Himmelfarb Health Sciences Library, The George Washington University
Health Sciences Research Commons

Doctor of Nursing Practice Projects | Nursing

Spring 2022

# Ventilator-Associated Pneumonia Bundle Compliance: A Quality Improvement Project

Keesha L. Holmes MSN, FNP, NE-BC

Follow this and additional works at: https://hsrc.himmelfarb.gwu.edu/son_dnp

Part of the Medicine and Health Sciences Commons

GW | Nursing

DOCTOR OF NURSING PRACTICE PROGRAM

**A DNP PROJECT**

**TITLE: Ventilator-Associated Pneumonia Bundle Compliance: A Quality Improvement Project**

**STUDENT NAME:** Keesha L. Holmes, MSN, FNP, NE-BC

**DNP PROJECT PRIMARY ADVISOR:** Karen Kesten, DNP, APRN, CCNS, FAAN

**DNP PROJECT SECONDARY ADVISOR:** Ann LoBasso, DNP, RN, NEA-BC

**DATE OF DEGREE: May 2022**

The George Washington University

Table of Contents

Abstract 5

Introduction 7

Background and Significance 8

Needs Assessment 9

Problem Statement 10

Purpose Statement 11

Aims and Objectives 12

Review Of Literature 13

EBP Translation Model 15

Methodology 16

- Setting 16
- Participant Recruitment 17
- Consent Procedure 18
- Risks/Harm 18
- Costs and Compensation 18
- Project Interventions 18
- Outcomes to be Measured 19
- Project Timeline and Evaluation Plan 20
- Resources Needed 20

Data Analysis, Maintenance and Security 20

Results 21

Discussion 22

Implications for Practice 22

Implications for Healthcare Policy 23

Implications for Executive Leadership 23

Implications for Quality/Safety 24

Limitations 24

Areas for Future Research 25

Plans for Sustainability 25

Conclusion 25

References 27

Appendices 32

Appendix A: SWOT Analysis Figure 32

Appendix B: Evidence Table 38

Appendix C: PDSA Model 43

Appendix D: Knowledge Assessment Questionnaire – Preventing Ventilator-Associated Pneumonia (Modified from Aziz et al. 2020) 44

Appendix E: Post-education Staff Self-Assessment Survey 49

Appendix F: Project Recruitment Flyer 50

Appendix G: Email Invitation to Participate in Project 52

Appendix H: Rutgers eIRB Approval 54

Appendix I: Precautions Ventilator Acquired Pneumonia Order Set – Current 59

Appendix J: Ventilator-Associated Pneumonia Precautions Bundle Care

Education 60

Appendix K: Donabedian Model of Structure, Process and Outcome 65

Appendix L: VAP Quality Improvement Project Gantt Chart 67

Appendix M: Pre- and Post-Knowledge Assessment Test Results 69

Appendix N: 4th Quarter 2021 and 1st Quarter 2022 Infection Prevention 71
VCB Documentation Compliance

Appendix O: 4th Quarter 2021 and 1st Quarter 2022 Analysis 72
Of Infection Prevention VCB Documentation Compliance

## Abstract

**Background:** In many hospitals, patients requiring mechanical ventilation are managed in an intensive care unit (ICU) or a unit that requires a higher level of care compared to a medical-surgical unit. Patients on mechanical ventilation are susceptible to acquiring ventilator-associated pneumonia (VAP) if precautionary measures are not taken.

**Aims/Objectives:** The purpose of this quality improvement project was to assess if after an identified group of critical care registered nurses (RN) participated in an education session on ventilator-associated pneumonia and ventilator-care bundle (VCB) interventions, would their knowledge be enhanced, would the RNs implement the knowledge learned into their practice, and if the RNs documentation compliance on completion of the interventions would improve.

**Methods:** An education program based on national guidelines and evidence-based VAP bundle interventions was developed and implemented. The RN group participated in a pre-intervention knowledge assessment test, an education session, a post-intervention knowledge assessment test and self-assessment survey. Assessment test data, self-assessment survey data and the organization's Infection Prevention's quarterly data was reviewed to identify improvement in the RNs documentation.

**Results:** Thirty MICU RNs participated in the study. The results of the project showed there was a significant difference in correct responses between post-test and pre-test, $p<0.05$ showing that an additional 7.33 RNs on average answered questions correctly as opposed to pre-test. There was no significant difference noted in the RNs documentation compliance from chart review audit data completed by the organization's Infection Prevention Department in 4$^{th}$ Quarter 2021 to 1$^{st}$ Quarter 2022.

**Conclusion:** VAP education was successfully implemented to a portion of the critical nurses that agreed to participate in the study. In addition to continuation of Infection Prevention's auditing of patient's charts for documentation compliance, an increase in monthly observational audits should be conducted to validate completion of bundle intervention tasks. Further study is needed with inclusion of the organization's other critical care units and further consideration for education sessions on VAP to be completed during annual competencies.

Ventilator-Associated Pneumonia Bundle Compliance: A Quality Improvement Project

## Introduction

Ventilator-associated pneumonia (VAP) is the 2nd most severe nosocomial infection around the globe. Worldwide, prevalence of ventilator-associated pneumonia is 12.6%, 13.5% in US 19.4% in Europe, 13.8% in Latin America and 16% in South Asia (Aziz, et al. 2020, p. 426). With these prevalence percentages, it is imperative for ventilator-associated pneumonia to remain a primary focus for nurses caring for patients requiring mechanical ventilation. Several studies have demonstrated that VAP results in an increased cost of care, prolonged hospitalization, and a substantial increase in the mortality rate (Aloush & Al-Rawajfa, 2019, p. 2). Ventilator-associated events are identified by using a combination of objective criteria: deterioration in respiratory status after a period of stability or improvement on the ventilator, evidence of infection or inflammation, and laboratory evidence of respiratory infection (NHSN, 2021). To prevent ventilator-associated pneumonia there are recommended guidelines provided by government agencies such as the Center for Disease Control and Prevention that, when followed, can help to decrease patient incidences. The goal of this project was to determine if implementation of an education plan on VAP and VCB interventions that help prevent VAP, enhanced the critical care nurse's knowledge of VAP and VCB, assessed if the nurse would implement the education learned into their practice, and improved the nurse's compliance in documentation of completion of those interventions.

## Background and Significance

In many ICUs, the healthcare team caring for patients on mechanical ventilation consists of registered nurses, respiratory therapists and the medical service team. A VAP "occurs 48-72 hours or thereafter following endotracheal intubation, characterized by the presence of a new or progressive infiltrate, signs of systemic infection (fever, altered white blood cell count), changes in sputum characteristics, and detection of a causative agent" (Kalanuria et al., 2014, p. 1). When a patient presents with a combination of these symptoms, the criteria are reviewed by the infection preventionist team to confirm whether the patient has acquired ventilator-associated pneumonia. To decrease the incidence of ventilator-associated pneumonia in the ICU setting, it is important that the healthcare team caring for patients on mechanical ventilation understand the criteria used to classify a patient determined to have ventilator-associated pneumonia and are knowledgeable in the recommended intervention bundles implemented to help prevent those incidences of VAP.

The setting for this quality improvement project was a 600-bed Level I trauma healthcare organization in the Northeast Region of the United States that had five intensive care units that manage patients on mechanical ventilation. Over the last five years, the organization has seen its quality metric rates surrounding VAP slowly increase with a slight decline most recently in 2020. The VAP rate per 1000 ventilator days is calculated by dividing the number of VAPs by the number of ventilator days and multiplying the result by 1000 (ventilator days) (NHSN, 2021, pp. 6-17). In looking back at the VAP incidences among the five units, in 2016 and 2017 there were seven confirmed incidences with a total rate of 0.8 and 0.9 respectively; in 2018 eleven confirmed incidences with a total rate of 1.2; in 2019 ten confirmed incidences with a total rate of 1.3; and in 2020 there were seven confirmed incidences at a total rate of 0.7. The organization

had set a unit goal for 2021 to decrease the rate of VAP incidences by 50%, compared to the previous year, for each of its intensive care units. To align with the organization's goals of continuing a decline in the VAP incidences, a quality improvement plan should be implemented to ensure that the ICU areas align with the goal.

## Needs Assessment

The healthcare organization where the quality improvement project took place was a 600-bed acute care hospital in the Northeast Region of the United States. The county that the healthcare organization was located in consisted of 25 urban and suburban municipalities and has 6.5% of families living in poverty. The organization was a Level I Trauma Center and was part of a large healthcare system. In the organization's Community Health Needs Assessment, the major issues identified in the community were access to care and services, preventive care and vaccination use, and nutrition and physical activity.

Assessment of barriers and facilitators, as well as organizational readiness for the implementation of the Ventilator-Associated Pneumonia (VAP) Bundle, was important for the success of the project. A needs assessment and SWOT analysis was conducted prior to project implementation. A SWOT analysis was performed to identify the strength, weaknesses, opportunities, and threats to implement a successful VAP Initiative (see Appendix A). The most important organizational barrier experienced was its leadership rotation. The organization recently experienced executive leadership changes in both their Nursing and Operations departments. In the past few months prior to starting this project, a new Interim Chief Nursing Officer was appointed. Additionally, the organization acquired a new Chief Executive Officer. With the appointment of new and interim leadership, the department awaits the leadership's assessment of what was seen as a need for improvement and how the organizational needs would

be prioritized. Due to the current pandemic due to the Covid-19 virus, there was an increase in intubated patients. This places the organization at more risk for patients developing ventilator-associated pneumonia. This Doctor of Nursing Practice project on improving critical care nurse's knowledge on VAP, preventative interventions that help decrease incidences on VAP, and improvement in documentation compliance, could help to improve patient outcomes and align with the organization's goal to decrease VAP incidences this year.

