included O_2 sat < 90 x 3 minutes, failure to maintain V_T > 5 mL/kg (IBW), HR > 130 (or increase of 20%), SBP < 90 or > 180, S_vO_2 < 60, sweating, anxiety, or change in RASS score, new dysrhythmia, chest pain, and any signs of distress. If SBT termination criteria were met, the SBT was terminated, and nurses documented the SBT results and the patient was returned to full support settings. If the patient completed the SBT, the following criteria were used to determine if it was successful: RR < 35, HR increase < 20% from baseline, SBP increase < 20 mmHg from baseline, ABG without respiratory acidosis, PaO_2 > 60 mmHg, cough on command (consider cuff leak assessment if anticipated airway edema), RASS score -1 to +1, and rapid shallow breathing index (RSBI) < 100. If the patient's SBT was successful, nursing documented the results and the patient was placed in a restful mechanical

ventilator mode. The decision to extubate was made by the provider within one hour of successful SBT completion. A chart audit was performed to assess nurse compliance with utilization of the UK Ventilator Separation Protocol. A comparative analysis between the educational intervention and in-patient room assessment tool was performed to assess compliance of trauma ICU nurses' utilization of the UK Ventilator Separation Protocol. To assess the impact on patient outcomes, a comparative analysis between mechanical ventilator days and ICU length of stays was performed.

Literature Review

A literature review was conducted to explore the benefits of using a structured mechanical ventilator weaning tool to reduce intubation days and improve patient outcomes. Search methods for the literature review included a database search using PubMed, The Cumulative Index to Nursing and Allied Health Literature (CINAHL), UpToDate, and Cochrane. Search terms and keywords used in the literature review for this project included: prolonged intubation, prolonged mechanical ventilation, negative effects of prolonged mechanical ventilation, risk factors for prolonged mechanical ventilation, weaning from mechanical ventilation, long-term outcomes of prolonged mechanical ventilation, effectiveness of evidence-based practice for nurses, and effectiveness of pre- and post-survey instruments. Inclusion criteria included articles published between 2016-2024, full text only, peer-reviewed, written in English, and involving only human participants. Exclusion criteria included articles published prior to 2016, without full text available, not peer-reviewed, written in any language other than English, and involving non-human participants. There were 29 articles which matched these criteria related to the focus of this DNP project.

The evidence shows that prolonged intubation and mechanical ventilation is associated with prolonged hospital and ICU length of stays, increased morbidity and mortality, as well as higher healthcare costs and burden on the healthcare system (Han, 2023; Ho et al., 2020; Hyzy, 2023; Liang et al., 2019; Na et al., 2022; Nagata et al., 2019; Patnaik et al., 2021; Trudzinski et al., 2022; & Yehya et al., 2019). The evidence supports that comprehensive mechanical ventilator weaning and extubation protocols, as well as structured reliable tools that measure patients' readiness to be weaned from mechanical ventilation which are based on meaningful physiologic and clinical variables shorten the total duration of mechanical ventilation, reduce weaning duration, decrease ICU length of stay, and lower resource use/medical costs without significantly impacting mortality, reintubation rates, or adverse events (Burns et al., 2021; Ghauri et al., 2019; Hetland et al., 2018; Jhou et al., 2021; Munshi & Ferguson, 2018; Nitta et al., 2019; Perkins et al., 2018; Pham et al., 2023; Saiphoklang & Auttajaroon, 2018; Statlender & Singer, 2021; & Vetrugno et al., 2020). Evidence supports the utilization of a validated mechanical ventilator weaning and extubation protocol to decrease intubation days and improve patient outcomes.

Literature supports the utilization of ICU protocols such as the UK Ventilator Separation Protocol to decrease prolonged intubation and mechanical ventilation on adult ICU patients and improve outcomes (Dehghani et al., 2016). Unfortunately, the utilization of such protocols in the trauma ICU was lacking. The gap in the trauma ICU lay in the fact that the trauma ICU nurses were not aware of the UK Ventilator Separation Protocol as formal education on this protocol was not included in their orientation or training. Evidence indicates that pre- and post-survey instruments may be valid and reliable in correlating with more time-sensitive, accurate assessment metrics in some applications (Davis et al., 2018). Research shows that educational

interventions improve nurses' evidence-based practice (EBP) knowledge, skills, attitude, confidence, and behavior. Therefore, EBP education interventions should be part of nurses' professional development in clinical settings. In addition, the use of displaying protocols in patient rooms standardizes and guides the use of such protocols which leads to improved outcomes and increases utilization of protocols (Sapri et al., 2022). The proposed practice change identified in this project is needed to improve the knowledge, confidence, utilization, and competency among the trauma ICU nurses at UK Healthcare concerning the benefits of using the UK Ventilator Separation Protocol.

Theoretical Framework

The Iowa Model of Evidence-Based Practice (EBP) was used to guide project implementation as it has several components to provide an organized approach to implementing research into practice, by focusing on key triggers that can be either problem-focused or knowledge-focused. The Iowa Model of EBP is composed of seven steps: (1) identifying an issue or opportunity, (2) stating the purpose, (3) forming a team, (4) assembling, appraising, and synthesizing the body of evidence, (5) designing and piloting the practice change, (6) integrating and sustaining the practice change, and (7) dissemination (Cullen et al., 2022). The Iowa Model of EBP helps explain how organizations can change their way of practice to provide high-quality patient care while controlling the cost of healthcare. It also assists healthcare providers in integrating best evidence into clinical practice. Most importantly, as new evidence becomes available, this model easily adapts to the latest evidence, whereas other models may need to adjust if new evidence negates the central beliefs behind them (Buckwalter et al., 2017).

This DNP project was actualized following the steps of the Iowa Model of EBP. First, the trauma ICU at UK Healthcare was examined for issues and/or opportunities and it was

discovered that the nurses were unaware of the UK Ventilator Separation Protocol as a validated mechanical ventilator weaning tool. Next, a purpose statement was developed for this DNP project. Then, a team was formed consisting of the trauma ICU patient care manager, clinical nurse specialists, respiratory therapists, and providers. A formal literature review was conducted and supported the utilization of a validated mechanical ventilator weaning and extubation protocol. A gap was identified between the trauma ICU nurses not being aware of the UK Ventilator Separation Protocol and a lack of formal education on this protocol in their orientation or training. This led to the development of an educational intervention as the primary intervention for this project. Additionally, an in-room assessment tool was placed in each patient room to promote its ongoing utilization. Finally, the principal investigator (PI) plans to establish the educational intervention as a requirement to be included in the orientation and training of the trauma ICU nurses moving forward, as well as leaving the in-room assessment tool in each patient room permanently.

