# A NEEDS ASSESSMENT OF BEDSIDE NURSES FOR VENTILATOR-ASSOCIATED PNEUMONIA PROPHYLAXIS EDUCATION

by

Anthony James Populo



A DNP Project Submitted to the Faculty of the

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THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Anthony James Populo, titled A Needs Assessment of Bedside Nurses for Ventilator-Associated Pneumonia Prophylaxis Education and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

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Final approval and acceptance of this DNP project is contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

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# DEDICATION

I would like to dedicate this project to my wonderful and beautiful wife, Elisabeth Populo. She has been my bright light during the dark times. Even when I did not think I could make it through the program, she was there to pick me up, to encourage me, and to show me love and compassion. Elisabeth, the last three years have been tough, but you seem to navigate through all the trials with ease. Through this program, I have tried my hardest to just be a good, caring, compassionate, intelligent human being, but you, Elisabeth, you are already there. You have all of the qualities anyone would want in a partner. You have worked tirelessly, and at times more than three jobs, just to help me reach my goal. Truly, I can say I would not be here or the man I am today without you by my side. I love you, and count my blessings that I have a partner as great as you!

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## ABSTRACT

**Background and Purpose:** Since the 1950's when researchers first acknowledged gram-negative bacillus pneumonia as the key pathogenic component to hospital-acquired infections there have been many studies suggesting how ventilator-associated pneumonia (VAP) continues to cause increase morbidity and mortality in mechanically ventilated patients. Initiatives to mitigate this pathology have been implemented and have ranged from increasing nursing knowledge and implementation of chlorhexidine gluconate oral care to selective oropharynx decontamination prophylactic strategies. The purpose of this study was to 1) Assess the need for continual and in-depth nursing education about VAP pathophysiology and prophylactic strategies; and 2) Assess individual perception/attitude towards the prophylactic tasks.

**Methods:** ICU nurses at St. Luke's Phoenix Hospital were asked to volunteer in a pre-test survey followed by an education module and post-test. The survey included four knowledge-based questions and five perception/attitude assessment questions. The education module was focused on pathophysiology of VAP and proper application process of prophylactic strategies.

**Results:** 13 nurses completed the pre/post-test and education module. Summary data of the pre-test and post-test score percentages (± SD) assessing VAP knowledge were 78.9% ± 0.27 and 98.1% ± 0.07, respectively, implying that the education module significantly improved VAP knowledge ($p < 0.05$, paired t-test, $n = 13$). On the other hand, change in perception/attitude towards VAP prophylactic tasks was not statistically significant ($p > 0.05$). However, 69.23% of the participants expressed interest in alternative techniques.

**Significance:** Data supported an increase in nursing knowledge of VAP, suggesting a need for further education ($p < 0.05$). Findings suggest that the education intervention increased knowledge but did not alter perceptions/attitudes.

# INTRODUCTION

Ventilator-associated pneumonia (VAP) continues to plague patients in the intensive care units (ICU) across North America (Klompas et al., 2014; Zimlichman, 2013). Mechanical ventilation is a vital tool for patient survival for a number of disease processes; however, VAP puts 10%-65% of this patient population at risk for a completely avoidable and treatable nosocomial infection (American Thoracic Society, & Infectious Diseases Society of America, 2005). Research has agreed, albeit with a wide range of occurrence rates, that this deadly hospital-acquired infection (HAI) causes close to 20% of incidences leading to mortality and costing each organization $40,144 (95% CI, $36,286-44,220) of unreimbursed expenses per incident (George, 1995; Kalanuria, Zai, & Mirski, 2014; Zimlichman, 2013). The problem with the wide range of occurrence rates lies solely with inadequate surveillance techniques and difficultly of diagnosis (Klompas et al., 2014; Klompas, 2007). With each diagnostic test incrementally being more invasive (from pulmonary secretion gram stains and radiographic cavitation to the detrimentally invasive bronchoscopy aspirate) sensitivity increases, though only to be suggestive of VAP (Klompas, 2007). I propose to examine knowledge and perceptions of VAP prophylaxis that will eventually inform practice regarding the most efficacious prophylactic method to prevent VAP rather than invest in more diagnostics and treatment.

## Background

Since the 1950's researchers have laid the initial foundation of evidence when first identifying gram-negative bacillus pneumonia as the culprit for the increased mortality in hospitalized patients (Rogers, 1959). Large leaps in scientific evidence have shown that the microbial burden of the areodigestive tract leads to the development of VAP (De Smet et al.,

2009). There are three schools of thought in “special approaches” techniques to decrease the microbial burden of the aerodigestive tract: 1) Selective oropharynx decontamination as a topical non-absorbable antimicrobial applied to the oropharynx; 2) selective digestive decontamination which is typically a combination therapy of selective oropharynx decontamination to decrease microbial burden in the oropharynx and gastrointestinal tract and systemic administration of antibiotics; and, 3) oral care with chlorhexidine (De Smet et al., 2009; Klompas et al., 2014; Pileggi, Bianco, Flotta, Nobile, & Pavia, 2011). Fear of regional and local antibiotic resistance has forced most of North American medical centers to favor the oral care with chlorhexidine preventative technique (Klompas et al., 2014). Further, continued evidence and clinical practice guidelines have shown topical antibiotics as means of selective oropharynx decontamination and selective digestive decontamination to be a far superior prophylactic technique (De Smet et al., 2009; Landelle et al., 2018; Klompas 2012). This is due partially to the lack of understanding and knowledge of the bedside nurse regarding chlorhexidine oral care. Correct implementation of chlorhexidine oral care is the largest stumbling block for successes with this technique. Although evidence supports the use of chlorhexidine as an adequate prophylactic technique, difficulties with chlorhexidine application limit effectiveness (Dale, Angus, Sinuff, & Rose, 2016). Many of the nurses articulated having trouble with navigating all the lines and tubes in various patients to have an effective oral care (Dale et al., 2016). There has been an increasing evidence that the addition of topical antibiotics such as colistin, tobramycin, and nystatin can increase the chlorhexidine prophylactic strategy by 28%, indicating that chlorhexidine efficacy can be augmented with additional antibiotics (Landelle et al., 2018). Thus, the gap between

theoretical application and real world application of VAP prophylaxis needs to be further understood at the level of bedside nursing strategies.

