VENTILATOR ASSOCIATED PNEUMONIA: EDUCATION AND PREVENTION

A RESEARCH PAPER
SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
MASTER OF SCIENCE
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DECEMBER 2011
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Abstract

RESEARCH SUBJECT: Ventilator Associated Pneumonia: Education and Prevention

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DATE: December, 2011

Critically ill patients experiencing a life-threatening illness often contract ventilator-associated pneumonia (VAP). Subsequent aspiration of contaminated secretions along with colonization of the aerodigestive tract increases morbidity and mortality. As a result, there is an increased cost of health care that accounts for almost half of all infections in critically ill patients, increasing length of stay in the ICU. The purpose of this observational study is to determine whether an educational initiative decreases rates of VAP in ICU. This study is a replication of Babcock et al. (2004) study. The Guidelines for Prevailing Health-Care Associated Pneumonia (CDC) is the framework. A VAP educational program will be conducted for ICU nurses and respiratory therapists emphasizing correct practices for the prevention of VAP. The study will be conducted in two community-based hospitals in southern Indiana. Forty ICU nurses and twenty respiratory therapists will be offered a structured self-study module on risk factors for and strategies to prevent VAP. Ventilator-associated pneumonia rates will be monitored for six months. Findings will provide evidence for educational programs to help reduce VAP and reduce length of stay in ICU. The evidence will provide ways on how to reduce VAP with inadequate staffing and limited resources through continuing education.
Chapter I

Introduction

Ventilator-associated pneumonia (VAP) is the most common and lethal form of hospital-acquired (nosocomial) pneumonia, mostly occurring in Intensive Care Units (van Niewenhaven et al., 2006). It occurs in approximately 28% of patients who need mechanical ventilation for more than 48 hours. Forty-six percent of ventilated patients who develop VAP die while 32% of ventilated patients never develop it. The Institute for Healthcare Improvement (IHI) has targeted VAP prevention as one of six interventions for its 100K Lives Campaign, a national initiative to improve patient care and prevent avoidable deaths in hospitals (Pruitt & Jacobs, 2006). Predisposition factors for a patient diagnosed with VAP are an endotracheal intubation and mechanical ventilation which interfere with the normal defense mechanisms by keeping organisms out of the lungs.

VAP is a growing problem in health care facilities which increases the cost of patient care and increases patient-care time, hospital length of stay, and patient morbidity. Ventilator-associated pneumonia increases healthcare costs by more than $40,000 per hospitalized patient (Lisboa, Kollef, & Rello, 2008). Centers for Medicare and Medicaid Services plan to stop paying hospitals for necessary care caused by preventable complications including nosocomial infections resulting in unintended fiscal circumstances (Lisboa et al.).
The Centers for Disease Control (CDC) established recommended guidelines to decrease the risk of VAP. It is these best practice interventions that nurses should follow when caring for mechanically ventilated patients. The 2003 CDC guidelines reported that 63% of admitted patients in the ICU have oral colonization associated with a pathogen resulting from VAP (Cason, Tyner, Saunders, & Broome, 2007). The CDC provided a set of seven guidelines to reduce risks related to hand washing, wearing gloves, suctioning, elevated head of bed (HOB), education, oral hygiene program, and use of antiseptic rinse. Studies suggested that best practices for reducing VAP were not consistently implemented.

According to the Centers for Disease Control, Pseudomonas aeruginosa and gram positive Staphylococcus aureus were the two most common bacteria linked to VAP (Babcock et al., 2004). Pseudomonas aeruginosa, a leading cause of nosocomial infections and most common antibiotic-resistant pathogen causing VAP, is responsible for 10% of all hospital-acquired infections (El Solh et al., 2008). Infections caused by these organisms are often severe, life threatening, difficult to treat, and result in adverse outcomes.

The National Healthcare Safety Network (NHSN) reports national statistics on hospital-acquired infections resulting from ventilator-associated pneumonia along other nosocomial infections. Results of the statistics led to efforts of healthcare workers to reduce the infection rates. Data from the National Nosocomial Infections Surveillance System (NNIS) reported in 1992-2004 a median VAP rate of 2.2-14.7 cases per 1000 patient days of mechanically ventilated patients in an adult ICU (Babcock et al., 2004).
Background and Significance

Besides urinary tract infections, VAP is the second most common hospital acquired infection and the most common hospital acquired infection among patients requiring mechanical ventilation (Babcock et al., 2004). VAP accounts for approximately 15% of all hospital acquired infections and 27% of infections in medical intensive care units. Patients who are mechanically ventilated are six to twenty-one times more likely to develop pneumonia. VAP continues to be a significant problem for hospitals and healthcare workers today. VAP is associated with increased length of stay, healthcare costs, morbidity, and mortality, which makes it relevant for nurses at all levels. The etiologic agent of pneumonia often remains unknown in 20% - 50% of cases with identifying new lung pathogens as a major public health goal (Hidron et al., 2008).

The first CDC Guidelines for Prevention of Nosocomial Pneumonia were published in 1981. The guidelines addressed the main infection control problems which included nebulizers attached to ventilators that received improper cleaning and disinfection or sterilization of respiratory care equipment, related to hospital acquired pneumonia.

In addition, as health care costs continue to rise, it is predicted that third party-payers may only provide reimbursement for interventions based on evidence-based practice. Because today’s health care consumers have increased access to healthcare information via the internet, media, and general publications, they are more involved in making decisions about their care (Melnyk & Fineout-Overholt, 2005). Consumers demand current best practice from their healthcare provider for themselves and their
family members. The clinical practice environment demands frequent evaluation of evidence-based care delivery, which may have a profound impact on patient outcomes.

Several standards of care have been developed in an attempt to reduce the incidence of VAP. Some interventions are costly, such as the use of kinetic therapy beds in the intensive care setting, while others are more cost effective, raising the head of the patient’s bed to a semi-recumbent position. While both interventions have supporting evidence in the prevention of VAP, each must be evaluated based on supporting scientific knowledge, cost-effectiveness, and outcomes realized by the patient.

Nurses have taken an aggressive role in developing best practice standards in an attempt to prevent VAP. One such standard includes elevation of the head of the patient bed. Nurses play an important role in patient positioning which has long been suspected to assist with the reduction of VAP (Cason et al., 2007). This literature review will focus on the guidelines affecting the prevention and control of VAP through positioning.

The CDC’s National Nosocomial Infection Surveillance System (NNIS) has provided standardized case definitions, data collection methods, and computerized data entry and analysis. Risk adjusted infection rates were recorded by site specific ICU types. During 1990-1999, VAP infection rates decreased with the lowest in the pediatric ICU and highest in surgical ICU with 13 cases per 1000 ventilator days (Hidron et al., 2008).

