Summer 8-7-2018

Improve Effectiveness in Trauma Teamwork

Ginger Miramontes
ginger.miramontes@gmail.com

Improving Effectiveness in Trauma Teamwork: Driving Ventilator Associated Events to Zero

Ginger Miramontes

University of San Francisco

Committee Members: Trauma Services, Intensive Care Unit, and Infection Control

July 2018

Acknowledgments

I would like to thank Professor Cathy Coleman – the inspiration and depth in leadership that she has shared will prove to be invaluable for my future growth. Professor Coleman's encouragement and support have assisted my professional growth and accomplishment of a Master Degree in the Nursing – Clinical Nursing Leadership program at University of San Francisco.

Special appreciation goes to my family who provided love and support as I endured all of the extra time studying. Gratitude to all of my closest friends who spent countless hours proofreading the complex papers that got me to this point. Returning to college to achieve the goal of a MS CNL degree is a tremendous undertaking for us all. Appreciation goes to my colleague and classmate Maykel Alonso, for his wit and assurance to endure this journey of advancing our education.

Thank you to Regional Medical Center of San Jose trauma department, intensive care unit, and respiratory care, operating room, and trauma surgeons, in addition to all the clinicians for providing the resources needed to complete the evidence-based project.

Abstract

On average, each Ventilator-Associated Event (VAE) is anticipated to increase the length of stay in the Intensive Care Unit (ICU), resulting in potential adverse events and cost to the organization. The Center for Disease Control (CDC) defines VAE as the increase of daily minimum positive end-expiratory pressure (PEEP) and fraction of inspired oxygen (FiO2) values, after a baseline period of patient stability or improvement on the ventilator (CDC, 2018). Standard endotracheal tube designs have led to the incidence of VAE because of the accumulation of subglottic secretions in the trachea. Untreated VAE can later result in Ventilator Associated Pneumonia (VAP). A clinical nurse leader (CNL) focuses on all clinical elements to reduce subglottic secretions by leading a practice improvement project in the Level II Trauma Center of a mid-sized suburban community hospital with assistance of a multidisciplinary team called *Prevent VAE Team.* The multidisciplinary team will assess the incidence of VAE and aim to evaluate interventions that increase adherence to evidence-based practices to reduce VAP. A retrospective case review reveals that the pattern and prevalence of VAE is primarily related to the presence of the standard endotracheal tube, which causes accumulation of subglottic secretions in the trachea, on patients hospitalized in the ICU setting. Based on the observed variation in the ICU microsystem, placing subglottic endotracheal tubes (SETT) into the operating room (OR) and emergency medical system (EMS) settings appears to address the root cause of excessive VAE in the ICU setting. Providing front line staff feedback, debriefing, and coaching brought awareness to achieve the long-term goal of reducing VAE to zero. Over a 6-month period, this improvement project resulted in reduction of VAE from 31 ICU events (six attributed to trauma patients) to three ICU events (0 attributed to trauma patients). The improvement project supports the creation of a culture of safety, continuous improvement,

evidence-based practice, and cost avoidance in the ICU. The organizational commitment to this project will extend over a 1-year period.

Keywords: Ventilator-Associated Event, Intensive Care Unit, positive end-expiratory pressure, fraction of inspired oxygen, Ventilator Associated Pneumonia, Ventilator Associated Pneumonia, subglottic endotracheal tube.

Introduction

Increased mortality projections have been associated with increase Intensive Care Unit (ICU) length of stay (Bekaert, 2011). The problem is that on average, a diagnosis including ventilator-associated event (VAE) is anticipated to increase ICU length of stay by a mean of 4.3 days with a 95% confidence interval, 1.5 – 7.0 day: P<.001 (Vincent, 2012).

The Center for Disease Control (CDC) defines VAE as the increase of daily minimum positive end-expiratory pressure (PEEP) and fraction of inspired oxygen (FiO2) values, after a baseline period of patient stability or improvement on the ventilator for over 48 hours (CDC, 2018). Daily min FiO2 has to increase >= 0.20 (20 points) for >=2 days. PEEP value is defined by a daily min PEEP increase >= 3 cm H2O maintained for >=2 days (NHSN, 2017).

Untreated VAE can later result in Ventilator Associated Pneumonia (VAP). For a VAP to occur, the VAE patient has to have a spike in temperature and increase of white blood cells (WBC). Fever is defined as a body temperature of >100.4 ºF or >38 ºC. White blood cell (WBC) is defined as increase of WBC >12,000 cells/mm³ or <4,000 cells/mm³. All ventilated patients with early identification of pneumonia will start new antimicrobial agent(s) and will continue the treatment for >= 4 days (NHSN, 2017). These differentiation factors determine whether a patient has VAE or a VAP.

Standard endotracheal tube designs have led to the incidence of VAE because of the accumulation of subglottic secretions in the trachea. With the accumulation of secretions, the patient is at risk to develop a biofilm that will lead to the growth of

microorganisms. Reduction of subglottic secretions will eliminate the bacterial-rich environment, which generates VAP (Muscedere et al., 2011). The diagnosis of VAP is normally seen in the electronic health record, so for the emphasis of this project will refer to VAP as the acute diagnosis derived from adverse ventilator associated event (National Health Safety Network [NHSN], 2017).

Available knowledge

In 2013, NHSN through a multidisciplinary collaborative integrated by Critical Care Societies, American College of Chest Physicians, American Thoracic Society, American Association for Respiratory Care, Association of Professionals in Infection Control and Epidemiology, Council of State and Territorial Epidemiologists, Healthcare Infection Control Practices Advisory Committee's Surveillance Working Group, Infectious Diseases Society of America, and Society for Healthcare Epidemiology of America, develop objective criteria for determining VAE as a hospital-acquired infections (NHSN, 2017). The VAE Surveillance Algorithm (Appendix A) objectively demonstrate a standardized measure to consistently define VAE.

Over 300,000 patients per year in the United States will incur medical conditions that warrant mechanical ventilation (Cason, Tyner, Saunders, & Broome, 2007). Ventilator-associated events are preventable. As CNLs, it is our mission to improve patient outcomes by ensuring the safe delivery of VAE prevention bundles. The goal of this quality improvement project is to reduce subglottic secretions, which produce biofilm on the endotracheal tubes that provide the bacterial-rich environment, which generates VAE.

Problem description

With the accumulation of secretions, the patient is at risk to develop a biofilm that will lead to the growth of microorganisms. Reduction of subglottic secretions will eliminate the bacterial-rich environment, which generates VAP (Muscedere et al., 2011). During a prospective meta-analyses cohort study with randomized controlled trials, a multicenter European study shows VAE to be the most common Hospital Associated Condition (HAC) in the ICU, with a mortality associated of 24% to 71%. The study shows that the most common causative organisms are Staphylococcus aureus, Pseudomonas aeruginosa, and Enterobacteriaceae. These organisms affect 9% to 24% of ventilated patients (Vincent, 2012).

The most costly HAC that affects the local Level II Trauma Center is VAE. The incidence of VAE that drew the trauma department's attention was that 21 VAE events has been attributed to ventilated trauma patients in 2017. In the first six months of 2018, 6 events are identified as HAC (CDM, 2018).

In a comprehensive microsystem assessment, VAE identification continues to be the highest HAC incidence of the Trauma Quality Improvement Program's (TQIP) report. Over the last year, the incidence of VAE has increased to be the number one HAC in the Level II Trauma Center's ICU. From January to June 2018, there has been six VAE cases identified. Although the number may not seem daunting, that increased mortality associated with VAE, is a stimulus for action for the multidisciplinary team, called *Prevent VAE Team* (TQIP, 2018).

The 2017 American College of Surgeons (ACS) verification report identifies that the Trauma department coordination with the medical center's Quality department is in need to improve quality, at the systems-level by reducing VAE as a HAC (ACS, 2017). As a risk anticipator, the CNL leading this project guide the system level change in the ICU micro-system.

The CNL from the Trauma department operates in the mesosystem and works as a patient advocate addressing VAE at the point of care. Coordination of the high-functioning multidisciplinary team requires focused understanding of the expertise that each team member brings to solve this multifactorial problem of eliminating VAE in the Level II Trauma Medical Center.

Knowledge

In the Level II Trauma Center, 96,000 patients receive treatment in 2017. 2,400 of these patients are Trauma. Out of the 96,000 patients, 117 are attributed to have a diagnosis of VAP. Of those 117 VAP patients, 93 are medical and 24 trauma patients. The cost to the patient is an increased risk for morbidity and mortality associated with the HAC. After examining the first six-months of 2018, there are six patients that developed VAP (CDM, 2018). Despite the slight decrease of VAP in 2018, the facility is still far from their goal of aim to zero VAP by 2019. Our goal is to drive the prevalence to zero within the year.

Evidence-based practice shows that the development of biofilm that travels from the endotracheal tube into the lungs is identified as the source that leads to VAP. The biofilm is the reservoir for the bacterial to grow, which is encapsulated and makes treatment more complicated (Levasseur, 2001).

Subglottic Endotracheal tube (SETT)

Endotracheal tube designs have led to the incidence of VAP. The design of endotracheal tubes, when positioned into the tracheal creates a space that accumulates subglottic secretions (American Thoracic Society, 2004). The area where these subglottic secretions pool is where that accumulation of fluid provides a great vector for growing bacteria, which then can migrate down

the endotracheal tubes. The original design of endotracheal tubes and even tracheostomy tubes is considered the cause of VAP (Tablan, Anderson, Besser, Bridges, & Hajjeh, 2003). Any device that leads to the buildup of secretions below the vocal cords, secured in place with a cuff that holds the airway device in place, is determined the contributing factor for VAP. The area of pooled secretions provides a direct path of bacteria into the lungs by way of the endotracheal tubes. Current research from Society of Healthcare Epidemiology of America (SHEA), Center for Disease Control and Prevention (CDC), and American Thoracic Society recommends SETT to reduce subglottic secretions in ventilated patients requiring over 48 to 72 hours of intubation (Klompas, 2015). The benefit of reducing subglottic secretions leads to the multidisciplinary team approach from clinical experts, with the focus by all is to reduce the environment that prevents biofilm growth.

