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Educating Nurses on Frequent Oral Care for Mechanically Ventilated Patients:

An Evidence-Based Practice Project Proposal

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Department of Nursing, Otterbein University In Partial Fulfillment of the Requirements for the Degree

Doctor of Nursing Practice

2024

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Abstract

The final scholarly project proposal is to implement oral care education for nurses in an intensive care unit (ICU). The proposal aims to create a guideline for an investigator to implement oral care recommendations for mechanically ventilated patients in order to reduce ventilator-associated pneumonia (VAP). The proposal consists of obtaining VAP data and oral care charting data for the unit studied, steps for providing oral care education, and analysis recommendations. Oral care involves swabbing the patient's mouth every two hours with a swab and mouthwash. Oral care education would include handouts and direct teaching. The proposal aims to increase oral care charting rates and decrease ventilator-associated pneumonia after educating the unit's nurses. There will also be recommendations for future practice in the unit and other ICUs. Dissemination will include a poster, presentation, paper, and submission to Digital Commons.

Keywords: Oral care, ventilator, pneumonia, ventilator-associated pneumonia, nursing

Introduction

Ventilator-associated pneumonia (VAP) is among the most deadly and expensive hospital-acquired infections in the United States. For every 1,000 cases of VAP, there are 140 excessive deaths (Agency for Healthcare, Research, & Quality (AHRQ), 2017). Healthcare workers utilize ventilator bundles to help decrease Ventilator-Associated Event (VAE) rates. Ventilator bundle components include frequent oral care, head-of-bed elevation, sedation restrictions, and stress ulcer prophylaxis (Klompas et al., 2022). By focusing on one nurse-driven intervention, frequent oral care, the project aims to decrease the rates of VAP in an intensive care unit (ICU).

The proposed project could take place in any hospital with an ICU. The author observed a need for more consistency from nurses in their own practice regarding the timing of performing and charting oral care, which led the author to appraise the literature for best practices. Following a literature appraisal on oral care frequency, an oral care education guideline was created for potential project team leaders to implement.

Background and Significance of the Problem

Patients in the ICU are critically ill and require immense medical support from medications, machines, and personnel. VAP is a complex, costly, and potentially fatal hospital-acquired infection that occurs frequently in the ICU. The Centers for Disease Control (CDC) tracks VAEs, defining them "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" (Centers for Disease Control (CDC), 2024). The CDC switched from studying VAP to VAEs in 2013 to provide broader criteria. VAEs include VAP, atelectasis, acute respiratory distress syndrome, and fluid

overload (Klompas, 2019). Not all VAP infections are included in the definition of VAEs because the patient must have a sustained increase in ventilator settings. A patient with a mild VAP infection may not require ventilator settings to be changed. The proposed project includes studies on VAP as well as VAEs due to the recent CDC tracking changes. VAEs increased by 12% from 2020 to 2021 (CDC, 2023). Nurses offer the most direct patient care; therefore, educating them on preventing VAP is crucial. Teaching nurses about the importance of regular oral care can substantially decrease VAP rates.

VAP is an expensive infection that is not paid for by Medicare or Medicaid. As of 2022, Medicare and Medicaid do not pay for healthcare-acquired conditions, including VAP (CareSource, 2022). A case of VAP can cost a hospital between $21,890 and $72,587 (AHRQ, 2017). If a hospital unit experiences just one case of VAP a month, the hospital could be responsible for up to $871,000 a year.

Gap Analysis

The proposed project focuses on educating nurses on the importance of performing oral care every two hours (Q2). The American Association of Critical-Care Nurses Procedure Manual for High Acuity, Progressive, and Critical Care states, “Oral cleansing, suctioning, and moisturizing every 2-4 hours is part of a comprehensive oral care that has shown to improve oral health and reduce the risk of healthcare-acquired pneumonia” (Weigand, 2017, p. 35). Q2 oral care was chosen as the oral care timing guideline for the project because the manual states, “Oral care given every 2-4 hours appears to provide a greater improvement in oral health. If oral care is not provided for 4-6 hours, previous benefits are thought to be lost” (Weigand, 2017, p. 34). A literature review confirmed the manual's recommendation of Q2 oral care. The literature review and appraisal are in the Literature Synthesis and Analysis and Annotated Bibliography sections

in the paper, as well as Appendix A. Nurses are the best people to educate on oral care since they provide the most direct care to patients. Regular oral care decreases VAP, ICU days, and ventilator-provided oxygen levels (Singh et al., 2022). Reinforcing oral care education would help improve patient outcomes.

PICOT

The question investigated is: For mechanically ventilated patients (P), will reinforcement of nursing education on performing oral care every two hours (I) compared with no education (C) decrease rates of ventilator-associated pneumonia (O) within a two-month time period (T)?

Problem Statement

VAP is a potentially fatal consequence of mechanical ventilation (Klompas et al., 2022). Many factors can contribute to the development of VAP. Kohbodi et al. (2022) classify the pathophysiology of VAP: Bacterial, fungal, or viral colonization in the lower airway causes pneumonia. VAP is a form of hospital-acquired pneumonia that occurs 48 hours or more after intubation. The pathophysiology of VAP colonization starts in the oral cavity. Bacteria, viruses, or fungi move down to the trachea, causing tracheitis, then into the lungs, causing pneumonia. With a ventilator, the tube maintains an open airway, obstructs some airway protective ciliary action, and can alter mucus secretion. The impaired defense mechanisms increase a patient's risk of getting pneumonia (Kohbodi et al., 2022). With proper oral care, the risk of VAP can significantly decrease from 26% to 18% by promoting a clean environment (Zhao et al., 2020). Oral care helps to dislodge bacterial deposits, remove excessive secretions, and maintain healthy tissue (Zhao et al., 2020). Routine oral care is imperative to reduce the risk of VAP.

There are numerous 24-hour oral care packets on the market. The packets usually include two packages of a suction toothbrush with sodium bicarbonate and an oral rinse, four packages

of a suction swab with a sodium bicarbonate oral rinse, and two oropharyngeal suction catheters (Stryker, 2024). Suction helps clear excessive oral secretions to reduce the risk of aspiration and decrease infectious colonization in the saliva. The nurse uses one swab every two hours to thoroughly swab the gums, teeth, tongue, and palate. Toothbrushes should be used once in the morning and evening to brush the patient's teeth (Weigand, 2017). The electronic medical record system is used to document oral care. Obstacles to conducting oral care every two hours include nurses needing more education, the patient's condition, and the inability to chart oral care. Physicians may order nurses not to perform oral care if the act may harm a patient, such as a patient with oral trauma. These patients should be excluded from the project. The limitations can be remedied by meeting with the system's stakeholders, holding re-education sessions, and setting physical reminder cards to document oral care at the nurses' station.

Objectives

The following objectives would direct the implementation of the proposed scholarly project in the ICU. The objectives help define the scope and limitations of the doctoral scholarly project.

