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## An Exploration of Nurse Adherence to Ventilator-Associated Pneumonia Bundle Interventions: A Quantitative Study

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An Exploration of Nurse Adherence to Ventilator-Associated Pneumonia Bundle Interventions:  
A Quantitative Study

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NURS 4993.H

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### Abstract

Ventilator-associated pneumonia (VAP) poses a significant health risk to patients on mechanical ventilation in hospital intensive care units (ICU). It is the responsibility of the nurse to implement VAP bundle interventions to decrease the prevalence of VAP in mechanically ventilated patients. The objective of the study was to measure nurse perception of adherence to VAP bundle interventions of oral hygiene, head-of-bed elevation, spontaneous breathing trials, daily sedation vacations, and peptic ulcer and deep vein thrombosis prophylaxis. A descriptive study involving a sample population of 28 ICU nurses at 3 hospitals in northern California was conducted. A 57-item questionnaire was developed to gather data on the degree to which VAP bundle interventions were implemented by the ICU nurses. All but one nurse reported implementing VAP bundle interventions in accordance with hospital policy. Self-reported nurse perception of adherence to VAP bundle interventions was considered met for 68% of the sample population. Self-reported adherence to VAP bundle interventions indicated nurses were appropriately implementing them in accordance with hospital policy/guidelines. More critical examination of VAP bundle hospital protocol is needed in order to identify areas for improvements in nursing practice.

*Keywords:* nurse adherence, ventilator-associated pneumonia, VAP, VAP bundle, nurse compliance

## **An Exploration of Nurse Adherence to Ventilator-Associated Pneumonia Bundle**

### **Interventions: A Quantitative Study**

Ventilator-associated pneumonia (VAP) is defined as pneumonia occurring 48 hours after the patient was intubated and put on mechanical ventilation. Mechanical ventilation is an intervention that assists patients in breathing by giving oxygen through a tube placed in the mouth, nose, or tracheostomy. Because the tube enters the trachea, microorganisms can invade the lower respiratory track and increase the risk for VAP. Though common signs and symptoms include progressive infiltrate on chest radiograph, leukocytosis, purulent tracheobronchial secretions, and gas exchange degradation, poorly defined clinical criteria makes VAP difficult to diagnose and treat appropriately. The Center for Disease Control algorithm helps to clarify the clinical criteria and aims to assist in correctly diagnosing VAP (Munro & Ruggiero, 2014).

Ventilator-associated pneumonia is a significant contributor to patient morbidity and mortality in Intensive Care Units (ICU) and makes up 86% percent of nosocomial pneumonias (Koenig & Truwit, 2006, p.637). VAP is associated with an estimated mortality rate between 20% and 70% and increased lengths of stay in ICU by 4-13 days for mechanically ventilated patients (Cason, Tyner, Saunders, & Broome, 2007; Koenig & Truwit, 2014). Increased lengths of stay and additional treatments that occur as a result of VAP contribute to high hospital costs. Despite its insidious onset, research has demonstrated that treatment within the first 48 hours can significantly reduce mortality by at least 30% (Koenig & Truwit, 2006, p.637). Preventative measures such as the VAP bundle can be taken to reduce the incidence of VAP during hospitalization. In doing so, the health and wellness of patients who are already in critical condition can be protected and improved.

### **Background of the VAP Bundle**

The VAP bundle is a series of evidence-based interventions designed to reduce the prevalence of VAP in mechanically ventilated patients. In 2005, the VAP bundle was part of the initiative, *100,000 lives campaign*, launched by the Institute for Healthcare Improvement (IHI); this initiative aimed to reduce mortality and morbidity in American healthcare (Resar et al., 2005, p.243). The five components that make up the IHI's bundle consist of 1) elevation of the head of the bed (HOB), 2) daily sedation vacations (when sedative drug infusions are paused to test the patient's stability) and assessment of readiness to extubate, 3) peptic ulcer disease prophylaxis, 4) deep vein thrombosis prophylaxis, and 5) daily oral care with chlorhexidine.

According to the IHI's standards, the HOB should be elevated at least 30 to 45 degrees. The patient's readiness to be extubated is determined through spontaneous breathing trials that test the patient's ability to breathe independently. Peptic ulcer disease prophylaxis is the use of antacid medications to decrease buildup of acid in the stomach. Deep vein thrombosis prophylaxis outlines the clinical recommendations for anticoagulants or sequential compression devices to prevent formation of clots. Lastly, daily oral care with chlorhexidine decreases the amount of bacteria in the patient's mouth through cleaning. According to the IHI, the implementation of all these interventions together would result in significantly better outcomes than if the interventions were implemented individually. Although clear definitive evidence demonstrating the success of the VAP bundle has yet to be shown, the bundle has resulted in better care by improving coordination of interventions among multi-disciplinary team members (Munro & Ruggiero, 2014). It is currently the best step towards providing evidence-based care for patients at risk for ventilator-associated pneumonia.

Although the IHI VAP bundle is available for use, nurses may not necessarily be



implementing the bundle despite evidenced-based research and hospital policy. Reasons for this can be attributed to lack of education or information about the bundle, limited time for interventions, or conflicting hospital policies. If identified appropriately, addressing barriers to nurse compliance or adherence can increase the quality of patient care provided and effectively prevent VAP in mechanically ventilated patients. Because of the high morbidity and mortality associated with ventilator-associated pneumonia, it is important that the nurses adhere to and implement the bundle to maximize the health of ICU patients.

### **Purpose Statement**

The purpose of this study was to measure perception of nursing adherence to the ventilator-associated pneumonia bundle interventions in hospital intensive care units (ICU). The instrument of choice was a questionnaire which was piloted in this study.

### **Literature Review**

Most articles report an examination of the level of compliance with VAP bundle interventions rather than adherence which this study aims to look at. Despite similar definitions, the word adherence was chosen to be used for this study because ‘compliance’ denotes a punitive connotation – that the bundle interventions are required to be completed on the basis of avoiding disciplinary action. In contrast, adherence was defined as the active completion of all VAP bundle interventions by nurses in the hospital ICUs as determined by the hospital’s policy. Nurse adherence to VAP bundle would not be met if an intervention was not provided in accordance with hospital policy/guidelines or was reported to be provided ‘some of the time’ or ‘very little/none at all’.

Six articles examining nursing compliance with VAP bundle and incidence of VAP were reviewed; in addition, 1 article was reviewed that examined the relationship between nurse-

reported hospital-acquired infections and quality of the Critical Care work environment. Google Scholar and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) were used to search for articles using the following terms: “ventilator-associated pneumonia”, “VAP bundle compliance”, and “nurse adherence to VAP bundle.” Relevant articles were chosen for full review after reading abstracts.

### **Efficacy of the Institute for Healthcare Improvement’s VAP Bundle**

According to a study by Munro and Ruggiero, the IHI bundle has aided in reducing VAP rates across the country (2014). The potential and efficacy of the IHI bundle was demonstrated in a study at Mercy and Unity Hospitals of Minnesota. Between the two hospitals, each with a 20-bed ICU, the researchers measured bundle compliance and the change in VAP rate by the end of the study. Their data results displayed a VAP rate decrease from 6.1 to 2.7 per 1,000 ventilator days (one ventilator-day refers to the total amount of time of all persons on mechanical ventilation during the 24-hour period, starting at midnight).

The IHI encourages the use of the VAP bundle which was demonstrated to reduce VAP rates as a response to increased nurse bundle compliance. From 2002 to 2004, teams of critical care professionals in 61 hospitals came together to improve care in ICUs. The team members entered the data into monthly organized templates, and collected data on the following: number of mechanical ventilator days, frequency of VAP, ICU mortality, rate of use of each intervention in the ventilator bundle, and ICU average length of stay. Adherence was met if all four components were accomplished. Resar et al. (2005) state that this “all-or nothing” measurement technique focused on the significance of all bundle interventions as part of the care for preventing VAP. The IHI’s study showed a VAP rate reduction by 61% with over 95% bundle

compliance. In comparison, hospitals that had less than 95% compliance had a VAP rate reduction of 40% (Resar et al., 2005, p.245).

Further success of the IHI's VAP bundle was demonstrated in the study by Bird et al. (2010). In their Bird et al.'s study (2010), the effect of VAP bundle adherence on the incidence of VAP in the surgical intensive care units (ICU) was evaluated. Bird et al. (2010) uses the word 'adherence' for their study's title, but interchanges adherence with 'compliance' throughout the report; no differentiation is made between the two. The information was collected retrospectively from the databases of Boston Medical Center's Trauma/General Surgery ICU (TICU) and surgical ICU in a 31-month period from October 2006 to May 2009. The hospital adopted the IHI bundle, but separated the daily sedation vacations and extubation readiness assessment into individual components. Bird et al.'s (2010) results demonstrated that total bundle compliance increased every year in both ICUs, though TICU showed the greatest increase in compliance; incidence of VAP in the two ICUs decreased as well, with the TICU having a greater reduction in VAP compared to the SICU (Bird et al., 2010).

### **Nursing Compliance with Infection Prevention Interventions and VAP Bundle**

#### **Interventions**

In one study from 2007, the researchers measured the adherence of 1200 nurses who attended critical-care education seminars in the United States. The nurses filled out a 29-item questionnaire based on guidelines from the Center for Disease Control and Association of American Critical Care Nurses; a total of 1596 surveys were distributed with a final response rate of 75% (Cason et al., 2007, p.32). Eighty-two percent of the respondents reported that they always washed their hands between patients, and 77% of those that responded reported that they always used gloves for oral care. Only half of the respondents reported maintaining head of bed

between 30 to 45 degrees for 100% of the day, and only 36% of the respondents reported always performing subglottic suctioning. Another third of the respondents considered subglottic suctioning to primarily be a respiratory therapy intervention (Cason et al., 2007, p.32-33). Despite the large number of participants, results from the survey may have been biased from collecting data solely from nurses who attended the seminar. No reliability testing was done for the instrument, which was listed as a limitation of the study, and little information about its validity was provided (Cason et al., 2007).

In another study, a real-time compliance dashboard was implemented to improve compliance with bundle parameters and decrease VAP rates in the surgical intensive care unit (SICU). Data about compliance to the ventilator-associated pneumonia bundle was analyzed for a year after dashboard implementation in July 2007. Within 11 months of implementation, average compliance improved from 39% to 89% and rates of VAP decreased from a mean of 15.2 to 9.3 events per 1000 ventilator days (Zaydfudim et al., 2009, p.656). Implementation of the real-time dashboard was associated with increased VAP bundle compliance and reduced VAP rates in the SICU.