Multidisciplinary team

The trauma center's multidisciplinary team is comprised of trauma surgeons, intensivist and emergency medicine doctors, and anesthesiologist to represent the physician component of our team. The nursing component is championed by emergency department (ED), operating room (OR), and ICU nurses. Department/facility leadership are members to facilitate the organizational changes at the macrosystem level. The Infection Control and Quality are at the heart of the team. Each clinical expert is a representative of a larger group of professionals to work with the multidisciplinary team and hard-wire the utilization of SETT and to improve performance on the ventilator bundles. The organizational goal is to reduce subglottic secretions and drive VAP to zero.

Rationale

Informational interviews are used to gain a clear understanding of what are the contributing factors that cause VAE (Morris et al., 2011). After a series of interviews, the CNL develops an Ishikawa diagram displaying the potential causes of a VAE in order to identify its root causes (see Appendix B). The fishbone diagrams are presented to the *Prevent VAE Team;* the team determines that the focus of reducing subglottic secretions is the specific aim for the phase I of the project. The fishbone demonstrates the relationships between VAE and reduction of subglottic secretions. The priority is to utilize a SETT for intubation greater than 48 hours during all ICU admissions (see Appendix B).

The CNL reviews the VAE quality performance bundles, current facility's policies, and perform daily nursing practice assessments to identify other causes that contribute to the VAE events. This is the foundation to prioritize the team plan for action. These findings are synthesized into a process flow diagram to facilitate a multidisciplinary team discussion about assignment of responsibilities, how the process should be completed, and how the project will succeed (see Appendix C).

Having an understanding of the leadership changes at the organization level provides a clear leadership path for the CNL to affect and impact a change of this size. The structure of the quality initiative is crucial to develop a culture that will align with the organizational goals to eliminate VAE. The adoption of the goal to reduce SETT secretions became evident, as the context of each multidisciplinary team members' anecdotal remarks led to that same intervention Identification of the varying aspects that each team represented to decrease subglottic secretions became the obvious first phase of the project to reduce VAE (*Prevent VAE Team*, 2018).

PICOT statement

Patient

The patients included in the Prevent VAE improvement project are all patients in the ICU who require mechanical ventilation for over 48 hours. Trauma patients are the primary focus due to the identification of the incidence in the Level II Trauma Centers ACS Report (ACS, 2017).

Problem

The problem occurs when the accumulation of subglottic secretions occur. When there is not a subglottic suction device present on the endotracheal tube, the ICU patient is more susceptible to VAE. Untreated VAE can later result in Ventilator Associated Pneumonia.

Intervention

Standardization of the Endotracheal tubes in the ICU that allows subglottic suctioning on all ICU admitted patients. Revision of the ICU daily rounding flowsheet is to align with VAE prevention bundles and to prevent inconsistency of practice amongst the multidisciplinary team.

Comparison

The comparison of patients who develop VAE with those patients who are ventilated and do not develop VAE.

Outcomes

Consistent reduction of subglottic secretions in all ICU ventilated patients and increase multidisciplinary team VAE bundle compliance to prevent VAP.

Time

The project consist of two phases. Phase 1: From July 1 to July 31, all ICU ventilated patients will prioritize the use of SETT and the team will assure compliance with the VAE bundle aimed by the use of the multidisciplinary ICU daily rounding flowsheet (see Appendix

D). Phase 2: The facility will evaluate the effectiveness of the SETT and facilitate evaluation of the SETT utilization in the prehospital environment (EMS).

Specific aim

The *Prevent VAE Team*'s aim is to implement evidence-based practice strategies to reduce the incidence of VAE. By July 31, 2018, the Level II Trauma Center will revise, operationalize, and improve the Prevent VAE teams' bundle compliance by 20%. This will improve performance of the following evidence-based practice guidelines.

Trauma Surgeons and Intensivists

- Prioritize utilization of endotracheal tubes with subglottic suctioning (hi-lo tube) to clear subglottic space. This will include a ICU assessment for switching to the SETT.
- Monitor daily VAE bundles for compliance.
- Orders to maintain the head of bed at 30° to 45° angle unless contraindicated.
- Provide daily sedation vacation to assess patient readiness to wean off of the ventilator.
- Provide enteral feedings within 48 hours of intubation**.**
- Provide peptic ulcer disease treatment.
- Provide Deep Venous Thrombosis prophylaxis treatment.
- Daily intensive care rounds held to evaluate progress, implement early goal-directed treatment plans, and identify any ventilator associated events.

Nursing

- Compliance with VAE bundles for evidence-based care.
- Perform hand hygiene before and after respiratory care.
- Prioritize maintenance of SETT.

- Utilize frequent suctioning, oral care with Chlorhexidine Gluconate twice a day.
- Communicate progress of spontaneous breathing trial with potential to wean.
- Facilitate early mobility.

Respiratory Therapist

- Maintain VAE bundles of trach cuff pressure of at least 20-centimeter water.
- Perform hand hygiene before and after any respiratory care.
- Use disposable ambu-bags that are single patient use only.
- Use heated wire circuits to provide humidity; do not allow condensation to drain backwards. Change circuits only when necessary (14 day cycle or when dirty).
- Participate in frequent suctioning and maintenance of functioning subglottic suction to endotracheal tubes.

Methods

Context

The utilization of a qualitative convergent-care research (CCR) method determines the direction and structure of the multidimensional project. The CCR consists of intentional solutions to a well-known problem, with the introduction of innovative practice improvement initiatives to accomplish a goal (Stevens, 2013). The process improvement project takes place in a 34-bed ICU in a Level II Trauma Center. The population consist of ventilated patients in the ICU setting during the month of July 2018. The project is to refine the multidisciplinary teams' performance to meet standards of evidence-based care. It was important during the change process to preserve the autonomy of the high-functioning multidisciplinary team yet maximize the continuity of the team's performance toward a common goal.

Ishikawa

Analysis of the informational interview process demonstrates the promotion of quality bundle compliance, starting with the assurance of the correct endotracheal tube utilization in the pre-hospital and OR environments. Both the pre-hospital and the OR areas currently are not using the SETT. Consequently, not having the SETT, will predispose the ICU patients to accumulate subglottic secretions, which could lead to a VAP.

The gateway of intubated patients from the pre-hospital setting and the OR are a primary focus to set the process improvement on track. It is determined that having the SETT in these areas, will improved compliance with preventative VAE measures.

The informational interviews held by the trauma in the role of a CNL are to analyze similarly structured open-ended questions format. The team participation, communication and clarification at the multidisciplinary meetings led to the normalization the CNL biases.

Plan

The data elements are collected between July 1 and July 30, 2018 in two phases. The first phase included a computerized data pull from data directly entered in the electronic health record. The development of an integrated database is in use to collect data elements that are structured by input from the multidisciplinary team. The Director of Quality creates the database. Additional manual data is collected from the ICU daily rounding form (see Appendix D).

To guarantee reliability, the information from the ICU rounding form is a standardized answer picklist, of the most common answers, with limited fill-in capacity. The format is created to standardize the approach. The rounding tool's design meets compliance to the local medical center's critical care team (see Appendix E).

Interventions

The initial step of the *Prevent VAE team* is to review the current Infection Control policy that describes each part of the VAE quality performance bundle. Through informational interviews with each discipline's champions and disruptors alike, their input added into the design of a cause and effect analysis (Levasseur, 2001). The Ishikawa diagram demonstrated the strengths and weakness for the prevention of VAE. Coordination and teamwork are determined to be our process improvement technique.

In a meeting on June 6, 2018, the review of the Ishikawa drawing were analyzed by the team for input. From there, the team engaged in a deep dive analysis, which unanimously pointed the multidisciplinary group in the direction of reducing subglottic secretions. Each discipline is a champion of a multifaceted approach to re-engage their team with top performance goals. The importance of utilizing a transformational leadership style is to engage the leaders within the microsystem, to unfreeze their team's current behaviors, and to prioritize a re-energizing spirit to adopt this change (Levasseur, 2001).

The members of the *Prevent VAE* team are challenged with a state of many organizational changes, competing priorities and transition of upper leadership. The focus is to drive quality initiatives and improve medical center performance as the mission of the organization in heading toward a "Highly Reliable Organization" (Beyea, 2012).

An understanding of the benefit to decrease VAE is to improve patient outcomes as the driving force for the team to be committed to the ventilator bundle compliance. The reduction in subglottic secretions is tied to ventilator bundle daily performance. The trauma nurse in the role of the CNL demonstrate the clinical expertise and leadership to navigate the multidisciplinary team to accomplish these goals.

The development of a VAE tracking database is championed with the assistance of the Director of Quality (see Appendix E). The ability to measure and communicate the team's results are key to benchmark progress in the program (AACN, 2017).

Operating room change process

One challenge is the introduction of the SETT into the OR. The anesthesia champion introduces the SETT process in the OR. Intubation of all patients not to be immediately extubated post-operatively will have the newly identified process utilizing the SETT. The change in equipment and practice requires education to the OR/anesthesia team. The staff education is provided on June 17 and June 19, 2018 by the CNL and the OR educator following the project timeline (see Appendix F). This included four sessions of education with the anesthesiologist on site. Evidence base articles are provided to reinforce knowledge. The change of SETT takes place as plan on July 1, 2018. The anesthesia champion engaged any technique questions and managed all performance measure in association with the utilization of the subglottic endotracheal tube.

The adaptation to placing the subglottic endotracheal tube is consider minor to address placement technique. The suggestions for managing the secondary pigtail associated with the subglottic suction are explained for optimal endotracheal tube placement (see Appendix G). The OR RN staff are educated on the elements to address connecting the subglottic suction to low intermittent suction and reassessment during the case to ensure functioning status and no clogging from thick secretions. Live demonstration, plus hands-on return demonstrations are utilized to instruct the OR team.

