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VAP Prevention in the CTICU

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Summary Brief
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Specific Aim: We aim to decrease the incidence of ventilator-associated pneumonia (VAP) in the cardio-thoracic intensive care unit (CTICU) to zero within the next six months (by August 31, 2015).

Background: The clinical microsystem is a busy 25-bed CTICU within a leading academic medical center that is Magnet designated and nationally recognized as a center for excellence in cardiovascular care. The patient acuity is typically high, and there has been a 35% increase in the volume of cases within the past year. The patients are admitted directly from surgery for post-operative care, the majority of whom require mechanical ventilation. Despite diligent efforts by the staff to prevent VAP, such as rapid extubation, mechanically ventilated patients (MVP) remain at risk for developing VAP.

Supportive Data: In 2014, four episodes of VAP were identified in the CTICU. The Fishbone diagram (See Appendix A, Figure 1) delineates the potential causes of VAP, which are categorized by staff, patients, policy and procedure, and documentation. The Process Map (See Appendix B, Figure 1) illustrates the VAP prevention strategies employed by the staff from the time the patient is admitted to the CTICU until mechanical ventilation is discontinued.

Microsystem Status Relative to the project: The CTICU's established record of zero incidence of VAP, as well as its academic medical center status, provides incentive to incorporate best practices. The SWOT analysis (See Appendix D, Figure 1) highlights the resources available in the institution and the staff potentials, particularly in the "strengths" and "opportunities" sections. The "weaknesses" and "threats" sections identify the challenges that the staff must overcome in order to ensure the success of the project. The recent episodes of VAP provided an impetus to participate in the CUSP 4 MVP-VAP or Comprehensive Unit-based Safety Program, which is aimed at improving the care for mechanically ventilated patients. This quality improvement program is federally funded through the Agency for Healthcare Research and Quality (AHRQ).

Search Strategies: The key words "VAP prevention" and "VAP prevention team" were used to generate peer-reviewed articles that are relevant to the project, with dates ranging from 2012 to 2014. The publications *American Journal of Critical Care* and *Critical Care Nurse* as well as the Institute for Healthcare Improvement (IHI) website were consulted for evidence-based information and guidelines for VAP prevention.

Databases Used: The search for evidence was performed using CINAHL and PubMed.

Summary of Evidence: The following articles strongly support the significance of interdisciplinary rounding and adherence to the principles of evidence-based practice for preventing VAP:

Goutier et al. (2014) suggest that the "Four E's" model (Engage, Educate, Execute, and Evaluate) promotes translation of guidelines or evidence into practice. Their study validated a high compliance rate for evidence-based practice among institutions that adopt this "Four E's" model.

Mendez et al. (2013) emphasize the value of a specific rounding team, rather than the primary medical team, that is tasked with addressing VAP prevention measures such as, weaning from sedation. Their study revealed better compliance with "sedation vacation" when managed by the ventilator rounding team, as opposed to the ICU rounding team.

Dosher et al. (2014) argue that a biweekly VAP prevention rounding to monitor staff compliance with protocols reduced VAP rates.

The IHI, with its Ventilator Bundle (n.d.), proposes that interventions contained in the guideline are more effective when implemented concurrently rather than separately. Moreover, Sedwick et al. (2012) emphasize that strict adherence to bundled practices for preventing VAP and interdisciplinary collaboration can significantly improve patient outcomes.

Theoretical Direction: The ACE Star Model of Knowledge Transformation supports the implementation of this project. This model follows a structured approach that includes the following steps: (1) discovery of new knowledge; (2) summary of evidence; (3) translation of the evidence for clinical practice; (4) integration of the recommended change into practice; and (5) evaluation of the impact of the practice change (Schaffer, Sandau, & Lee, 2012). These steps highlight the significance of incorporating the latest evidence when designing an outcomes-driven clinical practice guideline. Integrating change into practice remains the most challenging aspect of this evidence-based practice model. In order to overcome this barrier, a group of champions are tasked to educate, role model and evaluate staff, which will be explained further in the Methods section.