A cross-sectional descriptive study by Kiyoshi-Teo, Cabana, Froelicher, and Blegen (2013) aimed to identify factors that influenced adherence to guidelines for VAP prevention. The research involved 576 critical care nurses at 8 hospitals in Northern California; the nurses were surveyed in regards to user factors, guideline qualities, contextual factors and the facilitation of VAP guidelines adherence. Results from the study indicated that the most consistent facilitator for VAP guidelines adherence was nurses' positive attitude toward the guidelines. Nurse demographic information was also collected in the study and included education, specialty nursing certification, years of ICU experience, and hours worked during the week.

Approximately 75% of the participants had a bachelor's degree in nursing or higher; forty percent of the participants were nursing specialty certified in critical care or as a trauma nurse; the mean ICU experience was about 12 years (Kiyoshi-Teo et al., 2013, p.209). For their study, Kiyoshi-Teo et al. (2013) defined adherence as an "active decision to support a clinical practice and behavior changes accordingly" (p.207). Adherence was considered met if the nurses reported answers of 'always' and 'mostly adhere' to the interventions.

For a different study, a quality improvement initiative in 2014 that focused on education, practice performance and the evaluation of nursing documentation compliance was implemented in a SICU at a level I trauma center in southeastern United States. During the study, the researchers implemented a web-based education module, VAP bundle checklist, and documentation modification to increase VAP bundle compliance. Data was collected for three to four months from nurses. Results from the data analysis revealed a 44% increase between pre- and post-test scores for the education module and overall percent increase in compliance with each VAP bundle element over two intervention phases. One limitation of the study was the lack of standardized approach for VAP prevention and electronic documentation of the VAP bundle. Furthermore, they identified the need for a clear, specific, and standardized approach for VAP prevention and electronic documentation for VAP bundle (Munaco, Dumas, & Edlund, 2014, p.384-392).

### **Quality of the Work Environment in Relation to Reported Frequency of Infections**

In contrast to the aforementioned studies, Kelly, Kitney-Lee, Lake, and Aiken (2013) looked at the effect of the critical care work environment on nurse reported health care-associated infections (HAI). The various infections provided by the participants were reported as disaggregated data and included ventilator-associated pneumonia, urinary tract infections, and

central catheter infections; although the hospitals involved in this study were not identified, hospital characteristics such as teaching status and number of beds were reported. Kelly et al. (2013) aimed to determine whether the critical care nurse work environment was predictive of nurse-reported HAIs. Their study was a retrospective, cross-sectional design, in which the authors used critical care nurse reports to evaluate the work environment and report the frequency of infections. Kelly et al.'s (2013) data collection consisted of a large sample population of 3,127 critical care nurses in 320 hospitals. The researchers used the Practice Environment Scale of the Nursing Work Index (PES-NWI) tool to measure the quality of the critical care work environments in five subscales: 1) staffing adequacy; 2) nurses' ability to participate in policy decisions; 3) active staff development or continuing education programs; 4) satisfactory working relationships between physicians and nurses; and 5) support of nurses by supervisory staff. Based on the composite score of this tool, hospital quality was classified as having better (>75th percentile), mixed (25th-75th percentile), or worse (<25th percentile) critical care work environments; the PES-NWI was developed from the Nursing Work Index (Lake 2002). Logistic regression models were used to determine if the environments were predictive of HAIs.

As a result of the study, the authors found that nurses working in better environments were 36% to 41% less likely to report the occurrence of infections than nurses who worked in worse work environments (Kelly et al., 2013, p.486). The authors concluded that implementing a primary care staffing model, in which there is adequate resources, support staff, and support for nurse managers, could lower risk for development of HAIs. Conclusions drawn from the data analysis further encouraged improvement in ICU leadership and nurse support systems. The quality of care in critical care units and the risk of HAIs occurrence can be significantly impacted

by the critical care work environment for nurses (Kelly, et al., 2013).

### **Theoretical Framework**

The Health Belief Model (HBM) provides a framework for understanding medical compliance and developing health education strategies. It is based on three primary beliefs: a person will take a health-related action if the person: 1) feels that a negative health condition can be avoided: 2) has a positive expectation in preventing the negative health condition: and 3) can successfully provide the intervention. Six major concepts of the HBM include: Perceived Susceptibility: Perceived Severity: Perceived Benefits: Perceived Barriers: Cues to Action; and Self-Efficacy. These concepts are used in order to understand what guides people to take positive actions towards their health and safety. In turn, this can be applied to how nurses are led to make decisions for the best patient outcome. The HBM has been commonly applied to encompass a broad range of health behaviors and populations, which include preventive health behaviors, sick role behaviors (compliance with recommended medical regimens), and clinical use (Glanz et al., 2002).

Because VAP poses a significant risk for mechanically ventilated patients, the VAP bundle was developed to provide a protocol in VAP prevention; subsequently, it is the responsibility of the nurses to implement the VAP bundle according to hospital policy and protocol. In the HBM, there are different factors that influence a person's decision for action or change, which for this study is nurse adherence to the VAP bundle. These factors, such as how the nurse perceives the seriousness of the disease, what the complications are, perceived benefits or barriers to the action, and demographics, influence the nurse's decision to implement the VAP bundle. Consequently, the HBM provides guidance for understanding nurse adherence to the VAP bundle care by examining nurse perceptions of the bundle's efficacy and barriers to

adherence. For example, conflicting hospital policies and protocols would be a barrier to nurse adherence to the VAP bundle because conflicting and unclear guidelines make implementation difficult and discourage effective nursing practice. As the Health Belief Model supports the importance of strategies for health promotion, it is additionally important to take other factors into consideration such as nursing experience and hospital protocol. How the Health Belief Model is incorporated into this study is discussed further in the instrument section of this proposal.

### Research Design

This quantitative study employed a descriptive design to measure nurse adherence to VAP bundle interventions in hospital ICUs. The study aimed to collect data on a specific sample population (San Francisco Bay Area nurses in hospital ICUs) at this current point in time with no follow-up. The independent variable was the 5 VAP bundle interventions from the IHI's VAP bundle (see Table 1 below). In this study however, sedation vacations and spontaneous breathing trials were counted as separate interventions because spontaneous breathing trials do not occur if sedation vacations for mechanically ventilated patients are not successful.

*Table 1.*

Variable conceptual and operational definitions.

Variable	Conceptual Definition	Operational Definition
<b>Nurse</b>	A person trained to care for the sick or infirm, especially in a hospital	A person working at the hospital in the Intensive Care Unit as a registered nurse whose primary role is direct patient care in the ICU
<b>Nurse Demographics</b>	Quantifiable statistics of the ICU nurses	The nurse's age, gender, education at time of study
<b>Nurse Characteristics</b>	Information that is unique to the ICU nurse based on personality and work experience	Total years the participant has worked as a nurse (including ICU experience), the nurse's ICU experience in years, how many hours a week the participants works in the ICU, how many



		mechanically ventilated patients the nurse has taken care of in the past 2 weeks, nurse's perceptions of VAP bundle
<b>Adult patient</b>	A person who is fully grown or developed	A person 18 years and older hospitalized in the ICU
<b>Adherence</b>	The action of nurses actively choosing to implement VAP bundle interventions	Adherence is achieved when all VAP bundle interventions are reported to be implemented by the nurse as 'all the time' or 'most of the time' and are implemented in accordance with hospital policy.
<b>Mechanical Ventilation</b>	The use of a ventilator to assist or replace spontaneous breathing in hospitalized ICU patients	The use of a mechanical ventilator by a patient in the hospital ICU at risk for VAP
<b>Ventilator-associated pneumonia</b>	A lung infection that develops in a person who is on a ventilator (Koenig & Truitt, 2006)	A pneumonia where the patient is on a mechanical ventilator > 2 calendar days on the date of event, with day of ventilator placement being Day 1, and the ventilator was in place on the date of event or the day before (Munro & Ruggiero, 2014).
<b>IHI's VAP Bundle</b>	A series of interventions related to ventilator care that, when implemented together, will achieve significantly better outcomes than when implemented individually (IHI, 2013).	<ol style="list-style-type: none"> <li>1. HOB elevation of 30 to 45 degrees</li> <li>2. Daily sedation vacations (interruptions of sedative drug infusions that test patient's stability) and assessment of readiness to extubate (spontaneous breathing trials that test the patient's ability to breathe independently)</li> <li>3. Peptic ulcer disease prophylaxis – use of H2 blockers (preferred over sucralfate)</li> <li>4. Deep vein thrombosis prophylaxis—use of anticoagulants or sequential compression devices if anticoagulants are contraindicated</li> <li>5. Daily oral care with chlorhexidine—use of 0.12% chlorhexidine oral rinse</li> </ol>
<b>Sedation Vacation</b>	An intervention in which sedative medications are withheld from being given to the patient on a mechanical ventilator to test his or her medical stability and ability to breathe independently.	An intervention that is implemented based on the hospital protocol. Policy and protocols may differ among hospitals.

The dependent variable in this study was the nurses' perception of adherence to the VAP bundle, which was measured by self-reported intervention frequency in the questionnaire. For this study, adherence was defined as the degree to which a nurse actively chooses to implement the VAP bundle interventions for the patient.

### **Research Study Objectives**

Listed below were the research objectives that this study aimed to meet through implementation of the questionnaire.

- Measure ICU nurses' perceptions of adherence to VAP bundle interventions.
  - Full adherence would be considered met if the respondents report: all interventions were completed as stated by hospital policy/guidelines: the bundle intervention was implemented all or most of the time: and intervention was implemented as stated in the hospital policy/guidelines.
- Measure ICU nurses' perceptions of VAP, implementation of the bundle, and VAP bundle hospital policy/guidelines
- Determine perceived barriers to nurse adherence in relation to hospital facilitation and self-efficacy
- Identify deficiencies with the VAP bundle interventions, which would add to the knowledge base about the bundle and help determine its feasibility in hospitals

### **Content Validity of the Instrument**

- Test the content validity of the questionnaire through feedback from an expert panel of nursing faculty

### **Methodology**

The sample population, instrument, ethical considerations, data collection procedures,

and data management are discussed below.

### **Sample Population**

The population of interest was nurses who work in intensive care units (ICU) of San Francisco Bay Area hospitals and who take care of mechanically ventilated patients. Data was collected from a sample size of 28 ICU nurses. This was a purposive and convenience sample; ICU nurses from local hospitals were reached through nursing faculty who have professional ICU networks and associations. For the purpose of this study, the nurses helping to distribute the questionnaires were termed ‘research facilitators’. Research facilitators were chosen based on their availability and commitment to participate in the study along with their professional relationships with the sample population.