## Statement of the Problem

In this large metropolitan hospital system in the Northeast Region of the United States, there were five critical care units that managed mechanically ventilated patients, and there was close monitoring of the care these patients received to minimize VAP events. In 2020, the organization had a VAP rate of 0.7, which equated to seven VAP events among the five units. Speck et al. (2016) found the implementation of bundles designed to improve care for mechanically ventilated patients has been associated with significant reductions in VAP rates (p. 653). To reduce the potential incidences of ventilator-associated pneumonia in intubated patients, a VAP bundle was created and added to the electronic medical record (EMR) for clinical staff to carry out and document completion of the tasks. Jansson et al. (2014) explained:

> *A ventilator bundle comprises a group of evidence-based guidelines designed to reduce VAP and improve clinical outcomes. These include combinations of daily "sedation vacations" and assessment of readiness for extubation, elevation of the head of the bed between 30 and 45 degrees, daily oral care with chlorhexidine, adequate hand hygiene, and prophylaxis for peptic ulcer disease and deep vein thrombosis (p. 381).*

In current state, when providers placed a mechanical ventilator order for a patient, an additional order needed to be placed to populate the VCB interventions for the nurses to document completion of the tasks. When reviewing charts to identify deviations in practice when a VAP is

determined, it was identified that the elements of the bundle were found in different sections of the EMR and not bundled specifically to prevention of VAP. Due to the multiple areas in the EMR to document completion of these interventions, when departments such as Quality or Infection Prevention performed chart reviews, some reviews were identified as non-compliant. When reviewing audit findings with the RNs during a staff meeting in one of the ICU areas, it was identified that there was an understanding that if the RN documented that they completed oral hygiene, even though it did not include Chlorhexidine 1% that for the purpose of the VAP bundle, the intervention was completed. Another example identified was if the RN completed and documented suctioning performed, even though it was not subglottic suctioning, the intervention of suctioning was documented as completed. Dipanjali et al. (2020) identified "throughout empirical observation, nurses' lack of knowledge may be a barrier to adhere to evidenced-based guidelines for preventing VAP and translating evidence-based findings into consistently delivered care at the bedside remains a challenge" (p. 1422). After identifying these discrepancies in understanding the interventions, it became evident that additional education surrounding guidelines used to determine if a patient meets VAP criteria, the components of the VAP bundle and the importance of completing the VCB interventions was needed. The proposed DNP project developed and provided an education session that would educate the MICU nurses on VAP and the evidence-based VCB interventions ordered to prevent VAP incidences in the critically ill patient.

**Purpose Statement**

The purpose of this quality improvement project was to develop, implement and evaluate a VAP educational session for Medical Intensive Care Unit nurses with a goal of enhancing that their knowledge on VAP and VCB interventions to prevent VAP, assessing if the nurses would

implement the education into their practice, increasing compliance in documentation of completion of VCB interventions within the critical care unit.

**Aim**

The aims of this quality improvement project was to determine if a unit-based education initiative provided to the ICU RNs on VAP and VCB interventions would a) improve the RNs knowledge base on VAP, b) improve the RNs knowledge base on evidence-based VCB interventions ordered to prevent VAP, and c) improve documentation of completion of VCB interventions in the patient's electronic medical record.

**Objectives**

1. Identified the learning needs of nurses staffed in the MICU on VAP and VCB interventions utilized in the organization to prevent incidences of VAP.
2. Developed an education session for the nurses staffed in the MICU to enhance their knowledge on VAP and VCB interventions utilized in the organization to prevent incidences of VAP.
3. Assessed the pre- and post-intervention knowledge level of the nurses staffed in the MICU on VAP and VCB interventions utilized in the organization to prevent incidences of VAP utilizing a knowledge assessment test.
4. Reviewed infection prevention audit data for 4$^{th}$ Quarter 2021 and 1$^{st}$ Quarter 2022 to determine if there was improvement in documentation compliance on completion of VCB interventions.
5. Examined the differences between pre- and post-intervention knowledge assessment test to determine effectiveness of the project.

6. Evaluated the project's effectiveness by reviewing post-project self-assessment surveys administered to MICU nurses to determine if they felt their knowledge was enhanced and if they would implement the knowledge into their practice.

**Review of the Literature**

A review of the literature was completed of various sources of evidence that reviewed education of staff on VAP guidelines and bundles, implementation of VCB to decrease VAP rates and national guidelines or standards that determine how VAP is identified (Appendix B).

Four studies evaluated how RN adherence to completing the VAP bundle interventions affected VAP rates. Aloush and Al-Rawaifa (2020) evaluated compliance in utilizing VAP bundle guidelines in intensive care units and identified that nurses with more experience and previous education on VAP reported higher compliance. Nurses reported that lack of education, lack of policies and protocols, lack of resources and shortage of staff were barriers that affected compliance. It was determined that applying a tailored educational program may help compliance. Branco et al. (2020) evaluated nursing adherence to the VAP bundle after completion of continued education. It was identified that the general adherence of the nursing team to the elements that compose the prevention bundle was 92.7% (p. 3). One highlight was that there was an increase in compliance immediately after education on VAP bundles. Santos et al. (2021) utilized an improvement model on quality measures to monitor adherence to interventions. Data collection on completion of interventions were reviewed to determine if adherence of completion of bundle tasks improved and the research showed a reduction in utilization, but no significant reduction in the VAP rate. Wolfensberger et al. (2020) utilized a mixed-method approach to identify if adherence to completing the identified VAP bundle interventions decreased patient VAP rates. The authors identified limitations such as not having

a control group, limited study duration period and chart review completion as barriers to their data collection and results but did see use in understanding the values of bundle care.

Three studies evaluated how providing education to nurses could enhance the nurse's knowledge on nosocomial infections and VAP guidelines specifically. Alrubaiee et al. (2021) created a needs-based educational module on nosocomial infections that would be disseminated to two intervention groups--one self-study without training group and one in-person hands-on training group. The two intervention groups were then compared to a waitlist group to determine the effectiveness of the education modules. The results showed significant knowledge improvement in the intervention groups compared to the waitlist group and an increase when comparing the self-study group to the in-person intervention group. Dipanjali et al. (2021) utilized a pre- and post-test design on VAP prevention to determine if an inservice educational session would improve neonatal intensive care unit (NICU) nurse's knowledge on VAP prevention. The results of the study showed that the NICU nurse's knowledge and practice improved after the educational intervention. Lim et al. (2013) compared a before and after VAP density study to check the efficacy of the VAP bundle. Incorporation of a VAP bundle checklist modified from the Institute for Healthcare Improvement was utilized to improve the healthcare team's compliance with completion of VAP bundle interventions. The results showed an improvement in compliance of completing the VAP bundle interventions with implementation of the daily checklist.

Duszynska et al. (2020) completed a surveillance of infections and monitored compliance of preventative guidelines of hospital-acquired infections. The observational study was completed over three years and analyzed compliance to bundles on ventilator-associated pneumonia, catheter-associated urinary tract infection (CAUTI) and catheter-associated blood

stream infection (CLABSI). The study identified that one out of five patients in the intensive care unit acquired a hospital-acquired infection with VAP accounting for half of those infections. The infections were associated with an increased length of stay in the intensive care units.

Zampieri et al. (2020) examined if use of a bundle (endotracheal tube, urinary catheter and central venous catheter) coated with silver, palladium and gold reduced biofilm formation which would reduce device-related infections in the critically ill patient. The results of the study identified that use of a bundle of coated devices as initial treatment for severely ill patients is feasible. Patients in the coated-device group had more days alive and free of antibiotics.

**Evidence-Based Practice Translation Model**

To support the project's implementation, the Institute for Healthcare Improvement's Model for Improvement Framework was utilized as the evidence-based model. The Model for Improvement, developed by Associates in Process Improvement, is a simple, yet powerful tool for accelerating improvement (IHI, 2021, para 1). The model is not used to change practice but to encourage improvement. The model utilized the Plan, Do, Study, Act (PDSA) framework which tests change on a small scale (Appendix C). Gupta et al. (2020) explained that "The Model for Improvement is composed of three components, to structure and guide improvements" (p. 2). Because the project was a quality improvement project that would implement strategies to help improve current practice the PDSA framework would be a simple and useful model. A PDSA is used to test a change., First, a plan to test the change is developed (Plan), the test is carried out (Do), next observe, analyze, and learn from the test (Study), and last, determine what modifications, if any, to make for the next cycle (Act) (IHI, 2017, p. 1). The components of the Model for Improvement, setting an aim, defining measures and small tests of change helped to drive the project from recommendation to implementation. The PDSA model had been utilized

within the organization for other quality improvement projects, so many of the stakeholders were familiar with the model.

**Methodology**

This DNP project utilized an education development and evaluation design. The pre- and post-intervention design was used to measure enhancement of the MICU nurse's knowledge and improvement in documentation compliance of the VCB interventions completion. The education development and evaluation design included a review of the literature assisted in development of an educational PowerPoint that educated the nurses on evidence-based VCB interventions. The MICU nurse's baseline knowledge was measured using a modified version of Aziz's Knowledge Assessment Test (Appendix D) before the start of the project and at the end of the project. The evaluation on improvement in documentation compliance of VAP bundle interventions was completed by the project leader comparing 4th Quarter 2021 and 1st Quarter 2022 Infection Prevention's audit data team on documentation compliance. An evaluation on the decrease of VAP cases was completed by the Project Leader comparing Infection Prevention data on 4th Quarter 2021 and 1st Quarter 2022 Infection Prevention data. To determine if the MICU nurses felt the education session enhanced their knowledge and would incorporate the education into their practice, the project leader distributed a self-assessment survey to the participants (Appendix E).