## Purpose

The purpose of this needs assessment project is to improve bedside nursing perception and knowledge of VAP prophylaxis strategies. Specific aims for this project will be to: 1) Deliver a VAP education module to include the use of topical antibiotics (colistin, tobramycin, or nystatin) as selective oropharynx decontamination prophylaxis and proper application of oral care with chlorhexidine regarding alternative prophylactic methods to ICU nurses; and, 2) Assess ICU nurse knowledge and perceptions regarding VAP prophylactic methods using a pre- and post-test method.

## Study Question

What is bedside ICU nurses' knowledge and perception of current VAP prophylaxis strategies? Does knowledge and perception change after a focused 10-min education session on the pathophysiology of the aerodigestive microbial burden cause of VAP?

## Theoretical Framework

### Conceptual Model

The chosen theoretical framework for this needs assessment project is the Plan-Do-Study-Act (PDSA) cycles. Edward Deming first proposed PDSA (also known as PDCA) in 1986 as a simple four stage iterative process. This framework quickly became a staple in healthcare quality improvement initiatives and has been used as a unconnected structure or as a part of broader scale improvement approaches such as Model for Improvement, or Marita Titler's Iowa model (Melnyk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012; Taylor et al., 2014). For the

purposes of this needs assessment project, PDSA will provide a simple and elegant four-step approach: (1) Plan – gather fully appraised evidence; (2) Do – administer pre-test, nursing education, and post-test; (3) Study – gather, organize, and analyze pre-tests and post-tests; and, (4) Act – identify nursing perception, and education and theory to application gaps (Figure 1). This strategy allows for assessment of current practices and identification of disconnects in care and may be cycled and replicated with incremental advances in evidence and leading to small changes (Peters et al., 2013; Snyder et al., 2012).

## Synthesis of Evidence

Ventilator-associated pneumonia (VAP) continues to infect adult patients in the intensive care unit (ICU). However, first we must understand the gaps and difficulties in diagnosis of VAP. Diagnosis of a pneumonia infection in a mechanically ventilated patient greater than 48 hours post-intubation has proved a difficult task and currently there is not a widely accepted gold standard (Kalanuria, Zai, & Mirski, 2014). Gram stains of pulmonary secretions and radiographic cavitation has shown to only be suggestive of VAP (Klompas, 2007). VAP diagnostic power increases with progressively more invasive pulmonary secretion collection modalities. Fiber optic guided bronchoscopy as compared to blind bronchial aspirate increased likelihood of VAP diagnosis to 18 (95% CI, 1.1-302) from 2.1 (95% CI, 0.81-5.5) respectively (Klompas, 2007). Morehead and Pinto (2000) implore that clinical acumen alone is inaccurate for diagnosis of VAP, proposing that similar symptoms could be attributed to atelectasis, infarction, hemorrhage, and fibrosis. Statistical significance is bleak at best with only one criterion met for diagnosis of VAP, suggesting that multiple criteria need be met for accurate diagnosis (e.g., clinical presentation, radiographic cavitation, and pulmonary secretion culture (Klompas, 2007).

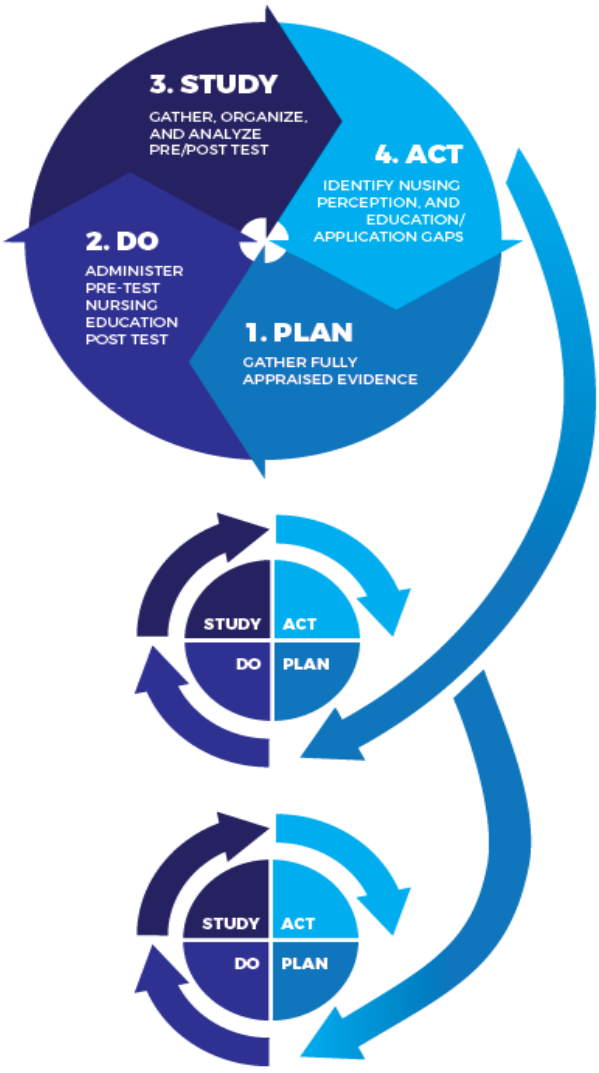


*FIGURE 1.* Plan-Do-Study-Act (PDSA). (Modified from Taylor et al., 2014)