Inclusion criteria for study participants included:

- Nurses who have taken care of at least one mechanically ventilated adult patient within the past month in the hospital ICU.
- Nurses working at a hospital that implement VAP bundle care, which will be self-reported by the nurses.
- Nurses employed by the hospitals and are considered full-time, part-time, per diem, or traveler registered nurses.
  - Full-time – works normal or standard amount of hours as defined by his/her employer (40 hours a week)
  - Part-time – works fewer than 30 or 35 hours per week
  - Per-diem – hired on a day to day basis based on employer
  - Traveler RNs – nurses who are hired to travel to work in temporary nursing positions

- Nurse's whose primary role is direct patient care in ICUs

Exclusion criteria for study participants included the following:

- Nurses who have not taken care of at least one mechanically ventilated adult patient within the past month.
- Nurses who are orienting to the unit when questionnaires are made available.
- Nurses whose role on the unit is supervisory or administrative.

### **Instrument**

The questionnaire of a similar study performed in northern California (Kiyoshi-Teo et al., 2013) was used as an inspiration for the development of this study's questionnaire. According to the authors, the pilot study for the original questionnaire yielded mixed results of reliability testing, "but [the participants] provided critical information to improve the survey" (Kiyoshi-Teo et al., 2013, p. 207). Although the questionnaire differs from that of Kiyoshi-Teo et al. (2013), permission was obtained from the primary researcher to use the tool (Appendix A).

Appendix B provides the questionnaire. A self-administered questionnaire was selected for this study because it was an appropriate way to collect a large amount of data in an organized and concise manner; it was a feasible option for an undergraduate research study.

The first section, items 1-12, asked the nurses about their work experience in the ICU, and about their demographics such as age, gender, education, and certification. The questionnaire incorporated several major concepts of the Health Belief Model into items 13-49 – perceived severity, perceived efficacy, and perceived barriers. The nurses' perceived severity of VAP in mechanically ventilated patients was measured in items 12-14. Perceived efficacy by the nurses of the VAP bundle interventions (how effective and useful they are for preventing VAP in mechanically ventilated patients) was measured in items 15, 24, 29, 34, 39, 44, and 49. Perceived

barriers related to hospital guidelines/policy was measured in items 25, 26, 30, 31, 35, 36, 40, 41, 45, 46, 50, and 51.

Items 16-20 measured the nurses' perceptions about their hospital's VAP bundle policy and VAP bundle implementation through a 5-point Likert scale. Item 21 asked the nurses what the most recent VAP rate on the unit was. Items 22, 27, 32, 37, 42, and 47 measured the extent to which nurses implement that specific VAP bundle intervention using a 4-point Likert Scale; their options were all the time/100% of the time (1), most of the time/80-99% of the time (2), some of the time/60-79% of the time (3), very little or not at all/59% of the time (4). The following questions (items 23, 28, 33, 38, 43, and 48) asked whether the nurses' implementation of the intervention is based on the hospital policy/guidelines. The 5-point Likert scales for items 12-20, 24-26, 29-31, 34-36, 39-41, 44-46, and 49-51 asked the participant about the extent to which they agree with the statements provided; their options were strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), and strongly agree (5). An open-ended section at the end of the questionnaire allowed the participants to provide any further comments about the VAP bundle interventions.

The study served as a pilot for the evaluation of the instrument's content validity using an expert panel of nurse faculty who have ICU experience. A request was sent to four professional nursing faculty members and one ICU nurse seeking their expertise and suggestions for improvement regarding the questionnaire; one nursing faculty member proposed changes regarding clarification of 'hospital policy' and possible contraindications of the VAP bundle interventions. These changes were incorporated; as a result, a statement clarifying 'hospital policy' was added to the description box of Section 3 of the questionnaire, and items 24, 30, 36, 42, 48, and 54 were included to address reported contraindications to the bundle interventions.

**Ethical Considerations**

This study was approved by the Institutional Review Board for the Protection of Human Subjects of Dominican University of California (IRBPHS Application #10383). In August 2015, the IRB had determined that the study met the requirement for minimizing risk and protecting the rights of the participants in my research (Appendix C). The sample population, which consisted of practicing ICU nurses directly taking care of mechanically ventilated patients, was informed about the study by the research facilitators and the consent form attached to the questionnaire. The survey data remained confidential and was shared only with the primary researcher and advising faculty. Participant consent was obtained through the consent form otherwise labeled as Letter of Introduction to Participants in Anonymous Survey Research (Appendix D). This letter explained the survey, gave the contact information of the primary researcher, and provided a signature page for consent. The letter also stated that risks to the nurses were minimal; answers would remain confidential and would not affect their employment. The questionnaires were stored in a locked filing cabinet in the primary researcher's office and were kept until presentation of the thesis to Dominican University of California's Honors Board upon which all questionnaires by participants were destroyed. The letter further explained that the nurses were free to withdraw from the study at any time and that their questionnaire would be discarded from the study should they choose to do so. The amount of discarded and completed questionnaires were included in the data analysis.

**Data Collection Procedures**

Paper copies of the questionnaire were distributed over a period of five weeks from mid-September 2015 to mid-October 2015 by two research facilitators; respondents had until mid-October to return the questionnaire. Nurses were given the option to complete the survey on their

own time. Because the research facilitators distributed the questionnaires, they signed a confidentiality agreement form to maintain participant anonymity and confidentiality (Appendix E). The five weeks length was chosen to maximize the opportunity for all ICU nurses who meet the inclusion criteria to fill out a questionnaire. The nurses only filled out one questionnaire for him- or herself. The participants were asked to seal the questionnaire in the accompanying returned envelope and submit it to the research facilitators.

If the participants had questions about the survey, they could ask the research facilitators. Participants were also welcome to contact the primary researcher or faculty adviser with any questions or concerns they had. Neither the primary researcher or faculty adviser were contacted by any participants throughout the duration of the study.

To encourage nurse participation, the participant was given the option to record their phone number or email at the end of the questionnaire. The survey numbers (Q1, Q2, etc.) of the participants that recorded either their phone number or email were put into a raffle once all data distribution and collection was completed. The winner of the raffle was contacted through email to claim a free 3M Littman stethoscope provided by the primary researcher.

### **Data Management**

Once the nurses completed the questionnaire, they were asked to seal it within the envelope provided. The sealed envelopes were collected by the researcher facilitator. Hard copies of the questionnaires were stored in a locked file cabinet in the primary researcher's office. Questionnaires were coded and the data was entered into spreadsheets by the primary researcher; all data was double-checked once entered into the spreadsheet. The file was also saved on the primary-researcher's password-protected Google Drive which acted as a back-up file location for the computer file. Hard-copy surveys were labeled as Q1, Q2, Q3, Q4, Q5 etc.

Two consent forms were attached to each questionnaire – one to be signed and given to the primary researcher and the other for the participant to keep. Each participant was given the second copy of the consent form so that the primary researcher could be contacted and discard the questionnaire if the participant chose to withdraw from the study. If the participants wanted to receive the results from the study, they indicated so at the end of the questionnaire and provided the email address they wish to be contacted through.

### **Results**

Reported answers for Sections 1, 2, and 3 of the questionnaire are discussed below.

Additional values are provided in Tables F2 and F3 of Appendix F.

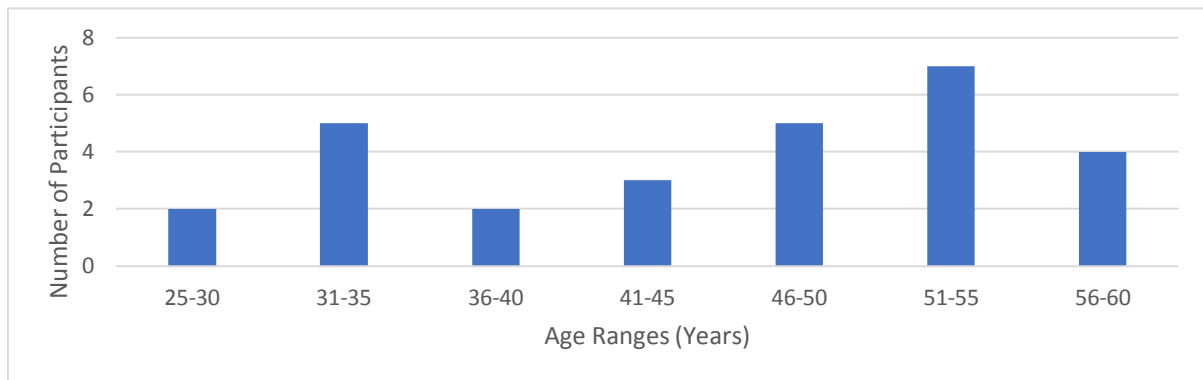
#### **Section 1: Nurse Factors**

Twenty-nine ICU nurses from three hospitals located in the San Francisco Bay Area of northern California participated in the study. One participant failed to answer Item 11 in Section 1 which asked the nurse how many mechanically ventilated patients he/she took care of in the past month; this participant's questionnaire was discarded because it could not otherwise be determined if the nurse met the criteria for participating in the study. Another participant answered Sections 1 and 3 of the questionnaire but did not fill out Section 2; their data was included in the final analysis.

A little over half of the sample population described their type of hospital environment as suburban (n=15) whereas the remaining stated their hospital as urban (n=11); two participants did not answer the question. Seventy-one percent (n=20) labeled the ICU they work in as a combined medical-surgical unit; eight others labeled their ICU as either a medical, cardiac or neurological unit. Twenty-one nurses identified themselves as female, making up 75% of the sample population.



**Age.** The youngest nurses (n=2) were between the ages of 25 and 30 whereas the oldest nurses (n=4) were between the ages of 56 and 60. Fifty-seven percent of the sample population (n=16) were of the ages 46 years or older. Of all the age categories, the majority of the nurses (n=7) were 51 to 55 years of age making up a quarter of the sample population.