The population of traumatic brain injury patients and trauma patients in extremus are determined to achieve the most benefit from early placement and evacuation of subglottic

secretions. On analysis of pre-implementation data, these two cohorts of patients had the highest incidence of VAE. The initial injury pattern was determined to play a factor in incidental aspiration at the time of injury/event. Stroke, as well as trauma patients, fell into a similar cohort of high incidence for VAE, who will benefit from prevention strategies.

Subglottic Endotracheal Tube Equipment

The proper equipment availability is an important factor to the success of the OR transition to SETT usage and for all in-hospital intubated patients. The endotracheal tube is standardized in all areas of the medical center, excluding the OR. The in-depth microsystem assessment involved working with the OR team, including the anesthesia technician, to evaluate a convenient location to store the subglottic endotracheal tubes for ease in accessibility. Order information is obtained from the respiratory department leader, and a process is developed to update the OR ordering form, plus reorganization of the anesthesiologists' carts to have the SETT readily available.

All other intubation trays had the SETT as a standard. The intubation tray stocking is managed by the respiratory therapy department, and they collaborate with OR to facilitate this long-awaited change in practice. Lewin's unfreezing process is part of the integration of evidence-based support to engage the OR team to collaborate in the key aspect of adopting the use of the SETT (see Appendix G) (Levasseur, 2001).

Model for Improvement

The model for improvement (MFI) is followed for improving the performance with the ventilator prevention bundles and the focus is to decrease subglottic endotracheal tube secretions. The MFI is used to implement small tests of change (Nuckton, Holko, McKay, & Newman,

2006). Team STEPPS briefing and debriefing was the concept used to support the team's efforts to hardwire successive change measures to accomplish a unified goal to reduce VAE to zero.

The first month of this process improvement project is to decrease the subglottic secretions. The second phase of the project is to introduce early mobilization into the medical center plan plus integrate the pre-hospital evaluation and training into the equation for success with VAE reduction. By analyzing the hurdles that are faced by the trauma/medical teams, the team designed the first phase role out of the project.

Change Strategy

The change strategy of Lewin's unfreezing previous behaviors is changing to new subglottic endotracheal tubes and refreezing the improved teamwork and performance strategies to reduce VAE by 10% within the next month and is the goal of the first phase of the project (Schriner et al., 2010). The team will focus on ensuring all endotracheal tubes utilize the subglottic suction to its fullest performance. The nurses' focus will be on consistent oral care and daily spontaneous breathing trials, in partnership with respiratory therapy and team communication on the updated ICU daily rounding flowsheet to navigate and benchmark the multidisciplinary team's performance.

Multidisciplinary Team Roles

The interdisciplinary team supervisor/director will be responsible for orienting new staff to the VAE reduction focus as part of new hire orientation at the Level II Trauma Center. The unit-specific champions will be responsible for onsite reinforcement for continued success of the project. Huddles will be used to focus priorities of the team communication and progress. Communication is the key element. The TeamSTEPPS briefing strategy will be utilized to provide strategic information to the units for benchmarking progress and motivation for team

effort to support improved VAE prevention bundle compliance (Betts & Healy, 2015). Utilizing the briefing strategy will reinforce the important information. Debriefing will be initiated by the trauma PI CNL, department leadership, and unit-based champions to drive this process 24 hours a day, seven days a week, 365 days a year. The communication will focus on engaging the support of the patient care staff for interactive questions and answers to support the teamwork.

Data

A benchmarking strategic plan will include monthly data distributed on a HACs dashboard to the ED, OR, and ICU. The data will be compiled from a joint effort of the trauma database and electronic medical record. An Access database, designed by the medical center's director of quality, will be used to demonstrate strategic performance. The complex data analysis includes monitoring between multiple ventilator days and complex team performance. Analysis of the process to incorporate all the data elements is essential for the team's improvement and benchmarking strength to drive individual, as well as team, performance. The structured database is designed for growth with each phase of the improvement process. Phase II will include early mobility metrics, in addition to emergency medical services' use of subglottic endotracheal tube placement, to trend improvement and success.

Initial Phase

The initial phase of this two-part project to reduce VAE will be completed by August 2018. Ongoing re-evaluation will be checked each month for the remaining part of 2018. Once the VAE performance bundle change is stabilized, the re-evaluation plan will be quarterly and progress reported to the trauma/medical quality review and operation team meetings.

Change Model

The initial step of the Prevent VAE team was to review the current infection control

policy that describes each part of the quality performance bundle. Through informational interviews with each discipline's champions and traditionalist (Stevens, 2013), we designed a cause and effect analysis of strengths and weakness for our ventilator bundles. Coordination and teamwork of forming, storming, norming, and performing was determined to be our research technique (Betts and Healy, 2015). In a meeting on June 6, 2018, we reviewed the Ischikawa drawing of the team's input. From there, we engaged in a deep dive analysis, which unanimously pointed the multidisciplinary team in the direction of reducing subglottic secretions. Each discipline championed a three-pronged approach to re-engage their team with top performance goals. Transformational leadership engaged the microsystem to unfreeze the current behavior to prioritize an improvement culture. The importance of the trauma PI CNL to utilize a transformational leadership style to engage each of the VAE disciplinary leaders was the important skill to unfreeze the current behaviors. Reprioritization and re-energizing the spirit to adopt the Prevent VAE change was the initial goal. This is an important problem, with the goal of improving outcomes for the ventilated ICU patients. The members of the Prevent VAE multidisciplinary team were challenged with many competing priorities within the organization, in addition to a change in leadership. The focus was to drive quality initiatives and improve medical center performance, so this was a common goal for the ICU department, the trauma department, and the macro system (Viana, Bragazzi, Couto de Castro, Alves, & Rocco, 2013). The clear understanding of complexities plus multivariate factors with each ventilated patient was the multidisciplinary team's motivation to drive their initiative in a competitive spirit (Viana et al., 2013). Understanding the benefit of decreasing VAEs and improving patient outcomes led to the team's commitment to the ventilator bundle compliance of decreasing subglottic secretions. The trauma process improvement RN, working as a clinical expert and leader, and

navigated the multidisciplinary team and developed a database, with the assistance of the quality liaison director, to measure and communicate the team's results.

Lewin's Change Strategy

One challenge is the introduction of the subglottic endotracheal tube into the OR. The OR staff are very structured and rigid to new changes creating a more traditionalist view of change (Schriner et al., 2010). The subglottic endotracheal tube introduction will bring new challenges for the team. The anesthesia champion introduced the change in process to intubate all patients that will not be immediately extubated post-op with the subglottic endotracheal tube. The change in equipment and practice required education for the OR/anesthesia team. On June 7, the OR was educated by the trauma PI CNL and the OR educator. This included four sessions of education that included the anesthesiologist on site. A plan for the change to be initiated July 1, 2018, with evidence-based literature articles, was sent the anesthesia team. The anesthesia champion engaged any technique questions and managed all performance measure in association to the utilization of the subglottic endotracheal tube. The adaptation to placing the subglottic endotracheal tube is considered minor in addressing placement technique with suggestions for managing the secondary pigtail associated with the subglottic endotracheal tube. The OR RN staff was educated on the elements to address connecting the subglottic suction to low intermittent suction and reassessment during the case to ensure functioning status and no clogging from thick secretions.

Population

The population of traumatic brain injury patients and trauma patients in extremus were determined to achieve the most benefit from early placement and evacuation of subglottic secretions. On analysis of pre-implementation data, these two cohorts of patients had the highest

incidence of VAE. The initial injury pattern was determined to play a factor in incidental aspiration at the time of injury/event. Stroke patients, as well, fell into a similar cohort of high incidence for VAE prevention strategies.

This equipment availability is an important factor to the success of the transition to subglottic endotracheal tube usage for all in hospital-intubated patients. The endotracheal tube is standardized in all areas, excluding the OR. The in-depth microsystem assessment involved working with the OR team, including the anesthesia technician, to evaluate a convenient location to store the subglottic endotracheal tube for ease in accessibility. Order information was obtained from the respiratory department leader and a process developed to update the OR ordering form and reorganize the anesthesiologist's carts to have the subglottic endotracheal tube readily available. All other intubation trays had the subglottic endotracheal tubes as a standard. The respiratory therapy department manages the intubation tray stocking, and they collaborate with OR to facilitate this long-awaited change in practice.

TeamSTEPPS

The MFI was the strategy followed for improving performance with the ventilator prevention bundles and the focus to decrease subglottic endotracheal tube secretions. The MFI will be used to implement small tests of change (Nuckton et al., 2006). Team STEPPS briefing and debriefing will be used to support the team's efforts to hardwire successive change measures to accomplish a unified goal to reduce ventilator associated events to zero. The first month of this process improvement project was to decrease the subglottic secretions. The second phase of the project is to introduce early mobilization into the equation for success with VAE reduction. After analyzing the hurdles faced by the trauma/medical teams, we designed the first phase role out of the project.

Change Strategy

The change strategy of Lewin's unfreezing previous behaviors and refreezing the improved teamwork and performance strategies to reduce VAE by 10% in the following month (Schriner et al., 2010). The team will focus on ensuring all endotracheal tubes utilize the subglottic suction to its fullest performance. The nurses will focus on consistent oral care, daily spontaneous breathing trials in partnership with respiratory therapy, and team communication on the updated ICU daily rounding flowsheet to navigate and benchmark the multidisciplinary team's performance.

Multidisciplinary Team Roles

The multidisciplinary team supervisor/director will be responsible for orienting new staff to the VAE reduction project as part of new hire orientation at the Level II Trauma Center. The unit-specific champions will be responsible for onsite reinforcement for continued success of the project. Huddles is used to focus priorities of the team communication and progress. The TeamSTEPPS briefing strategy is utilized to provide strategic information to the units for benchmarking progress and motivation for team effort to support improved VAE prevention bundle compliance. Utilizing the briefing strategy will reinforce the important information (Tibbs & Moss, 2014). Debriefing will be initiated by the trauma CNL, department leadership, and unit-based champions to drive this process, 24 hours a day, seven days a week, and 365 days a year. Communication will focus on engaging the support of the patient care staff for interactive questions and answers and to support the teamwork.