1. Obtain current VAP rates for the intended unit.
2. Develop an education tip sheet to reinforce the hospital's policy on oral care and VAP, as well as pre-education and post-education surveys.
3. Educate nurses on the importance of regular oral care.
4. After two months, a chart review will be used to gather previous VAP rates and oral care charting rates, as well as VAP rates and charting frequency after the nurses' education.

5. Complete an analysis of the chart review to see if education decreased VAP rates and increased oral care rates.

The proposed project aims to reduce overall ICU VAP rates and provide education on providing frequent oral care to mechanically ventilated patients.

Literature Synthesis and Analysis

Oral care is well known to reduce VAP rates. The expert guidance by Klompas et al. (2022) recommended providing oral care daily and deemed oral care an essential practice. The research obtained and analyzed showed that regular oral care can prevent VAP. Appendix A provides a literature synthesis and analysis.

A systematic review of 11 studies by Jansson et al. (2013) showed that VAP rates decreased by 75% after educating nurses on proper oral care techniques. Education included weekly lectures, sessions, self-study, and group discussions. The article showed that VAP rates decreased using any one of the education techniques. Sánchez Peña et al. (2021) conducted a quasi-experimental quantitative study that used numerous educational methods to teach nurses proper oral care techniques for mechanically ventilated patients. VAP dropped from nine to two cases, with the incidence rate being 9.0 per 1,000 ventilator days down to 3.5 per 1,000 ventilator days post-intervention. Both articles show the benefit of oral care education in reducing VAP incidence.

A study by Khan et al. (2016) implemented a new oral care protocol that included oral swabbing every two to four hours and tooth brushing every 12 hours. After including the intervention and other ventilator bundle elements, VAP rates decreased from 8.6 per 1000 ventilator days to 2.0 per 1000 ventilator days. While not the only variable studied, oral care effectively decreased VAP. Singh et al. (2022) implemented a new oral care protocol that

increased the frequency of oral care to every four hours from daily care. VAP rates dropped from 47.3% to 29.1%, and the mortality rate dropped from 60% to 44.5% after one year. Karimi et al. (2023) instituted a new protocol that increased oral care frequency from every 12 hours to every eight hours. VAP rates decreased from 64% in the control group to 5% in the intervention group. While each study included different oral care protocols and frequency, VAP incidence decreased in each study.

Three projects educated nurses on the importance of frequent oral care. The studies showed drastic decreases in VAP rates (100%, 89.7%, and 50%, respectively) and increases in documentation (Heck, 2012; Hutchins et al., 2009; Ross & Crumpler, 2007). Heck (2012) implemented a protocol that increased oral care practices to every four hours. The VAP rate per 1,000 ventilator days was 10.5 for 13 months before intervention and dropped to zero for 13 months after the oral care bundle implementation. Hutchins et al. (2009) found that VAP rates dropped from 12.6 cases to 1.3 cases per 1,000 ventilator days after educating the ICU personnel. Ross and Crumpler (2007) executed a new oral care protocol that decreased VAP rates by 50%, although there was no data on VAP rates per ventilator day. These studies show a correlation between more frequent oral care and lower incidence of VAP rates. Due to the overwhelming decrease in VAP rates, implementing nursing education on oral care frequency is invaluable.

Nurses are assigned countless responsibilities in the ICU. Of utmost importance is the safety of their patients. At any moment, the patient may rapidly decline. Frequent assessment and monitoring are crucial for critical care nurses. Educating the nurses to include oral care on their expected rounds could improve VAP rates. Re-education through multiple methods increased oral care rates and decreased VAP incidence. Even though oral care only takes a few minutes, the practice can save a patient’s life.

Theoretical Framework and Project Design

The model used to help design the project proposal is the Johns Hopkins Evidence-Based Practice Model (JHEBPM). The JHEBPM is a world-renowned model intended to help scholars implement best practices. The model is comprehensive, accessible, and aligns well with the project's goal. The model's concise yet comprehensive outline proved to be a good choice. There are three phases: practice question and project planning, evidence, and translation (Dang et al., 2022). The Johns Hopkins education website granted permission to use the work plan and model (Appendix B) (https://www.ijhn-education.org). A figure of the model can be found in Appendix C, and the JHEBPM Process Guide is in Appendix D. The authors explicitly designed the JHEBPM so that healthcare professionals could implement best practices quickly in the clinical setting.

Question development starts with a problem statement. The author recognized a need for change after observing a lack of nurses charting regular oral care on mechanically ventilated patients in the author's practice. The plan for change was initiated by creating a patient intervention, comparison, outcome, time (PICOT) question: "For mechanically ventilated patients, will the reinforcement of nursing education on oral care every two hours compared with no education decrease rates of ventilator-associated pneumonia within a two-month time period?". After careful consideration and a literature review, the author created a nursing education proposal to be implemented in any ICU.

Project planning was done through an evidence review via the Cumulative Index to Nursing & Allied Health (CINAHL), Cochrane, PubMed, Google Scholar, as well as the university and hospital system librarians. The synthesized literature included articles supporting regular oral care (Appendix A). The research compiled showed that oral care is essential.

Scholarly findings showed direct support for the proposed project. Components include creating an action plan, identifying recommendations for the practice setting, synthesizing and reporting results, and disseminating findings (Dang et al., 2022). The action plan would include creating educational materials using evidence-based practice (EBP) for oral care and recommending implementation steps for the project. Translation of the project findings will include a poster, presentation, paper, submission to stakeholders, and Digital Commons.

Project Team

The project team may include a project team leader, educational advisors, nurse managers, administrators, and healthcare informaticists. Gathering enough pre-intervention and post-intervention data could take two months to a year to complete. The project team leader could regularly meet with team members to review progress. Stakeholders could include nurse managers and hospital administrators. The proposed project would need the hospital's Institutional Review Board's (IRB's) approval before implementation.

Implementation Plan

Pre-Implementation Phase

After forming a project team, members can review their hospital's current oral care policy, the procedures set by Klompas et al. (2022), and the current CDC (2024) VAE rates. The team would collect the current VAP data and charting rates for their specific unit. Once the data is collected, project team leaders create and submit their project proposal to the hospital's IRB. Project team leaders are recommended to review their own institution's policy and procedures before choosing the timing of oral care to fit their institution's needs best. Exclusion criteria can also be made, such as patients with oral care trauma, lack of denture, or other conditions project team leaders see fit to exclude. All other mechanically ventilated patients may be included in the

project. The project is designed as a quality improvement project; therefore, there is no need for randomization or a control group.

Implementation Phase

Project team members review the proposed oral care tip sheet provided in Appendix E, along with the pre-education and post-education surveys (Appendix F). Education sessions would be conducted over one to two weeks during the nursing unit's safety huddles before each shift. The project team leaders hand out the surveys and tip sheets in a packet with random numeration to keep the survey responses confidential. After the education sessions are complete, the team members can review their findings.