Stakeholders: The primary stakeholders of this project are the mechanically ventilated patients in the CTICU and their families. Clinical key stakeholders include the CTICU health care staff—physicians, nurses, respiratory therapists, and rehabilitation staff.

Business Case: According to the Agency for Healthcare Research and Quality (AHRQ), VAP is the most common healthcare associated infection (HAI) in the ICU. It is costly and contributes to an increase ICU length of stay. The average cost of treating each episode of VAP is $40,000 to $57,000 (Sedwick, et al., 2012).

The cost associated with the project includes the Clinical Nurse Leader (CNL) student/nurse champion's salary for the 220 hours that were earmarked for educating staff at the bedside and during staff meetings, conducting research and audits, preparing reports, and attending meetings for an aggregate amount of $13,200. In addition, there is also an incurred expense for purchasing 6 units of sub-glottic ETT suction devices, which is valued at $4,200. In total, total project cost is $17,400. Conceivably, the savings that will be generated by preventing merely one episode of VAP will compensate for the cost to fund the project, thus yielding a minimum net benefit of $22,600, and a cost-benefit ratio of 2.3 for every dollar spent (See Appendix F, Figure 1). Moreover, meeting the goal of decreasing the VAP rate to zero each month within the next six months will save the institution at least $240,000, which could offset direct care wages, such as payroll costs.

The project's non-monetary benefits include increased patient and family satisfaction, and an enhanced reputation as a cutting-edge medical center. When clinical outcomes are optimized, so too are the savings in healthcare cost. Therefore, the project yields a positive return on investment.

Methods: Assessing the staff knowledge of VAP through online surveys and educating them of its implications were significant aspects of the project's implementation. During

the first six months, the focus was placed on reinforcing the Daily Care Processes for VAP prevention as highlighted in the CUSP Wheel poster (See Appendix C, Figure 1), which was displayed in the unit for educational purposes. The nursing champion monitored staff compliance by conducting a daily audit of the Daily Care Processes while simultaneously role modeling best practices to the staff. In addition, in-service presentations were conducted to promote staff awareness of the impact of VAP and to provide updates on the project's progress.

Steps for Implementation: This 2-year multidisciplinary project commenced in January 2015. The specific activities in each phase of the project and the corresponding evaluation tools are enumerated in the timeline chart (See Appendix E, Figure 1). In the planning phase, the CUSP team organized and identified the potential causes of VAP in the CTICU. In the initiation phase, the clinical staff's knowledge and awareness of the institution's safety culture and VAP prevention protocols were evaluated through online surveys. The execution phase focused on integrating evidence into practice through staff education and role modeling of best practices. Also during this phase, the champions monitored compliance with Daily Care Process measures and corrected the deficits that were identified. In the later part of the execution phase, the team designed a progressive mobilization plan for mechanically ventilated patients. The emphasis during the monitoring phase is on staff compliance and consistency with adopting best practices. Lastly, the effectiveness of the recommended CUSP VAP prevention measures was appraised during the evaluation phase.

Evaluation: The effectiveness of the CUSP project will be validated by the reduction or absence of VAP in the CTICU. The rate of staff adherence to VAP prevention measures was monitored during the Daily Care Processes audits whose results are monitored and analyzed each month for progress. These metrics are extremely valuable for measuring the success of the project and for ensuring that the staff provides standardized and evidenced-based care.

Results: The audit results revealed low compliance rate in the implementation of the Daily Care Processes, particularly in the areas of SAT and SBT. In addition, insufficient nursing and respiratory therapy collaboration and lack of standardized time for performing SAT and SBT were identified. Lastly, the champions noted limited use of sub-glottic ETT in the CTICU.

Outcomes: Since the project's implementation, there have been no episodes of VAP identified, which demonstrates the benefits of the CUSP guidelines. However, despite this positive outcome, the gaps in clinical practice with regard to the implementation of the Daily Care Processes, such as SAT and SBT, and the use of sub-glottic ETT need to be addressed accordingly.