Benchmark

A benchmarking strategic plan will include monthly data distributed on a HAC dashboard to each corresponding department team. The data is compiled from a joint effort of the trauma database and the electronic health record. An Access database provides additional information and is designed by the facility Director of Quality to demonstrate strategic performance.

The complex data analysis includes monitoring between multiple ventilator days and complex team performance. Analysis of the process to incorporate all the data elements is essential for the team's improvement and benchmarking strength to drive individual performance, as well as team performance. The structured database is designed for growth with each phase of the improvement process. Phase II will include early mobility metrics to trend for improvement and success.

The initial phase of this two-part project to reduce VAE is to be completed by August 2018 (Appendix F). Ongoing re-evaluation will be checked each month for the remainder of 2018. Once the VAE performance bundle change is stabilized, the re-evaluation plan will be quarterly and the progress is reported to the trauma/medical quality review and operation team meetings.

Study of the Intervention

The intervention strategy that the *Prevent VAE team* agreed to use is to improve performance on the VAE bundle compliance. A bundle is a structured way of improving the processes of care and patient outcomes—a small, straightforward set of evidence-based practices (Nuckton et al., 2006). The *Prevent VAE team* realizes that evaluating and improving team performance on the evidence-based practice guidelines is the foundation of the ICU *Prevent VAE's* improvement project. The *Prevent VAE* team analyzed their respective team's consistent

performance of the prevention bundles and realized that key opportunities to provide consistent bundle delivery are the foundation of the project. The data analysis from retrospective chart review brought new perspective to system issues that prevented optimal performance for VAE prevention bundle compliance. The *Prevent VAE team* identifies that the ICU rounding tool is an ideal structure to communicate and trend the required data elements for the aim to zero ventilator compliance strategy. Teamwork is the focus of the daily multidisciplinary rounding, and the tool is a useful way to share on-time information, adjust performance, and drive success for VAE prevention. The *Prevent VAE* 's champions revised the ICU rounding form to add key elements to track subglottic endotracheal tube usage. The ability to provide real-time feedback to anesthesia for prioritizing subglottic endotracheal tube utilization for patients who would require ongoing intubation in the ICU setting is valuable for debriefing about any variance in the process. The real-time feedback allows debriefing and planning to look at any variation in process. The trauma surgeons/intensivist that lead the ICU rounds provides the opportunity to drive the SETT exchange as a patient is stabilized. The standard endotracheal tubes are prioritized to be exchanged for SETT at this time. The daily goal of decreasing subglottic secretions, plus VAE prevention progress, are tracked and reinforced by the VAE champions to increase compliance with decreasing subglottic secretions.

Cohort Comparison

Cohort comparison case review led the team to determine that SETT introduction into the OR setting is heading in the direction to integrate the process of decreasing subglottic secretions. The new OR director joined the *Prevent VAE team* in progress of implementation. The anesthesiologist placement of the SETT is similar enough to the standard endotracheal tube placement so there is not a need for additional training (see Appendix G). Although this is the

overall pre-implementation thought process, the anesthesia team is supported by the anesthesia director, for performance evaluation and support for education. The team support is to place the subglottic endotracheal tubes for those patients requiring ongoing intubation into the ICU setting. The anesthesia director and the OR educator partnered with real-time feedback to those cases identified by the trauma CNL in the role of risk anticipator, to position the team for success by reinforcing the *Prevent VAE team's* strategic goals (AACN, 2017).

Operating Room Change

The OR is an extremely important area identified by the team for standardizing the use of SETT throughout the medical center. All other medical areas, including ED, ICU, rapid response team (RRT), and code carts, are stocked with only SETT. This identified area for process improvement is managed by the coordination of the *Prevent VAE team's* ability to share evidence-based practice information. The supporting studies from CDC, SHEA, and American Thoracic Society are used to unfreeze the traditionalists and create the awareness for disseminating information (Levasseur, 2001). The focus is designed to support the awareness required to motivate the change process. The OR integration is the first strategic step toward Level II Trauma Center endotracheal tube standardization to attack subglottic secretions.

Pre-Hospital Evaluation

Case review inquiry led the *Prevent VAE team* to analyze the organization for other ports of entry for standard endotracheal tubes. The identification of this fact led to the practice of standard endotracheal tubes being placed in the pre-hospital setting as the next phase on our mission to reduce subglottic secretions in ventilated patients. The field represents the area where injury patterns of decreased neurological status, proven from trauma, stroke, or shock, predisposed those patient populations for incidental aspiration. In order to manage the secretions

trapped in the trachea, the SETT is the ideal solution to combat the problem. Phase II of the *Prevent VAE* project includes the EMS providers' medical director, to perform a subglottic endotracheal tube evaluation. The SETT representative is in contact, and the initial educational process is scheduled in August 2018 for introduction of the new product into the EMS provider system. The trauma CNL will analyze data from trauma case review to drive process improvement change throughout the trauma mesosystem. Continuous trauma case review and process improvement will be driven by the ACS initiative to support evidence-based care nationwide.

Measures

Both quantitative and qualitative measures are in use to analyze data to evaluate the *Prevent VAE* measures, with the aim for zero improvement project. The data extracted will be derived from patient cohort identification, admission diagnosis, medical history, calculations of ventilator days and titration of ventilator settings of FIO2 and PEEP, type of endotracheal tube, percent of functioning subglottic suction, percent of oral care, and number of bronchoscopies in relation to the outcome measures of number of VAE to ventilated patients for the month of July 2018 (see Appendix E). During the month of July, there are three VAE for 48 ventilated patients. There are 39 SETT in ICU versus seven standard endotracheal tubes. There are 98.7% of the ESTT originated from the ED. The ED has been utilizing SETT for the past two years. More data will need to be attained to determine the success in the OR integration of the SETT. There are three endotracheal tubes placed in the pre-hospital setting and two in the OR. The use of SETT is the main element being evaluated in the *Prevent VAE* improvement process. Although the team does not see many originating from the OR, eight patients is transferred from ED to the OR already intubated. The data shows that only three VAE occurs in July, with one patient having

two episodes of VAE. This marks the progress of Phase I of the *Prevent VAE* project. No trauma patients with VAE for the past two months are identified.

Quantitative measures include the number of SETT used in comparison to the routine endotracheal tube during July. The 98.7% utilization of SETT is attributed to the decrease in incidence of VAE. Each month, the number of SETT are tracked in order to hardwire the progress of the *Prevent VAE* team. The data analysis and communication will be used to guide the aim of the project to reduce VAE to zero by December of 2019. The trauma center locations where endotracheal tubes are placed will be tracked to delineate future Prevent VAE project phasing. This factor is identified from the results of Phase I analysis and leads to the Phase II pre-hospital subglottic endotracheal tube evaluation.

The qualitative evaluation of the cohort case reviews, and the data from the ICU daily rounding flowsheet, are what attributes VAE prevention bundle effectiveness that are used to decrease subglottic secretions; as the means of data. The qualitative tool used to evaluate the progress of the multidisciplinary *Prevent VAE* team's ability to meet their goal still requires some improvement. The ability to increase the *Prevent VAE* bundle compliance is directly tied to the reduction in subglottic secretions by the functioning of the subglottic suction system, oral care bundles, and increased mobility; this information is difficult to track.

The effectiveness of ICU rounding, which has VAE performance measures integrated into them, provides improved team coordination of information for real-time continuous quality improvement (Nuckton et al., 2006). The ICU tool is in revision again to add additional ICU elements into the daily rounds. The increased awareness of the improvement project with the daily rounding helped maintain the *Prevent VAE* team's goals, despite the pitfalls of the tool. The team identified that there is a need to have a new rollout plan as the project moves forward.

Shared Initiative

The development of the Access database to compile the VAE results is a shared organization initiative to integrate the trauma improvement team, collaborating with the quality department, to drive mesosystem change. VAE is a reportable quality metric and an ACS focus to integrate performance measures across the continuum of the entire mesosytem (ACS, 2017). The multidisciplinary *Prevent VAE* team provides the Level II Trauma Center a beneficial forum to achieve quality success and improve patient outcomes. Although a majority of the ESTT are placed in the ED, utilizing it demonstrates the reduction in VAE during the month of July.

Ethical Consideration

Patient advocacy to protect the vulnerable is the number one ethical consideration for the Prevent VAE team**.** Advocacy is the CNL role that is at the center of all considerations for the multidisciplinary team. From the physiological requirement for ventilator support to the endotracheal tube exchange, the clinical decisions for the patient involve the analysis for risk and improved patient outcomes. Timing to predict when benefit will outweigh risk is attributed to every medical provider's decision to exchange an endotracheal tube. Physiological stability is always the qualitative measure to clearly make the endotracheal tube exchange decision.

Autonomy

Support for autonomy is an ongoing requirement for evaluating ventilator support in consideration to improve patient outcomes. When the patient is unable to actively participate or communicate their wishes, the family is able to follow what the patient has previously decided for themselves (Mehndiratta et al., 2016).

Through the multidisciplinary *Prevent VAE* team's evaluation, the decision to add early mobility into the VAE bundle compliance is unanimously determined as the next phase of the

process improvement. The culture for engaging frontline staff into continuous quality improvement is infectious in a positive nature. The autonomy and strength to incorporate ambulation inspires benefit to patients, their families, the entire multidisciplinary team, and the whole culture of the microsystem (Mendez-Tellez & Needham, 2012).

Outcome Measures Results

The effect that the implementation of decreasing subglottic secretions by implementing ICU daily rounding flowsheet to coordinate VAE prevention bundle compliance attributes qualitative measures to review the process improvement results. The trauma CNL reviews and analyzes all qualitative data. The standardization of clinical definitions are attribute by the CDC definitions for VAP. Variation of clinical biases is controlled by navigating fill-in responses to the most common information available from chart review prior to program implementation.

Database

The Access database developed by the quality director integrated computerized generated input directly from the electronic health record. The ability to present clear data is strength of the Prevent VAE team's benchmarking abilities. The collaboration of the quality department and trauma to work together to achieve a reduction in the most costly HAC in the organization demonstrated a new partnership for the organization.