Since the earliest diagnosis of nosocomial pneumonia, efforts to find the most empirical and efficacious anti-microbial therapy for treatment were priority (American Thoracic Society, 1996; Lee, Hua, Yu, Shieh, & See, 2005). However, VAP occurrence rates continue to be as high as 20%, which has demonstrated to be a gross underestimation of the true incidence of VAP due to diagnosis difficulties and nonspecific and subjective surveillance definitions (Klompas, 2012). Controversy surrounding accurate diagnosis of VAP and treatment prove to be a daunting task,

thus greater emphasis need to be applied on VAP prophylaxis. Klompas et al. (2008) published "Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals" and then updated in 2014, an effort supported by the Centers for Disease Control and Prevention, the Society for Healthcare Epidemiology of America, the Infectious Diseases Society of America, the American Hospital Association, the Association for Professionals in Infection Control and Epidemiology, and The Joint Commission (Klompas, 2014). Nevertheless, not all strategies, more specifically the use of selective oropharynx decontamination, have been adopted by acute care facilities despite the strong quality of evidence (De Smet et al., 2009; Klompas 2014). Thus, a robust literature review and evidence appraisal of current research needs to be established to better understand and differentiate the best prophylactic strategy for VAP (Appendix A).

Several literature searches were conducted using the following databases: PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and Embase. Keywords and phrases included ventilator-associated pneumonia, ICU, mechanically ventilated, pneumonitis, selective oropharynx decontamination, oropharynx, selected digestive decontamination, chlorhexidine, and prophylaxis. Articles were excluded if the publication was a review and if date preceded 2009 as to find only recent primary sources. Articles were also excluded if there is no direct correlated data to support a single strategy or the nursing perception of said strategy. Some literature evaluate the simultaneous implementation of a prophylactic "VAP bundle," which can include up to 10 different prevention measures (Álvarez-Lerma et al., 2018). For the purpose of this project, we sought to find research that directly evaluated the efficacy of three individual strategies outlined as "special approaches" by Klompas et al. (2014) (e.g., chlorhexidine, selective oropharynx or digestive decontamination).

Research reveals selective oropharynx decontamination and selective digestive decontamination, when compared to standard oral care or placebo decreased the risk ratio of mortality and incidence of VAP (De Smet et al., 2009; Saidel-Odes et al., 2010; Jongerden et al., 2010). Secondary outcomes measures also showed decreased length of stay and according to De Smet et al. (2009), there was not any statistically significant rise in development of antibiotic resistant pathogen, which was a popular concern for SOD and SDD in past years. When comparing chlorhexidine application to standard care, results showed statistically insignificant decrease in VAP rates, length of stay, and duration a mechanical ventilation (Bellissimo-Rodrigues et al., 2009; Berry, Davidson, Masters, Rolls, & Ollerton, 2011; Munro, Grap, Jones, McClish, & Sessler, 2009; Panchabhai, Dangayach, Krishnan, Kothari, & Karnad, 2009; Scannapieco et al., 2009) with the exception of Ćabov et al. (2010) research showing a decrease in bacterial colonization with the use of chlorhexidine gel application in non-edentulous patients. A decrease in probable VAP incidences and the resulting risk ratio (1.85% without chlorhexidine and 0.81% with) was shown in Enwere, Elofson, Forbes, and Gerlach (2016) research; however, it is important to note that the risk ratio evaluated probable and possible incidences of VAP and showed no statistically significance in mortality, length of stay, and duration of ventilation.

Overall evidence suggests promising prophylactic power of selective oropharynx decontamination and selective digestive decontamination when compared to standard care. Recent studies examining chlorhexidine application have showed insignificant results in preventing VAP or decreasing length of stay. De Smet et al. (2009) also suggest that comparing selective oropharynx decontamination vs. selective digestive decontamination, since there was similar mortality reduction in both strategies, selective oropharynx decontamination is the

preferred strategy due to ease-of-use and consistency. However, Jongerden et al. (2010) studied responses from core staff, which concluded that selective oropharynx decontamination and selective digestive decontamination increased workload, thus a recommended education program is indicated. Evidence shows a lack in knowledge in prophylactic care of mechanically ventilated patients and the grossly popular chlorhexidine oral care in western culture to be an inferior approach when compared to selective oropharynx decontamination and selective digestive decontamination (De Smet et al., 2009; Saidel-Odes et al., 2010; Jongerden et al., 2010)

## METHODS

### Purpose and Aims

The purpose of this quality improvement (QI) project is to assess ICU bedside nursing perception of VAP prophylactic strategies, and to educate about VAP pathophysiology. If initial perceptions about VAP do not align with current evidence, it is hoped that the education module will positively change bedside nursing knowledge and perceptions of prophylactic strategies. Currently, the majority of North American medical centers use chlorhexidine oral swabs in combination with standard oral care. However, recent studies suggest chlorhexidine application does not significantly reduce VAP incidence and the rational for this finding may be multifactorial (Enwere et al., 2016; Jongerden et al., 2010; Klompas et al., 2014). It is possible that chlorhexidine application does not occur according to protocol due to the busy bedside nurse schedule, faulty application process, and overall medical staff education (Jongerden et al., 2010). Many studies are examining the efficacy of selective oropharynx decontamination and selective digestive decontamination as a superior substitute to the traditional chlorhexidine oral swabs (De Smet et al., 2009; Saidel-Odes et al., 2010; Jongerden et al., 2010; Klompas et al., 2014). A QI

study regarding bedside nursing knowledge and perceptions of VAP needs to be assessed to further examine the best approach for prophylaxis of VAP.

## Design

The study design will be QI needs assessment using a questionnaire survey followed by an education session and a follow-up questionnaire. The sole purpose is to understand bedside nursing attitude towards VAP prophylaxis and to assess a need for a protocol change.

## Participants

Study participants will be gathered from an inner city medical center. The study size is projected to have at least 40 intensive care unit (ICU) bedside nurses. Inclusion criteria will be all English speaking ICU nurses on staff in the ICU (part time & fulltime). After receiving approval from the Institutional Review Board (IRB) (Appendix B), the director of nursing will be approached with the project proposal. If granted permission, the director of nursing will be asked to send out a notification inviting nurses to voluntarily participate in online VAP survey and education module hosted by Survey Monkey. The online education module will include a pre-survey, a PowerPoint education module and post-survey, as described below.