Although the optimal approach to reducing ventilator-associated pneumonia is unclear, studies indicate that educating health-care workers who care for patients receiving mechanical ventilation can decrease the rate of ventilator-associated pneumonia. In times of limited resources, focusing healthcare workers’ efforts on the
prevention of ventilator-associated pneumonia is important, especially given the association between inadequate staffing in the ICU setting and occurrence of nosocomial infections. Despite the importance of preventing nosocomial infections, studies suggest such infections are on the rise, resulting in warnings from professional and national agencies to refocus efforts on prevention (Babcock et al., 2004). This study is significant as the findings will provide the evidence needed to ensure the importance of educational plans and best practice used on mechanically ventilated patients.

*Problem*

Ventilator-associated pneumonia (VAP) accounts for almost half of all infections in critically ill patients, increasing length of stay in the ICU with prolonged mechanical ventilation (van Niewenhoven et al., 2006). VAP is a major complication of mechanical intubation and a serious concern during a patient’s stay. Subsequent aspiration of contaminated secretions along with colonization of the aerodigestive tract increases morbidity and mortality as well as an increase cost of health care.

*Purpose*

The purpose of this observational study is to determine whether an educational initiative could decrease rates of ventilator-associated pneumonia in a health-care system.

*Research Questions*

1. What are the current practices and interventions provided by ICU nurses in patients receiving mechanical ventilation?
2. What is best practice for healthcare workers in mechanically ventilated patients?
3. Is there a difference in the compliance rate of interventions by ICU nurses following an educational initiative?

**Conceptual Theoretical Framework**

Babcock et al. (2004) developed the organizing framework utilizing the Guidelines for Preventing Healthcare Associated Pneumonia from the Centers for Disease Control and Prevention (Tablan, Anderson, Besser, Bridges, & Hajjeh, 2004), recommendations, and review of current literature. The CDC recommendations include the development and implementation of educational sessions for nurses, physicians, and respiratory therapists who care for those at risk for the development of healthcare-associate pneumonia (Tablan et al.). In congruence with education, CDC provides guidelines for practices and interventions that can reduce VAP rates. This includes all mechanically ventilated patients in the ICU.

This framework is appropriate for this study because it provides the guidance and support necessary to ensure education on practices and interventions will benefit the patient by reducing the incidence of ventilator-associated pneumonia. Active ongoing surveillance and education will demand health care providers learn new methods and deliver care based on best practice and supportive research.

**Definition of Terms**

**Conceptual Definitions**

1. Practices and interventions: any act by a nurse that implements the nursing care plan for a mechanically ventilated patient in the form of support, limitation,
medication, or treatment for the current condition or to prevent the development of further stress.

2. Best practice: use of the most current and viable methods and recommendations from the CDC and review of literature (Vemelam, Daniels, & Hyde, 2001).

3. Mechanically ventilated patient: any patient that is supported by a respiration (breathing) device that can’t breathe independently (Torpey, Campbell, & Glass, 2010).

4. Compliance rate of interventions: the degree to which guidelines and recommendations provided are followed by healthcare workers caring for mechanically ventilated patients before and after an educational initiative (Schroy, 2002).

5. Educational initiative: an education program provided to healthcare workers defining appropriate measures to be taken in reducing VAP such as methods, tasks, and frequency. Education includes definition of VAP, incidence, causative pathogens, preventative measures, and care (Babcock et al., 2004).

Operational Definitions

1. Best practice: derived from the Centers for Disease Control and Prevention which recommends a series of guidelines ranging from education to hands on interventions to be used in ICU settings on those at risk of developing nosocomial infections (Lisboa et al., 2008).

2. Compliance rate of interventions: the degree to which recommendations are followed and measured through direct observation during pre-intervention phase
3. providing a baseline to compare interventions used during the post-intervention phase after an educational initiative (Schroy et al., 2002).

Limitations

Specific factors might have occurred coincidently while the interventions were set in place leading to unknown positive results. In addition, no other outcomes besides VAP were evaluated. Completion rates of the educational initiative varied among the hospitals even though the offering was mandatory and daily staffing not accounted for when gathering information. This may have caused bias because staffing ratios have an impact on care provided by healthcare workers.

Assumptions

Nurses would typically not provide specific interventions during the hours of 11 P.M. to 4 A.M. as the majority of nursing staff would not disturb the sleep cycle of a patient. This assumption indicates that the same practices and interventions are carried out during non-observational hours. Best practices do reduce ventilator associated pneumonia.

Summary

While critically ill patients experience a life-threatening illness, they commonly contract ventilator-associated pneumonia. Nosocomial pneumonia is one of the most significant and common infections found in hospitals today (Pruitt et al., 2006). The care provided to mechanically ventilated patients should be driven by evidence-based practice leading to positive outcomes. Education is key to preventing VAP. Studies at teaching hospitals reveal that VAP rates are decreased significantly when nurses complete an education program about risk factors and preventative strategies (Babcock et al., 2004).
The purpose of this study is to determine whether educational initiatives decrease VAP rates in a healthcare system. This will occur through extensive literature review and recommendations provided by CDC.
Chapter II

Literature Review

Best practice and preventative measures are important aspects of nursing care for patients who receive mechanical ventilation. Gaps exist between what is expected of healthcare workers to be practiced and what actual care patients receive. The purpose of this study is to observe current practice, define best practice, and measure compliance after an educational intervention.

The literature review consists of selected research studies that have been done on implementation of an education initiative, use of evidence-based practice, and guideline recommendations. This chapter organizes the literature into four sections: (a) organizing framework, (b) causes of ventilator-associated pneumonia, (c) knowledge and practices of guidelines by staff, and (d) interventions for ventilator-associated pneumonia.

Organizing Framework

Babcock et al. (2004) developed the organizing framework based on CDC Guidelines for Preventing Healthcare Associated Pneumonia (Tablan et al., 2004) and current supportive literature. The CDC guidelines include the development of a comprehensive oral hygiene program for patients in an acute-care setting who are at risk for developing hospital acquired infections (HAI) (Tablan et al.). The guidelines include all mechanically ventilated patients. The guidelines can be utilized to identify and adapt
evidenced-based nursing research for implementation in nursing practice settings. There are five suggestions from the CDC for hospitals to lower HAIs:

(a) Keep the head of the patient’s bed raised between 30 and 45 degrees unless other medical conditions do not allow this to occur; (b) Check the patient’s ability to breathe on his or her own every day so that the patient can be taken off of the ventilator as soon as possible; (c) Clean their hands with soap and water or an alcohol-based hand rub before and after touching the patient or the ventilator; (d) Clean the inside of the patient’s mouth on a regular basis; (e) Clean or replace equipment between use on different patients (Bingham, Ashely, De Jong, & Swift, 2010).