Analysis

Prevent VAE project analysis demonstrated a 98.7% utilization of SETT in July 2018. The 39 SETT per 46 ventilated patients attributed to the number of SETT used in the ICU. There are no endotracheal tubes exchanged by the intensivists in the ICU for the month of July 2018. Reinforcement for the *Prevent VAE* project's goal is to utilize SETT for ventilated patients over 48 hours was 80% for the month of July. The team will need to continue to educate and reinforce

the utilization of SETT.

Summary

By instituting the use of SETT in the OR, the facility standardize endotracheal tubes and work as the foundational process to decrease subglottic secretions as the vector that contributes to VAE at the Level II Trauma Center. The goal of a 10% reduction is achieved during Phase I of the project. The addition of incorporating the progress of the multidisciplinary team to attack the problem of VAE and improve quality bundle performance compliance is the largest contributing factor for the process improvement. The cost of a the subglottic endotracheal tube is $3.00 more than the standard endotracheal tube. The cost of one VAE is conservatively estimated to be $21,500 per diagnosis (Charge master, 2017). On average, each VAE demonstrates a 1.5 to 9 day increase in length-of-stay in the ICU (Bekaert et al., 2011). The *Prevent VAE* team designed a practical approach to reducing VAE. The Prevent VAE team's clinical expertise motivated the compliance of the frontline staff to guide the successes. The integration of the ICU rounding tool into delineating team progress and navigation is strategic to the improvement process. The ICU multidisciplinary rounding will be integral to the *Prevent VAE* communication and adaptation. Variations in practice can be identified and either corrected or adopted to evaluate for future best practice evaluation.

The *Prevent VAE* team learned that they could improve team performance more quickly working together on the same goal versus independently to achieve a common goal. Teamwork was the unifying structure that resonated the success of the aim to drive VAE to zero. The depth of clinical expertise in the multidisciplinary team and in the leadership in daily ICU rounding empowered the frontline staff to own and share in the pride of the performance on the *Prevent*

VAE clinical performance bundles to achieve improved outcomes for the ICU patients and their families.

The Prevent VAE team interpreted the OR change as a success at the mesosystem level. Identification of the EMS recommendation to utilize subglottic endotracheal tubes for all emergent intubations will present a new phase to continue the opportunity to decrease VAE, and plans to pursue the county evaluations. Analysis of this study is a contributing factor to demonstrate that utilization of SETT and teamwork to clear subglottic secretions as the best practice standard. This process requires further evaluation throughout the county system for possible adoption nationwide.

Limitations

The *Prevent VAE* team's limitations are a multitude of competing clinical priorities. In analysis of the clinical data, the *Prevent VAE* team evaluated the patient acuity and timing of consistent oral care. The hurdles of team compliance factors attributed to the availability of supplies is addressed by increasing oral care kits in the ICU, especially on weekends and holidays. Noted variation is attributed to the factor of accessibility of oral care with chlorhexidine. Consistency in the bundle compliance of oral care is focused as part of the bundle compliance for nursing. Suction regulator accessibility in the OR and the ICU became a factor of increased utilization of SETT. Department leadership identified a standard room set-up that included an additional suction regulator for SETT suction. Teamwork with frontline staff and department leadership attributed to the success of this on-going priority for consistent successful bundle compliance. Sustainability will be supported by evaluation at the ICU/trauma Quality Review (QRC) Committee meetings. Plans for the *Prevent VAE* team's ongoing needs will be prioritized at the QRC meetings, and ongoing loop closure measures will be placed into the

department performance dashboards.

Conclusion

In order to achieve the goal of driving VAE to zero in the ICU at the Level II Trauma Center, the development of a multidisciplinary *Prevent VAE* team is created. The combination of clinical expertise and champion mentoring, real-time debriefing, and coordination of progress with the daily ICU rounding supported the multidisciplinary team bundle compliance to reduce VAE (Tibbs & Moss, 2014). The implementation of this project is reproducible. Evidence-based bundle compliance is the standard of care. Transparency in the hurdles to optimal multidisciplinary team performance led the required system changes to support the bundle compliance. Teamwork with the response to the identified common goal to reduce VAE is integral to adoption and project success. Integration of the ICU rounding tool to navigate the project progress and to continue the support, is attributed to the success to reduce VAE at the Level II Trauma Center. The ICU team leadership includes intensivist, trauma, OR, nursing, and respiratory peer champions, who all collaborate to engage the staff with real-time support. The implications for practice are in utilizing the MFI change theory, with small test of change to allow the *Prevent VAE* project to adapt in real time to support the improved patient outcomes.

Clinical Nurse Leader Role

In the position of the trauma process improvement CNL, the role of continuous quality improvement is the expectation for the role. Trauma patients are assessed and data analyzed from the trauma database (CDM, 2018). The role of the CNL is to integrate systems level change from the point of care (AACN, 2017). The role is integrated into each phase of the improvement process. The CNL, as a leader, works as a horizontal member of the multidisciplinary team to coordinate systems level change and improve patient outcomes. Utilizing Tuckman's

teambuilding strategies, the CNL utilized data to encourage team participation and call to action to conquer the clinical problem of the HAC VAE.

References

Adair, C. G., Gorman, S. P., Feron, B. M., Byers, M., Jones, D. S., Goldsmith, C. E., … Milligan, K. R. (1999). Implications of endotracheal tube biofilm for ventilator-associated pneumonia. *Intensive Care Medicine, 25*(10), 1072-1076. doi:10.1007/s001340051014

American Association of Colleges of Nursing. (2017). AACN releases new recommended CNL practice experiences. *Journal of Professional Nursing, 33*(4), 260. doi:10.1016/j.profnurs.2017.06.009

American College of Surgeons. (2017). Report ACS verification 2017: Prevent ventilator associated events (Internal document: Information presented at employee team meeting).

American Thoracic Society, & Infectious Diseases Society of America. (2004). Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *American Journal of Respiratory and Critical Care Medicine, 171*, 388-416. doi:10.1164/rccm.200405-644ST

Bekaert, M., Timsit, J. F., Vansteelandt S., Depuydt, P., Vesin, A., Garrouste-Orgeas, M., … Benoit, D. (2011). Attributable mortality of ventilator-associated pneumonia: A reappraisal using causal analysis. *American Journal of Respiratory and Critical Care Medicine, 184*(10), 1133-1139. doi:10.1164/rccm.201105-0867oc

Betts, S., & Healy, W. (2015). Having a ball catching on to teamwork: An experiential learning approach to teaching the phases of group development. *Academy of Educational Leadership Journal, 19*(2), 1-9.

Beyea, S. C. (2005). High reliability theory and organizations. *AORN Journal, 81*(6), 1319-1322

Cason, C. L., Tyner, T., Saunders, S., & Broome, L. (2007). Nurses' implementation of guidelines for ventilator-associated pneumonia from the Centers for Disease Control and Prevention. *American Journal of Critical Care, 16*(1), 28-37. Retrieved from http://ajcc.aacnjournals.org/content/16/1/28.full

Centers for Disease Control and Prevention. (2018). Device-associated Module-VAE. In National Healthcare Safety Network (NHSN) patient safety component manual (Chapter 10). Retrieved from https://www.cdc.gov/nhsn/pdfs/pscmanual/10-vae_final.pdf

Internal document American College of Surgeons (ACS). (2017). Unpublished internal document.

Internal document Charge Master. (2017). Unpublished internal document.

Internal document Clinical Data Management (CDM) database. (2018). Unpublished internal document.

Internal document Trauma Quality Improvement Process (TQIP). (2018). Unpublished internal document.

Internal document Prevent Ventilator Associated Events: Prevent VAE Team. (2018). Unpublished internal document.

Klompas, M. (2015). Potential strategies to prevent ventilator-associated events. *American Journal of Respiratory and Critical Care Medicine, 192*(12), 1420-1430. doi:10.1164/rccm.201506-1161CI

Klompas, M., Branson, R., Eichenwald, E. C., Greene, L. R., Howell, M. D., Lee, G., … Berenholtz, S. M. (2014). Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update. *Infection Control & Hospital Epidemiology, 35*(8), 915-936.

doi:10.1086/677144

Levasseur, R. E. (2001). People skills: Change management tools—Lewin's change model. *Interfaces, 31*(4), 71-73. Retrieved from http://www.mindfirepress.com/uploads/Lewin_s_change_model_INTERFACES_2001.pdf

Mehndiratta, M. M., Nayak, R., Ali, S., Sharma, A., & Gulati, N. S. (2016). Ventilators in ICU: A boon or burden. *Annals of Indian Academy of Neurology, 19*(1), 69-73. doi:10.4103/0972-2327.167706

Mendez-Tellez, P. A., & Needham, D. M. (2012). Early physical rehabilitation in the ICU and ventilator liberation. *Respiratory Care, 57*(10), 1663-1669. doi:10.4187/respcare.01931

Morris, A. C., Hay, A. W., Swann, D. G., Everingham, K., McCulloch, C., McNulty, J., … Walsh, T. (2011). Reducing ventilator-associated pneumonia in intensive care: Impact of implementing a care bundle. *Critical Care Medicine, 39*(10), 2218-2224. doi:10.1097/CCM.0b013e3182227d52

Muscedere J., Rewa, O., McKechnie, K., Jiang, X., Laporta, D., & Heyland, D. K. (2011). Subglottic secretion drainage for the prevention of ventilator-associated pneumonia: A systematic review and meta-analysis. *Critical Care Medicine, 39*(8), 1985-1991. doi:10.1097/CCM.0b013e318218a4d9

National Health Safety Network. (2017). Retrieved from: Basics of Infection Prevention.

Nuckton, T. J., Holko, B. H., McKay, S. A., & Newman, J. M. (2006). The Institute for Healthcare Improvement ventilator bundle: Definitions, summary, and brief review of the evidence. *Journal of Organ Dysfunction, 2*(1), 48-52. doi:10.1080/17471060500462542

Schriner, C., Deckelman, S., Kubat, M. A., Lenkay, J., Nims, L., & Sullivan, D. (2010).