Post-Implementation Phase

After two months, the project team leaders could obtain and analyze VAE and oral care charting data to compare pre- and post-education rates. If the project is successful, the team will disseminate findings in a presentation, and practice guidelines will be established for implementation in other units. If the project is unsuccessful, the team will look at other standard VAP bundle components to educate nurses on next, such as head-of-bed elevation, sedation restrictions, and stress ulcer prophylaxis (Klompas et al., 2022). Project team leaders could complete another review six months after the education sessions to see if oral care charting rates decreased. If so, re-education may be necessary.

Timeline and Budget

The proposed budget and timeline estimate the cost and time it would take to execute the project. The timeline and budget figures are in Appendix G and Appendix H. It would take approximately one month for a group to research current recommendations, obtain VAP data and oral care charting rates, and create education materials. After the hospital’s IRB approves the

project, it will take two weeks to educate the unit. VAP data and oral care charting data could be collected starting approximately two months after educating the unit. After gathering the data, there would be about one to two weeks for project team leaders to review and assess the data before completing the project and disseminating findings.

The proposed budget includes proposed time researching, creating education, and educating the unit nurses. The budget does not contain the cost of paper, printing, ink, or other office supplies the hospital may provide. The project team can work with the hospital's supply chain to ensure oral care kits are supplied to the unit, which would be outside the proposed budget. The project would cost approximately $480 for eight hours of work reviewing and synthesizing scholarly articles. $240 would go towards obtaining and reviewing charts and VAP data. Completing unit education would take about eight hours ($480). Dissemination would range from two to four hours, approximately $180. Overall, the project would cost about $1,380. If the project decreases the unit's cases of VAP by only one case a year, the hospital should recoup the investment 16 to 53 times based on the estimated cost of a VAP infection as being $21,890 to $72,587 (AHRQ, 2017). The cost savings alone merit the execution of an oral care quality improvement project.

Outcomes and Analysis

The proposed project team would collect data after educating the unit's nurses via an electronic chart review and by working with the hospital's informaticists. Proposed measures to analyze would be daily oral care compliance, VAP rates, or other benchmarks the intended hospital has set to measure VAP infections. The project team could collect data starting two months after education sessions to allow data to be tabulated. The project team leader would enter the chart review data into a spreadsheet to analyze using the software's statistical models.

A t-score, p-value of ≤ 0.05, and standard error could determine if the data is statistically significant. The project team leader could compare the data to the national benchmarks (CDC, 2024). The analysis would determine if the implementation of the proposed EBP oral care guideline was beneficial or not.

Limitations, Recommendations, and Future Directions

A limitation to the project's success is adherence. After education, nurses would add oral care to their routines, per the hospital's policy. Successful execution would still require project team leaders to continue reviewing and analyzing chart review data and remind staff members to continue providing routine oral care. If the project team leaders cannot remain on the unit after implementation, the VAE data and oral care charting rates could be given to the unit's leadership team to review, and they could take over monitoring oral care frequency and charting on mechanically ventilated patients. There is a limitation in the author's research. The research gathered did not include all the hundreds of articles written on oral care for a mechanically ventilated adult. Therefore, specific methods may not be mentioned. Plus, there is more than one way to conduct oral care, so there may be many ways the procedure is accomplished as long as the principles of evidence-based practice are followed.

The value of the proposed project lies in the fact that team members may implement it in any facility where nurses care for mechanically ventilated patients. The proposal focuses on intensive care units, but team members can broaden the proposal to include other units. An important factor for project team leaders would be to obtain IRB approval before implementation. IRB approvals may take months, so while approval is pending, team members could work with informaticists to obtain preliminary data. Team members could recruit stakeholders from the hospital infection prevention department, nursing education department,

managers, and attendings to help obtain approval from the hospital's IRB and encourage staff to continue routine oral care. In conclusion, oral care is essential to decrease VAP and VAEs; educating nurses on the benefits of frequent oral care is of utmost importance.

Summary

The project proposal is designed to educate nurses on the importance of frequent oral care for mechanically ventilated patients. The author noticed a need for more consistency from nurses in their own practice regarding the timing and charting of oral care. Then, the author completed a literature review that included best practice recommendations and numerous quality improvement studies. After completing the literature review, the project was set up using the JHEBPM as a guide. Recommendations for potential project team members, implementation resources, objectives, and a budget and timeline were created. Finally, recommendations for implementation, limitations of the project, and directions the project can go are discussed.

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Appendix A

Literature Review and Annotated Bibliography

Citation	*Conceptual Framework or Model*	*Design or Method*	*Sample & Setting*	*Major Variables Studied*	*Outcome Measurements*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Estimating the additional hospital inpatient cost and mortality associated with selected hospital-acquired conditions. AHRQ. (2017). https://www.ahrq.gov/hai/pfp/haccost2017-results.html	n/a	Systematic review.	69 studies in 20 individual meta-analyses Setting: Inpatient.	Independent variables: IV1= Cost IV2= Mortality.	The cost was measured in the total cost of caring for the patient, not per day. Reliability information: A 95% confidence interval was used to estimate costs and excess mortality.	Statistical tests: Stata 14 to get cost estimates and mortality relative risk estimates. Qualitative analysis: Random-effect models included.	Out of five studies, cost estimates ranged from $19,325 to $80,013 per VAP infection. Estimates with 95% CI was $47,238 ($21,890 - $72,587). Out of ten studies, the relative risk of death ranged from 0.52 - 4.90. With 95% CI, the range was 1.48 (0.64-3.42). Underlying mortality was 0.300, the highest of any other condition studied. Excess mortality estimates with a 95% CI: 0.140 (-0.110- 0.730). There are 140 excess deaths per 1,000 cases of VAP.	Level I	Strengths: Looked at multiple meta-analyses on top of randomized control trials and cohort studies Limitations: A meta-analysis is limited by the quality of evidence in the studies included in the analysis. Some studies did not define the hospital-acquired condition they were studying. Most data were from the administration, not from electronic health records. Risk of harm if implemented: None. Feasibility of use in the project practice area: Feasible.

Annotated Bibliography Statement

The meta-analysis examined the cost analysis of different hospital-acquired infections (HAIs). For VAP, the cost ranged from $19,325 to $80,013, with an average of $47,238 per infection.

Thematic Analysis

1. Medicare and Medicaid do not reimburse for VAP, a costly HAI.

Citation	*Conceptual Framework or Model*	*Design or Method*	*Sample & setting*	*Major Variables Studied*	*Outcome Measurements*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Heck, K. (2012). Decreasing ventilator-associated pneumonia in the intensive care unit: A sustainable comprehensive quality improvement program. American Journal of Infection Control, 40(9), 877–879. https://doi.org/10.1016/j.ajic.2011.11.010	N/A	Quality improvement project.	The authors implemented an oral care protocol for all mechanically ventilated patients in an intensive care unit. A sample size was not given.	Q4 hour oral care along with Q12 hour teeth brushing.	VAP rates per 1,000 ventilator days.	Root-cause analysis.	Before initiating the QI program, the VAP rate per 1,000 ventilator days was 10.5 for 13 months pre-intervention and dropped to 0 (P 1⁄4 .016) for 13 months after the oral care bundle was implemented.	Level V	Feasible. Although a QI project, the results are worth integrating a Q4 oral care approach.