The use of this framework will guide itself the study as it provides steps for healthcare practitioners in reducing the incidence of ventilator-associated pneumonia.

*Causes of Ventilator-Associated Pneumonia*

The purpose of the study conducted by Grap et al. (2005) was to examine the relationship between backrest elevation and time spent in lower elevation on the incidence of pneumonia in the mechanically ventilated patient. Lower elevation was defined as less than 30 degrees. A 2-transducer system was utilized on all patient beds to continuously monitor backrest elevation. One transducer was placed on the bed frame just distal to the head gatch, and the other at the top of the bed frame. Grap et al. acknowledged a pilot test of the system was conducted for accuracy prior to implementation of the study. The patient’s Clinical Pulmonary Infections Score (CPIS) was used to determine the presence of VAP. The CPIS is a point total calculated for each patient, based on body temperature, white blood cell count, number of tracheal secretions,
oxygenation, chest radiographs, and tracheal aspirate cultures. The total point score is utilized to determine the development of pneumonia (Grap et al.). VAP is a multifaceted process which involves many different risk factors. Additional instruments utilized to evaluate the patient’s overall health status included an evaluation of the severity of illness using the Acute Physiology and Chronic Health Evaluation II (APACHE II) and an oral health status score by adding the number of decayed, missing, and filled teeth (DMF score) (Grap et al.).

The design of this research study was a longitudinal, descriptive study, which was conducted in a 12-bed intensive care unit in Richmond, Virginia. Only patients intubated and requiring mechanical ventilation within 23 hours of admission to the unit were included in the study. Patients who were re-intubated or had a diagnosis of pneumonia at the time of intubation were excluded from the study. Grap et al. (2005) noted that based on a mean VAP rate of 25%, a sample size of 60 patients was sufficient to evaluate the purpose of the study.

A total of 66 patients were included in the study. The mean age of the participants was 55 years old. Written, informed consent was obtained from the patient’s next-of-kin. Participants were continuously monitored for seven days after inclusion in the study, or until participants were extubated. During this time, the patient’s heart rate, blood pressure and backrest elevation were automatically downloaded every ten minutes. The patient’s CPIS was determined at the time of inclusion into the study on day four and seven. In addition, ventilator data, enteral nutrition data, and medications administered were recorded.
Grap et al. (2005) noted that participants remained in the study for a mean of 4.2 days for a total of 276 patient days. Findings on day four revealed 39 patients remaining in the study with 31 having completed data for CPIS calculation and 8 patients (26%) having VAP. Results on day seven of the study, identified that only 21 patients remained in the study, with 16 having completed data for CPIS calculation and 5 of those patients (31%) having VAP. Researchers were able to identify a relationship between the head of bed positioning and APACHE II scores, stating the effect of greater time spent in a low position during the first 24 hours was most predictive of VAP in patients with high APACHE II scores (Grap et al.).

Grap et al.’s (2005) study found patients more likely to develop VAP were severely ill and maintained at less than 30 degrees bedrest elevation for the majority of the time during the first day of intubation. No association between backrest elevation and VAP development could be drawn from the findings beyond the first day of intubation. Results of this study were limited by a small sample size at completion of the study; as a result, findings related to the development of VAP were based on day four versus day seven. In addition, Grap et al. identified the use of only CPIS to diagnosis VAP and lack of bronchoscopic evaluation for diagnosis of pneumonia as a limitation.

The purpose of the research study conducted by Hyllienmark, Gårdlund, Persson, and Ekdahl (2007) was to evaluate the possibility of implementing a hospital surveillance program for nosocomial pneumonia. In addition, the research sought to identify risk factors and establish the occurrence and prognosis of nosocomial pneumonia. Three hundred twenty-nine patients, 114 women and 215 men, were selected from an Intensive Care Unit at Karolinska University Hospital in Sweden. The patients were categorized as
trauma, medical, or surgical. Inclusion criteria included: ICU admission for greater than 48 hours and no diagnosis of pneumonia on admission. Exclusion criteria included patients who stayed in the ICU less than 48 hours, had community acquired pneumonia, had nosocomial pneumonia on admission, or unavailable for follow-up. The patients’ average age in the study was 43 years for trauma patients, and 60 years for non-trauma patients. Hyllienmark et al. (2007) used a correlational study design for the research project.

Instruments used by Hyllienmark et al. (2007) included the Kruskall-Wallis test and a multi variate logistic regression. The Kruskall-Wallis test was used to determine the effects pneumonia not associated with mechanical ventilation (NAP) and VAP had on length of stay in the ICU. A multivariate logistic regression model was used to evaluate mortality risk factors, and researchers scored patient severity of illness based on the APACHE II scores, temperature values, blood tests (C-reactive protein, leukocyte counts and blood cultures), chest x-rays, CAT scans, and bronchoscopy cultures (Hyllienmark et al.).

The researchers started monitoring nosocomial pneumonia in 2001 on all patients in the ICU. The measures used to reduce nosocomial pneumonia during the study included: using non-invasive ventilation whenever possible, suctioning of the subglottic space in mechanically ventilated patients, a weaning protocol, a daily wake-up test to allow for early extubation, positioning in the semi-recumbent position, and hygiene precautions (Hyllienmark et al., 2007).

Study results identified 33 patients who were diagnosed with VAP and 8 patients diagnosed with NAP (Hyllienmark et al., 2007). The remaining patients in the study
were noted to have a shorter ICU length of stay. On average, the length of stay was four days from intubation to diagnosis of VAP. Hyllienmark et al. (2007) found aspiration prior to or during mechanical ventilation of the patient to be a significant risk factor for VAP. Patients who did not aspirate experienced an increased risk of VAP for each day the patient remained on the ventilator, with the highest risk occurring on day two and three. In addition, Hyllienmark et al. noted that all patients on the ventilator for more than ten days developed VAP.

In conclusion, Hyllienmark et al. (2007) documented a VAP rate of 15% during the study, and identified the most prominent risk factor for developing VAP to be aspiration. Researchers also determined that an ICU surveillance program would be feasible and useful in improving the quality of care for the mechanically ventilated patients. In addition, a surveillance program could also supply a baseline for further preventative interventions for VAP.