Methods

Design

The design of the study was quasi-experimental as there was no randomization or control group. This design was chosen because the purpose of this project was to compare pre- and post-implementation data and utilize an in-room assessment tool, as well as complete fifteen patient chart audits as measurement to determine 1) if there was an improvement in baseline knowledge and confidence regarding use of the UK Ventilator Separation Protocol among the trauma ICU nurses, and 2) how often did the trauma ICU nurses adhere to using the UK Ventilator Separation Protocol, and 3) if there was improvement in patient mechanical ventilator days and ICU length of stays.

Setting

UK Healthcare is 991 bed academic research hospital located in Lexington, KY, and is one of only two level 1 trauma centers in the state of Kentucky. The trauma ICU at UK Healthcare consists of approximately twelve beds located on the seventh floor, tower 100, within Pavilion A. UK Healthcare's mission is to provide the most advanced patient care to improve the health of the people of Kentucky while improving the healthcare delivery system by partnering with community hospitals and physicians.

Project Congruence

UK Healthcare's Strategy 2025 is a strategic plan that outlines five key strategic objectives that will drive their future success which include: 1) Build Our Culture, 2) Invest in Our People, 3) Provide More Value, 4) Advance Care Strategically, and 5) Create a Healthier Kentucky. This project is in congruence with UK Healthcare's mission and strategic plan as it seeks to improve patient outcomes by collaborating with nursing staff to provide advanced patient care.

Stakeholders

The key project stakeholders included the patient care manager, clinical nurse specialists, respiratory therapists, providers (physicians & APRNs), Trauma Medical Director, trauma ICU nurses, and patients' families. The patient care manager and clinical nurse specialists served as protocol experts, staff resources, and assisted with the development of the educational intervention. The respiratory therapists worked closely with the nurses to ensure that the protocol was being utilized correctly, as well as ensured the appropriate protocol data was documented and communicated to the providers. The providers offered expert guidance to the nursing staff

and made the final decision regarding each patient's plan of care. The Trauma Medical Director helped build buy-in and support among supporters and opponents of the project throughout its development and implementation. Patients' families provided support to the patients during project implementation.

Facilitators and Barriers

Site-specific facilitators to project implementation included: experienced & well-trained nursing staff, easy to use protocol, nursing autonomy, and professional development. Site-specific barriers to project implementation included: laggards, competing nursing priorities, time constraints, and cost. To help overcome these barriers, the PI gave nursing staff the opportunity to raise their concerns and ask questions after a comprehensive review of the literature before and after the educational intervention in order to promote their buy-in and support for the project. The cost barrier was addressed by doing all of the project activities in-house to save money.

Sample

The target population consisted of all part- and full-time UK Healthcare trauma ICU nurses on both shifts employed between October 2023-March 2024. Exclusion criteria included nurses on orientation, nurses leaving the trauma ICU between October 2023-March 2024, nurses utilizing Family and Medical Leave Act (FMLA) between October 2023-March 2024, travel nurses, nurses pulled from other units, nurses hired between October 2023-March 2024, student nurses, divisional charge nurses, non-nurses, and nurses not involved in direct patient care. A non-probability sampling strategy known as purposive or judgmental sampling was used because it involves non-random selection based on convenience or other criteria, as well as the PI selecting a sample that was most useful to the purposes of their project.

Procedure

IRB Approval

Prior to the project, Institutional Review Board (IRB) approval was obtained from the UK Medical IRB. To facilitate approval, a letter was obtained from the Trauma Medical Director that demonstrated organizational support for the project. All data obtained from the project was based on anonymous survey responses without the possibility of determining individual respondents' identities and de-identified chart records obtained from patients' electronic medical records. Data was stored on firewall protected and encrypted computers linked to the UK Healthcare server.

Description of Evidence-Based Intervention

This evidence-based intervention was developed based on a comprehensive review of the literature to find support for using structured reliable tools to measure patients' readiness to be successfully weaned from mechanical ventilation. Based on the literature review, the UK Ventilator Separation Protocol met the criteria for being a reliable mechanical ventilation weaning tool. This project had five main components including: 1) an educational intervention on the UK Ventilator Separation Protocol, 2) pre- and post-surveys to measure trauma ICU nurses' knowledge on, and to self-rate their confidence level using, the UK Ventilator Separation Protocol, 3) utilization of an in-room assessment tool to increase use of the UK Ventilator Separation Protocol, 4) pre- and post-project implementation chart audits of fifteen trauma ICU patients to determine how often the trauma ICU nurses utilized the UK Ventilator Separation Protocol, and 5) pre- and post-intervention chart audits of fifteen trauma ICU patients to decrease mechanical ventilator days and ICU length of stays. Improvement in the implementation scores

compared to the baseline scores were assessed to determine the project's effectiveness and were used to provide recommendations to nursing leadership to improve intubated trauma patients' outcomes.

Measures & Instruments

For this project, the knowledge about the UK Ventilator Separation Protocol was based on five questions that covered specific content from the educational intervention. A total score was calculated, with higher scores demonstrating greater knowledge acquisition. The survey questions consisted of a mixture of yes or no, true or false, multiple choice, and Likert scale questions to access the trauma ICU nurses' knowledge of and confidence using the UK Ventilator Separation Protocol. Each of the five Likert scale questions were self-rated from 1 to 5, with higher scores demonstrating greater agreement. The same ten questions were asked before and after the educational intervention. The main outcome measure for this project was screening for protocol use. A laminated copy of the protocol was placed in each trauma ICU patient room after the educational intervention. This measure was based on a review of fifteen electronic patient medical records before and after the educational intervention, as well as after placement of the in-room assessment tool. For reviewed charts following the intervention, a chart was given a 'yes= 1' if protocol use occurred or 'no= 0' if it did not occur.