**Setting**

The project took place in a 600-bed, Level I Trauma Center in the Northeast Region of the United States. The organization currently has five intensive care units, the Medical Intensive Care Unit (MICU) had been identified as the unit to participate in the quality improvement project. In their brochure, the MICU Welcome Pamphlet (2021) mentions the unit "is a 16-bed

unit, providing intensive care for the critically ill patients staffed by licensed trained medical personnel and has special equipment that allows for continuous monitoring and life support."

**Participants**

The target participants for this project were the critical care nurses that currently work in the Medical Intensive Care Unit. There were approximately 55 MICU nurses who may have been eligible to participate in the project.

**Inclusion Criteria**

- Critical care nurses currently employed by the organization and working in the MICU
- Critical care nurses currently employed by the organization working full- or part-time in the MICU

**Exclusion Criteria**

- MICU nurses currently working as a per-diem, float pool, or contract travel RNs
- Nurses out on Medical or Extended leave at the time of this project
- Nurses working in areas other than the MICU
- Members of the VAP RN Council

**Recruitment**

The MICU Nurses were introduced to the project and its purpose during the unit's daily huddles and flyers placed on the unit's information board and in the breakroom (Appendix F). MICU Nursing Leadership assisted the project leader in ensuring that the nurses were available to participate in the testing and education sessions. The nurses were expected to complete a multiple-choice knowledge assessment test via Survey Monkey electronically.

**Consent Procedure**

An email invitation (Appendix G) was sent to all nurses currently working in the organization's MICU who performed bedside nursing care to participate in the project. The email discussed the aims of the project, eligibility and ineligibility criteria for participants and directed the nurses to click a link if they were willing to or declined participation in the project. The project was approved by the Institutional Review Board (IRB) as an exempt study (Appendix H).

**Risks/Harms**

There are no anticipated risks or harm to anyone who participated in the project as the purpose of this project is to increase knowledge. The project leader was compliant with the required Collaborative Institutional Training Initiative (CITI) certification requirements.

**Costs/Compensation**

There were minimal costs associated with this project. The cost of the Survey Monkey subscription was $192. A statistician was obtained via UpWorks to analyze the data and the cost of the statistician was $140. There was no fee associated with utilizing the modified knowledge assessment questionnaire. The author of this project reviewed the pre- and post-knowledge assessment test via Survey Monkey, provided the VAP education and reviewed Infection Prevention data on compliance of documentation and incidences of VAP. The project leader disseminated the education sessions in small groups on the unit due to limited availability of conference rooms. The sessions took approximately thirty minutes.

**Project Interventions**

The MICU nurses voluntarily participated in a pre-intervention knowledge assessment test to determine their baseline knowledge on VAP bundle interventions associated with mechanical ventilated patients. The tool used to assess the critical care nurse's knowledge will

be a modified version of a validated evaluation questionnaire on the components of a VAP bundle (Aziz et al. 2020). The pre-assessment tests were modified to fifteen multiple choice questions that aligned with the organization's current Precautions Ventilator Acquired Pneumonia Order Set (Appendix I). After determining the educational barriers from the results of the Knowledge Assessment Test, an education PowerPoint on VAP and VCB interventions was created, and the education was disseminated to the nurses in the MICU by the Project Leader (Appendix J). The project leader reviewed audit 4th Quarter 2021 data obtained by Infection Prevention pre-intervention to gather baseline compliance of completion of VCB intervention documentation. After the completion of the post-intervention exam, the RN was given a short three-question self-assessment knowledge survey to complete to gather feedback on whether they felt their knowledge was enhanced by the education session. The questions asked the RN to rate their knowledge on VAP and VCB pre-intervention, if the RN felt their knowledge was enhanced by the participating in the project, and if they would apply the education received to their current practice. After receiving all post-intervention exams and self-assessment feedback surveys, the project leader analyzed the data and reviewed infection prevention data to gather post-intervention documentation compliance.

**Outcomes Measured**

The outcomes were measured to identify effectiveness of the intervention as identified in the project's Donabedian Model of Structure, Process and Outcome (Appendix K). A pre- and post-education knowledge assessment was conducted. Participant satisfaction of the education session was measured with a post-education self-assessment survey. The organization's Infection Prevention data for 4th Quarter 2021 and 1st Quarter 2022 were reviewed to identify if

there was notable improvement in compliance of documentation on completion of VCB interventions.

**Resources Needed**

The resources needed were provided by the study site organization. The quality improvement project was conducted in the Medical Intensive Care Unit. The study participants were MICU nurses employed by the study site. Participation in the study was both voluntary and anonymous. Materials required for the knowledge assessment test and education session will be provided by the project leader.

**Project Timeline and Evaluation Plan**

The evaluation plan for this quality improvement project was outlined in a Gantt Chart to show the project's timeline (Appendix L). Each process objective was assessed for implementation by the project leader. The anticipated completion dates served as a guide for the anticipated time frame. A time log was maintained by the project leader and updated as needed with changes. The project leader met with project advisors periodically to gather feedback and ensure that the plan was on task.

**Data Analysis and Security**

This practice improvement project utilized a sample size based on the eligible MICU RNs interested in voluntarily participating. The demographic data of the participants was not gathered due to the organization's request for the participants to remain anonymous. Pre- and post-knowledge assessment test data was analyzed using the most recent version of IBM Statistical Package for Social Sciences (SPSS) software. A paired T-Test analysis was used to analyze the data.

Confidentiality was maintained and protected during all phases of the project. All Infection Prevention data was an aggregate percentage of chart reviews performed by the department. No identifying patient information was collected from the data reviewed. No compliance issues were identified.

**Results**

A two-sample t-test was conducted to assess whether there was any significant difference in the number of nurses who answered the 15 VAP questions correctly pre- and post-intervention. The results were significant, t (16.574) =3.268, p=.005. The rate of responses in the post-test (M=27.87, SD=2.53) was significantly higher than that of the pre-test (M=20.87, SD=8.31) (Appendix M.).

On average 13.20 nurses answered correctly on the pre-test and an additional 7.33 answered correctly on the post-test after receiving the education. Of the thirty nurses that completed the self-assessment survey, twenty-nine nurses stated that both their knowledge was enhanced, and they would incorporate the education into their practice. When comparing MICU nurse's documentation compliance data for 4$^{th}$ quarter 2021 to 1$^{st}$ quarter 2022 data, head of bed documentation compliance increased from 90 to 95%, CHG oral care twice a day increased from 82.9 to 91.7% and oral suctioning increased from 95.7 to 100% (Appendix N.). An analysis of the data showed there was no significant difference between the quarters compared. Infection Prevention audit data for 4$^{th}$ Quarter 2021 was Head of Bed (M=1.1000, SD=.30217), Oral Care (M=1.1714, SD =.37960) and Suction (M=1.0429, SD =.20400). In 1$^{st}$ Quarter 2022 audit data was Head of Bed (M=1.0500, SD=.21978), Oral Care (M=1.0833, SD = .27872), and Suction (M=1.0000, SD = .00000) (Appendix O).

## Discussion

The literature reviewed demonstrated that education on VAP and VCB interventions would benefit all disciplines within the healthcare organization that manage the care of mechanically ventilated patients. Continued annual education sessions on VAP and VCB interventions would allow staff to receive up-to-date evidence-based education that would allow them to continue to provide optimal quality care to their mechanically ventilated patients. Implementation of the education sessions in this quality improvement project did meet specific challenges for both the project leader and nurse participants. Due to the surge of the COVID-19 Omicron variant during the implementation process, the unit experienced staffing shortages due to staff illnesses. Additionally, the organization placed restrictions on in-person meetings, so the project leader was required to provide education sessions to smaller groups including one on one sessions with nurses. Despite the challenges faced, the project was successfully completed, and resulting data was analyzed for its effectiveness.

## Implications for Practice

Mechanically ventilated patients are managed by multiple disciplines within the healthcare organization. In addition to the critical care nurses, respiratory therapists could benefit from continuous education on VAP and VCB interventions. Incorporating VAP and VCB education sessions into annual competencies can serve as refreshers for staff and ensure that staff receive the most up-to-date, evidence-based knowledge surrounding VAP and VCB.

Implementation of this quality improvement project showed that the nurses felt that their knowledge was enhanced, and they would implement the education into their practice. Both the

self-assessment survey results and the improvement in the nurse's documentation compliance showed the staff's commitment to ensuring that their patients receive evidence-based interventions.

**Implications for Healthcare Policy**

Recommendations have been made by multiple governing bodies to support improving care provided to the mechanically ventilated patient. The Centers for Disease Control and Prevention (CDC), has defined VAP and provided guidelines for healthcare organizations to consider to decrease incidences of VAP. In addition, the Infection Prevention Department where this project was completed, utilizes the National Healthcare Safety Network's criteria to determine incidences of VAP within the organization. The CDC's National Healthcare Safety Network is the nation's most widely used healthcare-associated infection tracking system. NHSN provides facilities, states, regions, and the nation with data needed to identify problem areas, measure progress of prevention efforts, and ultimately eliminate healthcare-associated infections (CDC, 2021).

**Implications for Executive Leadership**

Executive leadership should be committed to implementing continued education to support optimal patient care. Implementation of an annual education session will ensure that staff receive current, evidence-based knowledge and that the mechanically ventilated patient receives the best care possible. In addition, if patients receive evidence-based care the expectation would be that their outcomes would be favorable. Favorable patient outcomes lead to decreased length of stay, higher patient satisfaction rates and financial reimbursement for the organization. Also, because this healthcare organization is a part of the healthcare system, implementing this VAP and VCB education program across the healthcare system would

streamline the care provided amongst each of the intensive care units. Executive leaders have a large stake in the organization's patient outcomes, satisfaction rates and financial stability.