Annotated Bibliography Statement

The quality improvement project implemented an oral care bundle, which included providing oral care every four hours and tooth brushing every 12 hours. The unit's average VAP rate was 10.5 cases per 1000 ventilator days. After the QI project started, VAP rates decreased to 0 cases per 1,000 days for over one year.

Thematic Analysis

1. Frequent oral care can decrease the incidence of VAP.

Citation	***Conceptual Framework or Model***	***Design or Method***	***Sample & setting***	***Major Variables Studied***	***Outcome Measurements***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Hutchins, K., Karras, G., Erwin, J., & Sullivan, K. L. (2009). Ventilator-associated pneumonia and oral care: A successful quality improvement project. *American Journal of Infection Control, 37*(7), 590–597. https://doi.org/10.1016/j.ajic.2008.12.007	N/A	Quality improvement project.	All mechanically ventilated patients admitted to the ICU at a small hospital between May 2005 and December 2007 were included.	Q4 oral care along with other ventilator bundle components.	VAP rates in those ventilated >48 hours. VAP was diagnosed by a medical doctor using radiographic and microbiologic evidence.	It is not listed.	The average rate of VAP on the unit in 2004 was 12.6 cases per 1000 ventilator days. After the QI project started, VAP rates decreased to 4.12 for May through December 2005, to 3.57 for 2006, and to 1.3 for 2007. It led to an 89.7% reduction in the VAP rate in vented patients from 2004 to 2007.	Level V	Feasible. Although a QI project, the results are worth integrating a Q4 oral care approach and other ventilator bundle elements into regular care.

Annotated Bibliography Statement

The quality improvement project implemented an oral care bundle, which included providing oral care every four hours. The average rate of VAP in the unit for 2004 was 12.6 cases per 1000 ventilator days. After the QI project started, VAP rates decreased to 4.12 for May through December 2005, 3.57 for 2006, and 1.3 for 2007. It led to an 89.7% reduction in the VAP rate in vented patients from 2004 to 2007.

Thematic Analysis

2. Frequent oral care, along with ventilator bundle components, can decrease the incidence of VAP.

Citation	*Conceptual Framework or Model*	*Design or Method*	*Sample & setting*	*Major Variables Studied*	*Outcome Measurements*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Jansson, M., Kääriäinen, M., & Kyngäs, H. (2013). Effectiveness of educational programmes in preventing ventilator-associated pneumonia: A systematic review. Journal of Hospital Infection, 84(3), 206–214. https://doi.org/10.1016/j.jhin.2013.04.009	n/a	Systematic review.	Studies published from 2003 to 2012 in databases were reviewed. Eight studies were included. Population: Critical care nurses.	Interventions: Continuing education/ clinical education	Learning outcomes and the incidence of VAP, mortality, morbidity, and adverse events.	The standardized Critical Appraisal Checklist for Cohort/ Case-control appraisal was used to assess the quality of the studies. $P < 0.05$ was considered statistically significant. Further analysis was limited because of the lack of available data.	VAP rates decreased by 75% after educating nurses on proper oral care techniques. Education included weekly lectures, sessions, self-study, and group discussions. The article showed that despite different education techniques, VAP rates still decreased. After attending educational programs, the level of nurses' knowledge was shown to increase significantly. ($P < 0.001$). Moreover, the quality of oral care also increased significantly ($P < 0.002$).	Level I	Feasible to add to practice. While limited in the number of studies identified (8), the reduction of VAP was high.

Annotated Bibliography Statement

The quality improvement project implemented oral care education in their unit. VAP rates decreased by 75% after educating nurses on proper oral care techniques. Education included weekly lectures, sessions, self-study, and group discussions. The article showed that despite different education techniques, VAP rates still decreased. After attending educational programs, the nurses' knowledge increased significantly, and the quality of oral care also increased significantly.

Thematic Analysis

1. Education on oral care led to higher quality practices and increased nurses' knowledge.

Citation	*Conceptual Framework or Model*	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions*	*Outcome Measurements*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Khan, R., Al-Dorzi, H. M., Al-Attas, K., Ahmed, F. W., Marini, A. M., Mundekkadan, S., Balkhy, H. H., Tannous, J., Almesnad, A., Mannion, D., Tamim, H. M., & Arabi, Y. M. (2016). The impact of implementing multifaceted interventions on the prevention of ventilator-associated pneumonia. *American Journal of Infection Control, 44*(3), 320–326. https://doi.org/10.1016/j.ajic.2015.09.025	n/a	Qualitative.	3665 patients who received mechanical ventilation in an intensive care unit.	A 7-element care bundle was implemented, including head-of-bed elevation 30°-45°, daily sedation vacation and assessment for extubating, peptic ulcer disease prophylaxis, deep vein thrombosis prophylaxis, oral care with chlorhexidine, endotracheal intubation with in-line suction and subglottic suctioning, and maintenance of endotracheal tube cuff pressure at 20-30 mmHg.	Total bundle compliance, VAP episode incidence, and rates of VAP per ventilator day.	A t-test was performed along with the standard deviation. A P-value of <0.05 was considered significant.	Total bundle compliance increased from 90.7% to 94.2%. The number of VAP episodes decreased from 144 during 2008-2010 to only 14 during 2011-2013. The rate of VAP decreased from 8.6 per 1000 ventilator days to 2.0 per 1000 ventilator days.	Level VI	The paper is a QI project showing that implementing a VAP bundle decreased hospital VAP rates. Feasible.

Annotated Bibliography Statement

The qualitative project implemented a comprehensive ventilator bundle in an intensive care unit. Bundle components included head-of-bed elevation 30°-45°, deep vein thrombosis prophylaxis, oral care with chlorhexidine, endotracheal intubation with in-line suction and subglottic suctioning, maintenance of endotracheal tube cuff pressure at 20-30 mmHg, daily sedation vacation and assessment for extubating, and peptic ulcer disease prophylaxis.

Thematic Analysis

1. A comprehensive ventilator bundle decreased VAP rates significantly. The bundle included frequent oral care with chlorhexidine.

Citation	***Conceptual Framework or Model***	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurements***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Karimi, S., Kolyaei, E., Karimi, P., & Rahmani, K. (2023). Effectiveness of supervised implementation of An oral health care protocol on ventilator-associated pneumonia patients in intensive care units: A double-blind multicenter randomized controlled trial. Infection Prevention in Practice, 5(3). https://doi.org/10.1016/j.infpip.2023.100295	n/a	A double-blind, multicenter randomized controlled trial.	Two hundred patients older than 18 years with no trauma, intubated within 24 hours of arrival with an incubation period of at least one week up to twelve weeks were included.	Control: Rinse the mouth with normal saline and suction, clean the tongue and teeth with gauze, and rinse with chlorhexidine 0.2%. Intervention: Report abnormal findings in the mouth, brushing for five minutes every 8-12 hours, using normal saline to rinse the mouth, applying chlorhexidine gluconate rinse, and applying a moisturizing gel every four hours.	VAP was assessed using the clinical pulmonary infection score by Johanson *et al.*, which the Centers for Disease Control suggested to assess for VAP.	A t-test was used for standard deviation and mean comparison. P <0.05 was statistically significant.	The VAP rate in the intervention group was 5% compared to 64% in the control group (P<0.001). The only other variable the authors noted could have caused VAP rates to change is the patient's Glasgow coma scale (GCS). Those with lower GCS scores had a higher incidence of VAP.	Level II	Double-blind-patients and outcome assessors were blinded to the intervention allocated.