Data Collection

Data collection for this project occurred with the educational intervention. Pre-surveys examining knowledge questions, self-rated confidence levels, and main outcome measures were sent in a survey link to participants. After completing the pre-surveys, the participants were sent the educational intervention via email through a listserv. Three months following the educational

intervention, the participants responded to the same post-survey questions. The data from the surveys was collected using Qualtrics, a survey and data collection software program. In addition, a laminated copy of the UK Ventilator Separation Protocol was placed in each trauma ICU patient room following the educational intervention. Finally, the PI performed pre- and post-intervention chart audits. The patient demographics were obtained through pre- and post-intervention chart audits and consisted of age, gender, body mass index (BMI), ethnicity, tobacco use, and comorbidities such as chronic obstructive pulmonary disease (COPD), hypertension (HTN), hyperlipidemia (HLD), type 2 diabetes mellitus (T2DM), and heart failure with reduced ejection fraction (HFrEF). The data from the chart audits was collected and documented using Microsoft Excel.

Data Analysis

Differences in knowledge items before and after the intervention were analyzed using two-sample t-tests. To assess changes in the proportion of charts that had documented protocol use, changes in protocol use before and after the intervention were analyzed using chi-square tests. To compare changes in patient mechanical ventilator days and ICU length of stays from pre- and post-intervention chart audits, Mann-Whitney U tests were performed. Missing data was addressed by using listwise deletion. Descriptive statistics were used to analyze patient demographics and comorbidities. All analyses were conducted using IBM SPSS version 28 with an alpha level of 0.05 used to indicate statistical significance. Due to the anonymous nature of the surveys, individual surveys were unable to be linked; therefore, an independent rather than paired method of analysis was used.

Results

The patient demographics were obtained through pre- and post-intervention chart audits and consisted of age, gender, body mass index (BMI), ethnicity, tobacco use, and comorbidities such as chronic obstructive pulmonary disease (COPD), hypertension (HTN), hyperlipidemia (HLD), type 2 diabetes mellitus (T2DM), and heart failure with reduced ejection fraction (HFrEF). While there were no statistically significant differences seen in the demographic variables and prevalence of specific comorbidities, most of the pre-intervention patients were over 65 years of age and most of the post-intervention patients were under 65 years of age. The post-intervention patients were nearly all male (93%), while over one-quarter of the pre-intervention patients were female (27%). Nearly half of the pre-intervention patients had a BMI >30 and were considered obese or morbidly obese (47%), while only 20% of the post-intervention patients had a BMI >30. Ethnicity was similar for the pre- and post-intervention patients with white being the most prevalent (86%), followed by black and Hispanic. Tobacco use was slightly higher in the pre-intervention patients (67%) compared to the post-intervention patients (60%). COPD was most prevalent in the pre-intervention patients (80%) compared to 47% of the post-intervention patients. The incidence of HTN was higher among the post-intervention patients (67%) compared to 60% of the pre-intervention patients. The prevalence of HLD was equal among both patient groups. The incidence of T2DM was higher in the pre-intervention patients (47%) compared to 27% in the post-intervention patients. HFrEF was more prevalent in the pre-intervention patients (27%) compared to only 7% in the post-intervention patients (see Table 1).

The top three mechanisms of trauma at UK Healthcare in 2023 leading to admission to the ICU were falls at 45.6%, motor vehicle crashes at 23.6%, and motorcycle crashes at 5.9%

(see Table 2). A total of 21 trauma ICU nurses completed the pre-survey and 17 trauma ICU nurses completed the post-survey. The two-sample t-test comparing the pre- and post-survey question *I have heard of the protocol* revealed a statistically significant increase (p = .008; see Table 3). Scores increased from 3.81 (SD = 1.17) to 4.65 (SD = 0.61). The pre- and post-survey question *I feel comfortable using the protocol* also revealed a statistically significant increase (p = .003). Scores increased from 2.95 (SD = 1.16) to 4.06 (SD = 0.97). Another pre- and post-survey question, *I feel confident speaking to the provider about the protocol,* revealed a statistically significant increase (p = .006; see Table 1). Scores increased from 3.57 (SD = 1.21) to 4.47 (SD = 0.62). The pre- and post-survey question *I know where to find information about the protocol* revealed a statistically significant increase as well (p = .012). Scores increased from 3.62 (SD = 1.12) to 4.47 (SD = 0.80). Fifteen pre-intervention chart audits revealed that zero nurses in the trauma ICU were documenting use of the UK Ventilator Separation Protocol. The chart audits of fifteen patients in the trauma ICU post-intervention showed an increase in nursing adherence to documenting protocol use from zero to five (33.3%). After placement of an in-room assessment tool in each trauma ICU patient room, a chi-square test comparing the fifteen post-intervention chart audits to the post-assessment tool chart audits revealed a statistically significant increase in protocol use and documentation (33.3% vs 80%; p = .010; see Table 4).

A Mann-Whitney U test comparing fifteen pre- and post-intervention trauma ICU patient chart audits revealed statistically significant decreases in both mechanical ventilator days (p = .001) and ICU length of stays (p = <.001). The median mechanical ventilator days in the pre-intervention patient chart audits was 6 days (IQR = 3-14 days) compared to 2 days (IQR = 1-3 days) in the post-intervention patient chart audits. The median ICU length of stay in the pre-intervention patient chart audits was 27 days (IQR = 10-44 days) compared to 2 days (IQR = 1-5

days) in the post-intervention patient chart audits (see Table 5). The injury severity score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. The three most severely injured body regions have their score squared and added together to produce the ISS. The ISS is on a scale of 0-75 with 0-9 indicating mild trauma, 10-15 indicating moderate trauma, 16-24 indicating severe trauma, and >25 indicating profound trauma. The ISS correlates linearly with patient morbidity, mortality, and hospital length of stay. The pre-intervention patients with an ISS >16 that were considered to have severe or profound trauma consisted of 47.3% of the patients and the post-intervention patients with an ISS >16 consisted of 27.4% of the patients (see Table 6).