The limitations of the study were not discussed; however, the exclusion of patient history would identify patient co-morbidities which might influence the amount of ventilator time required and risk for developing VAP. In addition, instrument reliability and validity was not disclosed in the study (Hyllienmark et al., 2007).

Knowledge and practices of guidelines by staff

Ventilator-associated pneumonia accounts for 47% of infections in patients in intensive care units (Cason et al., 2007). Adherence to best nursing practices recommended by the 2003 CDC guidelines for prevention of VAP should reduce the risk of VAP. VAP prolonged ICU length of stay and increased risk of death in critically ill patients. VAP continued to complicate the course of 8-28% of mechanically ventilated
patients. The purpose of this study was to identify the gap between what is known and what nurses report being practiced. The authors wanted to evaluate the extent to which ICU nurses implement best practices when managing adult patients receiving mechanical ventilation. The study was a cross-sectional survey of nurses who attended one of two national training programs.

The population of interest was critical care nurses who provided care for adult patients receiving mechanical ventilation and who worked in an US acute-care setting. Of the 1596 surveys distributed, 1285 were returned. Eighty-five surveys were discarded due to either incompleteness, completed by nonnurses, worked outside of the US, or worked in a long-term care facility. The final sample included 1,200 critical care nurses. The mean age of the sample was 43 years old with mean years of experience of 14. The majority of the sample was Bachelor of Science prepared nurses with one-third of nurses holding a CCRN certification.

An oral care of vented patients questionnaire was distributed to attendees at the training session prior to the education seminar to prevent bias results. The survey included questions about CDC guidelines, such as hand washing, knowledge of VAP rates, organisms, etc. Content validation was obtained by using a panel of three persons: an infection control nurse, infection control physician, and a nationally recognized nurse with expertise in pulmonary and ventilator topics.

The findings revealed that 82% of respondents reported hand washing between patients with females practicing this intervention more often than males. Seventy-seven percent of respondents reported always wearing gloves while doing oral care but when asked about suctioning secretions under the tongue before deflating the cuff, only thirty-
six percent reported completing this task. Thirty-two percent reported suctioning as a respiratory therapy intervention. It was revealed that only thirty-two percent of nurses knew the VAP rate on their unit while fifty percent knew the causative organism for VAP on their unit. Older respondents reported keeping the head of bed elevated 30 to 45 degrees, 75% more of the time than other younger respondents (Cason et al., 2007).

The authors concluded that according to the nurses’ survey reports, CDC recommended guidelines and evidence-based practices were not consistently and uniformly used by nurses. Of concern, 18% of nurses did not wash hands between patients and 23% not wearing gloves when providing oral care (Cason et al., 2007). Clearly, nurses’ compliance with hand washing and wearing gloves suggested by recommendations must be improved. There were four limitations to the study: (a) lack of a formal assessment of reliability of the survey; (b) survey distributed only at educational seminars; (c) survey results only self-reported; and (d) a fail-safe method to prevent participants from completing the survey more than once.

Ventilator support is a well-known risk factor for nosocomial pneumonia (NP); the incidence of NP is 26 times higher in patients treated with continuous ventilator support. Nosocomial pneumonia develops in mechanically ventilated patients at a rate of one to three percent per day of ventilation (Lam Soh, Koziol-McClain, Wilson, & Geoksoh, 2006). It’s likely that if critical care nurses (CCNs) have knowledge about NP prevention, as suggest by CDC guidelines, rates of NP could be decreased. The purpose of the study was to identify knowledge deficits concerning NP prevention among CCNs. The study also determined whether NP knowledge was associated with nurse characteristics.
The sample included 135 participants that fit the criteria of the study. The Nursing Council of New Zealand database provided 1,599 full and part-time critical care nurses that worked with vented patients the opportunity to participate in the study. One hundred thirty-five participants were non-eligible because they did not work with vents, the questionnaire not complete, or lived outside of New Zealand. Forty-four percent of the participants were diploma or hospital based registered nurses (Lamsoh et al., 2006).

A self-administered multi-choice questionnaire (MCQ) was selected for the study because it was suitable for testing knowledge with a high reliability related to consistent and objective scoring. The questionnaire consisted of three sections. If the nurse had not cared for a vented patient, the nurse did not proceed with the questionnaire. Section two consisted of 24 questions related to prevention knowledge. Section three contained information about nurse demographics and characteristics.

The findings revealed nosocomial pneumonia knowledge ranged from 21% to 92% with a mean of 48% (Lamsoh et al., 2006). Thirty-two percent agreed on having an infection control policy related to ventilators in the facility. Fifty-four percent of participants acknowledged receiving infection control education in the past 12 months. The findings revealed a mean of 67% of the participants had deficits related to risk factors and 43% had deficits in prevention knowledge. No nurse demographic or workplace characteristics were associated with NP knowledge.

The study concluded, nurses with awareness of risk factors and prevention, NP rates could be decreased. The study was descriptive not explanatory thus revealing nurses’ knowledge deficits. With increasing awareness, not only can NP rates decrease, but length of hospital stays and health care costs can be lowered. There were three
important limitations to the study, including (a) room for significant measurement error; (b) only 30% of nurses submitted questionnaires; and (c) no control over the respondent environment. (Lamsoh et al., 2006).

Babcock et al. (2004) conducted a study in which the purpose was to determine whether an educational initiative would decrease rates of VAP in a regional health-care system. The subjects of the study were patients who were diagnosed with VAP and had been admitted to one of four participating hospitals between January 1, 1999 and June 30, 2002. The research design used in the Babcock et al. study was a correlational predictive design which used pre and post-intervention observation. In addition, there was a component of the survey design which described the manner VAP rates were collected. The instrument used was an educational module directed toward ICU nurses and respiratory practitioners in all four ICUs in the integrated health care system. The educational initiative consisted of a ten page self-study module that summarized the information through utilization of the acronym WHAP VAP. W stood for “wean the patient” as soon as possible, H for “hand hygiene”, A for “aspiration precautions”, and P for “prevent contamination.”

The procedure Babcock et al. (2004) used to conduct the study included a data collection period to identify VAP rates prior to education of staff. VAP rates for the participating ICUs were tracked for one year prior to the intervention. During this time, nursing and respiratory staff were attending in-services, participating in the self-study module, and reviewing educational posters on the initiative. Once the initiative was introduced, VAP rates were collected and documented for an additional eighteen months.
The results of the Babcock et al. (2004) study addressed compliance with the educational initiative and VAP rates. Staff module completion rates for all the hospitals were 80.1% of ICU nurses and 89.9% of respiratory therapists. After training and additional data collection, VAP rates dropped from 8.75/1,000 ventilator days in 1999 and 7.81/1,000 ventilator days \((p = .161)\) in 2000, during the training period. Following staff education, the overall VAP rate dropped to 4.74/1,000 ventilator days \((p < .001)\) a decrease of 46\% following the intervention.