## Setting

The study will take place at St. Luke's Medical Center of Phoenix in their 28-bed general ICU.

## Data Collection

Once recruited the participants will be asked to complete a pre-survey followed by a 10-minute education presentation and a post-survey. The Qualtrics link will be dispersed to all current ICU nurses via their employee email. The pre-test will contain the questions on ICU

nurse demographics and the concepts of VAP prophylaxis and knowledge. Survey questions will be designed to be easily read and understood and should not take longer than five minutes to complete.

## Education

A 10-minute PowerPoint presentation education session will be held for all participating bedside nurses. After the online educational module, participants will be asked to complete a follow-up post survey. The purpose of the education session is to reiterate the pathology of VAP, understand the preventative techniques, provide best evidence, and introduce selective oropharynx decontamination and selective digestive decontamination techniques.

## Data Analysis

All questionnaires responses will be summarized using a spreadsheet to provide descriptive data of ICU nurses responses. After completing the education module, a follow-up post-survey questionnaire will be examined and compared to pre-test data. Changes in knowledge and perceptions will be examined in individual questions using non-parametric paired *t*-tests with significance of $p < .05$ assigned.

## Ethical Considerations

### Respect for Persons

All ICU nurses participating will be on a volunteer basis and their identities will be anonymous to protect privacy and encourage truthful participation.

### Beneficence

There are no identified risks for the participants to complete the pre-/post-survey and education module.

**Justice**

All ICU nurses have equal opportunity to participate in the research and should be able to benefit from the education mod

## RESULTS

Recruitment of the bedside ICU nurses at St. Luke's Phoenix Medical Center was first established via a recruitment email from the director of the ICU. Volunteers were given three weeks to complete the survey provided by a hyperlink in the email. At the end of the three weeks, the director agreed to introduce the project conductor to the nurses during the morning meeting, which included the night shift and day shift nursing staff. During the morning meeting, the ICU nurses were informed about the project goals of assessing for a need for supplementary VAP prophylactic education and individual perception of logistical application. An additional two weeks of recruiting via the morning meeting was approved. However, the recruitment period was interrupted due to an announcement of the immediate closure of the hospital. During the additional two weeks of recruitment, 28 ICU nurses attended the morning meeting, 15 agreed to taking the survey and 13 completed the pre-test and post-test. Demographic data collected at the end of the survey placed the 13 ICU nurses into one of four categories based on how many years of ICU experience each individual had: three (23.08%) had 0-2 years, three (23.08%) had 3-6 years, two (15.38%) had 7-10 years, and five (38.46%) had 10 or more years of experience.

The pre- and post-tests were separated into four multiple choice questions which were intended to assess VAP related knowledge as well as nurses perception, attitude, and interest towards VAP prophylactic strategies and implementation and nurses interest in changing strategies before and after the education. Summary data of knowledge questions were analyzed

using paired t-test with a significance level set to $p < .05$. Summary data of pre-test and post-test percentages (± SD) based on the four knowledge questions were 78.9% ± 0.27 and 98.1% ± 0.07, respectively. These data show that the education module improved VAP knowledge ($p < 0.05$, paired t-test, n = 13). Nurses' perception/attitude towards VAP prophylactic strategies assessed in the pre-test were very positive; most nurses found that oral care was easy, were willing to consider alternate strategies and rained oral care high on their priorities. As such, pre-test and post-test scores were not significantly different after education ($p < 0.05$) and these data indicate that the education intervention had little effect to change the already positive perception/attitude towards VAP. The results, as it relates to specific questions asked in the questionnaire, are summarized in Table 1. A paired Wilcoxon test was used to test for significant differences for all categorical data.

TABLE 1. *Summary of pre-test and post-test questions.*

| **Survey Question** | **Pre-Test Average Score (Mean ± SD)** | **Post-Test Average Score (Mean ± SD)** | **W statistic** | ***P value*** |
|---|---|---|---|---|
| *Knowledge Questions* | | | | |
| What is VAP? | 85% ± 0.38 | 100% ± 0 | 71 | P = 0.17 |
| How does VAP develop? | 77% ± 0.44 | 100% ± 0 | 104 | P = 0.08 |
| What is the mortality rate of VAP? | 77% ± 0.44 | 100% ± 0 | 104 | P = 0.08 |
| What is the best technique for application of Chlorhexidine Gluconate? | 77% ± 0.44 | 92% ± 0.28 | 116 | P = 0.21 |
| *Perception/Attitude Questions* | | | | |
| Do you find it difficult to adequately and properly perform routine oral care on critically ill and mechanically ventilated patients? | YES: 15.38%<br>NO: 84.62 % | YES: 15.38%<br>NO: 84.62% | | |
| Do you feel you need more education of VAP prophylactic strategies? | YES: 23.08%<br>NO: 76.2% | YES: 15.38%<br>NO: 84.62% | | |
| Would you be interested in implementing the Selective Oropharnyx Decontamination instead of Chlorhexidine? | YES: 69.23%<br>NO: 30.77% | YES: 69.23%<br>NO: 30.77% | | |
| How important do you think oral care is in the prevention of VAP? (On a scale of 0-10, 10 being the most important) | 9.62 | 10 | 71 | P = 0.17 |

TABLE 1 – *Continued*

| Survey Question | Pre-Test Average Score (Mean ± SD) | Post-Test Average Score (Mean ± SD) | W statistic | *P value* |
|---|---|---|---|---|
| *Perception/Attitude Questions - Continued* | | | | |
| Please rank the priority of Chlorhexidine gluconate mouthwash and oral care in the everyday care of a mechanically ventilated patient. (On a scale of 0-10, 10 being the highest priority) | 9.62 | 10 | 65 | P = 0.08 |

*Notes.* N=13. Significance level set to $p < .05$.