Discussion

The results from this study found that a web-based educational intervention along with an in-room assessment tool on the UK Ventilator Separation Protocol had a statistically significant impact on improving the confidence, utilization, and competency among nurses caring for mechanically ventilated patients in the trauma ICU at UK Healthcare, as well as improving patient outcomes. This is consistent with current literature which shows that educational interventions improve nurses' EBP knowledge, skills, attitude, confidence, and behavior (Sapri et al., 2022). The non-statistical significance noted in the five combined knowledge questions indicates that the trauma ICU nurses were already aware of the clinical indicators that predict readiness (or lack thereof) for an SAT and/or SBT but lacked the confidence to 1) use the UK Ventilator Separation Protocol and 2) discuss its outcomes with a provider in order to extubate patients sooner. Numerous studies have shown that prolonged intubation and mechanical ventilation is associated with prolonged hospital and ICU length of stays, increased morbidity and mortality, as well as higher healthcare costs and burden on the healthcare system (Han,

2023; Ho et al., 2020; Hyzy, 2023; Liang et al., 2019; Na et al., 2022; Nagata et al., 2019; Patnaik et al., 2021; Trudzinski et al., 2022; & Yehya et al., 2019).

On the pre-survey question *I know where to document the results of an SBT in EPIC,* a chi-square test was performed and revealed that 95.2% of the trauma ICU nurses knew where to document the results of an SBT in EPIC and 4.8% did not; however, this indicated that although they reportedly knew where to document these results, none of them did as the pre-intervention chart audit of fifteen patients found 0% compliance. The post-intervention chart audit of fifteen patients was slightly improved with 33.3% of the trauma ICU nurses documenting the results of an SBT in EPIC. The second post-intervention of hanging a laminated copy of the UK Ventilator Separation Protocol in each of the trauma ICU patient rooms significantly improved protocol use with 80% of the trauma ICU nurses documenting protocol use. This is consistent with existing evidence which shows that adherence to a protocol can be improved through purposeful, technical, and educational methods that focus on nursing interventions, technical updates, and electronic medical record (EMR) charting (Bounds et al., 2016).

Medians were used to compare pre- and post-intervention mechanical ventilator days and ICU length of stays instead of means as there were extreme outlier values that could have skewed the distribution. For instance, mechanical ventilator days improved from 6 days pre-intervention to 2 days post-intervention, while ICU length of stays improved from 27 days pre-intervention to 2 days post-intervention. This large difference may be the result of outliers which could represent true values from natural variation in the patient population such as underlying comorbidities, infection, trauma-related injuries, or surgery requiring intubation. This may also be the result of the 47.3% of pre-intervention patients being more severely injured and critically ill with an ISS >16 compared to 27.4% of the post-intervention patients. The pre-intervention

patients had demographic variables and comorbidities that made them more susceptible to requiring increased mechanical ventilator days and, therefore, increased ICU length of stays such as they were older, had higher BMIs, more tobacco use, and higher incidence of COPD, T2DM, and HFrEF. According to various studies, the prolonged use of mechanical ventilation is caused by several factors, one of which is the inability of patients to recover quickly due to complex illness, coupled with a history of previous illnesses suffered by the patients before being admitted to the ICU. There are numerous independent predictors related to patients' demographics (advanced age and gender) health status (COPD, elevated heart rate, low ejection fraction, and kidney dysfunction), and surgery-related incidents (Sumarlan et al., 2022). Increasing ICU length of stay is associated with higher 1-year mortality for both mechanically ventilated and non-mechanically ventilated patients (Moitra et al., 2016). Therefore, it was expected that ICU length of stay would decrease as mechanical ventilator days decreased. This project's findings are consistent with existing evidence which shows that comprehensive mechanical ventilator weaning and extubation protocols, as well as structured reliable tools that measure patients' readiness to be weaned from mechanical ventilation which are based on meaningful physiologic and clinical variables shorten the total duration of mechanical ventilation, reduce weaning duration, decrease ICU length of stay, and lower resource use/medical costs without significantly impacting mortality, reintubation rates, or adverse events (Burns et al., 2021; Ghauri et al., 2019; Hetland et al., 2018; Jhou et al., 2021; Munshi & Ferguson, 2018; Nitta et al., 2019; Perkins et al., 2018; Pham et al., 2023; Saiphoklang & Auttajaroon, 2018; Statlender & Singer, 2021; & Vetrugno et al., 2020).

The findings from this DNP project revealed that continued educational interventions on the benefits of using the UK Ventilator Separation Protocol are needed, as well as unit-specific

barriers to using and documenting the results in EPIC should be explored. In addition, the laminated in-room assessment tool should be left in each patient room along with making the protocol more accessible to the nursing staff by placing a copy in each nursing station and in the unit binder.

Implications for Future Practice

This project suggested that an educational invention and in-room assessment tool can improve the confidence, utilization, and competency among ICU nurses caring for mechanically ventilated patients using the UK Ventilator Separation Protocol at UK Healthcare, as well as improve patient outcomes. This improvement in confidence, utilization, and competency among nurses may have had a direct influence on decreasing the number of mechanical ventilator days and ICU length of stays for patients in the trauma ICU at UK Healthcare during the study period. Currently, no formal education on the UK Ventilator Separation Protocol is included in the orientation or training of the trauma ICU nurses. This lack of knowledge has been shown in the literature to lead to unnecessary consequences such as increased patient morbidity, mortality, ICU length of stay, and healthcare-related costs. Therefore, including this project's educational intervention in the trauma ICU nurses' mandatory yearly competency training, as well as in new hire nursing orientation should be strongly considered by nursing management.

This study revealed that future research exploring unit-specific barriers to using the UK Ventilator Separation Protocol as perceived by trauma ICU nurses could help to further improve documentation adherence. The addition of an in-room assessment tool significantly improved nursing compliance to documenting use of the UK Ventilator Separation Protocol after the educational intervention, suggesting that the protocol should be made easily accessible to the nurses by placing a laminated copy in the unit's nursing stations and in the unit binder.