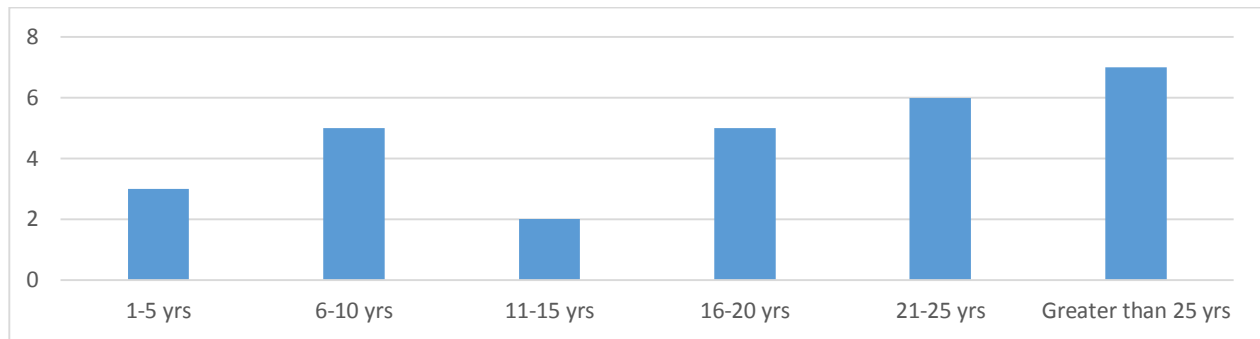


*Figure 1.* Ages of participants. This figure illustrates the amount of participant responses per age ranges.

**Highest education in nursing & certification.** Majority of the sample population (n=20) practiced with a bachelor's degree (71%); six nurses practiced with an associate's degree; another two participants practiced with graduate degrees in nursing. In regards to nursing certification, the same amount of nurses (n=12) reported having no certification as those who reported being Critical Care Registered Nursing (CCRN) certified; the remaining four reported other certifications of Trauma Nursing Core Course (TNCC), ICU, Critical Care, and ACLS/PALS.

A greater number of nurses received their highest nursing education in the United States, making up 54% (n=15) of the sample population. The remaining 13 participants reported having obtained their highest nursing degrees outside of the United States; seven stated having earned their degree in the Philippines while the other six nurses did not specify.

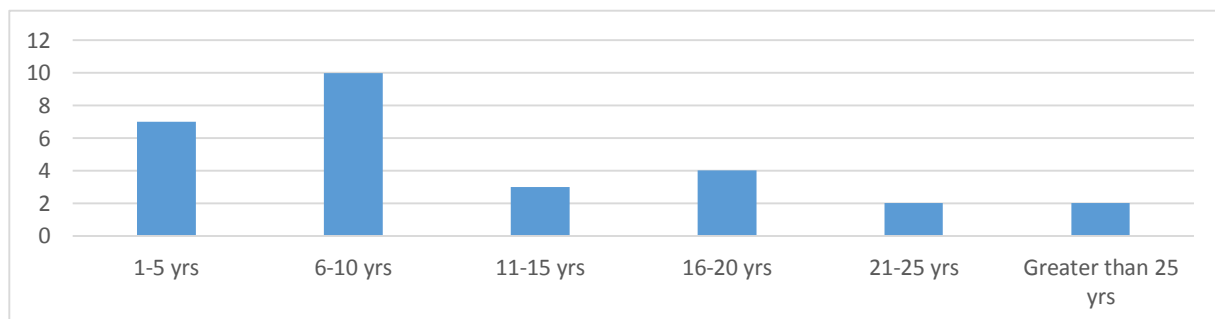
**Amount of experience as a nurse and as an ICU nurse.** In regard to the total amount of experience as a Registered Nurse (RN), 36% (n=10) of the participants reported having 1 to 15 years of experience. Thirty-eight percent of the sample (n=11) had 16 to 25 years of experience.



*Figure 2.* Total years of experience as nurse. This figure illustrates the amount of participant responses per amount of years worked as a nurse.

Among the different time ranges, the greatest number of nurses (n=7) reported their nursing experience as greater than 25 years; their answers ranged between 27 to 41 years. One participant stated having nursing experience of over 40 years but did not specify a number.

In comparison to the other number ranges, the majority of participants (n=10) had reportedly worked as ICU RNs for 6 to 10 years. Overall, 43% (n=12) of the sample population were ICU RNs for 11 or more years. Two other nurses specified working as ICU RNs for 29 years and 36 years.



*Figure 3.* Total years as ICU nurse. This figure shows the amount of participant responses per total amount of years worked as a nurse in the ICU.

**Hours worked per week.** Eighty-two percent (n=23) of the nurses reported working 32 to 46 hours per week whereas the remaining five participants reported working either 9 to 16 hours or 25 to 32 hours weekly.

**Amount of mechanically ventilated patients within the past month.** Nearly 90% (n=25) of the sample population reported taking care of 5 or more patients on a mechanical ventilator within the past month. Among all the categories, the majority (n=16) reported taking care of 7 or more patients within the past month.

## **Section 2: Nurse Understanding and Perceptions of VAP and VAP bundle**

Section 2 of the questionnaire addressed nurses' understanding and perception of VAP and VAP bundle within hospital policy/guidelines. For items 12 and 14-21, 63% to 85% (n=17) reported 'strongly agree' with the items whereas the remaining reported that they 'agree'. Item 13, which states "Ventilator associated pneumonia has a high mortality rate in mechanically ventilated patients", had the lowest amount of 'strongly agree' answers (n=12) among all the items. For that same item, four participants reported 'neither disagree nor agree' with the statement. For items 15-21, all participants reported either 'agree' or 'strongly agree'.

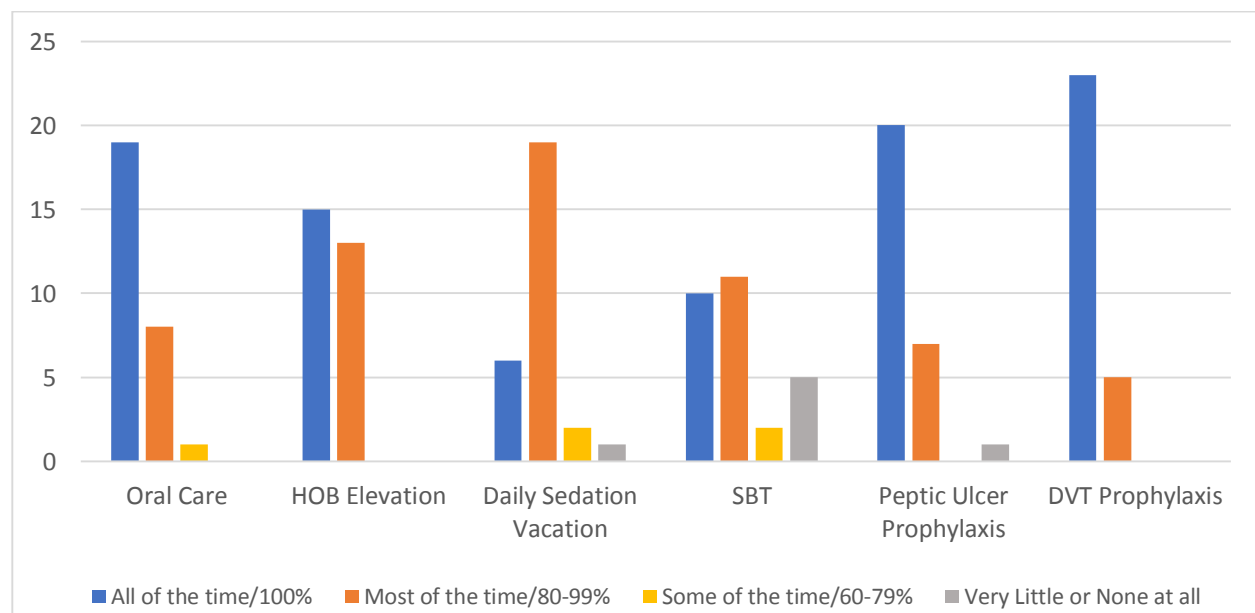
Item 21 asked the participant to state what the most recent VAP rate on the unit was within the past year. Seventy-one percent (n=20) stated that they do not know the VAP rate on their unit; three participants stated the VAP rate was 0 per 1000 ventilator days; three other participants reported their unit's VAP rate as 2, 15, and 167 per 1000 ventilator days.

## **Section 3: VAP Bundle Implementation According to Hospital Policy/Guidelines**

Section 3 addressed the degree to which the VAP bundle interventions were provided, whether the nurses' implementations were based on hospital policy, and known contraindications of the interventions. The interventions that were included were oral care with chlorhexidine,

head of bed (HOB) elevation, daily sedation vacation, spontaneous breathing trial (SBT), peptic ulcer prophylaxis, and deep vein thrombosis (DVT) prophylaxis. The mean, minimum, and maximum values for each item in Section 3 were calculated and organized according to VAP bundle intervention (Appendix F, Table F2).

Across all six interventions, 96% (n=27) of the participants reported ‘yes’ – that their implementation is based on hospital policy; only one nurse reported ‘I do not know’ for whether their implementation of spontaneous breathing trials is in accordance with hospital policies/guidelines. In regard to the degree of which interventions are implemented, peptic ulcer prophylaxis and DVT prophylaxis had the most responses to which the participants responded ‘all the time/100% of the time’ – 71% (n=20) and 82% (n=23) respectively. Daily sedation vacation had the most amount of participants (n=10) answer ‘most of the time/80-99%’ for that item. Spontaneous breathing trials had the most amount of participants answer ‘very little or not at all/59% of the time or less’ (n=5) for the extent of implementation.



*Figure 4.* Degree of implementation. This figure illustrates the amount of responses per VAP bundle intervention.

For whether there were contraindications to the interventions (Appendix F, Table F1), approximately 70% and 80% of participants reported 'yes' for HOB elevation and daily sedation vacations respectively; the interventions that had the lowest amount of participants report 'yes' to were oral care with chlorhexidine and peptic ulcer prophylaxis.

The last three questions of every intervention section asked the participant to what extent they agree that 1) the implementation will help prevent VAP, 2) the policy/guideline for the intervention is clear and specific, and 3) that there are other policies/guidelines that conflict with the intervention's policy. Overall, 75% or more (n=21) of the participants reported either 'agree' or 'strongly agree' towards whether implementation of the six bundle interventions will help prevent VAP in mechanically ventilated patients. Oral care was the only intervention in which 100% of the sample population reported 'agree' or 'strongly agree' that the implementation will help prevent VAP. Deep vein thrombosis prophylaxis had the lowest amount of participants who agreed with that statement; three participants reported 'disagree' to whether DVT prophylaxis will help prevent VAP, which is the most amount of participants in that answer category among the six interventions. Four participants reported 'neither disagree nor agree' for both daily sedation vacations and DVT prophylaxis.