Babcock et al. (2004) concluded that educational interventions were associated with decreased VAP rates in the ICU setting. It should be noted, the introduction of such an initiative is most successful with the involvement of ICU nurses and particularly respiratory therapists. Additionally, compliance rates seemed to be better in facilities which made the initiative part of their mandatory education (Babcock et al.).

There were several limitations noted in the study. The nonrandomized design of the study allowed for the possibility of extraneous variables which could influence VAP rates. Lack of demographic and severity of illness data may also have had an effect on the results. In addition, the use of the educational module may have resulted in other changes in the staff behavior, leaving open the possibility of additional variables other than the module itself. Other limitations of the study included monitoring only one single outcome, VAP rates, no evaluation of how the intervention may have influenced antibiotic utilization, length of hospital stay, or mortality was conducted. Additionally, researchers noted through literature review that study compliance was subject to appropriate staffing levels in the ICU setting. However, adequacy of staffing was not tracked during this research project.
Prevention of VAP focuses primarily on avoiding microaspiration of subglottic secretions, preventing oropharyngeal colonization with exogenous pathogens, and contamination of ventilator equipment (Blot, Labeau, Vandijck, Aken, & Claes, 2007). Although research efforts have been undertaken to determine the value of numerous preventive measures, interpretation of the results was not always obvious. Preventative measures may be effective, but were too expensive for general implementation. In response to the complexity of the issue, studies have resulted in evidence-based guidelines. The positive effect of preventive measures may decrease with length of time at risk. The purpose of the study was to determine intensive care nurses’ knowledge of evidence-based guidelines for the prevention of ventilator-associated pneumonia using a contextual framework.

Demographic data accounted for in the sample in Blot et al. (2007) study was gender, years of ICU experience, number of critical care beds, and holding of a special degree. Out of 855 possible participants, 638 completed the questionnaire. Most respondents were female (74%) and 24% had less than one year of ICU experience. When looking at years of experience, 111 respondents had one to five years, 100 six to ten years, and 274 more than ten years (Blot et al.). The majority of the respondents worked in a hospital with more than fifteen ICU beds. A degree in emergency and critical care was held by 68% of respondents.

A validated multiple-choice questionnaire was developed utilizing the evidence based VAP guidelines. The questionnaire was distributed at an annual congress for critical care nurses. Bias can be found with questionnaires as those interested in the topic
were more likely to participate and complete the questionnaire rather than be through randomization.

Findings of the Blot et al. (2007) study revealed an average score of 3.7 out of 9 on the questionnaire. No significant difference was displayed between male and female scores. Nurses with less than one year experience performed worse than nurses holding a special degree. Linear regression analysis identified years of experience and degree to be independently associated with better knowledge. In the survey, only 17% recognized the recommendation of closed systems and 12% were aware of recommendations of change in airway humidification systems weekly. Sixty percent of respondents knew draining subglottic secretions decreased risks of VAP (Blot et al.).

The authors concluded that nurses’ awareness about VAP guidelines was low and stressed the need for thorough education based recommendations. Increasing the level of knowledge was the first step to successful multifaceted education programs. Education should include supplementary support from current evidence-based guidelines.

Tolentino-DelosReyes, Ruppert, and Shiao (2007) conducted a research study titled “Evidence-Based Practice: Use of the ventilator bundle to prevent ventilator-associated pneumonia.” The purpose of this study was to evaluate the level of understanding critical care nurses had concerning the prevention of ventilator-associated pneumonia using the vent bundle. Ventilator bundle is defined as steps taken to incorporate the CDC guidelines into patient care practices (Tolentino-DelosReyes et al.). These steps include elevation of the head of bed to 30 degrees, 45 degrees unless medically contraindicated; continuous removal of subglottic secretions; change of ventilator circuit no more often than every 48 hours; and washing of hands before and
after contact with each patient. The sample population used in this educational study was staff nurses from a coronary care unit (CCU) and a surgical intensive care unit (SICU). Sixty one staff nurses participated in the study, 33 from the CCU and 28 from the SICU. Tolentino-DelosReyes, et al. conducted eight educational sessions for staff nurses from both nursing units. Sessions included a 30-minute PowerPoint presentation as well as a pre and post-test. An educational poster board with information derived from the PowerPoint presentation was left on both nursing units for staff members unable to attend the educational presentation. Additional printed information materials were left on the units to reinforce information received during the sessions. A ten item questionnaire was developed by the project director to test the knowledge of staff on VAP prevention practices using the ventilator bundle (Tolentino-DelosReyes et al.). The questionnaire was reviewed by two critical care nurse experts and educators to determine validity. Information in the 10-item questionnaire covered topics such as best practice guidelines, microorganisms related to VAP, hand washing techniques, supine positioning, enteral feedings, factors related to VAP, VAP definition, and diagnosis of pneumonia (Tolentino-DelosReyes et al.).

Direct observation was also utilized as the nursing staff was observed one month prior to the educational sessions and one month after the sessions were complete. Factors assessed during this observational period were head of bed positioning addressed during shift report, hand washing practices of the nursing staff, and hand hygiene practices which included the presence of artificial nails, nail polish, and rings.

Tolentino-DelosReyes et al. (2007) found improved test scores of nursing staff after completion of the educational sessions. On the 10 item questionnaire, the staff
nurses on both units tested better on 8 of the 10 questions ($p$ from .03 to < .001). The nursing staff showed greatest improvement in the areas of head of bed elevation, charting of head of bed elevation ($p = .009$), oral care ($p = .009$), checking nasogastric tube for residual volume ($p = .008$), washing hands before and after contact with patients, and limiting wearing of rings ($p < .001$) and nail polish ($p = .04$) (Tolentino-DelosReyes et al.).

The authors concluded that educational sessions were an effective means of increasing the knowledge of nurses and effective in changing clinical practice for mechanically ventilated patients. The researchers recommended further studies in the oral care and nasogastric tube feedings related to VAP and nursing practice. Study limitations include educational session availability for staff members from both units, the absence of a control group to compare the findings, the validity and reliability of the test questions administered to staff nurses, and the use of documentation by proxy for actual practice (Tolentino-DelosReyes et al., 2007).