Furthermore, ongoing chart audits for nursing documentation of adherence to protocol use could be performed by unit clinical nurse specialists to ensure continued compliance and improved patient outcomes. Additionally, future studies could further investigate patient variables that may have affected increased mechanical ventilator days and ICU length of stays such as infection, multiple comorbidities, barotrauma, coagulopathies, delirium, disease processes, traumatic injuries, age, gender, and race. Future studies should use a more robust patient sample size and could include retrospective patient chart audits to compare current patients with similar ones based on matched time frames, demographics, and comorbidities.

The cost implications for future practice from this study are potentially significant. According to Kaier et al. (2020), mechanical ventilation is associated with a 59% increase in average daily cost of ICU care. The average daily cost difference between mechanically ventilated versus non-mechanically ventilated patients is $4,772 and $3,250, respectively, with a total difference of $1,522 (Kaier et al., 2019). The cost-benefit analysis for this project yielded a cost-benefit ratio of 1.5. A cost-benefit ratio greater than one indicates that the benefits of this project exceed the costs, making the project financially viable. The average daily cost of a UK Healthcare trauma ICU patient stay versus a telemetry patient stay is $6,962 and $4,744, respectively, with a total difference of $2,218. The total benefit for UK Healthcare in the trauma ICU is $3,740 per day and $1.4 million per year.

Further implications for future practice include expanding this study to include eICU physicians in order to develop a fast-track extubation order set within EPIC to streamline the extubation process, as well as further reduce mechanical ventilator days and ICU length of stays for trauma ICU patients. This has been done successfully at other academic medical institutions across the country among different patient populations. Research has shown that a nurse-led

extubation protocol was as safe as physician-guided extubation, showing similar complications and mortality rates, significantly reducing mechanical ventilation time, and possibly being effective in cost reduction (Serena et al., 2019). Future studies should include patient variables and examine factors that could have led to increased mechanical ventilator days and ICU length of stays such as patient comorbidities and hospital complications as possible contributing factors. This could be done as a tiered study in which another researcher could measure patient outcomes at 6 months and 12 months and compare them based on contributing factors, as well as seasonality trends. Additional studies should focus on patient parameters that are modifiable and those that are not. Non-modifiable patient parameters include the patients' age, mechanism of trauma, and related injury severity. Modifiable patient parameters include measures such as specific mechanical ventilator strategies to prevent acute respiratory distress syndrome (ARDS), strategies to prevent infection, and fluid resuscitation using colloids to prevent increased mortality. Evidence has shown that by avoiding secondary effects, extended stays in the ICU might be considered preventable and strategies that sufficiently reduce complications can reduce ICU length of stay in trauma patients (Böhmer et al., 2014). Moving forward with this for practice, providers must consider the patient's ISS as well as comorbid conditions when considering extubation using the UK Ventilator Separation Protocol. Providers must always optimize medical management before considering extubation.

Limitations

There were several factors that limited the generalizability and strength of the results from this DNP project. Despite a response rate of 21 trauma ICU nurses to the pre-survey, only 17 nurses completed the post-survey. There were only about 32 total nurses who were eligible to complete the surveys, so this project was limited by the small sample size. The survey process

was anonymous, but the participants were asked to create a unique identifier using a street name they'd lived on followed by the year they were born. This made data analysis difficult when trying to match the pre-surveys to the post-surveys as only six of the participants used the same unique identifier on their pre- and post-surveys. Due to this, the data analysis had to be done using the pre- and post-surveys independent of one another which limited the findings and applicability of this study.

There was potential for bias related to the PI's position as an APRN in the trauma ICU at the beginning of this DNP project that may have unfairly influenced nursing participation. Due to the nature of this project's design, long-term information retainment was unable to be measured. This project was completed over the course of about six months including the dissemination of the pre-surveys and completion of fifteen patient chart audits, followed by the educational intervention then waiting approximately three months to disseminate the post-surveys. Next, fifteen post-intervention chart audits were completed then an in-room assessment tool was implemented, followed by another fifteen post-intervention patient chart audits. Although there were statistically significant increases seen in nursing confidence, utilization, and competence using the UK Ventilator Separation Protocol during this study, it is impossible to ascertain whether or not they will retain this information long-term, and this is a significant limiting factor. Additionally, the statistically significant decreases seen in both mechanical ventilator days and ICU length of stays among trauma ICU patients cannot be determined to solely be the result of nurses' use of the UK Ventilator Separation Protocol as there are numerous contributing factors present. Lastly, the educational intervention was not mandatory; therefore, differences in the post-intervention survey responses might not be attributed to the educational intervention itself.

Conclusion

Many patients in the ICU require intubation and respiratory support by a mechanical ventilator. Prolonged intubation and mechanical ventilation are associated with inadequate use of ICU and hospital resources compared to the number of days spent in an ICU, high in-hospital and post-discharge mortality, decreased functional capacity, poor quality of life after the ICU, and high healthcare costs compared with patients who have fewer intubation days and require mechanical ventilation for a shorter period of time (Hill et al., 2017). Patient demographic variables such as advanced age, male gender, BMI >30, white ethnicity, and tobacco use, as well as comorbidities such as COPD, T2DM, and HFrEF make them more susceptible to requiring increased mechanical ventilator days and, thus, increased ICU length of stays. The evidence supports that comprehensive mechanical ventilator weaning and extubation protocols shorten the total duration of mechanical ventilation, reduce weaning duration, decrease ICU length of stay, and lower resource use/medical costs without significantly impacting mortality, reintubation rates, or adverse events (Burns et al., 2021; Ghauri et al., 2019; Hetland et al., 2018; Jhou et al., 2021; Munshi & Ferguson, 2018; Nitta et al., 2019; Perkins et al., 2018; Pham et al., 2023; Saiphoklang & Auttajaroon, 2018; Statlender & Singer, 2021; & Vetrugno et al., 2020).

A formal literature review revealed a gap between the perceived importance of reducing intubation days and utilization of a validated mechanical ventilator weaning and extubation protocol in the ICU. Using the Iowa Model of EBP, this DNP project found that web-based educational interventions and in-room assessment tools can significantly improve the confidence, utilization, and competency among ICU nurses caring for mechanically ventilated patients in the trauma ICU at UK Healthcare, as well as improve patient outcomes. This project's findings were consistent with current literature and may serve as a foundation for addressing gaps in clinical

practice through mandatory yearly nurse competency training, as well as in new hire nursing orientation. The trauma ICU nurses, nurse management, and interdisciplinary team members, as well as leadership and other ICUs within UK Healthcare can utilize the findings from this project to implement additional evidence-based practices and innovative interventions that aim to reduce patient mechanical ventilator days and ICU length of stays, and thereby, improve ICU patients' overall health outcomes and recovery.