Annotated Bibliography Statement

The randomized controlled trial compared assessing the mouth every shift, brushing for five minutes every 8-12 hours with a normal saline and chlorhexidine rinse, and applying moisturizer every four hours to the hospital's previous oral care regimen.

Thematic Analysis

2. A more thorough oral care protocol with frequent care decreased VAP rates significantly.

Citation	***Conceptual Framework or Model***	***Design or Method***	***Sample & Setting***	***Major Variables Studied***	***Outcome Measurements***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Klompas, M., Branson, R., Cawcutt, K., Crist, M., Eichenwald, E., Greene, L., . . . Berenholtz, S. (2022). Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. *Infection Control & Hospital Epidemiology*, *43*(6), 687-713. https://doi:10.1017/ice.2022.88	N/A	Expert Guidance.	Inclusion: Articles from January 2012-August 2021 Exclusion: Outpatient Setting: Inpatient.	Dependent variables: VAP, NV-HAP, VAE, mortality.	Mortality, ICU length of stay (days), incidences of VAP.	Qualitative analysis: The literature was reviewed by an expert panel.	Statistical findings: - mortality of VAP is 10% -provide daily oral care with toothbrushing but without chlorhexidine. Meta-analyses report statistically lower rates of VAP with the use of chlorhexidine. However, they are not double-blind -blinded studies show no impact on the duration of mechanical ventilation or ICU length of stay and impact on VAP.	Level VII	Strengths: Expertly reviewed literature. Limitations: No statistical analysis was done on review articles Risk of harm if implemented: Little Feasibility of use: Very feasible.

Annotated Bibliography Statement

The expert review includes guidelines for hospitals to follow to reduce VAP rates. Daily toothbrushing is considered "essential" and should be implemented by all acute-care hospitals. Oral care with chlorhexidine is not recommended. Oral care without chlorhexidine has moderate levels of evidence to decrease VAP rates, mortality, and overall length of state. There is moderate evidence against using chlorhexidine, showing that the risk of increased mortality may outweigh the benefit.

Thematic Analysis

1. Unblinded studies showed significantly lower rates of VAP with chlorhexidine.
2. Double-blind studies showed no association between chlorhexidine and lower VAP rates.

Citation	***Conceptual Framework or Model***	***Design or Method***	***Sample & Setting***	***Major Variables Studied***	***Outcome Measurements***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Ross, A., & Crumpler, J. (2007). The impact of an evidence-based practice education program on the role of Oral Care in the prevention of ventilator-associated pneumonia. *Intensive and Critical Care Nursing*, *23*(3), 132–136. https://doi.org/10.1016/j.iccn.2006.11.006	N/A	Qualitative project.	Pre-education patient sample: 52. post-education sample size: 57.	An educational program consisting of posters, storyboards, and competency checklists with a return demonstration.	The frequency of oral care is charted every 2 hours, as well as VAP rates.	A two-tailed t-test analysis was used to determine the impact of the educational program.	With the improvement in the quality of oral care provided by the nursing staff following the educational program, the institution's VAP rate has decreased by 50%. The frequency of oral care documentation post-education improved.	Level VI	The paper is a QI project, but it shows that implementing an oral care education program decreased hospital VAP rates. Feasible.

Annotated Bibliography Statement

The quality improvement project implemented a nursing education program to increase oral care rates in an ICU. The educational program included posters, storyboards, checklists, and return demonstrations.

Thematic Analysis

1. Implementing an educational program can decrease VAP rates and increase bi-hourly oral care charting rates.

Citation	*Conceptual Framework or Model*	*Design or Method*	*Sample & Setting*	*Major Variables Studied*	*Outcome Measurements*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Singh, P., Arshad, Z., Srivastava, V. K., Singh, G. P., & Gangwar, R. S. (2022). Efficacy of oral care protocols in preventing ventilator-associated pneumonia in mechanically ventilated patients. Cureus, 14(4). https://doi.org/10.7759/cureus.23750	n/a	Prospective randomized control study.	220 ICU patients between 18 and 65 years of age.	The intervention group consisted of chlorhexidine wash, tooth brushing, using moisturizing gel over gums, buccal mucosa, and lips. The control group was treated with chlorhexidine wash only. The oral assessment was done at 4, 6, 8, and 12 hours using the Beck Oral Assessment Scale (BOAS). Pneumonia was assessed based on abnormal chest x-rays, fever, chest auscultation, endotracheal culture report, and the incidence of VAP and mortality was observed.	Incidence of VAP and mortality	Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) software. Comparisons were used using chi−square tests. P values ≤ 0.05 were considered statistically significant.	Signs of VAP (Abnormal chest x-ray findings, auscultatory findings, fevers, and positive cultures were significantly reduced in the intervention group compared to the control group. VAP and mortality incidence were significantly lower in the intervention group than in the control group.	Level II	Strengths: statistical analysis Limitations: Not double-blind Risk of harm if implemented: mild. Feasibility of use: feasible.

Annotated Bibliography Statement

The randomized controlled trial compared an oral care protocol of a chlorhexidine wash, tooth brushing, and moisturizing gel over gums, buccal mucosa, and lips compared with chlorhexidine wash only. The oral assessment was done at 4, 6, 8, and 12 hours.

Thematic Analysis

1. VAP and mortality incidence were significantly lower in the intervention group than in the control group.

Citation	*Conceptual Framework or Model*	*Design or Method*	*Sample & Setting*	*Major Variables Studied*	*Outcome Measurements*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Zhao, T., Wu, X., Zhang, Q., Li, C., Worthington, H.V., & Hua, F. Oral hygiene care for critically ill patients to prevent ventilator-associated pneumonia. (2020) C*ochrane Database of Systematic Reviews 2020*, Issue 12. Art. No.: CD008367. https://doi.org/10.1002/14651858.CD008367.pub4	Theory of Unpleasant Symptoms.	Meta Analysis.	Inclusion: RCTs, patients on mechanical ventilation for over 48 hours Exclusion: Setting: Inpatient.	IV1: chlorhexidine IV2: placebo/usual care IV3: toothbrushing IV4: no toothbrushing DV: VAP.	Scale(s) used: Reliability information.	Statistical tests: 95% confidence intervals, risk ratio (RR) for dichotomous outcomes and mean differences (MD) for continuous outcomes, random-effects model of meta-analyses.	Statistical findings: moderate evidence from 13 RCTs with 1206 participants probably reduces incidence of VAP compared with placebo, from about 26% to 18%. RR of 0.67. The number needed to treat for an additional beneficial outcome of 12. No evidence between the interventions with reducing mortality rate, duration of ventilation, or duration of stay in the ICU (low quality evidence).	Level I	Strengths: used statistical analysis and RCTs. Large number of participants (1206). Limitations: Included unblinded RCTs Risk of harm if implemented: low moderate to low level of evidence. Feasibility of use: Feasible.