Across all six interventions, an average of 95% of the participants reported 'agree' or 'strongly agree' that the interventions' hospital policy/guidelines were clear and specific. Three different participants reported 'disagree' in regards to oral care with chlorhexidine, daily sedation vacations, and peptic ulcer prophylaxis. Two participants reported 'neither disagree nor agree' for spontaneous breathing trials.

The last question for each intervention in Section 3 asked the participants to what extent they agree that there are other policies/guidelines that conflict with the intervention guideline.

Per intervention, the majority of participants, ranging from 46% (n=13) to 64% (n=18), answered 'disagree' or 'strongly disagree'. The interventions that had the most responses of 'agree' or 'strongly agree' were daily sedation vacations (n=13) and spontaneous breathing trials (n=12). Across all interventions, the percentage of participants that answered 'neither disagree nor agree' of the interventions ranged from 7% (daily sedation vacation, n=2) to 25% (peptic ulcer prophylaxis, n=7).

At the end of the instrument, an open-ended question was provided regarding whether the participants had any comments regarding VAP bundle interventions and/or implementation. Two of the 28 participants provided comments; one wrote, "It's best to extubate ASAP to prevent VAPs. However if extubation is not possible at the moment, implementation of the VAP bundle does reduce VAPs!" The other person commented, "If implemented consistently, VAP prevention bundles help with decreased incidence of VAP."

### **Statistical Analysis**

Analysis of Variance (ANOVA) was performed with SPSS, a software package used for statistical analysis, between nurse factors in Section 1 (age, gender, highest degree earned, etc.) and Section 3 (items 22-57). Significant data consisted of items that resulted in p-values less than 0.05. All nurse factors were included in ANOVA and consisted of age, gender, certification, total years as RN, hospital environment, type of ICU, years as ICU RN, and number of hours worked per week (See Appendix F, Table F3 for ANOVA results). The category of total years as RN yielded the most amount of significant results for differences between groups, having resulted in 12 significant p-values. Nurse factors of the highest degree earned, location of highest degree earned, and number of mechanically ventilated patients cared for revealed no significant results between groups.

**Age**

Among the different age groups, items 25, 32, 37, and 38 yielded significant results of .023, .32, .013, and .023 respectively. For item 25 (“Implementation of oral care with chlorhexidine will help prevent VAP.”) and item 32 (“The policy/guideline on HOB elevation is clear and specific.”), all age groups answered ‘agree’ or ‘strongly agree’. Upon analyzing participants’ responses, differences in answers were shown between the youngest nurses (ages 25 to 30) and the rest of the age groups. Those ages 25 to 30 tended to answer ‘agree’ whereas the older nurses answered ‘strongly agree’ for items 25 and 32; this was not a remarkable outcome because there is not enough difference between ‘agree’ and ‘strongly agree’ for the result to be significant. For item 37 (“Implementation of the sedation vacations will help prevent VAP”), those ages 31 to 35 tended to answer ‘neither disagree nor agree’ compared to older nurses who mostly answered ‘agree’ or ‘strongly agree’.

**Gender**

Between males and females, items 30, 34, 36, 40, and 55 yielded significant p-values of .03, .18, .048, .024, and .047. For item 30 (“Is there a contraindication(s) to elevating HOB 30 degrees?”), males tended to answer ‘no’ whereas majority of the females answered ‘yes’. For item 40 (“To what degree do you provide spontaneous breathing trials?”), all male participants answered ‘all the time/100% of the time’ or ‘most of the time/80-99% of the time’ whereas the female answers had mixed results among the four answer choices.

**Certification**

Between those who were CCRN certified and those who had no certification, items 34 and 40 yielded significant p-values of <.001 and .041. For item 34 (“To what degree do you provide daily sedation vacations...?”), CCRN certified participants tended to answer ‘all the

time/100% of the time’ whereas those with no certification all answered ‘most of the time/80% of the time’.

Similarly, for item 40 which asks the degree to which spontaneous breathing trials are implemented, those CCRN certified tended to answer ‘all the time/100% of the time’. Those with no certification either answered ‘most of the time/80-99% of the time’, or ‘very little or not at all/59% of the time or less’.

### **Total Years Worked as RN**

The nurse factor of how many total years the participants had worked as RNs yielded the greatest amount of significant results (items 24, 32-34, 37, 39, 43, 44, 51, 56, and 57). For item 24 (“Is there a contraindication(s) to providing oral care...?”), those who had worked 6-10 years tended to answer ‘yes’; all other nurses who worked less than six years and more than 10 years answered ‘no’. For item 33 (“There are other policies/guidelines that conflict with the HOB elevation guideline.”), those who had worked 16-20 years as an RN tended to answer ‘disagree’ and ‘strongly disagree’. Other groups yielded mixed results for item 33.

Participants who worked 16-20 years and over 25 years tended to answer ‘disagree’ or ‘strongly disagree’ for item 39 (“There are other policies/guidelines that conflict with the daily sedation vacation policy/guideline.”). In contrast to the other groups, all of the participants (n=3) who had the least amount of years worked as an RN (1-5 years) answered ‘agree’ for this item.

The group of participants who worked 6-10 years differed from other groups for item 43 (“Implementation of SBT will help prevent VAP”); they tended to answer ‘neither disagree nor agree’ whereas other groups answered ‘agree’ or ‘strongly agree’. For item 57, the group that worked as RNs for 21 to 25 years mostly answered ‘agree’ or ‘strongly agree’. Other range groups yielded mixed answers for item 39, 51, and 57.



### **Discussion**

Despite high implementation averages of the interventions, majority of the nurses are unaware of their unit's most recent VAP rate. The success of VAP bundle implementation is dependent on knowing the VAP rate because the VAP rate is an indication of whether the bundle interventions are effective in preventing VAP. Based on this information, nurses may be implementing the interventions without conscious thought towards evidence-based practice and preventing VAP. Several reasons may contribute to this such as how involved the hospital is in preventing healthcare-associated infections, how adequately staffed the units are, or whether hospital protocols or algorithms are in place to standardize and simplify implementation. The promotion of using evidence-based practice on the units may also play a factor in how the quality of patient care is improved or evaluated.

Nurses who are tired, busy, or overworked may not give an extra thought to the VAP rate of their unit, especially if there other issues that take priority on the floor. Additionally, nurses who work in hospital environments that promote infection control or current evidence-based practice may be more cognizant of their own nursing practice and the status of where their workplace stands in regards to infection rates.

### **Section 3: VAP Bundle Implementation According to Hospital Policy/Guidelines**

As discussed earlier, nurse perception of adherence to VAP bundle interventions was considered met if 1) each intervention was reportedly implemented in accordance with hospital policy/guideline, 2) the degree to which the interventions were implemented were reported as 'all the time/100% of the time' or 'most of the time/80-99% of the time', and 3) all 6 interventions were reported to be implemented 'all the time' or 'most of the time' by that individual participant.

According to the data, it is the nurses' perception that they are appropriately implementing the VAP bundle interventions according to the hospital policy and guidelines. With this, adherence to oral care with chlorhexidine was met for 96% (n=27) of the population and HOB elevation was met for 100% of the sample population. For daily sedation vacation, 89% (n=25) of the population indicated adherence whereas only 75% (n=21) met the adherence criteria for implementation of the spontaneous breathing trials. For peptic ulcer prophylaxis and DVT prophylaxis, adherence was considered met 96% (n=27) and 100% of the sample population respectively. Altogether, 68% (n=19) of the sample population met all three criteria.

The nurses' ability to effectively implement the interventions is also reflected in their belief that the intervention policy and guidelines are clear and specific – averages ranging from 4.5 to 4.6 – and the reported degree of intervention implementation which ranged from 1.2 to 2.1. Spontaneous breathing trials had the lowest average of degree implementation of 2.1. This result may be due to several factors. Depending on the unit, spontaneous breathing trials require collaboration with the respiratory therapist and can be time consuming. Other factors that may have affected this result include the lack of clarification in the questionnaire of whether the nurse is working day, evening, or night shift since trials may only be done during the day or a lack of clear protocol for when spontaneous breathing trials may be implemented. Spontaneous breathing trials also had the lowest average of agreement for item 45 (“There are other policies/guidelines that conflict with the SBT policy/guideline.”) where the mean tended toward ‘neither disagree nor agree’. Based on these results, more clarification or standardized protocol for when spontaneous breathing trials should be implemented may be needed on those units.

Daily sedation vacations and HOB elevation had the highest mean for the presence of contraindications; this meant that nurses tended to report ‘yes’ there are contraindications to the

interventions. This may be so because daily sedation vacations are performed based on the hemodynamic status of the patient and whether or not the patient has minimal agitation and restlessness without sedation. It may take the critically ill patient several days to heal and recover before being in optimum condition to be weaned from the sedation. The most commonly reported contraindications to HOB elevation included the placement of femoral lines and unstable hemodynamic status.

Deep vein thrombosis prophylaxis had the highest reported degree of intervention implementation (average of 1.2), which means that the nurses tended to report implementing them 'all the time/100% of the time'. In contrast, DVT prophylaxis had the lowest average of 4.2 on whether the nurses believe the DVT prophylaxis will help prevent VAP overall. Although DVT prophylaxis focuses on preventing the formation of blood clots in the lower extremities, its indirect role in preventing VAP may not be well known. According to what the Institute of Healthcare Improvement terms the 'bundle effect', it is the idea that all of these six interventions implemented together will better prevent VAP overall than if they were unstandardized or implemented separately. Oral care with chlorhexidine and peptic ulcer prophylaxis had the highest reported averages of 1.9 for the presence of contraindications; this meant the nurses found minimal contraindications to those two interventions.

For the last question in each intervention's section, the nurses were asked to report the extent to which they agree that there are other guidelines that conflict with the intervention guidelines. Based on the averages among all six interventions which ranged from 2.4 to 3, the nurses tended to report 'neither disagree nor agree'. This gives the impression that the presence of policies/guidelines that conflict with intervention policy may not be well distinguished in the ICU hospital environment despite frequent implementation.