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List of Tables

Table 1: Comparison of Pre- and Post-Intervention Patient Demographics and Comorbidities

	Pre-intervention (n = 15) n (%)	Post-intervention (n = 15) n (%)	p-value
Age			
18-40	3 (20%)	6 (40%)	.14
41-65	3 (20%)	4 (27%)	
66-87	9 (60%)	5 (33%)	
Gender			
Male	11 (73%)	14 (93%)	.14
Female	4 (27%)	1 (7%)	
BMI			
<18.5	1 (6%)	0 (0%)	
18.5-24.9	3 (20%)	9 (60%)	.072
25-29.9	4 (27%)	3 (20%)	
30-39.9	4 (27%)	3 (20%)	
>40	3 (20%)	0 (0%)	
Ethnicity			
White	13 (86%)	13 (86%)	1.00
Black	1 (7%)	1 (7%)	
Hispanic	1 (7%)	1 (7%)	
Tobacco use			
Yes	10 (67%)	9 (60%)	.70
No	5 (33%)	6 (40%)	
COPD			
Yes	12 (80%)	7 (47%)	.058
No	3 (20%)	8 (53%)	
HTN			
Yes	9 (60%)	10 (67%)	.70
No	6 (40%)	5 (33%)	
HLD			
Yes	8 (53%)	8 (53%)	1.00
No	7 (47%)	7 (47%)	
T2DM			
Yes	7 (47%)	4 (27%)	.26
No	8 (53%)	11 (73%)	
HFrEF			
Yes	4 (27%)	1 (7%)	.33
No	11 (73%)	14 (93%)	

Table 2: Top 3 Mechanisms of Trauma at UK Healthcare in 2023

	Fall (n = 2130)	MVC (n = 1104)	MCC (n = 278)
Mechanism of Trauma	45.6%	23.6%	5.9%

Table 3: Comparison of Knowledge and Confidence Using the UK Ventilator Separation Protocol Pre- and Post-Intervention

	Pre-intervention (n = 21) *mean* (SD)	Post-intervention (n = 17) *mean* (SD)	p-value
Heard of Protocol	3.81 (1.17)	4.65 (0.61)	.008
Comfort Using Protocol	2.95 (1.16)	4.06 (0.97)	.003
Confidence Speaking to Provider About Protocol	3.57 (1.21)	4.47 (0.62)	.006
Know Where to Find Info on Protocol	3.62 (1.12)	4.47 (0.80)	.012

Note: Response options ranged from 1-5 with 1 = 'Strongly Disagree/Extremely Uncomfortable' to 5 = 'Strongly Agree/Extremely Comfortable'

Table 4: Comparison of Pre-Intervention, Post-Intervention, and Post-Assessment Tool Patient Chart Audits Using the UK Ventilator Separation Protocol

	Pre-intervention (n = 15)	Post-intervention (n = 15)	Post-assessment tool (n = 15)
Protocol used, % yes	0%	33.3%	80.0%

Table 5: Comparison of Pre- and Post-Intervention Patient Mechanical Ventilator Days and ICU Length of Stays

	Pre-intervention median (interquartile range)	Post-intervention median (interquartile range)	*p*-value
Mechanical Ventilator Days	6 (3-14)	2 (1-3)	.001
ICU Length of Stays	27 (10-44)	2 (1-5)	<.001

Table 6: Comparison of Injury Severity Score Pre- and Post-Intervention

	Pre-intervention (n = 54)	Post-intervention (n = 30)
Injury Severity Score >16	47.3%	27.4%

List of Appendices

Appendix A: Departmental Letter of Support

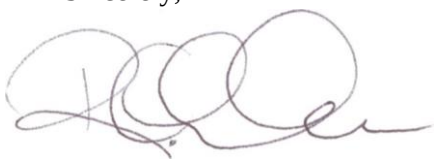
June 29, 2023

To Whom It May Concern,

The letter is to indicate my support of Brittany Monroe's nursing research project to improve the knowledge, confidence, and competency among trauma critical care nurses concerning the benefits of the Ventilator Separation Protocol, to be conducted at UK HealthCare.

Prolonged intubation and mechanical ventilation are associated with prolonged use of critical care services, increased hospital length of stay, increased mortality, increased risk of hospital acquired infections, and poorer quality of life post discharge. Increasing the knowledge and competency for utilizing this protocol could reduce intubation days as well as improve the overall outcomes for these patients.

Please feel free to contact me at 859-323-4392 if I can provide any additional information.
Sincerely,



Rebecca Charles, DNP,NEA-BC
Patient Care Manager
Trauma/Surgical Services 7-100 IC

Appendix B: Nursing Research Counsil Approval Letter

Date: 8/09/2023

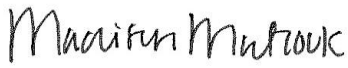
Dear Brittany Monroe,

Your proposal "Improving knowledge, confidence, and competency among ICU Nurses concerning the benefits of using the UK Ventilator Separation Protocol" was reviewed via Zoom by the Nursing Research Council on 08/09/2023 at the University of Kentucky Medical Center, and we are happy to report that your proposal has been approved. If you have not yet obtained approval for your research through the University of Kentucky Institutional Review Board (IRB), you must complete this process as well.

The Nursing Research Council reviews all proposals to conduct scientific inquiry that involve UK nursing staff in an effort to assess for a number of indicators: to determine the feasibility of conducting the proposed research, to establish the level of support from nursing management or administration to conduct the research, to determine the applicability to nursing, to facilitate IRB review ensuring proper protections are present, and to assess the completeness of the proposal. If your proposal is amended in any way such that the methods or procedures are modified significantly, your proposal must be resubmitted for review by this Council. ***You are required to provide your IRB number, approval date, status and completion date to this council for compliance with Magnet verification requirements. If this information is not supplied to the NRC, we reserve the right to obtain this information from the IRB for compliance with Magnet designation and verification requirements.***

Please contact us if you need further assistance, have questions, or wish to discuss anything.