Recommendations: In order to sustain a zero VAP rate in the CTICU and correct gaps in clinical practice, revision of policies to conform to CUSP guidelines, interdisciplinary collaboration, and staff engagement are essential. A culture of inquiry must be promoted to increase staff awareness of evidence-based practice. In addition, a CNL who possesses an in-depth knowledge of the CTICU patient population, integrating evidence into practice, and the role function of each member of the interdisciplinary team must be employed to help facilitate this initiative. Lastly, hospital senior executives must be solicited for their support of policy changes, and to appropriate funding for the necessary resources (adequate staffing) and equipment (sub-glottic ETT and suction) to ensure the continued success of this quality improvement project.

Appendix A
Fishbone Diagram

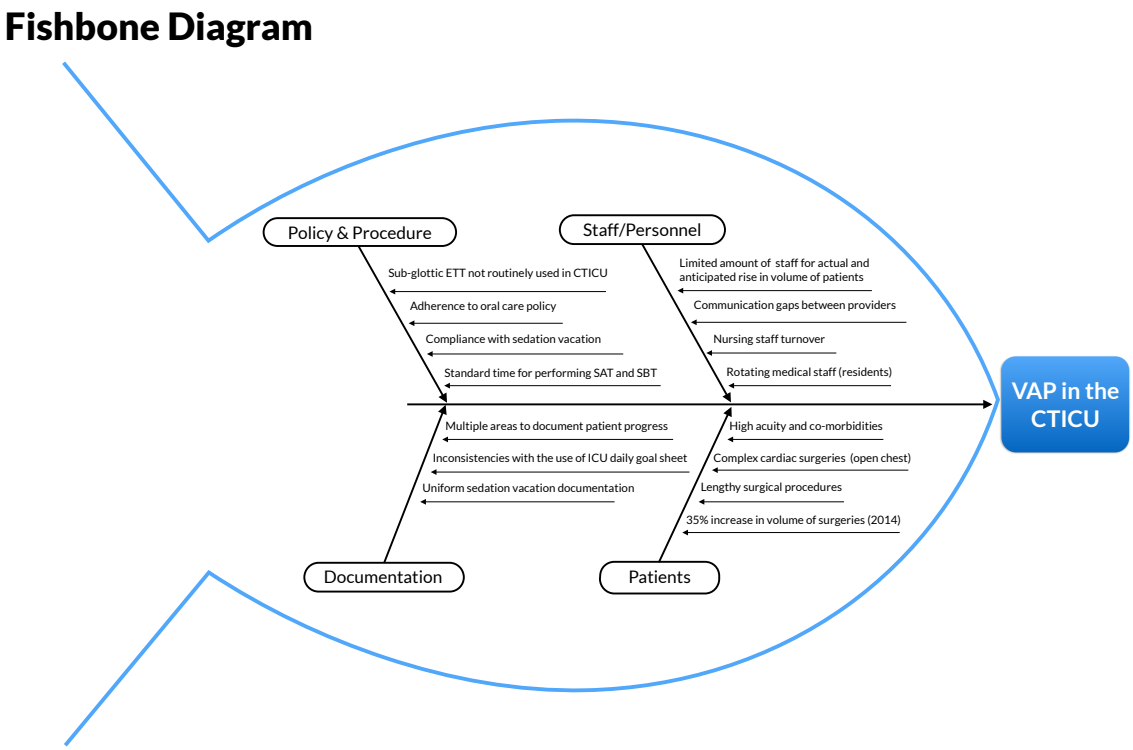

Figure 1. Fishbone Diagram. This figure delineates the potential causes of VAP in the CTICU into different categories.