### **Research Study Limitations**

There are several drawbacks of this study. A potential drawback of the study was that the nurses who filled out the survey may have felt they have done a poor job, which would have affected their perceptions of VAP bundle care and job performance. If a part of the questionnaire included how the nurses felt about the quality of bundle care they provide, the nurses who have a negative perception of their abilities could be identified; this would give their data context for more accurate analysis. Another negative aspect of this study included relying on the participants' memory for data; to minimize this potential threat, the participants were asked to report on patients the nurse had taken care of within the past month. Lack of adequate responses from nurse faculty for content validity was also a drawback because the questionnaire could have been improved with faculty feedback; further analysis of the questionnaire from different perspectives could have assisted in improving how items of the questionnaire were phrased, inclusion of question topics, and/or formatting. It might have been useful to also have the sample population indicate which shift they work (day, evening, or night) since daily sedation vacations and spontaneous breathing trials may be only done during the day depending on the unit; this would affect the quality of the resulting data and the presence of contraindications for the interventions in Section 3 of the questionnaire. Lastly, if a nurse chose to complete the questionnaire during his or her shift, the flow of patient care on the unit could have been interrupted.

### **Implications for Nursing Practice**

A tool with established reliability and validity is needed in order to accurately capture nurse perceptions of their practice. Information gathered from nurse perceptions may also clue in researchers to current nursing culture in hospitals in regards to using evidence-based practice. A

larger variety of hospitals (urban, suburban, and rural) and nurse demographics is needed in order to generalize any data with the larger regional population.

Other benefits may come of this study. Participating nurses who examined their use of the VAP bundle in the ICU setting may recognize a need for change in their practice (or unit) and be more conscientious about preventing VAP in mechanically ventilated patients.

Additionally, they may also become aware of areas for improvement and change in regards of how to better implement VAP bundle interventions. This study adds to the nursing knowledge base about the VAP bundle and current nurse adherence to VAP bundle in hospital ICUs.

In recognizing areas of the VAP bundle where perception of adherence may be weak or low, more critical analysis of that unit's intervention protocols can be examined and then refined as a result. Identifying needed changes in nursing protocol and practice is a significant step in advancing the nursing profession and ultimately improving patient care and outcomes.

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## Appendix A

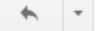
## Permission from Original Researcher to Use Tool

## Seeking Permission for Use of Tool

Fa15 Nursing x

**Alexis Luna** <alexis.luna@students.dominican.edu>

Aug 29 ☆



to kiyoshi, Olivia ▾

Good Morning Dr. Kiyoshi-Teo,

I am a nursing student from Dominican University of California and am in need of your assistance with my senior thesis. My thesis adviser, Dr. Catolico, is cc'd here.

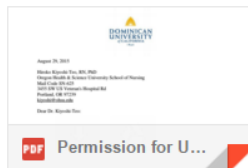
Please see the attached cover letter for more information.

Thank you,

Alexis Luna

(510) 599-4127

[alexis.luna@students.dominican.edu](mailto:alexis.luna@students.dominican.edu)

**Hiroko Kiyoshi-Teo** <kiyoshi@ohsu.edu>

Sep 2 ☆



to me, Olivia ▾

Hi Alexis,

Thank you for your inquiry. You have my permission to use the instrument. I would be very interested in what you find in your study! Let me know if you have any questions. Good luck!

**Hiroko Kiyoshi-Teo PhD, RN**

Clinical Assistant Professor

**VANAP Faculty (VA-Nursing Academic Partnership)**

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## Appendix B

## VAP Bundle Questionnaire



## VENTILATOR-ASSOCIATED PNEUMONIA BUNDLE QUESTIONNAIRE

This questionnaire aims to assess nurse adherence with VAP bundle interventions. Confidentiality and anonymity of the persons filling this out will be maintained.

<b>SECTION 1: Nurse Demographics (Check one box)</b>	
1. What is your age?	<input type="checkbox"/> 18-24 <input type="checkbox"/> 41-45 <input type="checkbox"/> 61-65 <input type="checkbox"/> 25-30 <input type="checkbox"/> 46-50 <input type="checkbox"/> 66-70 <input type="checkbox"/> 31-35 <input type="checkbox"/> 51-55 <input type="checkbox"/> 71 and older <input type="checkbox"/> 36-40 <input type="checkbox"/> 56-60 <input type="checkbox"/> Prefer not to answer
2. What is your gender?	<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Other: (specify) _____ <input type="checkbox"/> Prefer not to answer
3. What is your highest degree earned in Nursing?	<input type="checkbox"/> Diploma <input type="checkbox"/> Associate <input type="checkbox"/> Bachelor's <input type="checkbox"/> Graduate degree <input type="checkbox"/> Ph.D
4. What is your current nursing specialty certification status?	<input type="checkbox"/> None <input type="checkbox"/> Critical Care Registered Nurse (CCRN) <input type="checkbox"/> Neurosurgical <input type="checkbox"/> Emergency Room <input type="checkbox"/> Acute Care Nurse Practitioner <input type="checkbox"/> Other (specify): _____

5. Where did you obtain your highest degree?	<input type="checkbox"/> United States <input type="checkbox"/> Outside of U.S. (specify) _____
6. How long have you been working as a nurse (total years as RN)?	<input type="checkbox"/> Less than 1 year <input type="checkbox"/> 11-15 years <input type="checkbox"/> 1-5 years <input type="checkbox"/> 16-20 years <input type="checkbox"/> 6-10 years <input type="checkbox"/> 21-25 years <input type="checkbox"/> Other: _____
7. What type of hospital environment best describes where you work?	<input type="checkbox"/> Urban <input type="checkbox"/> Suburban <input type="checkbox"/> Rural
8. What kind of ICU do you currently work in?	<input type="checkbox"/> Medical <input type="checkbox"/> Combined Medical-Surgical <input type="checkbox"/> Surgical <input type="checkbox"/> Cardiac <input type="checkbox"/> Neurological <input type="checkbox"/> Others: _____
9. How long have you worked as a nurse in this ICU (total years as ICU RN)?	<input type="checkbox"/> Less than 1 year <input type="checkbox"/> 11-15 years <input type="checkbox"/> 1-5 years <input type="checkbox"/> 16-20 years <input type="checkbox"/> 6-10 years <input type="checkbox"/> 21-25 years <input type="checkbox"/> Other: _____
10. Hours worked per week:	<input type="checkbox"/> 1-8 hours <input type="checkbox"/> 25-32 hours <input type="checkbox"/> 9-16 hours <input type="checkbox"/> 32-39 hours <input type="checkbox"/> 17-24 hours <input type="checkbox"/> 39-46 hours <input type="checkbox"/> Other: _____
11. How many mechanically ventilated patients have you taken care of in the past month?	<input type="checkbox"/> 1-2 patients <input type="checkbox"/> 3-4 patients <input type="checkbox"/> 5-6 patients <input type="checkbox"/> 7 or more patients <input type="checkbox"/> None

**SECTION 2: Nurse Understanding and Perceptions of VAP and VAP bundle within hospital policy/guidelines**

**To what extent do you agree with the following statements? Please check one box.**

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
12. Patients on mechanical ventilation have a high risk of acquiring ventilator associated pneumonia.					
13. Ventilator associated pneumonia has a high mortality rate in mechanically ventilated patients.					
14. Preventing ventilator associated pneumonia is a high priority when providing care for mechanically ventilated patients.					
15. VAP bundle interventions significantly reduce VAP in mechanically ventilated patients.					
16. My hospital has VAP bundle intervention guidelines in place.					
17. I have completely read through the hospital's VAP bundle intervention policy/guidelines.					
18. The hospital's VAP bundle intervention policy/guidelines are helpful in my practice.					
19. I understand when VAP bundle interventions are indicated.					
20. There is a high standard of providing safe patient care on my unit.					
21. What was the most recent VAP rate on your unit within the past year? <i>Ex. 6 per 1000 ventilator days</i>	<div>_____ per 1000 ventilator days</div> <div><input type="checkbox"/> I do not know</div>				

**SECTION 3: VAP Bundle Implementation According to Hospital Policy/Guidelines**

**The next sub-sections (A-F) ask you to describe the degree of which you implemented each intervention for mechanically ventilated adult patients (over 18 years of age) you've cared for within the past month.**

**Hospital policy, as referred to in the questions below, refer to what the protocol is defined by the facility for nurse implementation of the VAP Bundle component.**

**A. Oral Care with Chlorhexidine**

**If there is NO oral care policy/guideline at your unit, skip to the next section.**

22. To what degree do you provide oral care with chlorhexidine according to policy at your facility for mechanically ventilated patients?:  
(check one)

- ☐ All the time/100% of the time  
☐ Most of the time/80-99% of the time  
☐ Some of the time/60-79% of the time  
☐ Very little or not at all/59% of the time or less

23. Is your implementation of oral care with chlorhexidine based on the hospital's policy?

- ☐ Yes, it is based on the hospital's policy  
☐ No, it is not based on the hospital's policy  
☐ I do not know

24. Is there a contraindication(s) to providing oral care for mechanically ventilated patients?

- ☐ Yes (specify):

\_\_\_\_\_

If yes, please specify what the contraindication(s) was.

- ☐ No

**To what extent do you agree with the following statements? Please check only ONE box per item.**

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
25. Implementation of oral care with chlorhexidine will help prevent VAP.					
26. The policy/guideline on oral care with chlorhexidine is clear and specific.					
27. There are other policies/guidelines that conflict with the oral care with chlorhexidine policy/guideline.					

**B. Elevation of the Head of Bed Policy/Guideline***Head of bed is elevated 30 degrees.****If there is NO HOB elevation policy/guideline at your unit, skip to the next section.***

28. To what degree do you elevate the head of the bed (HOB) according to policy at your facility for mechanically ventilated patients?: (check one)

- ☐ All the time/100% of the time  
☐ Most of the time/80-99% of the time  
☐ Some of the time/60-79% of the time  
☐ Very little or not at all/59% of the time or less

29. Is your implementation of the HOB elevation based on the hospital's policy?

- ☐ Yes, it is based on the hospital's policy  
☐ No, it is not based on the hospital's policy  
☐ I do not know

30. Is there a contraindication(s) to elevating head of bed 30 degrees for mechanically ventilated patients?

☐ Yes (specify):

---

If yes, please specify what the contraindication(s) was.

☐ No

***To what extent do you agree with the following statements? Please check only ONE box per item.***

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
31. Implementation of the HOB elevation will help prevent VAP.					
32. The policy/guideline on HOB elevation is clear and specific.					
33. There are other policies/guidelines that conflict with the HOB elevation guideline.					