## DISCUSSION

The study explored the need for further education relating to oral care for VAP prophylaxis and the perceptions/attitudes towards current prophylactic strategies. Knowledge was assessed using four questions that directly tested the individual nurses' knowledge of the pathophysiology of VAP and proper prophylactic technique. Our primary finding, which the education module did improve overall nursing VAP related knowledge, is consistent with current literature proposing a gap in knowledge and the need for continuing education (De Smet et al., 2009; Saidel-Odes et al., 2010; Jongerden et al., 2010). However, in contrast to this literature, most nurses (76.2%) responded "No" to the pretest question: "Do you feel you need more education of VAP prophylactic strategies?" Via the questionnaire, nurses also felt that oral VAP prophylactic tasks are important and ranked preventative care high among their tasks in the pre-test assessment (9.62 on a range from 1-10), leaving no room for improvement by the intervention. These results are consistent with previous studies, which have reported nurses self-ranking high on a scale both oral care task priority and their perceived knowledge of VAP, yet have demonstrated lack of knowledge of VAP prophylaxis (Andargie & Kassahun, 2019; Ganz et al., 2009; Jordan et al., 2014). Although we did not find a significant change in perception

towards VAP oral care task priority after the education module, other studies have shown nurses to improve VAP oral care practice and an enhanced attitude when provided with more resources and learning opportunities (Andersson, Wilde-Larsson, & Persenius, 2019; Lin, Chang, Chang, & Lou, 2011). The discrepancies may be due to the ambiguity of our questions as compared to the study by Lin et al. (2011) where their questionnaire was structured to have the nurses' prioritize various nursing activities for the ICU patients instead of ranking a single task. It was also interesting to note that more than half of the participants had seven plus years of experience in the ICU, which could have had a general effect on the overall disinterest toward supplemental education being unnecessary. Lin et al. (2011) also found that senior nurses with more ICU experience tended to perform oral care tasks, comply with clinical care guidelines, and overall have enhanced knowledge of VAP prophylaxis (Cason, Tyner, Saunders, & Broome, 2007; Labeau et al., 2008). Our study did not include years of experience and is a consideration for future data collection. Based on our findings and in concert with many previous studies we recommend a collaborative, systems-level approach to include the organization's executive leadership and educational project managers to provide ICU nurses with readily available education modules. Just as proposed by Lin et al. (2011), education modules should focus on pathophysiology, accepted timeline and frequency of oral care, oral care protocol, and nurses should be encouraged to use toothbrushes.

Overall, most perception/attitude assessment questions were unchanged from pre-test to post-test; a large portion of the nurses were interested in exploring alternative techniques (i.e., selective oropharynx decontamination). The responses collected differ from Jongerden et al. (2010) study in that the researchers found an overall disinterest in the use of selective

oropharynx decontamination and feeling of increased task burden. Their study placed nurses into a group-randomized, controlled, crossover study in which the nurses performed standard care, selective digestive decontamination, or selective oropharynx decontamination for six months and analyzed perceptions via questionnaires (Jongerden et al., 2010). While, in our study, the nurses' perception of the importance of oral care in mechanically ventilated patients did not change after the intervention, the results show that a majority (69.23%) responded positively to exploring alternative prophylactic techniques. Given this data and the amount of nurses' willing to try selective oropharynx decontamination, it is likely that this sample group is ready for a protocol change. Further studies should be completed to assess nurses' perception of selective oropharynx decontamination after an experimental trial similar to the Netherlands study done by Jongerden et al. (2010). A potential barrier, there have not been any recent studies to show successful or meaningful implementation of selective oropharynx decontamination prophylactic strategies in North America. Moreover the Center for Disease Control and Prevention's endorsement of the 2014 update of "Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals" clinical guidelines, show high quality of evidence to support the use of selective oral and digestive decontamination as a "special approach" to VAP prophylaxis (Klompas et al., 2014). With our data to support nursing readiness for a protocol change and current evidence to support alternative strategies (De Smet et al., 2009; Klompas et al., 2014; Jongerden et al., 2010; Saidel-Odes et al., 2010), we suggest the next step in the 'Plan' phase is to assess North American hospital organizational executive leadership overseeing current protocols and initiatives, and prescribing providers readiness for a change in protocol.

Another possibility in our findings is that the education level and understanding of VAP may not be the central issue rather the amount of support for implementation. Most of our participants ranked the importance and priority of the preventative measure high on the Likert scale (9.62 & 10, pre-test & post-test, respectively) and the majority of the participants would be considered senior nurse with many years of ICU experience. One question could be asked, "How much support do the nurse have for implementation of the VAP protocols?" It is imperative to examine each medical center at the systems-level. Henderson et al. (2012) suggested a collaborative, systems-level approach by encouraging project champions to include multidisciplinary teams, such as nurses, executive leadership, educators, and prescribers. A critical component to assembling a systems-level approach and team is to examine each organization's competing demands for current and new initiatives (Henderson et al., 2012). Alvarez-Lerma et al. (2018) examined many successful VAP-specific prevention "bundles" with various recommendations. In this study, they found that the adherence to the recommended initiatives to be the largest influence on success and reduction of VAP (Alvarez-Lerma et al., 2018). Furthermore, we recommend research to be conducted in respect to understanding what is needed to support the nursing staff for increased adherence to current guidelines.

The major limitation of this study may be attributed to the small sample size (n=13) such that these responses are not a complete representative sample to be generalized in other facilities. While most nurses expressed an interest in completing the study (n=28), only a small percentage were willing to complete the whole survey. This high of an attrition rate may be due to the study site's announcement of permanent closure during the recruitment phase. Although the nurses were assured that the participation and results would be of benefit for their future and the

industry, the nurses were then presented with a choice of focusing on their future job securities vs participation in a voluntary survey. This limits the amount of dedication to the survey, which could directly affect the perception/attitude portion. Future research design should consider other limitations to our study instrument, which was designed by experts and the project committee. The questionnaire pre-test and post-test were limited by the content and thus may only reflect the knowledge, attitude, and perceptions specified in the questionnaire. Further research should examine the validity or the questionnaire to the instrument, as we were limited to content validity through a pre-test and post-test to assess the instrument.