Collaboration of nursing faculty and college administration in creating organizational change. *Nursing Education Perspectives, 31*(6), 381-386.

Stevens, K. R. (2013). The impact of evidence-based practice in nursing and the next big ideas. *Online Journal of Issues in Nursing, 18*(2). doi:10.3912/OJIN.Vol18No02Man04

Tablan, O. C, Anderson, L. J., Besser, R., Bridges, C., & Hajjeh, R. (2004, March 26). Guidelines for preventing healthcare-associated pneumonia, 2003. *MMWR Recommendations and Reports, 53*(RR03), 1-36. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

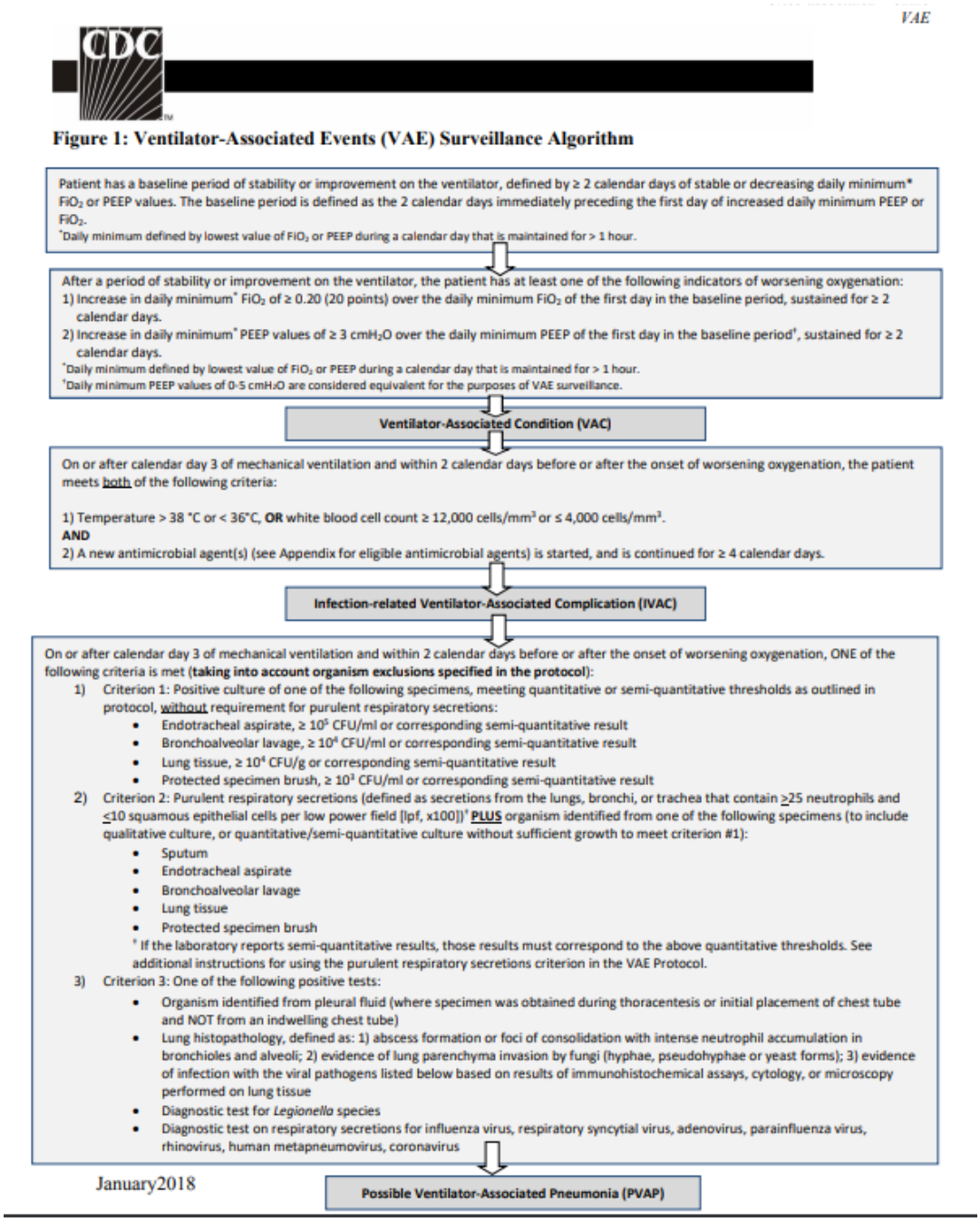
Tibbs, S. M., & Moss, J. (2014). Promoting teamwork and surgical optimization: combining TeamSTEPPS with a specialty team protocol. *AORN Journal, 100*(5), 477-488. doi:10.1016/j.aorn.2014.01.028

Viana, W. N., Bragazzi, C., Couto de Castro, J. E., Alves, M. B., & Rocco, J. R. (2013). Ventilator-associated pneumonia prevention by education and two combined bedside strategies. *International Journal for Quality in Health Care, 25*(3), 308-313. doi:10.1093/intqhc/mzt025

Vincent, J-L. (Ed.). (2012). *Annual update in intensive care and emergency medicine 2012*. New York, NY: Springer

Appendix A

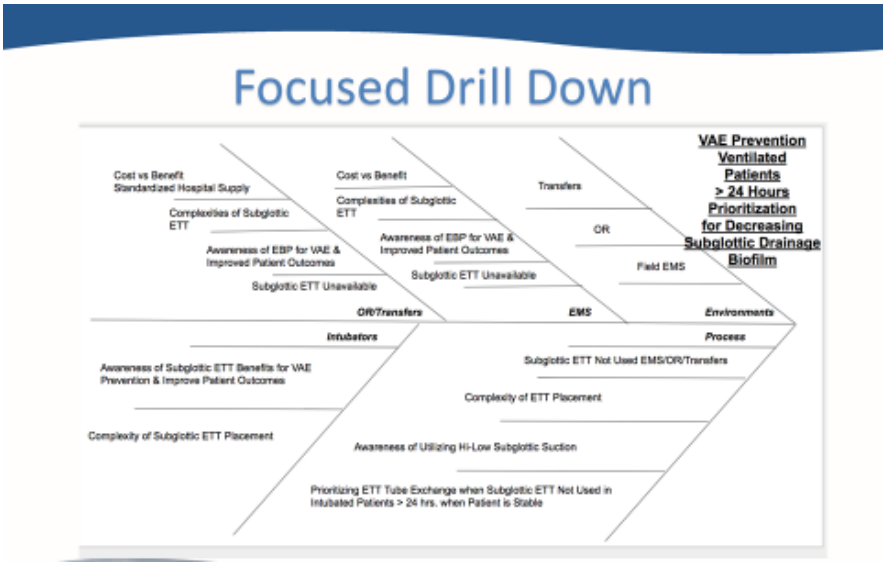
Ventilator-Associated Events (VAE) Surveillance Algorithm



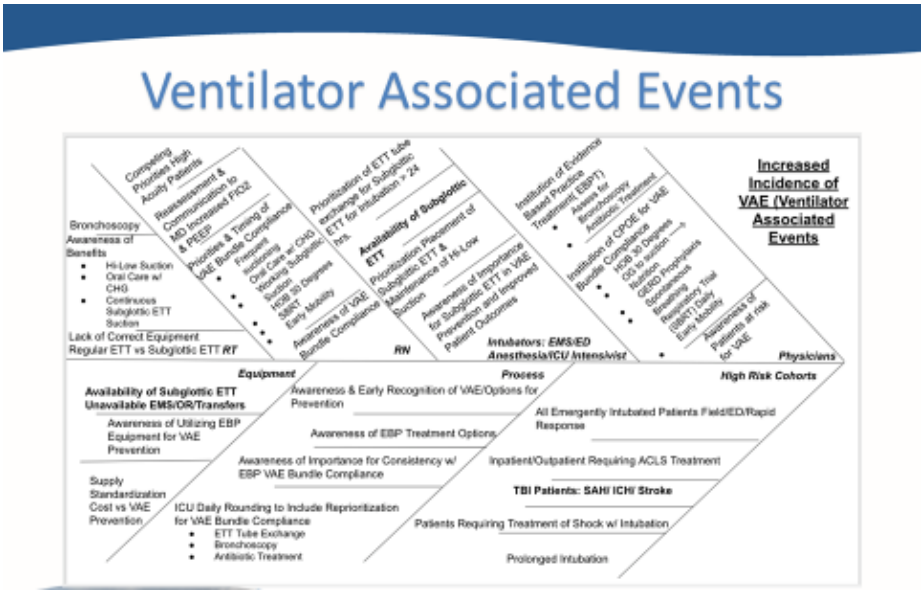
Note: Retrieved from CDC Algorithm for Ventilator – Associated Events, January 2018.