**C. Daily Sedation Vacations***Interruptions of sedative drug infusions that test patient's stability****If there is NO daily sedation vacations policy/guideline at your unit, skip to the next section.***

34. To what degree do you provide daily sedation vacations according to policy at your facility for mechanically ventilated patients?:  
(check one)

- ☐ All the time/100% of the time  
☐ Most of the time/80-99% of the time  
☐ Some of the time/60-79% of the time  
☐ Very little or not at all/59% of the time or less

35. Is your implementation of daily sedation vacations based on the hospital's policy?

- ☐ Yes, it is based on the hospital's policy  
☐ No, it is not based on the hospital's policy  
☐ I do not know

36. Is there a contraindication(s) to daily sedation vacations for mechanically ventilated patients?

- ☐ Yes (specify):

If yes, please specify what the contraindication(s) was.

- ☐ No

***To what extent do you agree with the following statements? Please check only ONE box per item.***

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neither disagree nor agree</b>	<b>Agree</b>	<b>Strongly Agree</b>
37. Implementation of the daily sedation vacations will help prevent VAP.					
38. The policy/guideline on daily sedation vacations is clear and specific.					
39. There are other policies/guidelines that conflict with the daily sedation vacation policy/guideline.					

**D. Spontaneous Breathing Trials (SBT)***Process of testing the patient's ability to breathe independently****If there is NO spontaneous breathing trials policy/guideline at your unit, skip to the next section.***

40. To what degree do you provide spontaneous breathing trials according to policy at your facility for mechanically ventilated patients?: (check one)	<input type="checkbox"/> All the time/100% of the time <input type="checkbox"/> Most of the time/80-99% of the time <input type="checkbox"/> Some of the time/60-79% of the time <input type="checkbox"/> Very little or not at all/59% of the time or less				
41. Is your implementation of spontaneous breathing trials based on the hospital's policy?	<input type="checkbox"/> Yes, it is based on the hospital's policy <input type="checkbox"/> No, it is not based on the hospital's policy <input type="checkbox"/> I do not know				
42. Is there a contraindication(s) to spontaneous breathing trials for mechanically ventilated patients?  If yes, please specify what the contraindication(s) was.	<input type="checkbox"/> Yes (specify): <hr/> <input type="checkbox"/> No				
<b><i>To what extent do you agree with the following statements? Please check only ONE box per item.</i></b>					
	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neither disagree nor agree</b>	<b>Agree</b>	<b>Strongly Agree</b>
43. Implementation of the SBT will help prevent VAP.					
44. The policy/guideline on SBT is clear and specific.					
45. There are other policies/guidelines that conflict with the SBT policy/guideline.					

**E. Peptic Ulcer Prophylaxis**

***If there is NO peptic ulcer prophylaxis policy/guideline at your unit, skip to the next section.***

<p>46. To what degree do you provide peptic ulcer prophylaxis according to policy at your facility for mechanically ventilated patients?: (check one)</p>	<p><input type="checkbox"/> All the time/100% of the time  <input type="checkbox"/> Most of the time/80-99% of the time  <input type="checkbox"/> Some of the time/60-79% of the time  <input type="checkbox"/> Very little or not at all/59% of the time or less</p>				
<p>47. Is your implementation of peptic ulcer prophylaxis based on the hospital's policy?</p>	<p><input type="checkbox"/> Yes, it is based on the hospital's policy  <input type="checkbox"/> No, it is not based on the hospital's policy  <input type="checkbox"/> I do not know</p>				
<p>48. Is there a contraindication(s) to peptic ulcer prophylaxis for mechanically ventilated patients?</p> <p>If yes, please specify what the contraindication(s) was.</p>	<p><input type="checkbox"/> Yes (specify):  <hr/></p> <p><input type="checkbox"/> No</p>				
<p><b><i>To what extent do you agree with the following statements? Please check only ONE box per item.</i></b></p>					
	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neither disagree nor agree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<p>49. Implementation of the peptic ulcer prophylaxis will help prevent VAP.</p>					
<p>50. The policy/guideline on peptic ulcer prophylaxis is clear and specific.</p>					
<p>51. There are other policies/guidelines that conflict with the peptic ulcer prophylaxis policy/guideline.</p>					



**F. Deep Vein Thrombosis (DVT) Prophylaxis**

***If there is NO deep vein thrombosis prophylaxis position policy/guideline at your unit, skip to the next section.***

<p>52. To what degree do you provide DVT prophylaxis according to policy at your facility for mechanically ventilated patients?: (check one)</p>	<p> <input type="checkbox"/> All the time/100% of the time  <input type="checkbox"/> Most of the time/80-99% of the time  <input type="checkbox"/> Some of the time/60-79% of the time  <input type="checkbox"/> Very little or not at all/59% of the time or less         </p>				
<p>53. Is your implementation of DVT prophylaxis based on the hospital's policy?</p>	<p> <input type="checkbox"/> Yes, it is based on the hospital's policy  <input type="checkbox"/> No, it is not based on the hospital's policy  <input type="checkbox"/> I do not know         </p>				
<p>54. Is there a contraindication(s) to deep vein thrombosis prophylaxis for mechanically ventilated patients?</p> <p>If yes, please specify what the contraindication(s) was.</p>	<p> <input type="checkbox"/> Yes (specify):  <hr/> <input type="checkbox"/> No         </p>				
<p><b><i>To what extent do you agree with the following statements? Please check only ONE box per item.</i></b></p>					
	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neither disagree nor agree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<p>55. Implementation of the deep vein thrombosis prophylaxis will help prevent VAP.</p>					
<p>56. The policy/guideline on DVT prophylaxis is clear and specific.</p>					
<p>57. There are other policies/guidelines that conflict with the deep vein thrombosis prophylaxis policy/guideline.</p>					

***Provide any further comments about your perception of VAP and/or the VAP bundle in the space below.***

**Thank you for your participation!**

In gratitude for your time, provide your phone number or email for a chance to win a free 3M Littman Lightweight II S.E. Stethoscope! You will not be contacted otherwise.

**Phone number or email:** \_\_\_\_\_

If you would like to receive the results of this study, please provide your email address below. You will not be contacted otherwise.

**Email:** \_\_\_\_\_

## Appendix C

## Dominican University IRB Approval



July 30, 2015

Alexis Luna  
50 Acacia Ave.  
San Rafael, CA 94901

Dear Alexis:

I have reviewed your proposal entitled *An Exploration of Nurse Adherence to Ventilator-Associated Pneumonia (VAP) Bundle Interventions: A Quantitative Study Proposal* submitted to the Dominican University Institutional Review Board for the Protection of Human Subjects (IRBPHS Application, #10383). I am approving it as having met the requirements for minimizing risk and protecting the rights of the participants in your research.

In your final report or paper please indicate that your project was approved by the IRBPHS and indicate the identification number.

I wish you well in your very interesting research effort.

Sincerely,

Martha Nelson, Ph.D.  
Associate Vice President for Academic Affairs  
Chair, IRBPHS

cc: Olivia Catolico

## Appendix D

## Letter of Introduction to Participants in Anonymous Survey Research/Consent Form



## Letter of Introduction to Participants in Anonymous Survey Research

Dear nurse,

My name is Alexis Luna, and I am a senior nursing student at Dominican University. I am conducting a research study, which is being supervised by Olivia Catolico, Ph.D, Professor of Nursing at Dominican University of California. You are invited to participate in this research study about ICU nurses' implementation of a ventilator-associated pneumonia (VAP) bundle in accordance with hospital ICU policy. The Institute for Healthcare Improvement describes the VAP bundle as nursing actions consisting of the following five components: oral care with chlorhexidine, head of bed (HOB) elevation of 30-45 degrees, daily sedation vacations and spontaneous breathing trials, peptic ulcer prophylaxis, and DVT prophylaxis.

Participation in this study requires a one-time completion of the attached questionnaire about implementation of the VAP bundle.

ICU nurses who are allowed to participate in the study must meet all of the following criteria:

- Nurses who have taken care of at least one mechanically ventilated adult (over 18 years of age) in the ICU within the past month
- Nurses working at a hospital that implements VAP bundle interventions
- Nurses who are full-time, part-time, per diem, or traveler registered nurses in the ICU
- Nurses whose primary role is direct patient care on the ICU floor

Nurses who may **NOT** participate in the study include the following:

- Nurses who are currently in training on the ICU floor
- Nurses who are floating from a non-ICU

- Nurses who have not taken care of at least 1 mechanically ventilated adult (over the age of 18) within the past month
- Nurses whose role on the unit is supervisory or administrative

This questionnaire contains three sections: the first section addresses nurse demographics such as age, gender, education, and nursing experience; the second section asks you to describe the degree to which you agree about statements concerning ventilator-associated pneumonia, the VAP bundle interventions, and its relation to hospital policy. The third section asks you to describe the degree in which VAP bundle elements are implemented. There are 51 items total; the questionnaire should take approximately up to 20 to 40 minutes to complete.

Anonymity of the participants and confidentiality of the information provided will be maintained. Members of the research team who are involved in the study have signed an agreement form to not disclose your identity and your answers on the questionnaire to anyone. There are no known risks associated with this research. The benefit of participation is that professional knowledge about VAP bundle adherence will grow and barriers to adherence can be identified and addressed to improve and promote patient care by preventing VAP in mechanically ventilated patients.

Your participation in this research study is voluntary. Your employment will not be affected should you decide not to participate. Should you choose to participate, please sign the consent line below, fill out the questionnaire, seal it within the accompanying manila envelope and return it back to the research facilitator. The completion of this survey indicates your consent to participate.

If you have any questions or concerns about this study, please contact me by email at alexis.luna@students.dominican.edu or by phone (510)-599-4127. To reach the Dominican faculty advisor, please contact Olivia Catolico by email at olivia.catolico@students.dominican.edu or by phone (415)-257-0156. To reach the Dominican University of CA's Institutional Review Board about this study, please contact June Caminiti by email at june.caminiti@dominican.edu.

Your participation and help in this study is sincerely appreciated.

### **Statement of consent**

I have read the above information and have received answers to any questions I asked. I consent to take part in the study.

Participant Signature \_\_\_\_\_ Date \_\_\_\_\_



Letter of Introduction to Participants in Anonymous Survey Research  
(PARTICIPANT'S COPY)

Dear nurse,

My name is Alexis Luna, and I am a senior nursing student at Dominican University. I am conducting a research study, which is being supervised by Olivia Catolico, Ph.D, Professor of Nursing at Dominican University of California. You are invited to participate in this research study about ICU nurses' implementation of a ventilator-associated pneumonia (VAP) bundle in accordance with hospital ICU policy. The Institute for Healthcare Improvement describes the VAP bundle as nursing actions consisting of the following five components: oral care with chlorhexidine, head of bed (HOB) elevation of 30-45 degrees, daily sedation vacations and spontaneous breathing trials, peptic ulcer prophylaxis, and DVT prophylaxis.