**Implications for Quality and Safety**

Instituting an annual competency education session supports the organization's quality and safety efforts by establishing its commitment to providing quality care and promoting safe practice. This commitment reiterates to all clinical staff within the organization, that both the care the patient receives, and the clinician's practice is a priority. Within the healthcare organization, both the Infection Prevention and Performance Improvement Departments should have a laser focus on ensuring that clinicians are providing evidence-based practice to their patients.

**Limitations**

There were several limitations throughout the course of the project. Due to changes in the nursing department's Executive Leadership team the approval process for IRB was delayed. Because the nurse leaders that left the organization were the organization's representatives for project approval, the project leader experienced a delay while an approver was set up. In addition to being the IRB liaison for the organization, one of the leaders who left the organization was the designee who served as the main Principal Investigator for most of the nursing research and mentored nurses through their projects.

Additionally, the organization requested that the project be voluntary and anonymous. The project leader had to educate the entire MICU nursing staff due to the anonymity of the participants. This request also did not allow the project leader to provide demographics of the participants. The project leader had to provide a range for the years of service of the nurses and gender. This information could not be narrowed down to the specific participants.

**Areas for Future Research**

There are multiple areas of additional research to be conducted based on the completion of this project. The prevention and reduction of healthcare-associated infections is a top priority for the U.S. Department of Health and Human Services (HHS) (CDC, 2015). In addition, the healthcare organization where this project was performed has made a commitment to improving its hospital-acquired infection rates. The organization would benefit from continued research on preventing VAP and including both its nursing and respiratory departments in the studies. Additionally, as the organization transitions to a new electronic medical record system, it would be beneficial to determine if population of a VCB interventions into the nurse's worklist with a ventilator order improves documentation compliance with standardized charting. This would also minimize the number of areas charting in completed and would better allow information to populate when running reports and auditing charts.

**Plans for Sustainability**

Because staff already attend annual competency day, there should be minimal barriers in adding the VAP and VCB education to critical care sessions. There would be no required additional funds to add this to annual education. Since the education demonstrated improvement in quality, the continued use of the education module as well as expanded education on the topic to other departments such as Respiratory Therapy would be beneficial. In addition to continuation of Infection Prevention's auditing of patient's charts for documentation compliance, an increase in monthly observational audits should be conducted to validate completion of bundle intervention tasks.

## Conclusion

In conclusion, there are several strategies that are implemented to address VAP and its complications, but ventilator-care bundle (VCB) carries utmost importance in this concern (Aziz, et al., 2020, p. 427). With implementation of an education program that focuses on VAP and VCB interventions, the expected goal of increasing the critical care nurse's knowledge was achieved. In addition, the goal of improving compliance of completion of VCB intervention tasks and the documentation of completion in the EMR improved as well. Labeau et al (2007) explained "The reductions in the rates of hospital-acquired infection that occurred after educational programs on strategies to prevent infection provide indirect evidence for the value of knowledge" (p. 372). Therefore, with a commitment to continuing education on VAP and VCB interventions for all disciplines managing the care of the mechanically ventilated patient, there will continue to be a decline of incidences of VAP within this healthcare organization.

**References**

Aloush, S., and Al-Rawaifa, O. (2020). Prevention of ventilator-associated pneumonia in intensive care units: barriers and compliance. *International Journal of Nursing Practice,* 26, 1-7. **https://doi.org/10.1111/ijn.12838**

Alrubaiee, G., Baharom, A., Faisal, I., Shahar, H., Daud, S., and Basaleem, H. (2021). Implementation of an educational module on nosocomial infection control measures: a randomised hospital-based trial. *BMC Nursing*, 20(33), 2-10. doi: https://doi.org/10.1186/s12912-021-00551-0

Aziz, Z. Kausar, S., Zahid, S., Farooqi, S., Aziz, Z., and Ahmad, R. (2020). Knowledge and practice of ventilator care bundle for preventing ventilator associated pneumonia by ICU nurses of tertiary care hospitals of Lahore. *Anaesthesia, Pain, & Intensive Care,* 24(4), 426-434. Doi: 10.35975/apic.v24i4.1315.

Branco, A., Lourencone, E., Monteiro, A., Fonseca, J., Blatt, C., and Aquino, R. (2020). Education to prevent ventilator-associated pneumonia in intensive care unit. *Revista Brasileira de Enfermagem,* 73(6), 1-7, doi: 10.1590/0034-7167-2019-0477

Centers for Disease Control and Prevention. (2019). Frequently asked questions about ventilator-associated pneumonia. *Centers for Disease Control and Prevention.* Retrieved from: https://www.cdc.gov/hai/vap/vap_faqs.html

Centers for Disease Control and Prevention. (2015). Healthcare-associated infections. *Centers for Disease Control and Prevention.* Retrieved from: Preventing Healthcare-associated Infections | HAI | CDChttps://www.cdc.gov/hai/vap/vap_faqs.html

Centers for Disease Control and Prevention. (2021). National healthcare safety network (NHSN). *Centers for Disease Control and Prevention.* Retrieved from: NHSN | CDC

Dipanjali R., Shivananda, I., and Yashoda, S. (2020). Effectiveness of an educational intervention on knowledge and practice of staff nurses on prevention of ventilator-associated pneumonia among neonates in neonatal intensive care unit. International Journal of Caring Sciences, 13(2), 1421-1430. Retrieved from: Effectiveness of an Educational Intervention on Knowledge and Practice of Staff Nurses on Prevention of Ventilator Associated Pneumonia among Neonates in Neonatal Intensive Care Unit - ProQuest (wrlc.org)

Duszynska, W., Rosenthal, V., Szczesny, A., Zajaczkowska, K., Fulek, M., and Tomaszewski, J. (2020). Device associated-healthcare associated infections monitoring, prevention and cost assessment at intensive care unit of university hospital in poland (2015-2017). *BMC Infectious Disease* 20(1), 1-10, doi: 10.1186/s12879-020-05482-w

Gupta, P., Thomas, M., Patel, A., George, R., Matthews, L., Alex, Seenu. Siji, J., Simbulan, C., Garcia, M., Balushi, S, and El Hassan, M. (2020). Bundle approach used to achieve zero central line-associated bloodstream infections in an adult coronary intensive care unit. *BMJ Open Quality,* 10(1), doi: 10.1136/bmjoq-2020-001200.

Institute for Healthcare Improvement. (2021). How to improve? *Institute for Healthcare Improvement*. Retrieved from: How to Improve | IHI - Institute for Healthcare Improvement

Institute for Healthcare Improvement. (2021). Plan-do-study-act (pdsa) worksheet. *Institute for Healthcare Improvement.* Retrieved from: Plan-Do-Study-Act (PDSA) Worksheet | IHI - Institute for Healthcare Improvement

Institute for Healthcare Improvement. (2017). Quality improvement essentials toolkit: pdsa worksheet. *Institute for Healthcare Improvement,* 1-6. Retrieved from: Quality Improvement Essentials Toolkit | IHI - Institute for Healthcare Improvement

Jansson, M., Ala-Kokko, T., Syrjala, H. and Kyngas, H. (2014). Development and psychometric testing of ventilator bundle questionnaire and observation schedule. *American Journal of Infection Control,* 42, 381-384. Doi:https://doi.org/10.1016/j.ajic.2013.11.007

Kalanuria, A., Zai, W., and Mirski, M. (2014). Ventilator-associated pneumonia in the icu. *Critical Care,* 18(208), 1-8. Retrieved from: Ventilator-associated pneumonia in the ICU.: EBSCOhost (wrlc.org)

Labeau. S., Vandijck, D.M., Claes, B., Van Aken, P., and Blot, S.I. (2007). Critical care nurses' knowledge of evidence-based guidelines for preventing ventilator-associated pneumonia: an evaluation questionnaire. *American Journal of Critical Care,* 16(4), 371-377. https://doi.org/10.4037/ajcc2007.16.4.371

Lim, K., K., S., Ko, W., Sheng, W., Chang, Y., Hong, M., Sun, C., Chen, Y., and Chang, S. (2015). Efficacy of ventilator-associated pneumonia care bundle for prevention of ventilator-associated pneumonia in the surgical intensive care units of a medical center. *Journal of Microbiology, Immunology and Infection,* 48(3), 316-321. http://dx.doi.org/10.1016/j.jmii.2013.09.007

National Healthcare Safety Network. (2021). Pneumonia (Ventilator-associated [vap] and nonventilator-associated pneumonia [pneu] event. *Center for Disease Control and Prevention,* 6-1-6-19. Retrieved from: Pneumonia (cdc.gov)

National Healthcare Safety Network. (2021). Ventilator-associated events. *Center for Disease Control and Prevention.* Retrieved from: Ventilator-associated Event (VAE) (cdc.gov)

Oliviera, J., Zagalo, C., and Cavaco-Silva, P. (2014). Prevention of ventilator-associated pneumonia. *Portuguese Journal of Pulmonology,* 20(3), 152-161. https://doi.org/10.1016/j.rppneu.2014.01.002

Santos Wolmer de Melo, L., Monteiro de Abreu, M., de Oliveira Santos, B., Washington Casimiro Carreteiro, M., Moura de Souza, M., Andrade Lins de Albuquerque, M., Lacerda Vida, C. and Ramos-Lacerda, H. (2021). Partnership among hospitals to reduce healthcare associated infections: a quasi-experimental study in brazilian ICUs. *BMC Infectious Diseases,* 21(212), 1-9. DOI:10.1186/s12879-021-05896-0

Speck, K., Rawat, N., Weiner, N., Tuiuba, H., Farley, D., and Berenholtz, S. (2016). A systematic approach for developing a ventilator-associated pneumonia prevention bundle. *American Journal of Infection Control,* 44(6), 652-656. doi:10.1016/j.ajic.2015.12.020.