**Interventions for Ventilator-Associated Pneumonia**

Mechanically ventilated patients in neuro and other ICUs were at increased risk of VAP due to decreased level of consciousness, dry, open mouth, and microaspiration of secretions. VAP can be prevented by initiating interventions from the IHI’s VAP bundle including elevate head of bed, good oral hygiene, early mobilization, and performing neurological checks at 10am every morning (Fields, 2008). The purpose of the study was to support the premise that oral care in combination with the VAP bundle can prevent the occurrence of VAP through a randomized controlled trial.

The study took place in a 24 bed critical care unit inside a 925-bed, level I trauma center. The desired sample size of Fields (2008) study was 200 mechanically ventilated
patients or 2,000 ventilator days, whichever came first. Patients eligible included any mechanically ventilated patient on a stroke/medical ICU who had been intubated for less than 24 hours and no prior diagnosis of pneumonia. Inclusion criteria stated the patient must be over 18 years of age, have had no prior tracheotomy, no history of AIDS or patients who were edentulous. Patients were randomized into a control group that received regular as needed oral care. Inclusion and exclusion criteria were used at the beginning of the study but dropped after six months due to results.

A result of Fields (2008) study, VAP rates plummeted from 4.625% to 0% in six months. A VAP rate of 0.62% was in a total of 1850 ventilator days after instituting an oral care project (Fields). The study started as a randomized control trial, but because of the success of the intervention group and development of VAP in four of the control group participants, the control group was dropped and all intubated patients were placed in the intervention group. At the end of the study, rates increased from 0.62% to 1.17% due to lack of effort from nursing staff (Fields). To validate the study and support relationship between tooth brushing and VAP, the study needs to be replicated using a larger randomized sample over a longer period of time. A dedicated person should track documentation daily and ensure adequate equipment is available to staff in order to perform oral care. The study saved lives, changed nursing practice, and saved the hospital more than $724,000 (Fields). The study proved simple interventions such as brushing teeth three times a day and using the IHI VAP bundle can be powerful prevention tools.

Several education based interventions were known to lower VAP incidence. Translating education based findings into consistent delivered care was an ongoing
challenge for bedside nurses. Not all effective interventions are universally practiced by contrary to evidence. Active implementation strategies include staff education, clinical reminders, audits, and organizational change, but knowledge of strategies for behavior changes is essential for success (Hawe, Ellis, Cairns, & Longmate, 2009). The purpose of the study was to describe an active, multifaceted implementation of a VAP prevention bundle with evidence base actions and lower incidence of VAP.

All patients admitted to an adult medical/surgical ICU between September 1, 2005 and December 31, 2007 were assessed for VAP. A total of 1,068 patients were admitted over the 28 months. In the passive implementation period, 675 patients were included with 388 being male. During the active implementation period, out of the 393 participants 216 were males. Patients included in the passive and active implementation, cohorts were similar with respect to sex, ventilator rates, length of stay, severity of illness, admitting diagnosis, and source of admission. Criteria includes being on mechanical ventilation for greater than forty-eight hours (Hawe et al., 2009).

The quasi-experimental study used before and after interventional cohorts. The possibility for bias in the Hawe et al. (2009) was possible in the results as data collection and educational interventions were performed by the same individuals. During the passive implementation period, findings revealed there were 49 episodes of VAP and 2,556 ventilator days compared with ten cases of VAP and 1,327 ventilator days during active implementation (Hawe et al.). The rate difference was 0.39. There was a trend toward lower unit mortality in the active implementation period. Passive implementation was associated with poor compliance with elements included in the VAP bundle. The multimodal “active” implementation was associated with significant improvement,
lowering VAP incidence rates from 19.2% to 7.5/1,000 ventilator days between the passive and active periods (Hawe et al.).

Passive implementation of the VAP prevention bundle was associated with low levels of compliance. Compliance increased during an active multimodal implementation period as a result of process and outcome management, operational changes on the unit, and a staff education program. Decreased VAP rates showed significant reduction when associated with the implementation (Hawe et al., 2009).

Keeley (2007) conducted a quantitative, randomized clinical trial to compare the effects of positioning the head of bed at 45 degrees rather than the standard 25 degrees. Patients were randomly placed in either the control group, head of bed elevation of 25 degrees, or the treatment group, head of bed elevation of 45 degrees. Exclusion criteria for this study included previous intubation (within the last 30 days), recent abdominal surgery with vacuum dressing that required frequent position changes to maintain seal and/or suction, severely obese patients unable to tolerate head elevation of 45 degrees, hemodynamic instability (mean arterial pressure less than 60mmHg for more than 30 minutes), refractory to colloid therapy or inotropic support, patients receiving renal replacement therapy whose body position resulted in ineffective blood flow to continue treatment, pregnancy, spinal surgery or trauma that required the patient to lie flat, and patients intubated for more than 12 hours prior to admission to ICU. Inclusion criteria included all critical care patients intubated within 12 hours of admission to the ICU, resulting in a sample of convenience (Keeley).

At the beginning of the trial, patients’ names were placed in envelopes then sealed. The envelopes were shuffled and randomly selected by an independent person in
order to assure random assignment to either the control or treatment group. The clinical trial lasted for three to five months and resulted in a sample size of 54 patients. Twenty-nine patients were placed into the treatment group and 25 into the control group.

Pneumonia was diagnosed as either clinically suspected or microbiologically confirmed (Keeley, 2007).

The results of the study found that 29% of the treatment group developed VAP and 54% of the control group. Though there was a 25% reduction in the incidence of VAP in the treatment group as compared with the control group a statistical significance was not reached. Minitab computer software was used to compile the statistical data. Keeley (2007) utilized the chi-squared test to analyze differences between observed frequencies within the data and frequencies that were expected. In addition, the t-test was used to determine significant differences between measures of the two groups. The limitation of this study was sample size, resulting in a Type II error. Keeley suggested using a larger sample size or increasing the length of the study to capture more patients and allow for a greater statistical difference. In conclusion, failure to elevate the head of a patient’s bed greater than 25 degrees can result in a higher incidence of VAP; however, additional research on head of bed elevation is needed to support this theory (Keeley).