Sincerely,



Madison Matlock, BSN, RN
Chair Nursing Research Council

Office of the Executive Vice President for Health Affairs
University of Kentucky • 317 Wethington Building • 900 South Limestone • Lexington, Kentucky 40536-0200
Phone: (859) 323-5126 • Fax: (859) 323-1918 • www.ukhealthcare.uky.edu

Appendix C: Cover Letter

To Potential Study Participants:

Researchers at the University of Kentucky (UK) are inviting you to take part in a pre- and postsurvey about your knowledge, confidence, and competency using the UK Ventilator Separation Protocol. The purpose of this study is to improve the knowledge, confidence, and competency among trauma ICU nurses at UK Healthcare concerning the benefits of using the UK Ventilator Separation Protocol. This will be achieved by you first completing a pre-survey to measure your knowledge of and self-rated confidence level using the UK Ventilator Separation Protocol. Next, an educational PowerPoint presentation regarding the use of the UK Ventilator Separation Protocol will be presented and published. Then, those who chose to participate will be given a post-survey to assess for an increase in their baseline knowledge and self-rated confidence using the UK Ventilator Separation Protocol. Finally, a post-survey chart audit of 15 trauma ICU patients will be performed to determine nursing compliance to using the UK Ventilator Separation Protocol.

Although you may not get personal benefit from taking part in this research study, your responses may help us understand more about what steps might be appropriate in reducing intubation days, and thereby improving overall outcomes, for patients in the trauma ICU at UK Healthcare. Some volunteers experience satisfaction from knowing they have contributed to research that may possibly benefit others in the future.

Researchers will review and collect information from your survey answers and through postsurvey chart audits. You will be asked to enter a unique identifier in the survey, such as the year you were born with a street name, to match your pre- and post-surveys for data analysis while still maintaining your anonymity. This identifier will not reasonably disclose who you are.

If you do not want to be in the study, there are no other choices except not to take part in the study. The survey will take about 10 minutes to complete. Although we have tried to minimize this, some questions may make you upset or feel uncomfortable and you may choose not to answer them. If some questions do upset you, we can tell you about some people who may be able to help you with these feelings.

Your response to these surveys is anonymous which means no names, IP addresses, email addresses, or any other identifiable information will be collected with the survey responses. We will not know which responses are yours if you choose to participate.

We hope to receive completed surveys from about 25 people, so your answers are important to us. Of course, you have a choice about whether or not to complete the surveys, but if you do participate, you are free to skip any questions or discontinue at any time. You will not be penalized in any way for skipping or discontinuing the surveys.

Please be aware, while we make every effort to safeguard your data once received from the online survey company, given the nature of online surveys, as with anything involving the internet, we can never guarantee the confidentiality of the data while still on the survey company's servers, or while en

route to either them or us. It is also possible the raw data collected for research purposes will be used for marketing or reporting purposes by the survey/data gathering company after the research is concluded, depending on the company's Terms of Service and Privacy policies.

If you have questions about the study, please feel free to ask; my contact information is given below. Thank you in advance for your assistance with this important project. To ensure your responses will be included, please submit your completed survey within 4 weeks of receiving this invitation.

If you agree to participate, the survey can be assessed here:

https://uky.az1.qualtrics.com/jfe/form/SV_8D19yPwNPEd4n8a

Sincerely,

Brittany Monroe
College of Nursing, University of Kentucky
(859) 533-1350 brittany.monroe@uky.edu

Dr. Candice Falls
College of Nursing, University of Kentucky
(270) 535-4262
cdharv0@uky.edu

If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the staff in the University of Kentucky Office of Research Integrity at 859-257-9428 or toll-free at 1-800-400-9428.

Appendix D: IRB Approval Letter

XP Initial Review

Approval Ends:	IRB Number:
10/4/2024	89167

TO: Brittany Monroe, BSN, MSN
College of Nursing
PI phone #: 8595331350

PI email: brittany.monroe@uky.edu

FROM: Chairperson/Vice Chairperson
Medical Institutional Review Board (IRB)

SUBJECT: Approval of Protocol

DATE: 10/6/2023

On 10/5/2023, the Medical Institutional Review Board approved your protocol entitled:

Improving Knowledge, Confidence, and Competency Among ICU Nurses Concerning the Benefits of Using the UK Ventilator Separation Protocol

Approval is effective from 10/5/2023 until 10/4/2024 and extends to any consent/assent form, cover letter, and/or phone script. If applicable, the IRB approved consent/assent document(s) to be used when enrolling subjects can be found on the approved application's landing page in E-IRB. [Note, subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless special waiver has been obtained from the IRB.] Prior to the end of this period, you will be sent a Continuation Review (CR)/Annual Administrative Review (AAR) request which must be completed and submitted to the Office of Research Integrity so that the protocol can be reviewed and approved for the next period.

In implementing the research activities, you are responsible for complying with IRB decisions, conditions and requirements. The research procedures should be implemented as approved in the IRB protocol. It is the principal investigator's responsibility to ensure any changes planned for the research are submitted for review and approval by the IRB prior to implementation. Protocol changes made without prior IRB approval to eliminate apparent hazards to the subject(s) should be reported in writing immediately to the IRB. Furthermore, discontinuing a study or completion of a study is considered a change in the protocol's status and therefore the IRB should be promptly notified in writing.