Appendix B

Ishikawa Diagrams VAE Prevention: Cause & Effect Global Factors



Ishikawa Diagrams VAE Prevention: Cause & Effect Specific AIM

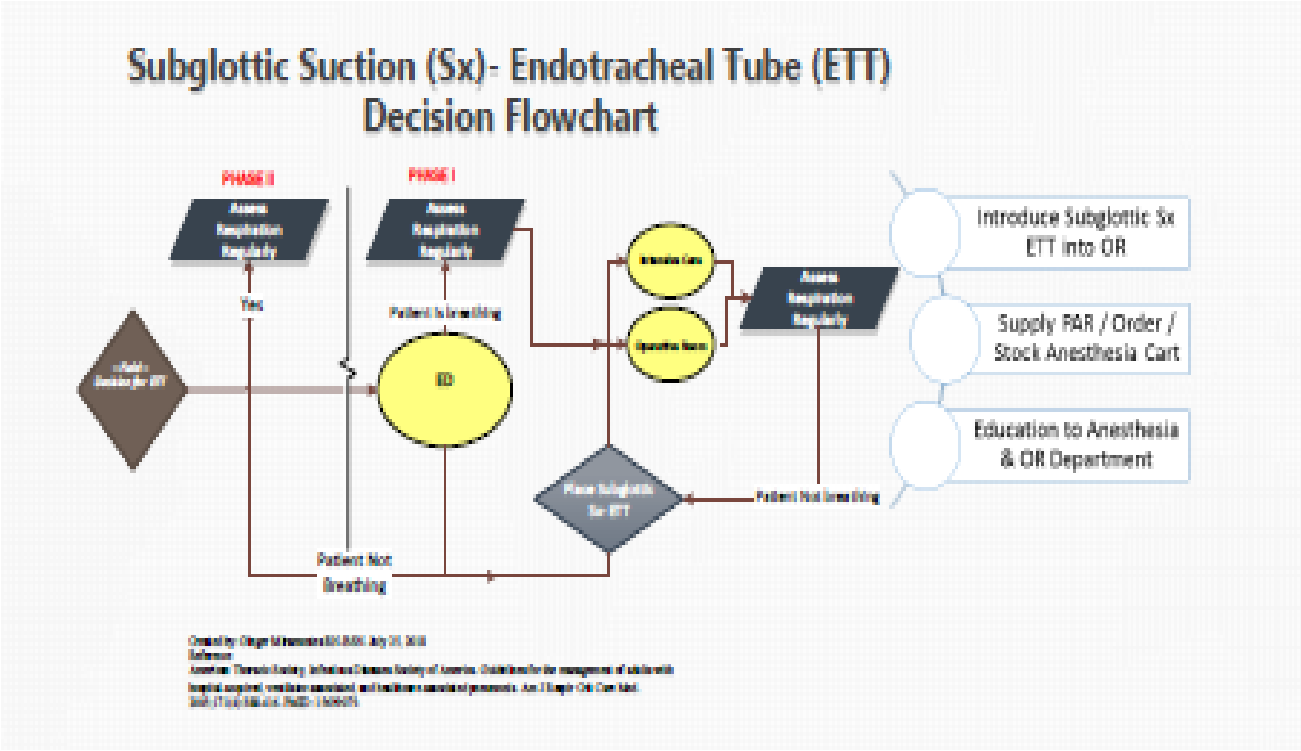


Note: Multidimensional factors identified for Prevent VAE Team prioritization to decrease incidence of subglottic secretions

Created by Ginger Miramontes June, 2018

Appendix C

Decision Flow Chart for Subglottic Endotracheal Tube Process



Note: Created by Ginger Miramontes RN-Trauma Process Improvement (PI)

Appendix D

Daily ICU Rounding Tool

ICU Interdisciplinary Rounds

ICU ADMIT DATE:						PATIENT LABEL:	
HOSPITAL LOS:			Attending MD:				
CONSULTED PHYSICIANS: Intensivist Cardio Pulm GI Endo ID Renal							
ADMIT DX/REASON FOR ICU ADMIT:							
CODE STATUS: FULL CODE PARTIAL CODE DNR PALLIATIVE							
ICU Day	1	2	3	4	5	6	7
Vent Day #							
Intubation Date							
☐Sub- Glottic ETT ☐ETT	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Subglottic Suct Functioning	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Total hours on Vent: (report in # of hours up to 96 hrs)							
Vent Settings: Mode, Rate, FiO2, PEEP, PS	Mode Rate FiO2 PEEP PS	Mode Rate FiO2 PEEP PS	Mode Rate FiO2 PEEP PS	Mode Rate FiO2 PEEP PS	Mode Rate FiO2 PEEP PS	Mode Rate FiO2 PEEP PS	Mode Rate FiO2 PEEP PS
Vent Plan: Next 24 hrs							
SBT Recommendations	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail
Oral Care q 4 ____ CHG q 12___	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Head of Bed ≥ 30°	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Analgesia: Agent/Dose	/	/	/	/	/	/	/
Pain: CPOT (goal < 3)							
Sedative: Agent/Dose	/	/	/	/	/	/	/
RASS Actual							
RASS Goal							
CAM-ICU (if +, cause of delirium & next steps)	Pos/Neg Delirium Cause:	Pos/Neg Delirium Cause:	Pos/Neg Delirium Cause:	Pos/Neg Delirium Cause:	Pos/Neg Delirium Cause:	Pos/Neg Delirium Cause:	Pos/Neg Delirium Cause:
SAT Recommendations	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail
Mobility Level:							
Pressors: Agent/Dose	/	/	/	/	/	/	/

Note: Briefing tool integrating VAE tracking elements by Ginger Miramontes RN Trauma Process Improvement (PI)

Appendix E

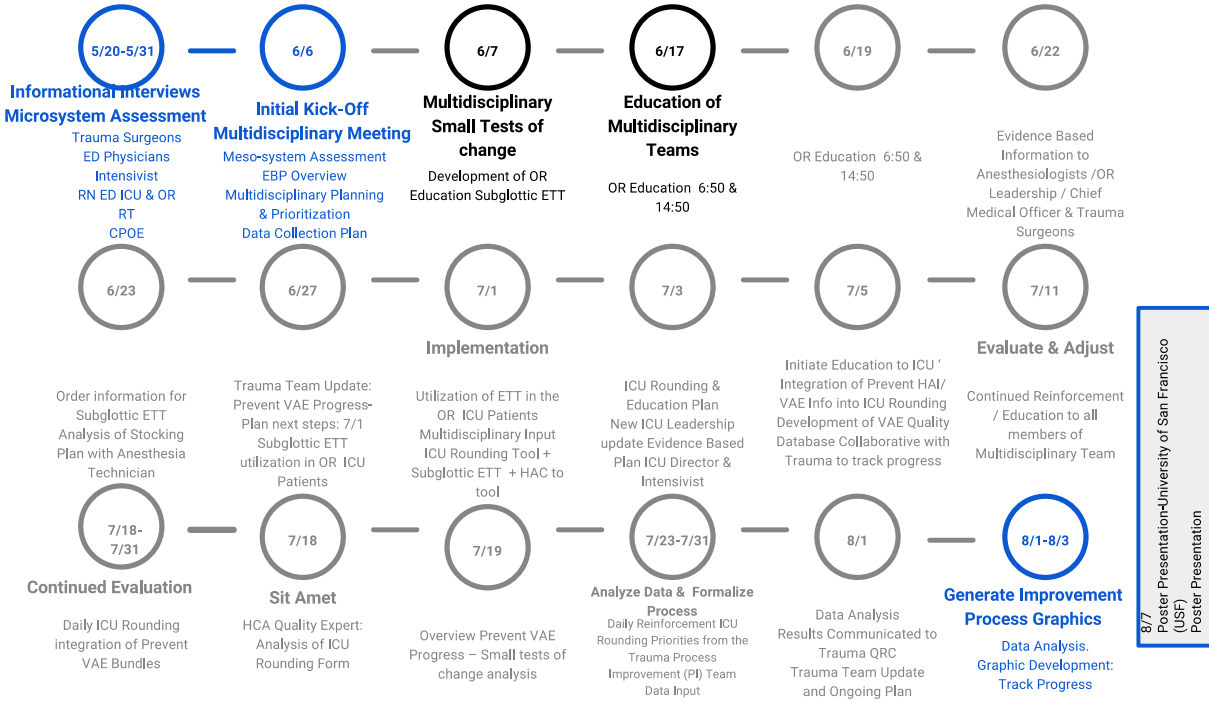
Project Specific Database

Ben Yind Siu-James MD, MSCIS Director of Clinical Analytics Quality Department

Note: Screen shots of new database. Developed for project specific data collection and analysis. Data retrieved from Regional Medical Center of San Jose facility's Quality Department Created by Director of Quality Services to support the Prevent VAE Team on July 31, 2018.