A study developed by van Nieuwenhoven et al. (2006) examined the feasibility of placing mechanically ventilated patients in the semi-recumbent position and how this positioning impacts the incidence of ventilator associated pneumonia. The authors defined the semi-recumbent position as 45 degrees, as compared to that of the supine position with ten degrees of backrest elevation. The diagnosis of VAP was based on criteria defined by the CDC and microbiological confirmation (van Nieuwenhoven et al.).
Van Nieuwenhoven et al. (2006) identified the study design as a prospective, randomized clinical trial conducted in three university hospitals in the Netherlands, from January 1999 through December 2000. Inclusion criteria included adult patients intubated within 24 hours of admission to the intensive care unit with an expected duration of 48 hours or more of assisted ventilation. Exclusion criteria included those patients who were undergoing selective decontamination of the digestive tract, those who could not be randomized to one of the two positions due to trauma, patients with extensive abdominal surgery, neurosurgical patients, or patients who were cared for in beds in which backrest elevation could not be altered (van Nieuwenhoven et al.).

Although 255 patients were eligible for the study, 34 patients were excluded due to patient or family request, resulting in 211 participants. Written, informed consent was obtained for all participants. Patients were randomly assigned to either the semi-recumbent position or the supine position by means of closed, numbered envelopes. An independent person randomized the envelopes before generating a group assignment. The experimental group consisted of 112 patients in the semi-recumbent position, and the control group consisted of 109 patients in the supine position. Baseline characteristics were similar for both groups (van Nieuwenhoven et al., 2006).

The extent of head of bed elevation was measured by a transducer with a pendulum placed on each subject’s bed frame. This device was calibrated before placing the patients in their randomized position. Computerized measurements were recorded every sixty seconds during the first week. Deviations of more than five degrees from the randomized position were recorded. Labels were placed at each patient’s bedside to continuously remind staff of the patient’s randomized position. A dedicated research
nurse was assigned to each ICU to control and maintain patient position (van Nieuwenhoven et al., 2006).

Backrest elevation was recorded for a mean of six days. An average elevation for the semi-recumbent group was 28.1 degrees on day one to 22.6 degrees on day seven. The targeted elevation of 45 degrees was not met 85% of the time. The supine group averaged elevations of 9.8 degrees on day one to 16.1 degrees on day seven. VAP was diagnosed in thirteen patients in the semi-recumbent group (10.7%), as compared to eight patients in the supine group (6.5%). There were no other major differences identified in the care and treatment of both groups (van Nieuwenhoven et al., 2006).

Van Nieuwenhoven et al. (2006) concluded the difference in position, 28 degrees versus 10 degrees, did not prevent the development of VAP. One limitation of the study was the failure to maintain patients in the full 45 degrees of head of bed elevation, despite having a dedicated research nurse assigned to each setting to maintain proper positioning. It is unclear whether lack of compliance with semi-recumbent position was caused by patient intolerance or health-care worker compliance (van Nieuwenhoven et al.).

The purpose of the study conducted by Baxter et al. (2005) was to introduce an Intensive Care Unit (ICU) protocol to help reduce the incidence of VAP and measure its effectiveness. In addition, researchers worked to approximate the financial impact of VAP and the implementation of the ICU protocol. Research participants included 705 patients admitted to the ICU in the six months prior to the implementation of the intervention; these patients were evaluated for baseline data prior to the ICU protocol. A total of 3,507 patients were included in the research study by Baxter et al. following protocol implementation. Patients were categorized by type which included medical,
medical subspecialties, and surgical. Researchers used a posttest-only with a comparison

group research design (Baxter et al.).

Several instruments were used during this research study. A VAP audit tool and
an ICU protocol, developed by researchers, included several interventions of different
levels of evidence to reduce the incidence of VAP. Patient information and the presence
of VAP were recorded in an ICU computer database. Chi square tests were used to
compare the amount of patients admitted from each service, actual mortality and

calculated mortality before and after the implementation of the ICU protocol. T tests were
used to compare patient’s length of ICU stay and Apache II score (Baxter et al., 2005).

Baxter et al. (2005) collected data from the ICU database and from hospital
charts. Following data collection, a multidisciplinary team was put together to design and
implement an evidenced based VAP prevention protocol. Baseline data was collected six
months prior to the implantation of the protocol. In January of 2000, Baxter et al.
introduced the protocol into clinical practice. Included in the protocol were both an
educational and preventative intervention which was given to physicians, nurses,
pharmacists, and respiratory therapists. Some preventative measures included in the
protocol were part of current practice; however, reemphasized to improve compliance
with the physicians and staff. Strict hand hygiene was enforced; ventilator circuits were
monitor regularly; condensation was removed as needed; circuits were replaced weekly
or when contaminated; nasogastric and endotracheal tubes were removed as soon as
possible; measures were implemented to prevent early extubation and subsequent re-
intubation; nasal intubation was avoided when possible; heat and moisture exchange
humidifiers were utilized; closed in-line suction was established; medicine was
administered to increase gastrointestinal motility when gastric residual volumes were high; and sedatives and analgesics were titrated to the lowest possible levels to prevent gastroparesis. Additional measures initiated included placing the patients in the semi-recumbent position, transpyloric enteral feeding, and antiseptic mouthwash. Patient audits monitored compliance with the protocol and identified barriers to compliance (Baxter et al., 2005).

Study results after implementation of the ICU protocol indicated a drop in VAP rates from 94 per year prior to initiation of the protocol to 51.3 per year following protocol implementation. The incidence of VAP decreased \( p < .0003 \), overall \( p = .0148 \) within the medical patient group, and \( p = .0062 \) within the surgical patient group; however, changes were not noted within the medical subspecialties group. It should be noted that the patient population mix did change during the data collection period (Baxter et al., 2005).

The risk for early onset VAP increases secondary to aspiration and Baxter et al. (2005) identified a higher risk 48 to 96 hours after endotracheal intubation. In order to implement a VAP protocol, staff and physician compliance was required. Additional continuing education, monitoring and feedback were essential for successful protocol use. It was concluded that the protocol was a simple, cost effective way to reduce the incidence of VAP and improve quality of patient care (Baxter et al., 2005).

Limitations within the study included a lack of stated inclusion and exclusion criteria, and identification of co-morbidities on participants within the study. Reliability and validity of instruments used within the study were not identified by (Baxter et al., 2005). In addition, demographic data did not include the sex or average age of
participants. Although study findings support other research, limitations should have been identified by research authors.

Through an extensive literature review, evidence displays the importance of an education program for staff in contact with mechanically ventilated patients whether it is nurses or respiratory therapists. In combination of best practice guidelines and education, VAP rates could be lowered at astonishing rates in intensive care units. With collaboration among a multidisciplinary team and the use of evidence base practice, health care costs and length of stays can be decreased.
Chapter III

Methodology and Procedures

Introduction

Ventilator-associated pneumonia (VAP) is the most common hospital-acquired infection among patients mechanically ventilated producing excessive mortality rates, increased length of stay in ICU parallel to rising medical care costs (Babcock, 2004). Although, the optimal approach for decreasing VAP rates is unclear, education for both Intensive Care Unit (ICU) nurses and respiratory therapists can supplement decreasing incidence rates. The purpose of this study was to determine whether an educational initiative decreases rates of VAP in ICU supported by literature review and recommendations from the Centers for Disease Control and Prevention. This chapter presents the population, sample, methodology, and procedures that will be utilized for this study.