Annotated Bibliography Statement

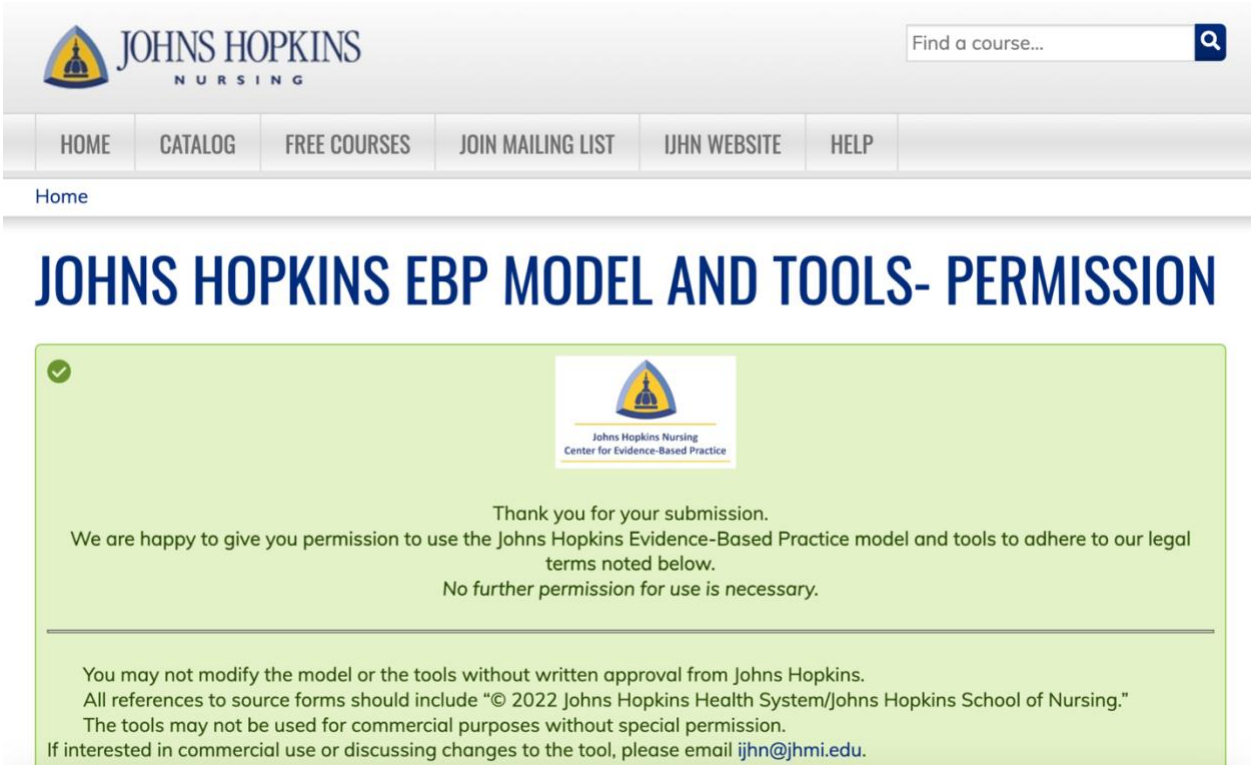
The systematic review compared oral toothbrushing and toothbrushing with chlorhexidine to usual care (placebo) and rates of VAP. There was no evidence between interventions in reducing mortality rate, ventilation duration, and stay duration. Oral care with or without chlorhexidine was better than the placebo at reducing VAP rates.

Thematic Analysis

1. Oral care is beneficial in reducing VAP rates.
2. There was no evidence that oral care reduced mortality rate, ventilation duration, or stay.

Appendix B

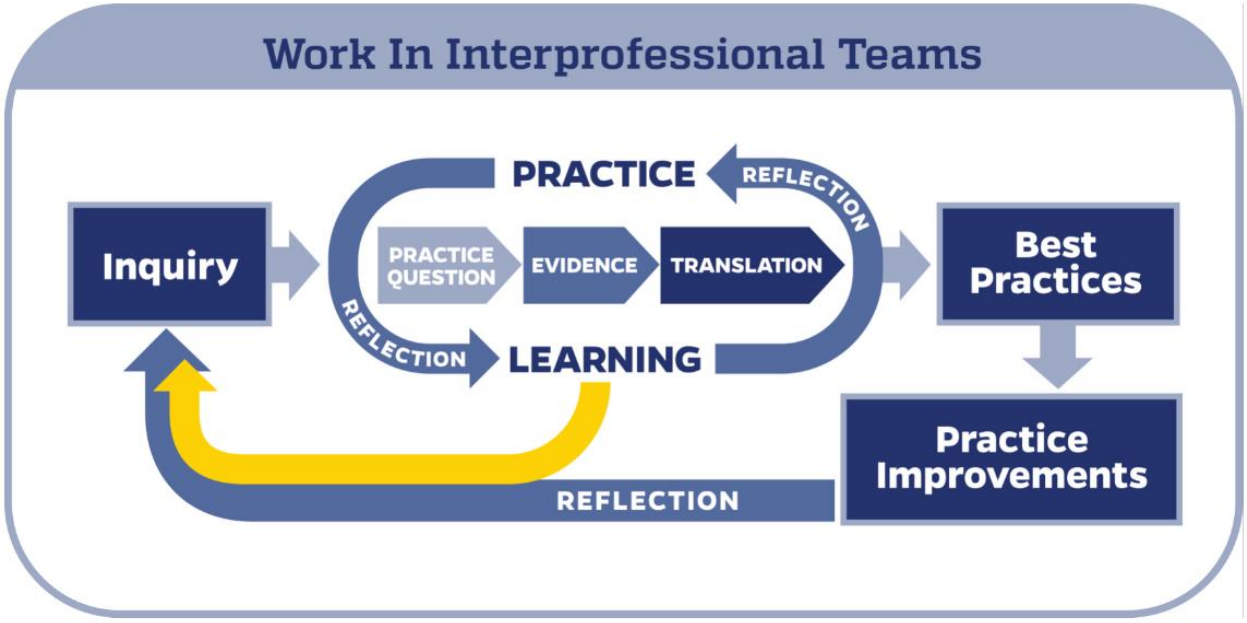
Permission from Johns Hopkins for the use of the EBP Model



Note. © 2022 Johns Hopkins Health System/Johns Hopkins School of Nursing.