Appendix B
Process Map for VAP Prevention in the CTICU

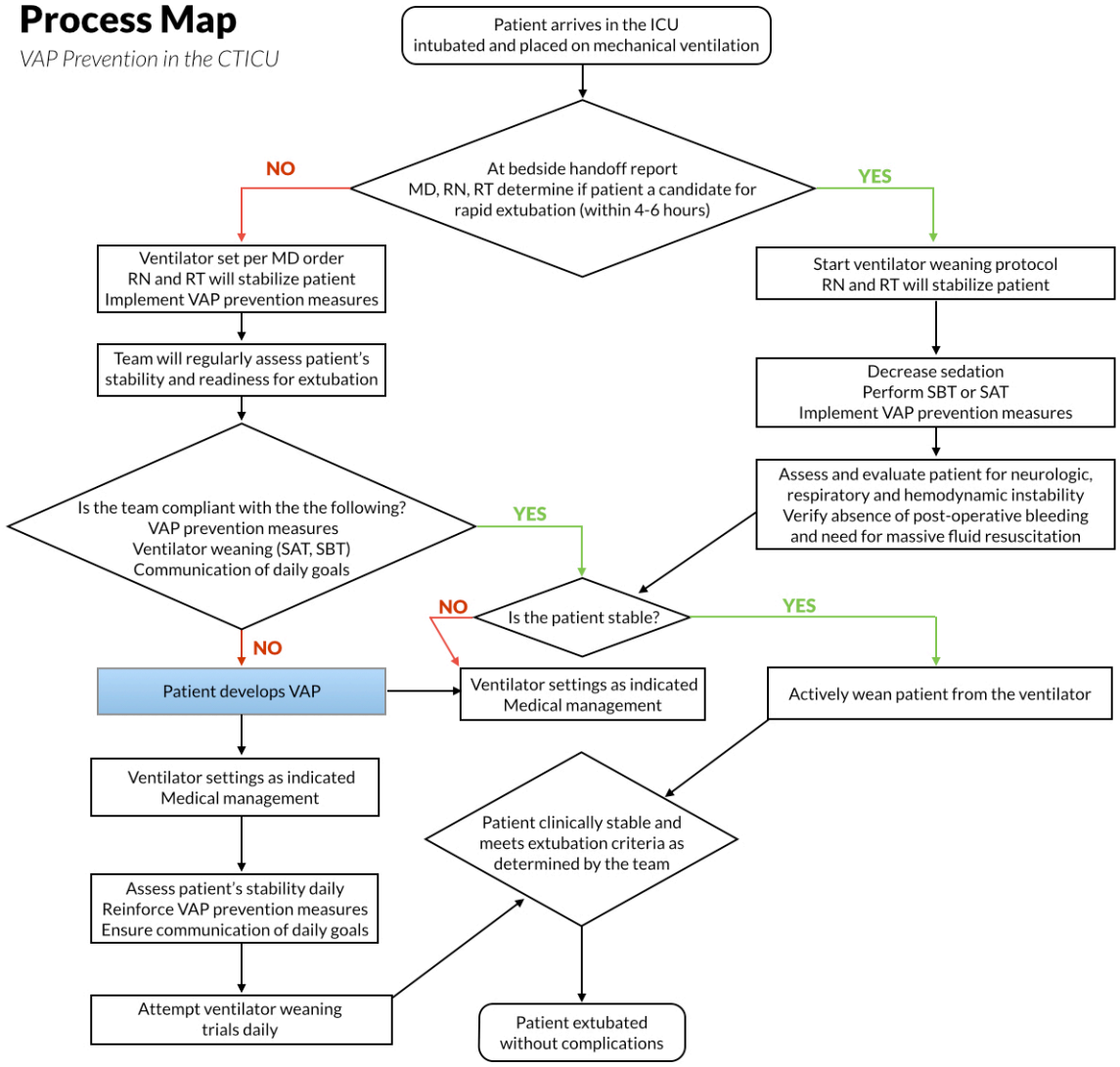

Figure 1. Process Map. This algorithm demonstrates the appropriate steps of implementing the rapid extubation protocol in the CTICU, which is a VAP prevention measure.