This project aligns with multiple Doctor of Nursing Practice (DNP) essentials. Doctoral prepared nurse practitioners (NP) are taught a scientific foundation meant to provide complete healthcare to patients and act as leaders in the industry. As leaders in this ever-changing industry, a DNP essential is to review and appraise current evidence-based practice and apply research to an advanced practice. This project helps to assess the need for a policy change in VAP prophylactic strategies; nevertheless, results suggest that further studies should be done to evaluate the ICU nurses readiness to implement alternative VAP prophylactic techniques.

## Conclusion

Data continues to show an alarming rate of VAP incidences leading to morbidity and mortality. Although the study was limited to a small sample and various extrinsic factors that could potentially skew answers, the data showed statistically significance that the education module did increase nursing knowledge ($p < 0.05$). Also of note, the majority of participants were interested in exploring selective oropharynx decontamination as an alternative strategy to

chlorhexidine gluconate. Going forward, further research should be conducted to evaluate nursing perception with a hands-on experience using the alternative techniques.

# APPENDIX A:

# SYNTHESIS OF LITERATURE

*Synthesis of Literature*

| Reference | Study Design | Sample and Setting | Methods | Main Outcome Measures | Results | Challenges to Scientific Rigor |
|---|---|---|---|---|---|---|
| Bekaert et al. (2011) | Longitudinal prospective study | Sample<br><br>Patients who have a least a 2 day stay in the ICU and were mechanically ventilated within 48hours (n=4,479)<br><br>Setting<br><br>French multicenter Outcomerea database | Records were analyzed from 1997 to 2008. Patients were then divided by descriptive analysis based on Simplified Acute Physiology Score (SAPS), Sequential Organ Failure Assessment (SOFA), and Logistic Organ Dysfunction score. A logistic regression model was used to determine the probability of acquiring VAP | Primary<br><br>Assess the attributable probability of mortality from VAP<br><br>Secondary<br><br>N/A | Primary<br><br>Patients acquired VAP: n=685 (15.3%)<br><br>30-Day VAP mortality: 4.4% (95% CI, 1.6-7.0%)<br><br>60-Day VAP mortality: 5.9% (95% CI, 2.5-9.1%)<br><br>Secondary<br><br>N/A | Internal Validity<br><br>Temporal Ambiguity: It is unclear whether or not that VAP caused mortality or other confounding factors<br><br>External Validity<br><br>Replication: Multicenter French database |
| Bellissimo-Rodrigues et al. (2009) | Double blind, randomized, placebo-controlled trial. | Sample<br><br>Patients admitted to the ICU with a suspected Length of stay greater than 48 hours (n=194)<br><br>Setting<br><br>ICU in a tertiary care hospital at Cambridge University. Cambridge, UK | Patients were randomly assigned to 2 groups: Chlorhexidine (n=98) and placebo (n=96). A risk ratio assessed patient incidence of respiratory tract infections and the VAP rates per 1,000 ventilator-days | Primary<br><br>Respiratory tract infections and VAP rates<br><br>Secondary<br><br>Duration of mechanical ventilation.<br><br>Length of Stay | Primary<br><br>Total incidences of respiratory tract infections: RR 1.0 (95% CI, 0.63-1.60)<br><br>VAP rates per 1,000 ventilator days: (22.6 vs 22.3; P=0.95)<br><br>Secondary<br><br>Duration of mechanical ventilation: (11.1 vs | Internal Validity<br><br>History: Severity of illness was not recorded.<br><br>External Validity<br><br>Replication: Limited to single site study |

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| | | | | | 11.0 days; P=0.61)<br><br>Length of stay: (9.7 vs 10.4 days; P=0.67) | |
| Berry, Davidson, Masters, Rolls, & Ollerton (2011) | single blind randomized comparative study | Sample<br><br>Adult patients with an expected mechanical ventilation of more than 48 hours (n=109)<br><br>Setting<br><br>20-bed medical-surgical ICU at a metropolitan university hospital | Patients were randomized into one of three study regiments: Group A (second hourly oral rinse with sterile water)(n=43); Group B (Sodium bicarbonate mouth wash second hourly)(n=33); Group C (twice daily irrigation with chlorhexidine 0.2% oral rinse and second hourly irrigation with sterile water)(n=33). Using APACHE score, and SAPS to assess baseline characteristics of the patients. ANOVA, multinomial logistic regression and chi-squared tests to assess data. | Primary<br><br>Microbial colonization of dental plaque or gums in mechanically ventilated patients from Day 1 to Day 4<br><br>Secondary<br><br>VAP incidence | Primary<br><br>No significant differences were demonstrated in reduction of bacterial colonization at Day 4 of admission (P=0.302)<br><br>Secondary<br><br>VAP incidences:<br><br>Group A n=1<br>Group B n=4<br>Group C n=4 | Internal Validity<br><br>Mortality/Attrition: the study was conducted over 8 days in the ICU<br><br>Instrumentation: APACHE and SAPS scores were not evaluated at the end of the study<br><br>External Validity<br><br>Replication: Limited to single site study<br><br>Representativeness: Small sample size |
| Ćabov et al. (2010) | prospective, randomized, double-blind, placebo-controlled clinical trial | Sample<br><br>60 adult nonedentulous patients in a surgical ICU with a minimum stay of 3 days<br><br>Setting<br><br>Surgical ICU in | 2 randomized treatment groups: antiseptic decontamination of dental plaque and the use of chlorhexidine gel; control group treated with placebo gel.<br><br>Dental status was assessed using a caries-absent-occluded (CAO) score. Dental plaque, oral mucosa, | Primary<br><br>Bacterial colonization by aerobic pathogens throughout their ICU stay<br><br>Secondary<br><br>Length of stay | Primary<br><br>Increased bacterial colonization was shown in control group (26.7%) as opposed to the treated group (6.7%).<br><br>Secondary | Internal Validity<br><br>Selection: Patient Characteristic and severity of illness were not analyzed.<br><br>External Validity<br><br>Replication: Single facility study site |