Research Questions

1. What are the current practices and interventions provided by ICU nurses and respiratory therapists in patients receiving mechanical ventilation?
2. What is best practice for healthcare workers in mechanically ventilated patients?
3. Is there a difference in the compliance rate of interventions by ICU nurses and respiratory therapists following an educational initiative?
Population, Sample, and Setting

The population for this study will include all full-time and part-time ICU registered nurses along with all full-time and part-time respiratory therapists (RTs) employed with two community hospitals located in southern Indiana. In combination, the acute care hospitals will contain 350 beds total. A convenience sample of 40 nurses and 20 respiratory therapists is anticipated. Criteria for inclusion will be current employees working at least part-time for at least six months. All ICU patients who are mechanically ventilated and agree to participate will be invited. For staff members that decide to not participate, they will be encouraged to review educational materials posted throughout the unit as well as contact the Infection Control Nurse on ways to reduce VAP during the education initiative.

Protection of Human Subjects

This study will be submitted for approval to the Institutional Review Boards of Ball State University and participating hospitals. Patients and family members will be informed about the study with a cover letter. ICU nurses and respiratory therapists (RTs) will be informed about the study when given the opportunity to participate in the structured self-study module. Confidentiality will be maintained. No risks have been identified with the study. Benefits will include the opportunity for ICU nurses and RTs to contribute to the acquisition of information which may reveal how to decrease the incidence of VAP through continuing education.

Procedures

After each Institutional Review Board approval is received, a letter will be sent to the Vice President of Nursing at both hospitals requesting a meeting. The meeting will
discuss the outline and purpose of the study, inclusion criteria, and request for ICU RN and Respiratory Therapist participation in the study. Subsequent meetings will then be held individually with the unit managers and staff from each hospital to discuss the criteria.

Participating ICU nurses and Respiratory Therapists in contact with mechanically ventilated patients will be offered a structured self-study module on risk factors for and strategies to prevent ventilator-associated pneumonia. VAP rates will be monitored for six months in the ICU. ICU nurses and RTs will not be informed as to when the observers would be present in the unit or why. Specially trained researchers will observe interventions and practices at random blocks of three hours that will include early morning through evening shifts.

All mechanically ventilated patients will be included during the six month time frame of the study. Exclusion criteria include any patient less than 18 years of age, any patient that opts to withdraw from the study, or if the family does not grant permission.

Instrumentation

Observation will be the method of measurement used in the study. Trained observers will document frequency, tasks, and tools used to decrease risks during the random four-hour time frame by walking around the unit and watching nurses and respiratory care personnel perform tasks. Items located at bedside will be documented as well as when tasks are performed, such as suctioning. All staff members will be monitored including ICU nurses and respiratory therapists. Data documented include oral assessment, respiratory assessment, suctioning, suction tubing change, positioning, and other care.
Interrater reliability is the comparison of the observers’ data in a research study. Determining the reliability of the study is a more immediate concern in research and will be used in this study. The values of interrater reliability will be collected and reported in the study. The formula to be used will be the number of observational agreements divided by the number of possible agreements (Burns & Grove, 2009). To eliminate bias, a protocol will be developed for standardization. A check-off sheet created by RNs and RTs will be given to each observer containing particular items and interventions to be monitored. The observers will consist of four RNs and three RTs. All of the designated observers will be given the check-off sheet and instructed to observe all staff providing care for mechanically ventilated patients. Other strategies can be developed to monitor and reduce the decline of interrater reliability but it would entail considerable time and expense; therefore, the checklist will be utilized. There is no absolute value in which interrater reliability is acceptable but a value below 0.80 will generate serious concern about the reliability of the data. The validity of this tool is less certain than other tools used because staff will perform care differently when observers are present. Most nurses will perform minimal care between the hours of 11 P.M. to 4 A.M. due to patients’ time of rest.

Research Design

The study will utilize a Pre-test Post-test design to determine preventative interventions delivered to mechanically intubated patients in the ICU at baseline and after an educational intervention. This study will examine the differences as they occur naturally in the setting.
The study will consist of three phases: baseline, educational, and post-intervention. The baseline phase will last for six months. Baseline data collection will include observation of current practices in patients mechanically ventilated. A twenty question test created by the author assessing current knowledge on ways to prevent ventilator-associated pneumonia will be given prior to the education for baseline data. Data will be collected on the types of products used, methods used to decrease risks, and frequency of the practices. Baseline VAP rates will be monitored during the six month time frame.

During the educational phase, a self-study module will be offered to the ICU and RT staff partaking in the study. The self-study module will include epidemiology, risk factors, etiology and methods used to decrease VAP. Information will be reinforced through posters and fact sheets visible to staff. Monthly educational in-services by Infection Preventionists will be offered during this time for staff included in the study. Furthermore, staff not participating in the study are encouraged to attend. Mandatory competencies will be completed by the study sample. The educational intervention period will last for four months and will include approximately 40 ICU staff and 20 Respiratory Therapists (RTs). Definitions of VAP defined by the CDC will be used to determine if the subjects meet criteria to be included. Patients’ demographics such as gender, age, and medical diagnosis will be collected. Demographics of the ICU nurses and RTs also will be collected. Participants collected data will include years of ICU experience, gender, and educational level.
**Intended Method for Data Analysis**

Descriptive statistics will be used for continuous data and frequencies and percentages for categorical data. Variables included are types of supplies used, defined methods used, and frequency. VAP rates will be recorded for twelve months during the post-intervention phase. Statistical information will be entered into the database for Infection Control and Hospital Epidemiology Consortium of the health system. The pre-test and post-test scores will be examined for a significant difference.

**Summary**

Multiple variables affecting mechanically ventilated patients exist, reducing risk factors that could potentially cause ventilator-associated pneumonia is an important dimension in the critical care nursing setting. ICU nurses and RTs will be educated in methods to decrease risks in a Pre-test Post-test design. In order for healthcare providers to make serious advances in preventing VAP, practices must be current and follow best practice. An educational initiative directed for nurses and RTs can decrease the incidence of nosocomial pneumonia.
References