Appendix C

Johns Hopkins Evidence-Based Practice Model



Note. © 2022 Johns Hopkins Health System/Johns Hopkins School of Nursing.

Appendix D

Johns Hopkins Practice Question, Evidence, Translation (PET) Process Guide

EBP Work Plan										
Initial EBP question:										
EBP team leader(s):										
EBP team members:										
Goal completion date:										
Steps		Month								
		1	2	3	4	5	6	7	8	9
Practice Question & Project Planning	1. Recruit interprofessional team									
	2. Determine responsibility for project leadership									
	3. Schedule team meetings									
	4. Clarify & describe the problem									
	5. Develop & refine the EBP question									
	6. Determine the need for an EBP project									
	7. Identify stakeholders									
Evidence	8. Conduct internal & external search for evidence									
	9. Appraise the level & quality of each piece of evidence									
	10. Summarize the individual evidence									
	11. Synthesize findings									
	12. Develop best evidence recommendations									
Translation	13. Identify practice setting–specific recommendations									
	14. Create action plan									
	15. Secure support & resources to implement action plan									
	16. Implement action plan									
	17. If change is implemented, evaluate outcomes to determine if improvements have been made									
	18. Report results to stakeholders									
	19. Identify next steps									
	20. Disseminate findings									

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Appendix E

Education Tip Sheet

Q2 ORAL CARE FOR VENTILATOR- ASSOCIATED PNEUMONIA

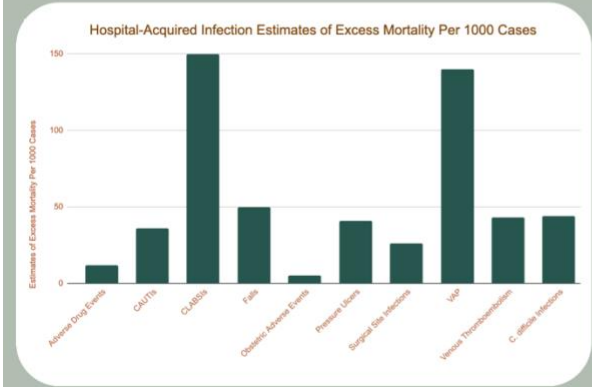
Grace Alford, MSN, RN

VAP PATHOPHYSIOLOGY

- Pneumonia that develops >48 hours post intubation
- Bacteria, viruses, or fungi move down to the trachea from the oral cavity
- They move into the lungs causing pneumonia
- A ventilator tube maintains an open airway, obstructs ciliary action, and alters mucus secretion
- These impaired defense mechanisms increase the patient's risk of getting pneumonia

THE ROOT OF THE PROBLEM

- Biofilms that form in the oral cavity can be removed via friction and cleaning solutions
- Frequent oral care decreases biofilm production, ventilator-provided oxygen, ICU days, and increase patient comfort



KEY FACTS

- VAP is the most common infection in critically ill patients
- For every 1,000 VAP cases, there are 140 excess deaths
- VAP is the second most costly and deadly healthcare-acquired condition
- Oral care can decrease rates of VAP between 50 to 100%
- AACN recommends providing oral care every 2-4 hours