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| | | University Hospital Dubrava | and nasal/tracheal aspirate samples were collected to assess for bacterial culture. | | ICU stay was longer in the control group than in treated group (5.1 ± 1.6 *vs.* 6.8 ± 3.5 days, P = 0.019) | Representativeness: Small Sample size |
| De Smet et al. (2009) | A controlled, crossover study using cluster randomization | Sample<br><br>Adult patients in the ICU with an expected intubation duration of more than 48 hours or a length of stay in the ICU for more than 72 hours (n=5939)<br><br>Setting<br><br>13 ICU's in Netherlands between May 2004 and July 2006 | From May 2004 to July 2006, a randomized control study was conducted. Standard care cohort (n=1990); SOD cohort (n=1904); SDD cohort; (2045). Random-effects logistic-regression model for age, sex, APACHE 2 score, intubation, and medical specialty as covariates. Compared odds ratios for death at day 28 with SOD and SDD groups as compared to Standard care | Primary<br><br>Mortality ratio at day 28<br><br>Secondary<br><br>Monthly point-prevalence to analyze antibiotic resistance | Primary<br><br>SOD compared to Standard care: 0.86 (95% CI, 0.74-0.99)<br><br>SDD compared to Standard care: 0.83 (95% CI, 0.72-0.97)<br><br>Secondary<br><br>Development of antibiotic resistant pathogen:<br><br>C. difficle (n=29)<br>VRE (n=8)<br>MRSA (n=0) | Internal Validity<br><br>History: Cohort randomization was unable to balance baseline characteristics and severity of illness<br><br>External Validity<br><br>Replication: Study site is in Netherlands where there is low reported antimicrobial resistance. |
| Enwere, Elofson, Forbes, & Gerlach, (2016) | Retrospective cohort study | Sample<br>Mechanically ventilated adult patients for more than 48 hours (n= 3634)<br><br>Setting<br>Adult patients in a 44-bes surgical intensive care unit at a University | From January 2009 to December 2009 mechanically ventilated (>48 hours) patients admitted to the SICU and met inclusion criteria were evaluated for VAP incidence prior to Chlorhexidine mouthwash implementation (n=1780)<br><br>From March 2010 to | Primary<br>Probability of VAP incidences for pre-chlorhexidine implementation compared to post-implementation<br><br>Secondary<br>Duration of ventilation, Length | Primary<br>Significant decrease in probable VAP:<br><br>Pre-group (33 events in 1780) 1.83%<br>Post-group (15 events in 1854) 0.81% (*P*=0.0082)<br><br>Secondary<br>No statistical | Internal Validity<br><br>History: Severity of illness was unrecorded<br><br>External Validity<br><br>Replication: Single facility study site and cohorts were analyzed in deferent years. |

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| | | Medical Center. | February 2011 mechanically ventilated (>48 hours) patients admitted to the SICU and met inclusion criteria were evaluated for VAP incidences post implementation of Chlorhexidine mouthwash (n=1854) | of stay, and in-hospital mortality.<br><br>Fisher's exact test for nominal data and Mann-Whitney U test for continuous. | significance in length of stay, duration of ventilation, and in-hospital mortality | |
| Jongerden et al. (2010) | Group-Randomized, Controlled, cross-over questionnaire study | <u>Sample</u><br>Bedside nurses and physicians in the ICU<br><br>Nurses: n=1024<br>Physicians: n=253<br><br><u>Setting</u><br><br>13 ICU's across multiple facilities in the Netherlands | During a 6-month period, nurses and physicians were randomly assigned to 1 of 3 groups: SDD, SOD, or standard care.<br><br>At the end of the 6 months, nurses and physicians were expected to fill out a questionnaire. | Main Outcome<br><u>Primary</u><br><br>Determine expectations from staff on SDD effectiveness<br><br><u>Secondary</u><br><br>To evaluate perceived workload and patient friendliness or SDD and SOD from staff | Results<br><u>Primary</u><br><br>Staff expectation of SDD to improve patient outcome increased from 71% to 82% (P=0.004)<br><br><u>Secondary</u><br><br>Both nurses and physicians considered SDD and SOD to increase workload (median 4.0 compared to standard care median 2.0) and less patient friendly (median 4.0 compared to standard care median 6.0) | Challenges to Scientific Rigor<br><u>Internal Validity</u><br><br>Instrumentation: questionnaire was thought to be confusing to staff.<br><br>Mortality/Attrition: of the 1757 participants only 1277 returned a questionnaire<br><br><u>External Validity</u><br><br>Interaction effect: The nurses and physicians in Netherlands might be more accustomed to using SDD and SOD in care and therefore place an external threat to validity when comparing to other countries. |