Wolfensberger, A., Clack, L., von Felten, S., Kusejko, K., Hesse, M., Jakob, W., Saleschus, D., Meier, MT, Kouyos, R., Held, L., and Sax, H. (2020). Implementation and evaluation of a care bundle for prevention of non-ventilator-associated hospital-acquired pneumonia (nvHAP) – a mixed-methods study protocol for a hybrid type 2 effectiveness-implementation trial. *BMC Infectious Diseases,* 20(603), 1-11. doi: 10.1186/s12879-020-05271-5

Zampieri, F., Elias de Oliveira, N., Nassar, A., Leonardo de Oliveira Manoel, A., Grion, C., Lacerda, F., Maia, I., Thompson, M., Giancursi, T., de Aquino Martins, P., Lisboa, T., Abait, T., Damiani, L., Machado, F., and Cavalcanti, A. (2020). Bundle of Coated

Devices to Reduce Nosocomial Infections in the Intensive Care Unit CRITIC Pilot Randomized Controlled Trial. *Annals of the American Thoracic Society,* 17(10), 1257-1263, https://doi.org/10.1513/AnnalsATS.202003-206OC

**Appendix A - SWOT Analysis**

| (Problem) | (SWOT Analysis to identify a specific problem, list it here) |
|---|---|
| **Strengths:**<br>● Describe your organizational setting.<br>● What is your organization's greatest strength?<br>● Do you consider your organization leadership team strong? Why?<br>● What does your organization offer to its employees that make it worthwhile to belong to your organization? What's in it for them?<br>● Are your colleagues active and engaged?<br>● Additional strengths | ● The healthcare organization is a Level I trauma, 600-bed acute hospital in the Northeast Region of the United States.<br>● The hospital is a Level I trauma center, whose Centers of Excellence include cardiovascular care, cancer care, stroke care, neuroscience, orthopedics and women's and children's care. The hospital is a teaching hospital that has a collaborative relationship with a highly regarded university.<br>● The organization has a strong leadership team that are committed team that holds a wealth of experience and knowledge of the healthcare field.<br>● The organization offers professional development opportunities to everyone in the organization. Specific to the nursing department, the organization offers the clinical ladder program, mentoring program, tuition reimbursement and a competitive salary package.<br>● My colleagues are active and engaged despite going through various changes in their executive leadership team. They are committed to changes in practice that will help the department meet its nursing quality goals. |
| **Weaknesses:**<br>● What is your organization's biggest weakness?<br>● What can be improved?<br>● What necessary expertise / manpower do you currently lack? | ● The organization is struggling with meeting their goals in nursing quality indicators. In all indicators, CLABSI, CAUTI, VTE, VAE, pressure injury, and patient falls the organization rated among the lowest of the 13 hospitals in the system. Because the organization has had multiple Chief |

| | |
|---|---|
| ● Does your organization have adequate resources for this project?<br>● Additional weaknesses | Nursing Officers in the past few years, it has been difficult to develop a change in practice and see the change through to implementation. With the multiple changes in leadership and appointments of interim leadership, views and priorities stalled the practice change.<br>● To improve practice, there should be a review of the quality improvement structure and processes currently in place.<br>● To help with quality improvement, there will be a need for an interdisciplinary approach. Various members of both the clinical and non-clinical teams such as nursing, physicians, advance practice providers, respiratory, research assistants, case management and other areas depending upon quality indicator.<br>● The organization does have adequate human and monetary resources for this project. |
| **Opportunities:**<br>● What is your organization's greatest opportunity?<br>● What environmental trends might impact your organization?<br>● What external changes or factors present interesting opportunities?<br>● Additional opportunities | ● Creation of task forces to review each quality indicator, the team will review policy and procedure and develop an improvement program. The team should also be tasked with monitoring device utilization such as the number of indwelling catheters placed and their indications or utilization of protective resources such as bed and chair alarms to prevent falls.<br>● The organization should incorporate staff nurses in the change process to improve staff inclusion and buy-in.<br>● External factors such as the population present interesting opportunities. The organization serves as a community hospital to many patients that experience homelessness, substance abuse, obesity and many other factors affecting health. Many of these patients are considered highly susceptible to experiencing many of these negative events.<br>● Patient experience is also a huge area of opportunity, in December 2020, the organization's year-to-date rate my hospital percentage was 63.7% which ranked within the 33% percentile amongst the peer groups |

| | |
|---|---|
| | surveyed. The patient survey's domains are communication with nurses, responsiveness of staff, communication with doctors, cleanliness, quietness, communication about medications and discharge instructions. The organization has also made this an area of attention coming into 2021.<br>● Employee engagement and staff wellness are additional areas that the organization has opportunity to improve in specifically post-pandemic. Staff have expressed difficulty dealing with what they experienced while caring for patients during the Covid-19 pandemic. Although self-care forums and employee assistance programs were offered, staff felt that the remote options were not personal and not helpful. |
| **Threats:**<br>● What is your organization's biggest threat?<br>● What obstacles do you face?<br>● What are other organizations doing that yours is not?<br>● What challenges can be turned into opportunities?<br>● Are external economic forces affecting your organization?<br>● Additional threats | ● One of the organization's biggest threats is neighboring institutions that offer the same services and rate better on patient experience surveys and patient outcomes.<br>● Physician and staff buy-in to changes in practice. Without support of our primary team and nurses to accept the change practices and utilize them, the recommended processes will not be successful and not allow the organization to improve and reach its goals.<br>● Other organizations have implemented best practices and created strategies surrounding auditing compliance.<br>● The organization can partner with one of the higher performing hospitals in the system to determine what works for them in these areas that make them successful. Perform a PDSA on one of the lower performing relative units to pilot a change in practice.<br>● With loss of experienced nurses, the organization loses the expertise of the nurse. Specifically, in the critical care areas, onboarding of a new experienced ICU nurse can take anywhere from 6-8 weeks and a |

| | |
|---|---|
| | new inexperienced ICU can take up to 12 weeks. It is imperative to focus on retention of experienced nurses as well. |
| **What needs to happen to ensure your organization's health and success?** | ● Improved interdisciplinary collaboration such as interdisciplinary rounds where all team members attend and discuss need for lines and safety concerns. Currently, some units have two sets of rounds, one with nursing leadership, primary nurse and case management. And then rounds with the nurse leader, case management and the provider which does not allow all parties to collaboratively discuss the patient<br>● Improved quality improvement processes which includes the nursing, quality, infection prevention and hospital PI teams working together to improve quality measures and not working fragmented<br>● Investment in self-care and wellness for staff and leadership such as in-person counselling sessions, staff felt that remote sessions seemed impersonal and not genuine<br>● Improved executive leadership support of new processes, new leadership assessing where the team left off in quality improvement and evaluating if it is appropriate to pick up where they left off versus changing the entire process giving the team the impression they need to start from scratch. |

**SWOT Analysis**

| | **Helpful**<br>To achieving the objective | **Harmful**<br>To achieving the objective |
|---|---|---|
| **Internal Origin** {Attributes of the organization} | **Strengths**<br>• Physical Environment<br>• Clinical Expertise<br>• Collaborative Organizational Relationships<br>• Competitive Salaries<br>• Employee Commitment | **Weaknesses**<br>• Leadership Rotation<br>• QI Structure and Process<br>• Care Management<br>• Staffing<br>• Employee Engagement<br>• Staff Wellness and Resilience |
| **External Origin** {Attributes of the organization} | **Opportunities**<br>• Community Outreach<br>• Quality Improvement<br>• Patient Experience<br>• Employee Engagement<br>• Staff Wellness and Resilience | **Threats**<br>• Competition<br>• System-Wide Goal Setting<br>• Interdisciplinary Collaboration<br>• Leadership Focus<br>• Recruitment and Retention |

**Appendix B - Evidence Table**

| Article # | Author & Date | Evidence Type | Sample, Sample Size, Setting | Study findings that help answer the EBP Question | Observable Measures | Limitations | Evidence Level & Quality |
|---|---|---|---|---|---|---|---|
| 1 | Wolfensberger,BMC Infectious Diseases, 2020 | Mixed-Method | 50 patients in a medical-surgical unit | Looking to correlate nvHAP rates with adherence data of the prevention bundle and with qualitative measures of implementation success | Quantitative: Definition that describes hospital-acquired pneumonia Qualititave: Uses action plan interviews with local implementation, drop-in interviews with frontline staff and focus group interviews | Does not include a control group, duration of the study shortened due to Covid-19 pandemic | Level III, Good |
| 2 | Santos Wolmer de Melo, 2021 | Quasi-experimental | 48 ICU beds in 5 public tertiary hospitals | Used IHI Improvement Model and PDSA cycle testing to evaluate effectiveness | Quantitative: mean monthly reduction of VAP ID and a decrease at the end of the testing period | Does not include a control group, difficult to maintain adherence to the VAP bundle in the ICUs | Level II, Good |