Appendix C
CUSP Wheel

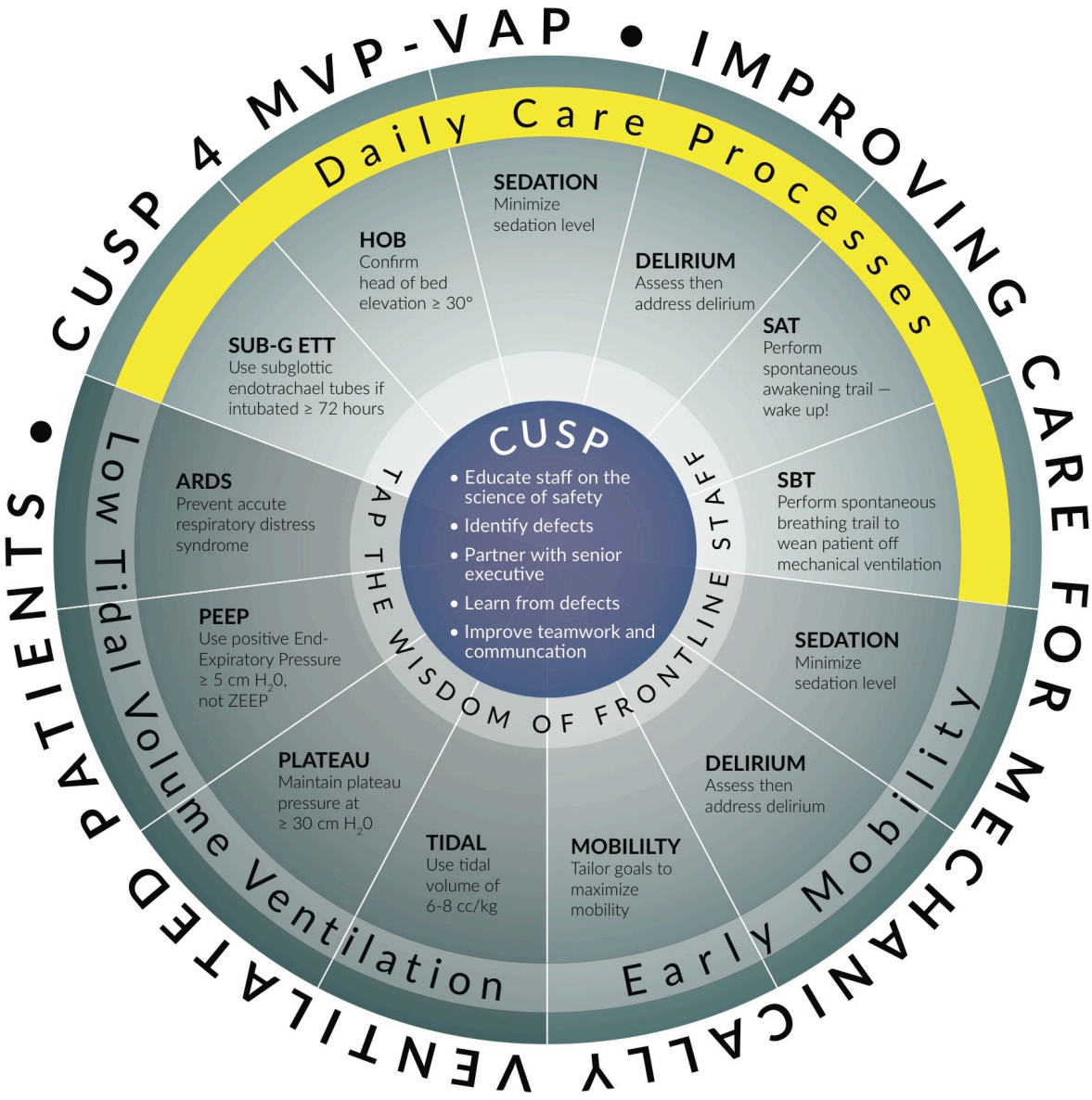

Figure 1. CUSP Wheel. The highlighted section of the CUSP Wheel poster illustrates the Daily Care Processes for VAP prevention, which was the focus of the project.