Appendix F

Prevent VAE Timeline

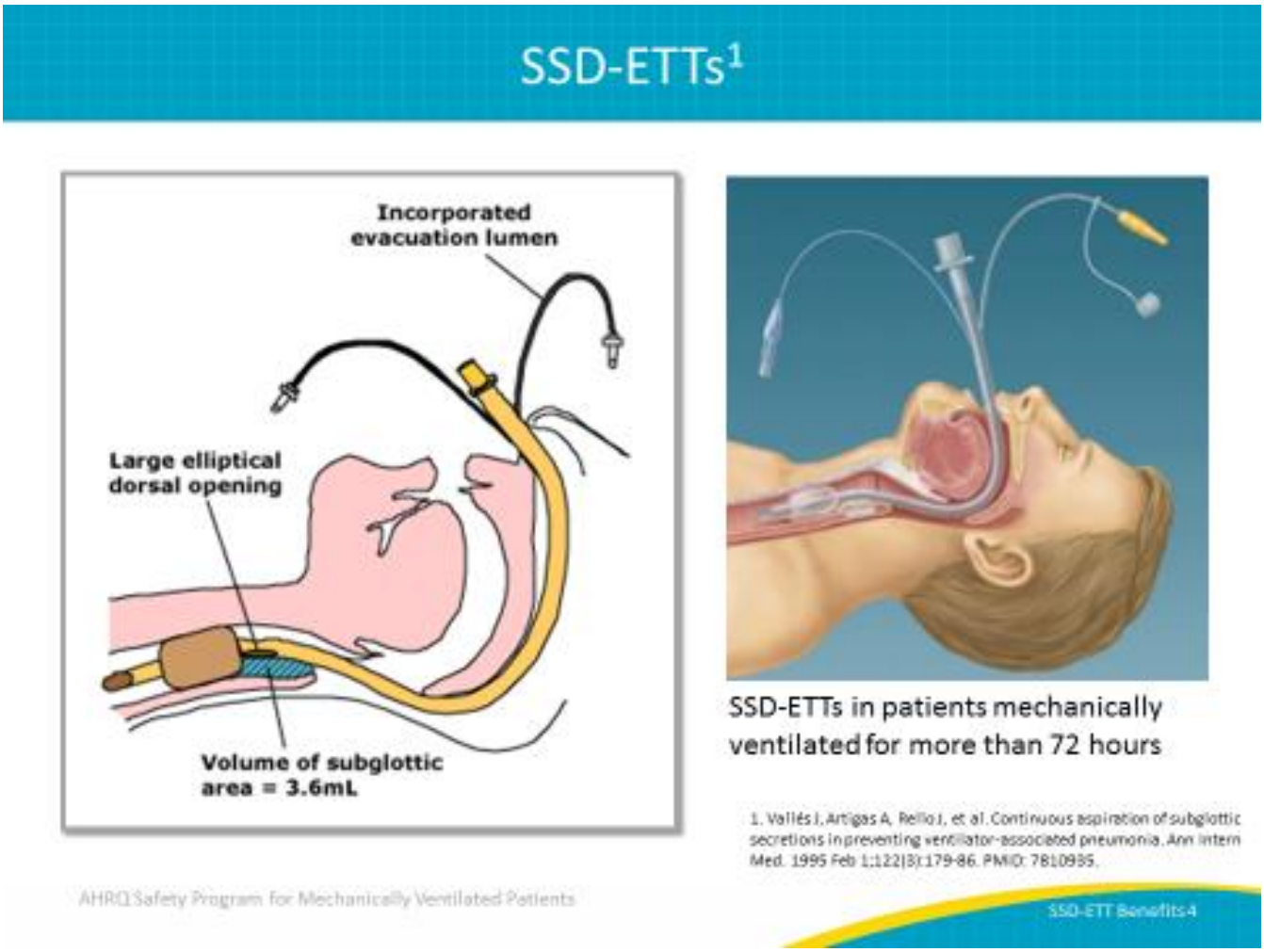


Note: Timeline for Prevent VAE Improvement Project Phase I

Created by Ginger Miramontes RN

Appendix G

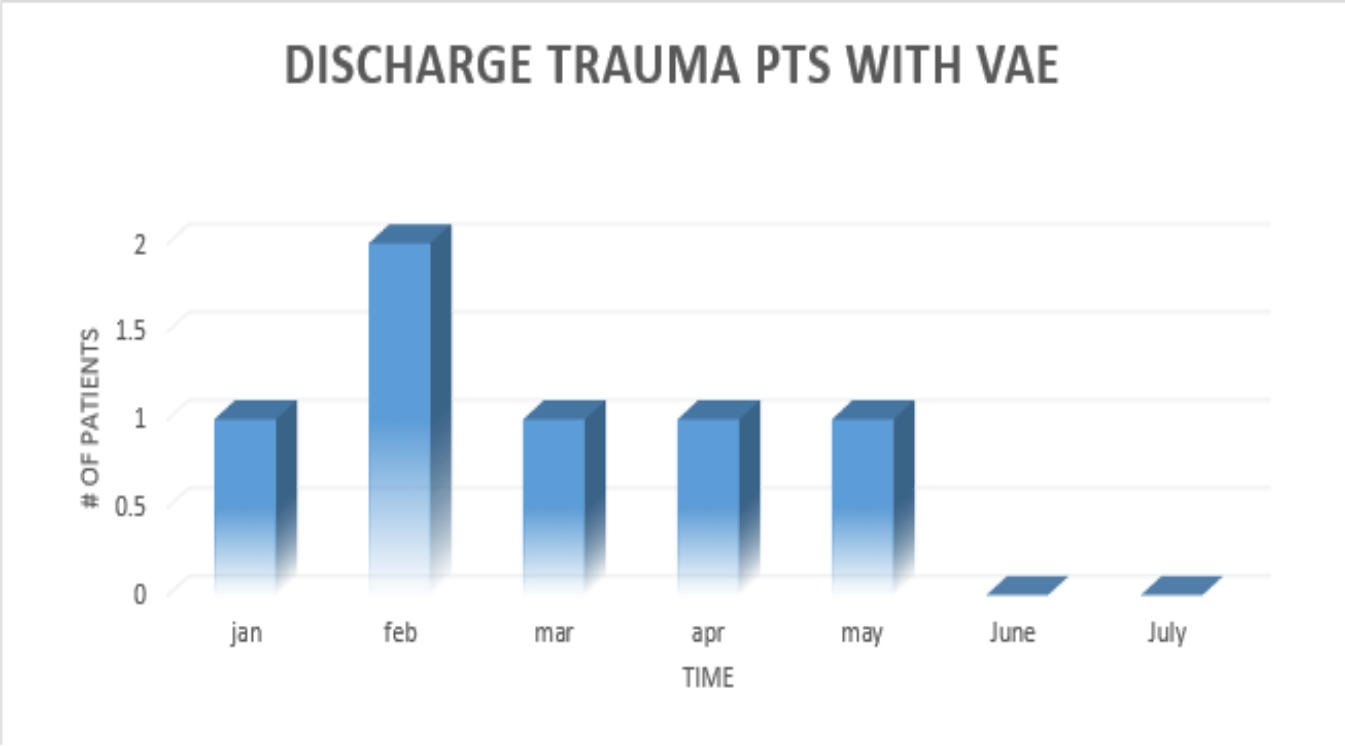
Pictorial- Rational for Utilization of Subglottic Endotracheal Tube



Note: Adapted from (Muscedere, 2011**)** Rational for Utilization of Subglottic ETT to clear subglottic secretions

Appendix H

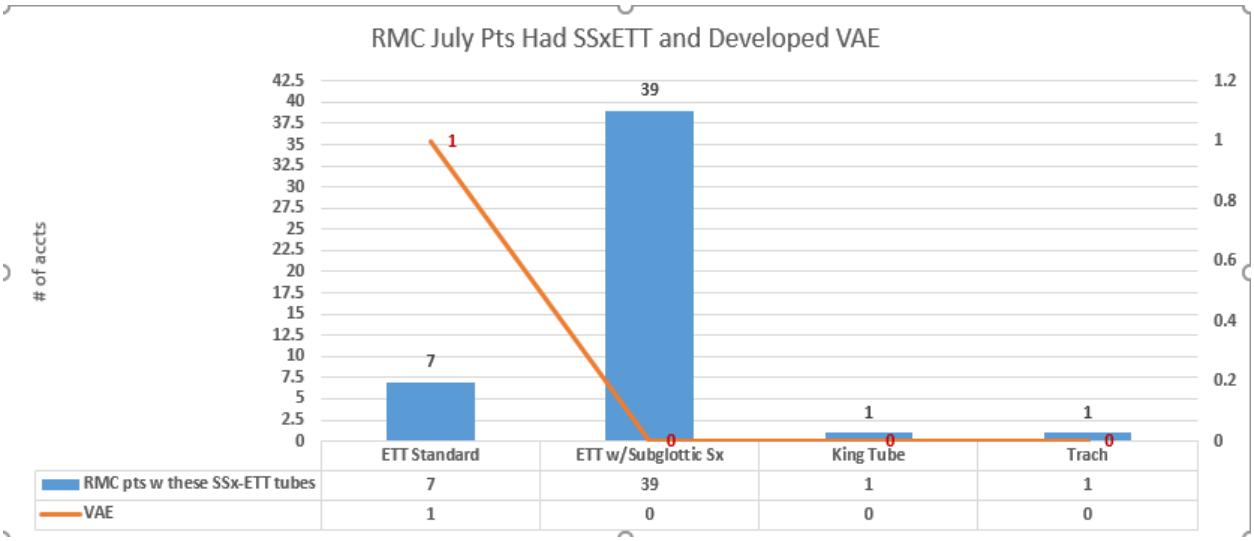
Level II Trauma Center

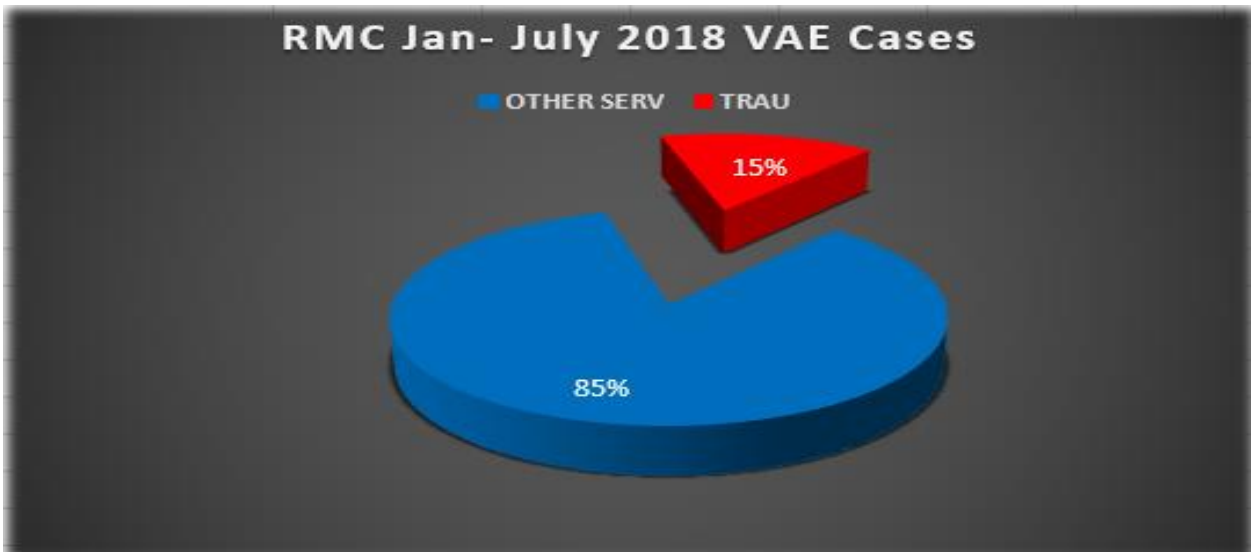


Data retrieved from Regional Medical Center of San Jose facility's Quality Department Created by Director of Quality Services to support the Prevent VAE Team on July 31, 2018.

Appendix I

Level II Trauma Center





Data retrieved from Regional Medical Center of San Jose facility's Quality Department Created by Director of Quality Services to support the Prevent VAE Team on July 31, 2018.