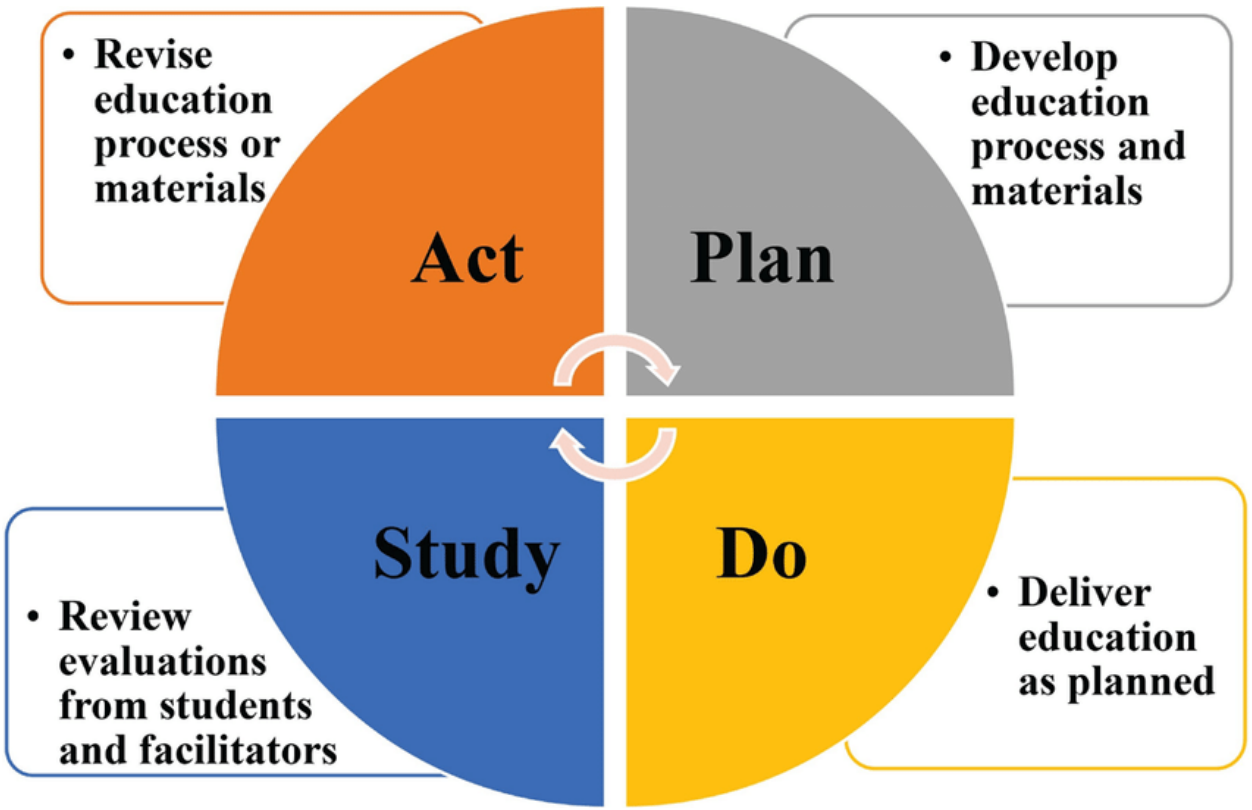
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | Zampieri, 2020 | RCT | 103 patients in 12 ICUs, | Compared groups endotracheal tubes coated and uncoated endotracheal tubes to prevent formation of biofilm which is one cause of ventilator-associated pneumonia | Patients in the coated group had more days alive and free of antibiotics | Large portion of patients excluded after randomization, | Level I, Good |
| 4 | Alrubaiee, 2021 | Randomized trial | 540 nurses providing direct care in public hospitals | Study aims to evaluate the implementation of an education module on nosocomial infections among nurses, education module looking to enhance the nurse's knowledge on nosocomial infections | Participation in the intervention groups produced a significant improvement in mean knowledge scores | Limited to nurses with a 3-year nursing diploma in public hospitals in a specific region | Level II, good |
| 5 | Aloush, 2020 | Cross-sectional | 294 ICU nurses in nine | Focused on the nurse's maintenance of | Identified nurse's compliance | Use of self-reporting to assess | Level III, good |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | design, non-experimental | participating hospitals | the endotracheal tube, evaluating the compliance of nurses with VAP prevention guidelines and barriers to compliance | improved with increased knowledge of VAP guidelines | compliance with VAP guidelines, some evaluated items are not nurse exclusive interventions | |
| 6 | Branco, 2020 | Quasi-experimental | 302 ICU patients on mechanical ventilation | Evaluating nursing adherence to the VAP prevention bundle, and incidence rate before and after conducting continuing education | Significant increase in nursing compliance of oral care and teeth brushing after education, there was a decrease in the density of VAP incidence after the implementation of prevention bundles | Difficult data collection due to incomplete patient profiles | Level II, Good |
| 7 | Lim, 2015 | Quasi-experimental | 27,125 patient charts reviewed – 12,913 pre-VAP bundle | Checking the efficacy of the VAP bundle by comparing the before- and | Ventilator utilization significantly decreased and VAP density decreased | Variable patient characteristics and surgical types, limited to the SICU in | Level III, Good |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | phase and 14,212 post-bundle phase | after-the bundle VAP density | significantly post-bundle phase | one surgical center, study lacked the compliance rate | |
| 8 | Duszynska, 2020 | Non-research | 1353 patients evaluated and observed | Evaluation of compliance guidelines for nosocomial infections, surveillance of bundle compliance and outcomes | Device associated infections found in 1/5 patients, generated additional treatment costs and prolonged length of stay | Only focused on one medical center, compliance of bundle was monitored not its effect on infection, no comparison of patients with infection vs. non-infection groups | Level V, Good |
| 9 | Dipanjali, 2021 | Quasi-experimental | 41 Level IIIA NICU nurses from a tertiary hospital | Identification of the need to increase nurse knowledge on VAP guidelines | Study showed improvement in knowledge and practice of the nurses surrounding VAP guidelines after implementation of teaching modules | Small sample size so findings can't be generalized, conducted in only one setting | Level III, Low |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | National Healthcare Safety Network, 2021 | Guidelines | N/A | Guidelines define VAP criteria and reporting instructions followed by healthcare institutions | N/A | | Level IV, High |

**Appendix C – PDSA Model**



**Appendix D - Knowledge Assessment Questionnaire – Preventing Ventilator-Associated Pneumonia (Modified from Aziz et al. 2020)**

1. VCB is:
    a. A checklist used as a protocol of care for mechanically ventilated patients.
    b. Guidelines used to reduce the risk of atelectasis
    c. Interventions to treat malignancies of lungs
    d. I do not know
2. Non-compliance to VCB tends to be associated with:
    a. Decreased risk of VAP
    b. High mortality in mechanically ventilated patients
    c. Reduced morbidity in mechanically ventilated patients
    d. I do not know
3. Which component is not included in the VCB for the prevention of VAP?
    a. Oral care
    b. Head of bed elevation
    c. Daily sedation vacation

d. Administration of antibiotics

4. VAP occur in patients who have received mechanical ventilation for:
    a. 6 hours
    b. 12 hours
    c. 24 hours
    d. 48 hours
5. Which is the recommended position for mechanically ventilated patient for the prevention of VAP?
    a. Supine position
    b. Semi-recumbent position
    c. Prone position
    d. Side-lying position
6. Head side of the bed should be elevated at:
    a. 0-15 degree
    b. 15-30 degrees
    c. 30-45 degrees
    d. I do not know

7. What is the effect of kinetic beds for the prevention of VAP?
    a. Increases the risk for VAP
    b. Reduces the risk for VAP
    c. No effect
    d. I don't know
8. Which route is best recommended when intubating a patient?
    a. Oral intubation is recommended
    b. Nasal intubation is recommended
    c. Both routes of intubation are recommended
    d. I do not know
9. Evidence-based guidelines for preventing VAP recommend changing ventilator circuits how frequently?
    a. Every 48 hours
    b. Every 72 hours
    c. Every week
    d. Every new patient
10. A nurse caring for a ventilated patient is required to wash hands:
    a. Before oral and ETT suctioning

b. After oral and ETT suctioning

c. Before and after oral and ETT suctioning

d. I do not know

11. It is recommended to perform oral care by using a swab moistened with chlorhexidine 1%:

a. Once a shift

b. Every 4 to 6 hours and whenever necessary

c. Twice daily

d. I do not know

12. One of the components of VCB is:

a. Chest physiotherapy

b. Sedation Interruption

c. Daily ventilator circuit changes

d. I do not know

13. Early weaning:

a. Reduces the risk for VAP

b. Increases the risk for VAP

c. Early weaning does not influence the risk for VAP

d. I do not know

14. What is your opinion regarding respiratory physiotherapy for the prevention of VAP?

a. Highly recommended

b. Can be recommended

c. There is no evidence of efficacy

d. I don’t know

15. Contraindication for DVT prophylaxis include:

a. Thrombocytopenia (HIT)

b. Active bleeding (GI Bleed)

c. Presumed or confirmed clot in lower extremity

d. All of the above

**Appendix E: Post-Intervention Staff Self-Assessment Survey**

1. Before receiving this education, my knowledge on the Ventilator-Associated Pneumonia Bundled Care was:
    a) Excellent
    b) Good
    c) Fair
    d) Poor

2. After receiving this education, do you feel your knowledge on Ventilator-Associated Pneumonia Bundled Care has been enhanced?
    a) Yes
    b) No

3. Will you apply this education received to your current practice?
    a) Yes
    b) No

**Appendix F - Project Recruitment Flyer**

**Ventilator-Associated Pneumonia Bundle Compliance: A Quality Improvement Project**

*Participants Needed for Quality Improvement Project!*

Who: All full-time and part-time Medical Intensive Care Unit Nurses

When: November 1, 2021 – January 15, 2022

What: This research study is a quality improvement project that will assess the knowledge of the MICU nurses on ventilator-associated pneumonia and ventilator-associated pneumonia bundle care. The Principal Investigator (PI) is the AVP of Critical Care and Trauma Services and Keesha Holmes, MSN, FNP, NE-BC.

Where:

The research study will take place in the MICU Conference Room

Why: The purpose of this research study is to explore the impact that a structured education program has on the knowledge of the nurse on ventilator-associated pneumonia bundle interventions.

The benefits of this study may be none, but some participants may experience an increase in knowledge. You will be asked to commit to participating in three phases of the study over the next 10 weeks and you will be asked to complete a pre-intervention knowledge assessment test, attend a 30-minute education session, complete a post-intervention knowledge assessment test and a self-assessment survey.