Appendix D
SWOT Analysis of the VAP Prevention Project

Strengths	Weaknesses
• Staff commitment for optimizing clinical outcomes • Availability of clinical resources and experts given its academic medical center setting • Maximum RN/patient ratio in the ICU of 1:2 • Rapid extubation protocol for cardiac surgery patients • Daily multidisciplinary rounds	• Recent high nursing staff turnover • Inadequate staff education about the implications of the project • Inconsistencies with the use of sub-glottic ETT • Low adherence to established protocols by some staff • Constant change in medical staff coverage
Opportunities	**Threats**
• To participate in a multi-center patient safety and quality improvement project • To incorporate best practices based on current evidence • To promote patient-family centered care • To foster teamwork among CTICU staff	• High patient acuity and clinical instability that my hinder rapid extubation and other VAP prevention measures • Multiple competing projects • Projects are perceived as additional work for frontline clinicians

Figure 1. SWOT Analysis. This figure highlights the significance and challenges of implementing the CUSP 4 MVP-VAP prevention project.

Appendix E
Activities Timeline

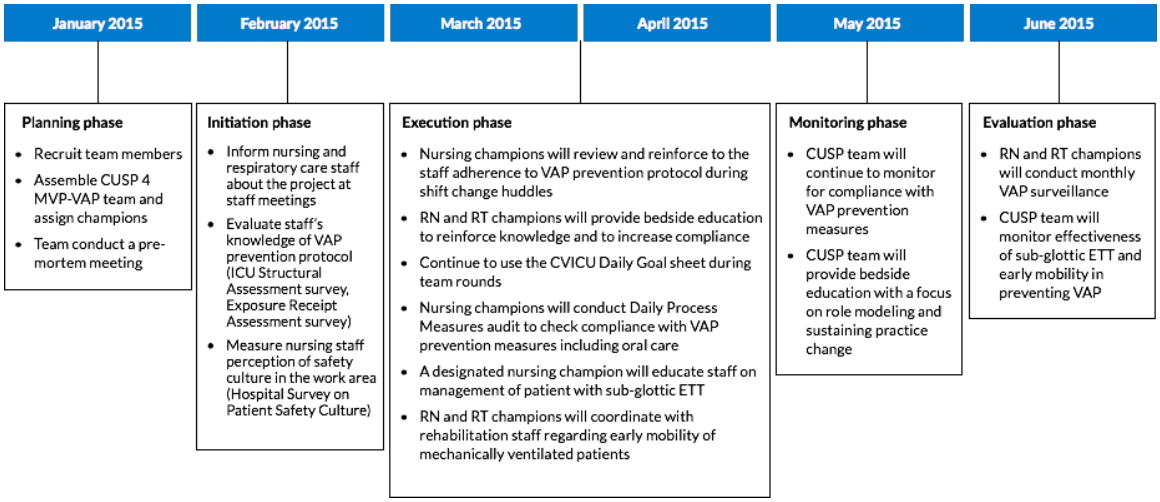

Figure 1. Activities Timeline. This figure chronicles the specific activities in each phase of the VAP prevention project during the first six months of implementation.

Appendix F
Cost Benefit Analysis and Cost Benefit Ratio

Item	Cost	Net Benefit
Each episode of VAP	**$40,000**	
Nurse champion salary (220 hours)	$13,200	$26,800
Suction equipment	$4,200	$35,800
Total project cost	**$17,400**	**$22,600**
Cost benefit ratio	**2.3 for every dollar spent**	

Figure 1. Cost Benefit Analysis and Cost Benefit Ratio. Bold written items include the cost to treat each episode of VAP, total project cost, net benefit, and cost-benefit ratio.

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