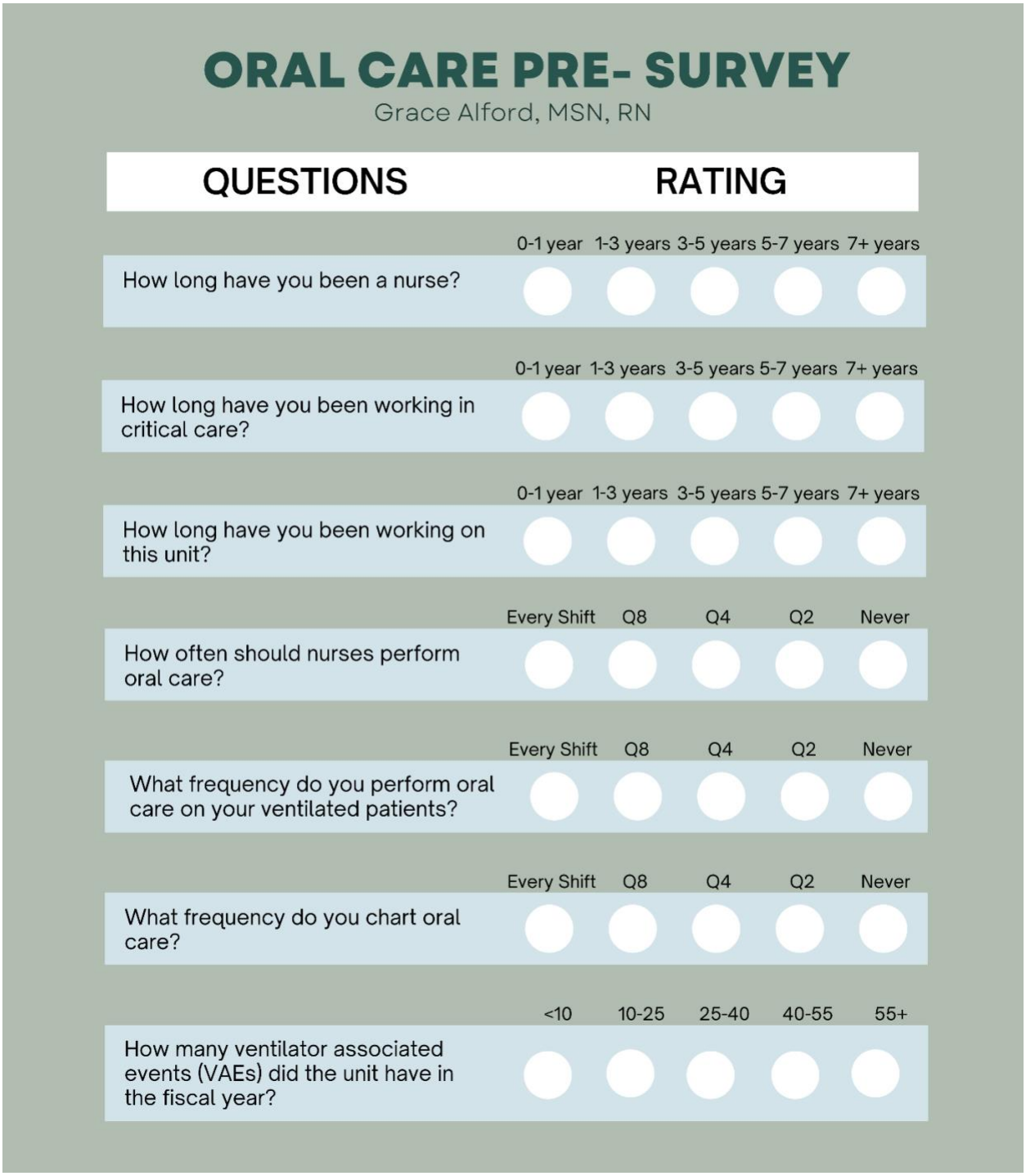
ORAL CARE KITS

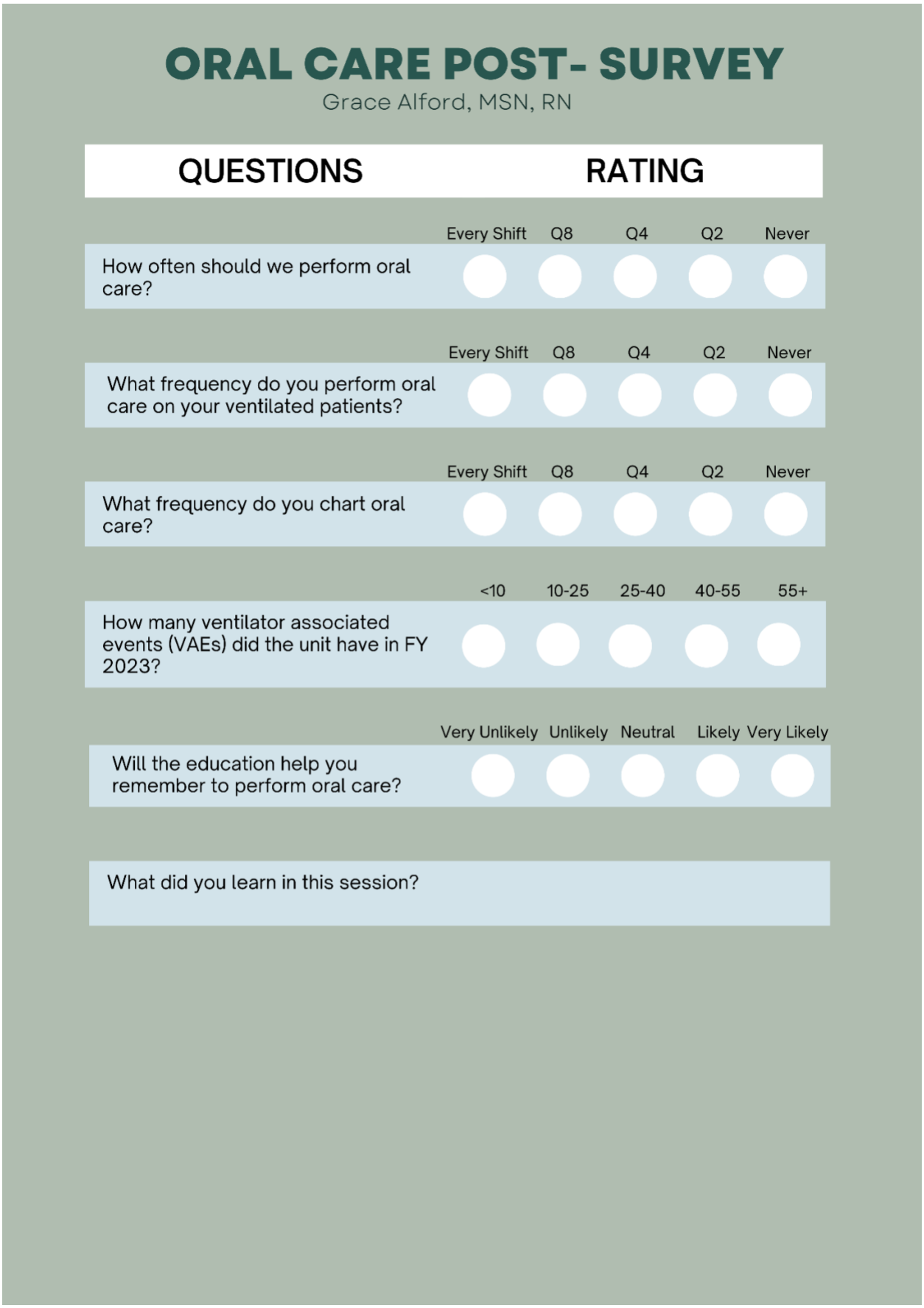
- Designed for 24 hour oral care
- Use one swab + cleanser every 2 hours
- Brush teeth every 12 hours
- Cost: $10 per patient a day

References: Diaconu, O., Siriopol, I., Poloşanu, L. I., & Grigoraş, I. (2018). Endotracheal tube biofilm and its impact on the pathogenesis of ventilator-associated pneumonia. The Journal of Critical Care Medicine, 4(2), 50–55. https://doi.org/10.2478/jccm-2018-0011 Estimating the additional hospital inpatient cost and mortality associated with selected hospital-acquired conditions. (2017). AHRQ. https://www.ahrq.gov/hai/pfp/haccost2017-results.html. Kohbodi, G. A., Rajasurya, V., & Noor, A. (2022). Ventilator-associated pneumonia - statpearls - NCBI bookshelf. Statpearls. https://www.ncbi.nlm.nih.gov/books/NBK507711/. RMH.POL.P-128.051

Appendix F

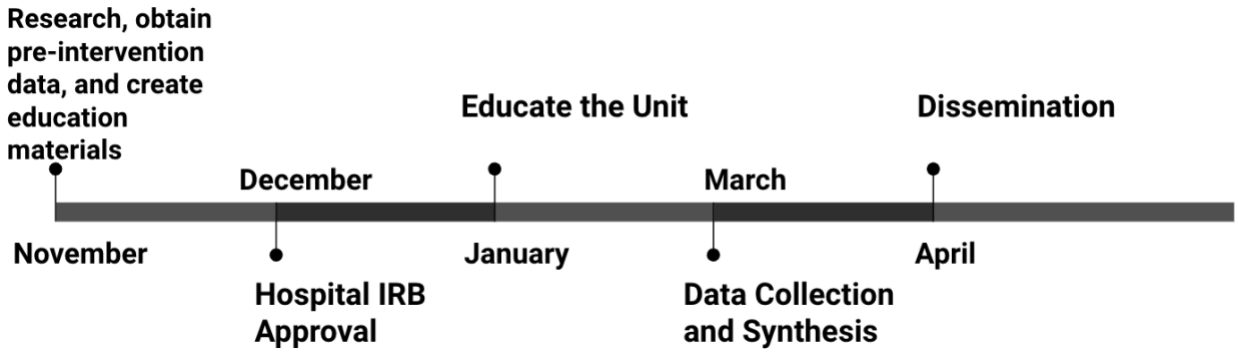
Education Surveys




ORAL CARE POST- SURVEY
Grace Alford, MSN, RN
QUESTIONS
RATING
How often should we perform oral care?
Every Shift Q8 Q4 Q2 Never
What frequency do you perform oral care on your ventilated patients?
Every Shift Q8 Q4 Q2 Never
What frequency do you chart oral care?
Every Shift Q8 Q4 Q2 Never
How many ventilator associated events (VAEs) did the unit have in FY 2023?
<10 10-25 25-40 40-55 55+
Will the education help you remember to perform oral care?
Very Unlikely Unlikely Neutral Likely Very Likely
What did you learn in this session?

Appendix G

Timeline



Appendix H

Budget