If you would like to participate please submit your email to Keesha Holmes she will review the consent in detail with you.
Refreshments will be provided

**Appendix G - E-mail Invitation to Participate in Project**

Dear Medical Intensive Care Nurses:

I am writing to invite you to voluntarily participate in a performance improvement evidence-based project conducted by George Washington University School of Nursing titled:

***Ventilator-Associated Pneumonia Bundle Compliance: A Quality Improvement Project***

You may ask questions about anything you do not understand by contacting me via email or phone. You may refuse to participate, and it will not impact your job in any way.

**Project Director Contact Information:**

Keesha L. Holmes, MSN, FNP, NE-BC

Telephone: 732-258-9475

Email: kholmesfnp@gwu.edu

**Aim of Project:**

The aims of this quality improvement project is to determine if a unit-based education initiative provided to the ICU RNs on VAP and the VAP bundle interventions will a) improve the RNs knowledge base on VAP, b) improve the RNs knowledge base on evidence-based VAP bundle interventions ordered to prevent VAP, c) improve documentation of completion of VAP bundle interventions in the patient's electronic medical record, and d) decrease incidences of VAP in the ICU areas of this organization.

**Explanation of Procedures:**

Participation in the project will entail completion of a Pre-Intervention Knowledge Assessment Test on Ventilator-Associated Pneumonia Bundle Care, attendance in a thirty-minute education session, completion of a Post-Education Knowledge Assessment Test and lastly, completion of a Post-Education Self-Assessment Survey.

**Time Required:**

The Knowledge Assessment Test will take approximately thirty minutes, the education session will take about thirty minutes and Self-Assessment survey will take about ten minutes.

**Risks:**

There are no known risks associated with this project.

**Benefits:**

Although there will be no direct benefits due to your participation in this project, refreshments will be provided during the sessions.

**Confidentiality:**

No identifying information will be included in any of the components. Your email will not be collected at any time.

**Inclusion Criteria for Participation:**

All full- and part-time direct care MICU RNs who are off nursing orientation are invited to participate.

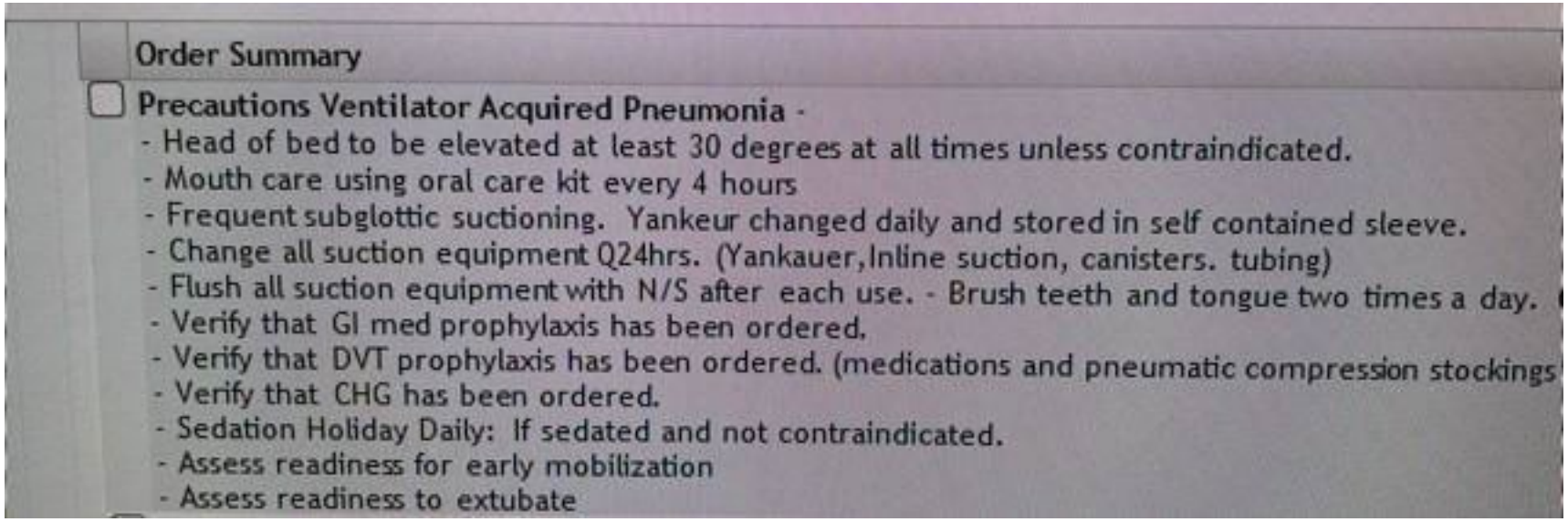
If you are interested in participating in this project please click on the following link to complete the pre-education knowledge assessment test.

Thank you.

Sincerely,

Keesha L. Holmes, MSN, FNP, NE-BC

## Appendix I – Precautions Ventilator Acquired Pneumonia Order Set - Current



Order Summary

Precautions Ventilator Acquired Pneumonia -
- Head of bed to be elevated at least 30 degrees at all times unless contraindicated.
- Mouth care using oral care kit every 4 hours
- Frequent subglottic suctioning. Yankeur changed daily and stored in self contained sleeve.
- Change all suction equipment Q24hrs. (Yankauer,Inline suction, canisters. tubing)
- Flush all suction equipment with N/S after each use. - Brush teeth and tongue two times a day.
- Verify that GI med prophylaxis has been ordered.
- Verify that DVT prophylaxis has been ordered. (medications and pneumatic compression stockings
- Verify that CHG has been ordered.
- Sedation Holiday Daily: If sedated and not contraindicated.
- Assess readiness for early mobilization
- Assess readiness to extubate

**Appendix J: Ventilator-Associated Pneumonia Precautions Bundle Care Education**

# Ventilator-Associated Pneumonia Precautions Bundle Care

Keesha L. Holmes, MSN, FNP, NE-BC

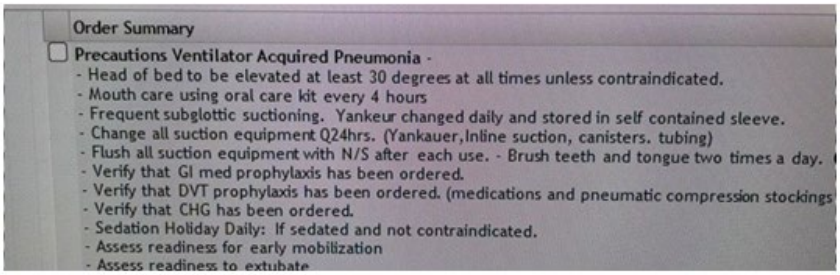
## What is Ventilator-Associated Pneumonia

- A lung infection that develops in a person who is on a ventilator
- A ventilator is a machine that is used to help a patient breathe by giving oxygen through the tube
- An infection may occur if germs enter through the tube and get into the patient's lungs
- The infection can be treated with antibiotics and the antibiotic depends on which germ is causing the infection

# Ventilator-Associated Pneumonia Bundle Care

- Consists of a small set of preventive measures with proven efficacy
- Ensures more efficient prevention of disease
- VAP Bundles are comprised of interventions such as:
  - Elevated Head of Bed
  - Sedation Interruption
  - Assessment of readiness to extubate
  - Daily oral care we Chlorhexidine
  - Deep Vein Thrombosis Prophylaxis
  - Peptic Ulcer Disease Prophylaxis
  - Hand hygiene

# Precautions VAP Order Set - Current


Order Summary

Precautions Ventilator Acquired Pneumonia -
- Head of bed to be elevated at least 30 degrees at all times unless contraindicated.
- Mouth care using oral care kit every 4 hours
- Frequent subglottic suctioning. Yankeur changed daily and stored in self contained sleeve.
- Change all suction equipment Q24hrs. (Yankauer,Inline suction, canisters. tubing)
- Flush all suction equipment with N/S after each use. - Brush teeth and tongue two times a day.
- Verify that GI med prophylaxis has been ordered.
- Verify that DVT prophylaxis has been ordered. (medications and pneumatic compression stockings
- Verify that CHG has been ordered.
- Sedation Holiday Daily: If sedated and not contraindicated.
- Assess readiness for early mobilization
- Assess readiness to extubate

## Head of Bed Elevation

- Head of bed elevation at 30 – 45 degrees helps avoid supine position
- Prevents gastroesophageal reflux
- Reduces risk for aspiration to lower airways

## Oral Hygiene and Subglottic Suctioning

- Antiseptic oral hygiene reduces and prevents oropharyngeal colonization by bacterial pathogens
- Chlorhexidine was the most studied antiseptic and its efficacy in prevention of VAP has been proven
- Chlorhexidine has a broad spectrum of action, covering microorganisms such as P. aeruginosa, S. aureus, Acinetobacter and MRSA
- Subglottic secretion drainage reduces incidence of VAP

## Gastrointestinal and Deep Vein Thrombosis Prophylaxis

- Probiotics
  - Are viable microorganisms present in sufficient number so that they can have a beneficial effect on the health of the host in the gut
  - decrease the presence of potential pathogens by favoring the growth of bacterial species beneficial to the organism
- Sequential Compression Devices
- Early Ambulation Assessment

## Extubation Assessment

- Spontaneous breathing trials allow the observation for signs of respiratory failure
- Patients breathe spontaneously through the endotracheal tube connected to a T-piece which provides humidified oxygen connected to a CPAP and/or pressure support ventilation for short periods of time
- Assessment also includes weaning from sedatives also known as sedation holiday