Participation in this study requires a one-time completion of the attached questionnaire about implementation of the VAP bundle.

ICU nurses who are allowed to participate in the study must meet all of the following criteria:

- Nurses who have taken care of at least one mechanically ventilated adult (over 18 years of age) in the ICU within the past month
- Nurses working at a hospital that implements VAP bundle interventions
- Nurses who are full-time, part-time, per diem, or traveler registered nurses in the ICU
- Nurses whose primary role is direct patient care on the ICU floor

Nurses who may **NOT** participate in the study include the following:

- Nurses who are currently in training on the ICU floor
- Nurses who are floating from a non-ICU
- Nurses who have not taken care of at least 1 mechanically ventilated adult (over the age of 18) within the past month
- Nurses whose role on the unit is supervisory or administrative

This questionnaire contains three sections: the first section addresses nurse demographics such as age, gender, education, and nursing experience; the second section asks you to describe the degree to

which you agree about statements concerning ventilator-associated pneumonia, the VAP bundle interventions, and its relation to hospital policy. The third section asks you to describe the degree in which VAP bundle elements are implemented. There are 51 items total; the questionnaire should take approximately up to 20 to 40 minutes to complete.

Anonymity of the participants and confidentiality of the information provided will be maintained. Members of the research team who are involved in the study have signed an agreement form to not disclose your identity and your answers on the questionnaire to anyone. There are no known risks associated with this research. The benefit of participation is that professional knowledge about VAP bundle adherence will grow and barriers to adherence can be identified and addressed to improve and promote patient care by preventing VAP in mechanically ventilated patients.

Your participation in this research study is voluntary. Your employment will not be affected should you decide not to participate. Should you choose to participate, please sign the consent line below, fill out the questionnaire, seal it within the accompanying manila envelope and return it back to the research facilitator. The completion of this survey indicates your consent to participate.

If you have any questions or concerns about this study, please contact me by email at alexis.luna@students.dominican.edu or by phone (510)-599-4127. To reach the Dominican faculty advisor, please contact Olivia Catolico by email at olivia.catolico@students.dominican.edu or by phone (415)-257-0156. To reach the Dominican University of CA's Institutional Review Board about this study, please contact June Caminiti by email at june.caminiti@dominican.edu.

Your participation and help in this study is sincerely appreciated.

### **Statement of consent**

I have read the above information and have received answers to any questions I asked. I consent to take part in the study.

Participant Signature \_\_\_\_\_ Date \_\_\_\_\_

## Appendix E

## Confidentiality Agreement Form for Research Facilitators

**CONFIDENTIALITY AGREEMENT**

**Title of Research Project:** An Exploration of Nurse Adherence to Ventilator-Associated Pneumonia Bundle Interventions: A Quantitative Study

**Research Facilitator:**

As a member of this research team I understand that I may have access to confidential information about study sites and participants. By signing this statement, I am indicating my understanding of my responsibilities to maintain confidentiality and agree to the following:

- I understand that names and any other identifying information about study sites and participants are completely confidential.
- I agree not to divulge, publish, or otherwise make known to unauthorized persons or to the public any information obtained in the course of this research project that could identify the persons who participated in the study.
- I understand that all information about study sites or participants obtained or accessed by me in the course of my work is confidential. I agree not to divulge or otherwise make known to unauthorized persons any of this information, unless specifically authorized to do so by approved protocol or by the primary researcher acting in response to applicable law or court order, or public health or clinical need.
- I understand that I am not to read information about study sites or participants, or any other confidential documents, nor ask questions of study participants for my own personal information but only to the extent and for the purpose of performing my assigned duties on this research study.
- I agree to notify the primary researcher and faculty adviser immediately should I become aware of an actual breach of confidentiality or a situation which could potentially result in a breach, whether this be on my part or on the part of another person.

---

Signature of Research Facilitator

---

Date

---

Printed name

---

Signature of Primary Researcher

---

Date

---

Printed name

---

Signature of Faculty Advisor

---

Date

---

Printed name



## Appendix F

## Data Results

Table F1

*Reported Contraindications to VAP Bundle Interventions*

<b>VAP Bundle Intervention</b>	<b>Reported Contraindications</b>
<b>Oral Care with Chlorhexidine</b>	<ul style="list-style-type: none"> <li>• Patient is unstable</li> <li>• Neurological issues (increased intracranial pressure) – may change frequency</li> <li>• Hypersensitivity</li> <li>• Trauma patients with jaws wired shut</li> </ul>
<b>HOB Elevation</b>	<ul style="list-style-type: none"> <li>• Patients with low blood pressures (septic, shock)</li> <li>• During a code situation</li> <li>• Spinal, facial, or neck issues</li> <li>• Intravenous lines in groin/femoral artery</li> <li>• Intra Arterial Balloon Pump</li> <li>• Abdomen surgery</li> <li>• Hemodynamically unstable</li> </ul>
<b>Daily Sedation Vacation</b>	<ul style="list-style-type: none"> <li>• Respiratory conditions: Acute Respiratory Distress Syndrome (ARDS), hypoxia, too many secretions, not ready for extubation</li> <li>• Patients on rotoprone beds</li> <li>• Hemodynamically Unstable</li> <li>• Agitation</li> <li>• Patients with recently inserted tracheostomy</li> <li>• Acute myocardial infarction</li> <li>• Neurological issues: <ul style="list-style-type: none"> <li>○ Active seizures</li> <li>○ Evidenced or increased intracranial pressure</li> </ul> </li> <li>• Paralytics (Nimbex, Rocuronium)</li> <li>• Acute alcohol withdrawal, delirium tremens</li> <li>• Complicated surgical procedures (Open heart)</li> </ul>
<b>Spontaneous Breathing Trials</b>	<ul style="list-style-type: none"> <li>• Fluid overload</li> <li>• Compromised or unstable respiratory status (pneumothorax, CHF, ARDS, no spontaneous breathing)</li> <li>• Active Myocardial Infarction</li> <li>• Active agitation</li> <li>• Respiratory parameters <ul style="list-style-type: none"> <li>○ Oxygen saturation less than or equal to 80%</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ FiO2 &gt;50%</li> <li>○ PEEP over 8</li> <li>• On vasopressor titration of over 5mcg/kg/min</li> <li>• Patients who did not pass sedation vacation</li> </ul>
<b>Peptic Ulcer Prophylaxis</b>	<ul style="list-style-type: none"> <li>• Patients whose platelet counts may be affected</li> </ul>
<b>DVT Prophylaxis</b>	<ul style="list-style-type: none"> <li>• Thombocytopenia (HIIT)</li> <li>• Active bleeding (GI bleed)</li> <li>• Recent pre/post-op patients (less than 24 hours)</li> <li>• Presumed or confirmed clot in lower extremity</li> <li>• Compromised circulation</li> <li>• Wound at site (leg ulcer)</li> <li>• Patient refusal despite being educated on risk</li> <li>• Limb amputation</li> </ul>

Table F2

*Mean, Minimum, and Maximum Values for Section 3*

	To what degree do you provide _____ according to policy at your facility for mechanically ventilated patients?			Is your implementation of _____ based on the hospital's policy?			Is there a contraindication(s) to _____ for mechanically ventilated patients?			Implementation of the _____ will help prevent VAP.			The policy/guideline on _____ is clear and specific.			There are other policies/guidelines that conflict with the _____ policy/guideline.		
	1 - All the time 2- Most of the time 3- Some of the time 4- Very little or not at all			1 - Yes 2- No 3- I do not know			1 - Yes 2- No			1- Strongly Disagree 2- Disagree 3- Neither disagree nor agree 4- Agree 5- Strongly Agree			1- Strongly Disagree 2- Disagree 3- Neither disagree nor agree 4- Agree 5-Strongly Agree			1- Strongly Disagree 2- Disagree 3- Neither disagree nor agree 4- Agree 5- Strongly Agree		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
<b>Oral Care</b>	1	1.4	3	1	1	1	1	1.9	2	4	4.8	5	2	4.6	5	1	2.4	5
<b>HOB Elevation</b>	1	1.5	2	1	1	1	1	1.3	2	3	4.7	5	3	4.6	5	1	2.9	5
<b>Daily Sedation Vacations</b>	1	1.9	4	1	1	1	1	1.2	2	2	4.4	5	2	4.5	5	1	2.9	5
<b>Spontaneous Breathing Trials</b>	1	2.1	4	1.1	1	3	1	1.4	2	3	4.5	5	3	4.5	5	1	3	5
<b>Peptic Ulcer Prophylaxis</b>	1	1.4	4	1	1	1	1	1.9	2	2	4.5	5	2	4.5	5	1	2.6	5
<b>Deep Vein Thrombosis Prophylaxis</b>	1	1.2	2	1	1	1	1	1.5	2	2	4.2	5	3	4.6	5	1	2.75	5

Table F3

*ANOVA Nurse Factors and Section 3 VAP Bundle Results*

<b>Nurse Factor</b>	<b>Item 24</b>	<b>Item 25</b>	<b>Item 30</b>	<b>Item 31</b>	<b>Item 32</b>	<b>Item 33</b>	<b>Item 34</b>	<b>Item 36</b>	<b>Item 37</b>	<b>Item 38</b>	<b>Item 39</b>	<b>Item 40</b>	<b>Item 43</b>	<b>Item 44</b>	<b>Item 50</b>	<b>Item 51</b>	<b>Item 55</b>	<b>Item 56</b>	<b>Item 57</b>
<b>Age</b>		.023			.032				.013	.023									
<b>Gender</b>			.003				.018	.048				.024					.047		
<b>Highest Degree</b>																			
<b>Certificate</b>							<.001					.041							
<b>Degree Location</b>																			
<b>Total Years as RN</b>	.002				.015	.005	.045		.013	.006	.017		.013	.009		.013		.002	.003
<b>Hosp Environ</b>												.018							
<b>Type ICU</b>																		.014	
<b>Years as ICU RN</b>											(.052)	.006			(.051)				
<b>Work Hrs/Wk</b>						.037													
<b># Mech Vent Pts</b>																			

*Note.* Significant p-values < 0.05. Numbers listed at the top of each column refer to items of the questionnaire. Parentheses (see “Years as ICU RN”) indicate results that were not significant, but close. Blank boxes indicate no significant results for that item and nurse factor.