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| Munro, Grap, Jones, McClish, & Sessler (2009) | Randomized controlled clinical trial | Sample<br><br>Intubated adult patients (older than 18 years of age) in 3 ICU's. (n=471)<br><br>Patients with a clinical diagnosis of pneumonia at the time of intubation and edentulous patients were excluded<br><br>Setting<br><br>3 ICU's (medical, surgical/trauma, and neuro-science) at Virginia Commonwealth University Medical Center | Patients were assigned to 1 of 4 treatment groups:<br><br>0.12% chlorhexidine oral swab twice daily (n=119)<br><br>tooth brushing three times daily (n=113)<br><br>both chlorhexidine and tooth brushing (n=116)<br><br>Control group (usual care) (n=123)<br><br>The Clinical Pulmonary Infection Score (CPIS) tool determined VAP. Descriptive statistics were used to group characteristics of the study population. | Primary<br><br>To examine the different techniques efficacy on prevention of VAP<br><br>Secondary<br><br>N/A | Primary<br><br>No statistical difference was made between the 4 groups:<br><br>Chlorhexidine (P=0.29)<br>Tooth brushing (P=0.95)<br><br>Secondary<br><br>N/A | Internal Validity<br><br>Mortality/Attrition: many of the subjects were extubated by day 5 and only 158 patients remained intubated.<br><br>External Validity<br><br>Replication: single facility study site<br><br>Representativeness: small sample size |
| Panchabhai, Dangayach, Krishnan, Kothari, & Karnad (2009) | Randomized controlled clinical trial | Sample<br><br>Adult patients admitted to the ICU after cardiac surgery (=471)<br><br>Setting<br><br>Medical-Neuro ICU of King Edward VII Memorial Hospital, a tertiary care | Patients were randomly assigned to 1 of 2 groups:<br><br>0.2% Chlorhexidine twice daily (n=250)<br><br>Control group (n=262) | Primary<br><br>Effects on the incidence of nosocomial pneumonia<br><br>Secondary<br><br>Length of ICU stay and in-hospital mortality | Primary<br><br>Incidence of nosocomial pneumonia after completion of the protocol:<br><br>Chlorhexidine: 16 of 224 (7.1%)<br><br>Control: 19 of 247 (7.7%) | Internal Validity<br><br>History: Patient prior illness involvement in the study was unrecorded<br><br>External Validity<br><br>Replication: single facility study site<br><br>Representativeness: small sample size |

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| | | teaching hospital in Mumbai, India. | | | (p=0.82; RR 0.93; 95% CI, 0.49-1.76)<br><br><u>Secondary</u><br><br>Median ICU stay: 5 days (IQR, 3.0-8.0) vs 6 days (IQR, 3.0-8.0)<br><br>Mortality (34.8% vs 28.3%) | |
| Saidel-Odes et al. (2010) | Randomized, double-blind, placebo-controlled trial | <u>Sample</u><br><br>Adult patients with confirmed Carbapenem-Resistant Klebsiella pneumonia (CRKP) (n=40)<br><br><u>Setting</u><br><br>1,000 bed tertiary care university hospital | Patients were randomly placed into 1 of 2 groups:<br><br>Treatment group (SDD): oral gentamicin and polymyxin E gel 4 times daily, oral solution gentamicin 4 times daily, and polymyxin E 4 times daily for 7 days. (n=20)<br><br>Placebo Group: (n=20)<br><br>Throat cultures and rectal cultures were analyzed during intervention and applied to an odds ratio | <u>Primary</u><br><br>Assessing the effectiveness of SDD for eradication CRKP.<br><br><u>Secondary</u><br><br>N/A | <u>Primary</u><br><br>Throat cultures were negative after day 3 using SDD (P<0.0001).<br><br>Negative Rectal cultures: 16.1% of the placebo group and 61.1% in the SDD group (OD, 0.14; 95% CI, 0.02-0.74; P<0.0016)<br><br><u>Secondary</u><br><br>N/A | <u>Internal Validity</u><br><br>History: Patients were not divided by descriptive characteristics, severity of illness, or comorbidities<br><br><u>External Validity</u><br><br>Replication: single facility study site<br><br>Representativeness: small sample size (n=40) |
| Scannapieco et al. (2009) | Randomized, double-blind, placebo-controlled clinical trial | <u>Sample</u><br><br>Mechanically ventilated adults in the ICU (n=115) | Patients were randomly assigned to 1 of 3 groups:<br><br>Placebo/Control (n=42) | <u>Primary</u><br><br>Determine the minimum frequency (once or | <u>Primary</u><br><br>Neither once or twice daily chlorhexidine | <u>Internal Validity</u><br><br>Mortality/Attrition: Though minor, 175 patients were initially |

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| | | <u>Setting</u><br><br>Trauma ICU of Erie County Medical Center | Chlorhexidine once daily (n=36)<br><br>Chlorhexidine twice daily (n=37)<br><br>Results were analyzed by ANOVA and/or chi-squared test | twice a day) for application of chlorhexidine to reduce colonization of pathogens<br><br><u>Secondary</u><br><br>N/A | application showed statistical significance when compared to the placebo group (P=0.8423)<br><br><u>Secondary</u><br><br>N/A | enrolled and provided informed consent and 29 patients were extubated or missing relevant data.<br><br><u>External Validity</u><br><br>Replication: single facility study site<br><br>Representativeness: small sample size |
| *Note.* SICU = Surgical intensive care unit; VAP = Ventilator-associated pneumonia; SOD = Selective oropharynx decontamination; SDD = Selective digestive decontamination | | | | | | |

# APPENDIX B:

# THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

THE UNIVERSITY OF ARIZONA
Research, Discovery & Innovation

Human Subjects Protection Program

1618 E. Helen St.
P.O.Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
http://rgw.arizona.edu/compliance/home

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| **Date:** | September 24, 2019 |
| **Principal Investigator:** | Anthony James Populo |
| **Protocol Number:** | 1909985853 |
| **Protocol Title:** | A NEEDS ASSESSMENT OF BEDSIDE NURSES FOR VENTILATOR-ASSOCIATED PNEUMONIA PROPHYLAXIS |
| **Determination:** | Human Subjects Review not Required |

**Documents Reviewed Concurrently:**

**HSPP Forms/Correspondence:** *Populo DNP_Sep 12 determination_v2019-02-25.pdf*

**Regulatory Determinations/Comments:**

- Not Research as defined by 45 CFR 46.102(l): As presented, the activities described above do not meet the definition of research cited in the regulations issued by U.S. Department of Health and Human Services which state that "Research means a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge. Activities that meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program that is considered research for other purposes. For example, some demonstration and service programs may include research activities. For purposes of this part, the following activities are deemed not to be research."

The project listed above does not require oversight by the University of Arizona.

If the nature of the project changes, submit a new determination form to the Human Subjects Protection Program (HSPP) for reassessment. Changes include addition of research with children, specimen collection, participant observation, prospective collection of data when the study was previously retrospective in nature, and broadening the scope or nature of the study activity. Please contact the HSPP to consult on whether the proposed changes need further review.

The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).

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