**Appendix K**: **Donabedian Model of Structure, Process and Outcome**

| **Outcome** | **Objective** | **Evaluation** | **Methods** |
|---|---|---|---|
| Improve participant's knowledge on ventilator-associated pneumonia guidelines and ventilator-associated pneumonia bundle care interventions | Implement an education session about VAP guidelines and evidence-based VAP interventions for the mechanically ventilated patient | The percentage of participants with improved Knowledge Assessment Test scores | Quantitative analysis using descriptive techniques T-tests |
| Improve participant's compliance in documentation of completion of ventilator-associated pneumonia bundle interventions | Complete chart reviews of mechanically ventilated patients and review ventilator-associated pneumonia bundle interventions documented as completed in the patient's electronic medical record | The percentage of patients with VAP bundles completed in the electronic medical record | Quantitative analysis using descriptive techniques |
| **Process Measures** | **Objective** | **Evaluation Plan** | **Methods** |
| Ability of the program to educate all qualified nurses | Sessions will be scheduled to ensure they are available to all qualified nurses | Prearranged schedule to ensure all staff attend | Categorical data |

| | | | |
|---|---|---|---|
| Participants rating of their satisfaction of the education session | Participants will be satisfied with the education session | Post-education Staff Self-Assessment Survey | Quantitative Analysis |
| **Structure** | **Objective** | **Evaluation Plan** | **Methods** |
| Education program will be offered through the Center for Professional Development, Innovation & Research | Course will be incorporated into the annual nursing competency sessions | Number of sessions offered during the annual competency timeframe by the Center for Professional Development, Innovation & Research | Track number of annual competency sessions through early 2022 |

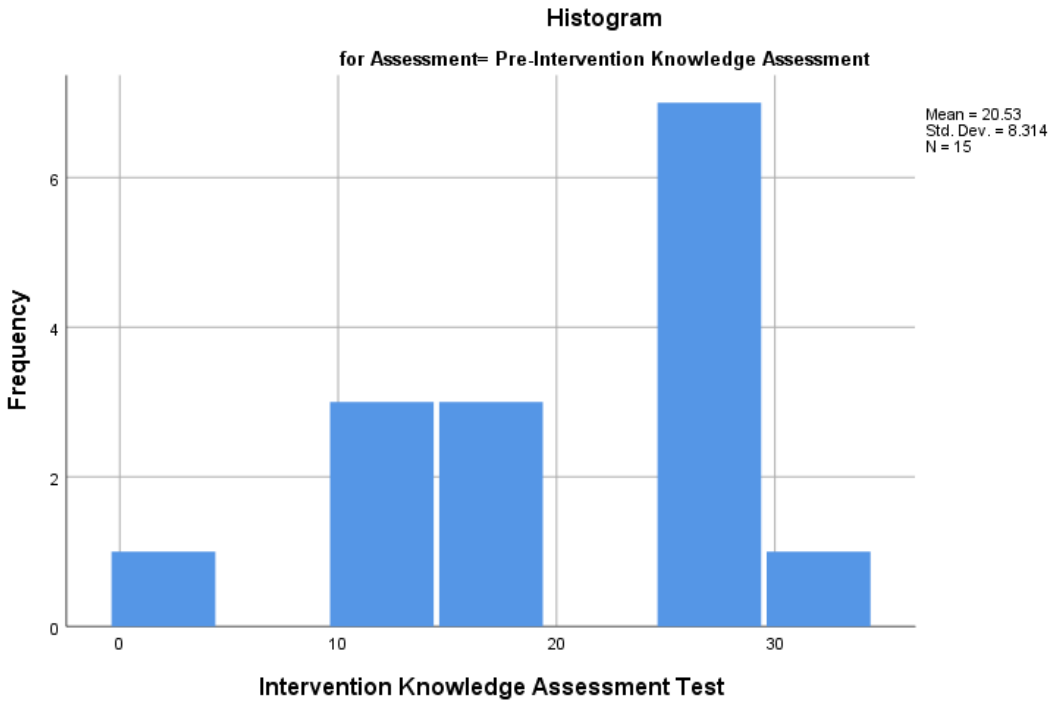
**Appendix L. VAP Quality Improvement Gantt Chart**

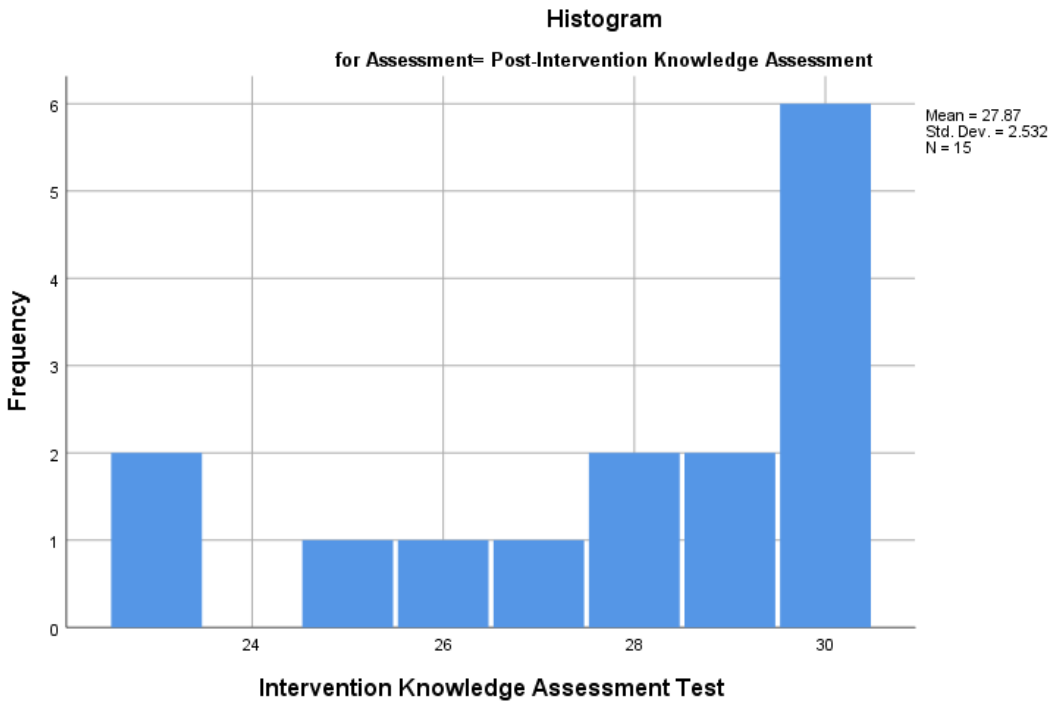
| Task | Expected Length of Time | Jul | | Aug | | Sept | | Oct | | Nov | | Dec | | Jan | | Feb | | Mar | | Apr | | May |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Obtain DNP Proposal Approval from Primary and Secondary Advisors | 2 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Present DNP proposal to EBP Steering Committee at Practice Site | 1 Day | | | | | | | | | | | | | | | | | | | | | |
| Obtain IRB approval | 4 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Announce QI Project to Study Participants at daily department huddles | 2 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Disseminate pre-intervention knowledge assessment questionnaire to participating MICU RNs | 2 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Provide ventilator-associated pneumonia bundle education to all included MICU RNs | 3 Weeks | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Disseminate post-intervention knowledge self-assessment survey to participating MICU RNs | 2 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Conduct review of infection prevention documentation compliance data | 4 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Data Analysis | 4 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Write up report | 6 Weeks | | | | | | | | | | | | | | | | | | | | | |
| Dissemination of results via abstract, poster, repository, presentation and conference | 8 Weeks | | | | | | | | | | | | | | | | | | | | | |

**Appendix M. Pre- and Post-Knowledge Assessment Test Results**

| VAP Bundle Compliance | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Post-Intervention Knowledge Assessment | 15 | 27.87 | 2.532 | .654 |
| Pre-Intervention Knowledge Assessment | 15 | 20.53 | 8.314 | 2.147 |




Histogram
for Assessment= Post-Intervention Knowledge Assessment
Mean = 27.87
Std. Dev. = 2.532
N = 15
Frequency
0
1
2
3
4
5
6
24
26
28
30
Intervention Knowledge Assessment Test

## Appendix N. 4th Quarter 2021 and 1st Quarter 2022 Infection Prevention VCB Documentation Compliance

Quarter 4 2021 – Infection Prevention VAP Bundle Completion of Documentation Audit

| | | HOB Elevation | | CHG Oral Care 2x | | Suctioning | |
|---|---|---|---|---|---|---|---|
| | Charts Reviewed | Documented | % | Documented | % | Documented | % |
| MICU | 70 | 63 | 90 | 58 | 82.9 | 67 | 95.7 |

Quarter 1 2022 – Infection Prevention VAP Bundle Completion of Documentation Audit

| | | HOB Elevation | | CHG Oral Care 2x | | Suctioning | |
|---|---|---|---|---|---|---|---|
| | Charts Reviewed | Documented | % | Documented | % | Documented | % |
| MICU | 60 | 57 | 95.0 | 55 | 91.7 | 60 | 100 |

**Appendix O. 4th Quarter 2021 and 1st Quarter 2022 Analysis of Infection Prevention VCB Documentation Compliance** Q4 2021 – Analysis of Infection Prevention Audit Data

**Statistics**

| | | HOB | OralCare | Suction |
|---|---|---|---|---|
| N | Valid | 70 | 70 | 70 |
| | Missing | 0 | 0 | 0 |
| Mean | | 1.1000 | 1.1714 | 1.0429 |
| Median | | 1.0000 | 1.0000 | 1.0000 |
| Std. Deviation | | .30217 | .37960 | .20400 |

Q1 2022 – Analysis of Infection Prevention Audit Data

**Statistics**

| | | HOB | OralCare | Suction |
|---|---|---|---|---|
| N | Valid | 60 | 60 | 60 |
| | Missing | 0 | 0 | 0 |
| Mean | | 1.0500 | 1.0833 | 1.0000 |
| Median | | 1.0000 | 1.0000 | 1.0000 |
| Std. Deviation | | .21978 | .27872 | .00000 |