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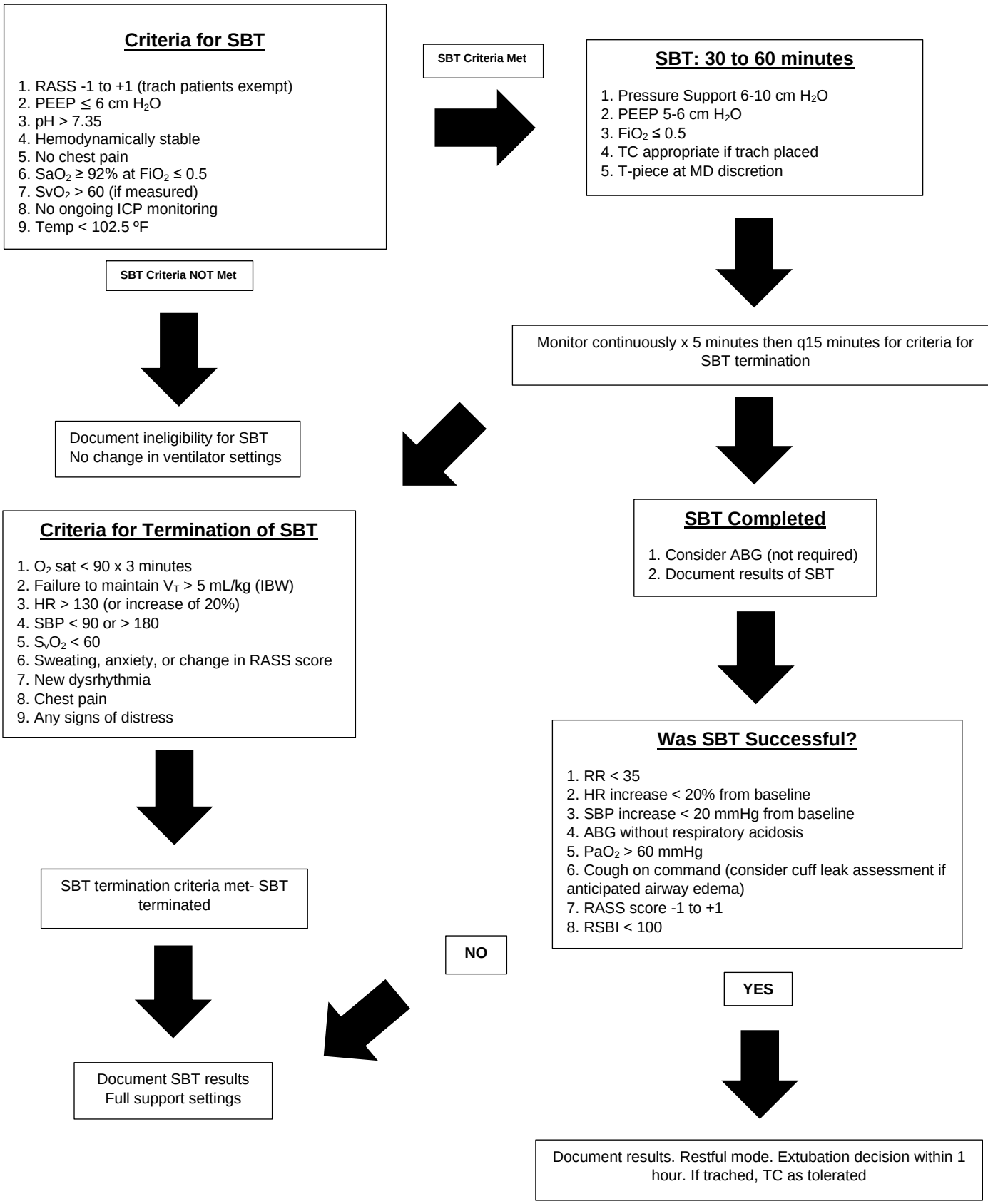
For information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research" available in the online Office of Research Integrity's IRB Survival Handbook. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI's web site. If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at 859-257-9428

Appendix E: UK Ventilator Separation Protocol



Appendix F: Pre- and Post-Intervention Survey Questionnaire

UK Ventilator Separation Protocol Survey

1. If a patient is on a low-dose vasopressor, do they qualify for a spontaneous breathing trial?

- **Yes**
- **No**

2. A patient on an FiO2 of 50% and PEEP of 6 should receive a spontaneous breathing trial.

- **True**
- **False**

3. A patient can be on sedation and still receive a spontaneous breathing trial.

- **True**
- **False**

4. A patient who has this is considered to have failed their spontaneous breathing trial.

- **HR >130**
- **SBP <100**
- **RR >30**
- **All of the Above**

5. Which criteria does a patient have to meet to pass a spontaneous breathing trial?

- **RR <35**
- **RSBI <100**
- **PaO2 >60**
- **All of the Above**

6. I know where to document the results of a spontaneous breathing trial in EPIC.

- **True**
- **False**

7. I have heard of the UK Ventilator Separation Protocol.

- **Strongly disagree**
- **Somewhat disagree**
- **Neither agree nor disagree**
- **Somewhat agree**
- **Strongly agree**

8. I feel comfortable using the UK Ventilator Separation Protocol.

- **Extremely uncomfortable**
- **Somewhat uncomfortable**
- **Neither comfortable nor uncomfortable**
- **Somewhat comfortable**
- **Extremely comfortable**

9. I feel confident speaking to the provider about the UK Ventilator Separation Protocol pass/fail criteria.

- **Strongly disagree**
- **Somewhat disagree**
- **Neither agree nor disagree**
- **Somewhat agree**
- **Strongly agree**

10. I know where to find information about the UK Ventilator Separation Protocol.

- **Strongly disagree**
- **Somewhat disagree**
- **Neither agree nor disagree**
- **Somewhat agree**
- **Strongly agree**

Appendix G: Chart Audit Form

UK Ventilator Separation Protocol Chart Audit Form

Did the patient meet the criteria for a spontaneous breathing trial? Y or N

Did the patient receive a spontaneous breathing trial? Y or N

Did the nurse continuously monitor for 5 minutes then every 15 minutes (and document) for a total of 30-60 minutes for spontaneous breathing trial termination? Y or N

Did the patient meet any of the spontaneous breathing trial termination criteria and was this documented? Y or N

If the spontaneous breathing trial was successful, was it documented appropriately? Y or N

If the patient passed their spontaneous breathing trial, were they extubated within 1 hour of spontaneous breathing trial completion? Y or N

If the patient passed their spontaneous breathing trial, but were not extubated within 1 hour of spontaneous breathing trial completion was the reason documented? Y or N

Did the nurse caring for this patient correctly follow all of the UK Ventilator

Separation protocol criteria and document everything appropriately? Y or N