

ORAL CARE PRACTICES FOR PREVENTION OF VENTILATOR-ASSOCIATED
PNEUMONIA
RESEARCH PROPOSAL
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Abstract

RESEARCH PAPER: Oral Care Practices and Interventions for Prevention of Ventilator-Associated Pneumonia

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Mechanical ventilation is a life-saving measure utilized when the respiratory status of a critically ill patient has become compromised. Ventilator Associated Pneumonia (VAP) is a complication of mechanical ventilation (Cutler & Davis, 2005). The purpose of this study is to identify current practices of oral care in patients receiving mechanical ventilation and measure compliance with an intervention of standardized oral care. The organizing framework is the Guidelines for Prevailing Health-Care Associated Pneumonia (Centers for Disease Control and Prevention). The sample will include 250 mechanically ventilated patients in a Medical and Surgical Intensive Care Unit with 21 beds at a local community hospital in the State of Indiana. Inclusion criteria are individuals over 18 year old and requiring mechanical ventilation for longer than 48 hours. Time blocks of 8 hours will be randomized over the intensive care units to observe oral care on all intubated patients. Observational baseline data on oral care practices will be collected before implementation of the education program and compared to post-interventional data.

Identification of current practices will occur through an oral care survey and direct observation. During the intervention phase, compliance of the protocol will be monitored and compared to pre-protocol practices. Findings will provide information regarding oral care practices among nurses and if such practices reduce the incidence of Ventilator Associated Pneumonia.

Chapter One

Introduction

Approximately 2 million people in the U.S. acquire an infection during hospitalization annually (Weber, Rutala, Sickbert-Bennett, Samsa, Brown, & Niederman, 2007). Hospital-acquired infections are considered serious adverse patient events. Preventable adverse patient events are responsible for 45,000 to 100,000 deaths each year (Abbott, Dremse, Sterwart, Mark, & Swift, 2006). Health care-associated infections remain a major cause of morbidity, mortality, and cost despite concerted efforts of the Centers for Disease Control and Prevention (CDC) for nearly a half-century (IHI, 2007).

Hospital-acquired infections caused by Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant Enterococci (VRE) are particularly problematic as MRSA accounts for greater than 50% of hospital-acquired infections. Methicillin Resistant *Staphylococcus Aureus* (MRSA) occurs most frequently among patients who undergo invasive medical procedures or who have weakened immune systems while being treated in hospitals (CDC, 2007). MRSA in healthcare settings commonly causes serious and potentially life threatening infections, such as bloodstream infections, surgical site infections, or pneumonia. Hospitals are setting forth a concerted effort to decrease MRSA.

The National Healthcare Safety Network (NHSN) reports statistics on hospital-acquired infections resulting from Ventilator-Associated Pneumonia (VAP), Catheter-Related Blood Stream Infections (CR-BSI), and urinary catheter-associated urinary tract infections (UTI's) (Edwards, Peterson, Andrus, Tolson, Goulding, Mincey, Pollock, Horan, 2007). Hospitals throughout the country contribute to this data. Results call for concerted efforts of healthcare workers to reduce hospital-acquired infections.

Hospital-acquired pneumonia (HAP), ventilator-associated pneumonia (VAP), and healthcare associated pneumonia (HCAP) remains important causes of morbidity and mortality despite advances in antimicrobial therapy (STS, 2007). According to the Society of Thoracic Surgeons (2007), hospital-acquired pneumonia occurs 48 hours or more after admission. The patient was not incubated at the time of admission.

Ventilatory-associated pneumonia (VAP) refers to pneumonia that arises more than 48-72 hours after mechanical intubation. Ventilator Associated Pneumonia is the most common infectious complication among all critically ill patients and accounts for up to 47% of all infections. Patient populations that commonly acquire nosocomial pneumonia are infants, young children, individuals who are greater than 65 years of age, persons with severe underlying disease, immunosuppression, depressed sensorium, and/or cardiopulmonary disease (CDC, 2007).

The CDC's National Nosocomial Infection Surveillance System (NNIS) reported that in 2002, the median rate of VAP per 1000 ventilator-days in NNIS hospitals ranged from 2.2 in pediatric ICUs to 14.7 in trauma ICUs. In other reports, patients receiving continuous mechanical ventilation had 6-21 times the risk of developing

hospital-associated pneumonia compared with patients who were not receiving mechanical ventilation (CDC, 2007). As a result, in the last two decades, most of the research on hospital-associated pneumonia has been focused on VAP.

Data from the National Nosocomial Infections Surveillance System (NNIS) reported a median VAP rate of 2.2 to 14.7 cases per 1000 patient days of mechanical ventilation (Cason, Tyner, Saunders, & Broone, 2007). VAP complicates the course of recovery of approximately 8% to 28% of all patients receiving mechanical ventilation. Patients who acquire a VAP during mechanical ventilation have an estimated mortality rate of 20 % to 70 % (Cason et al., 2007). VAP also causes prolonged hospital length of stay with a cost burden ranging from \$30,000 to \$40,000 per case. Reducing the risk of VAP can be achieved through multiple nursing and medical interventions and should be considered high priority in Intensive Care Units (Cason et al., 2007).

Hospital acquired pneumonia (HAP) is typically caused by a wide spectrum of bacterial pathogens, are commonly polymicrobial, and rarely due to viral or fungal pathogens in the immunocompetent host (STS, 2007). It accounts for up to 25% of all ICU infections and for more than 50% of the antibiotics prescribed (STS, 2007). In 2006, seven states implemented mandatory reporting of all Hospital-acquired infections and other states are considering this mandated legislative maneuver. When a hospital-acquired infection has been confirmed, patients have longer hospital stays up to 7 to 9 days per patient. With the initiation of the new reimbursement system, the Centers for Medicare and Medicaid services will eventually reimburse less than 5% of the additional cost as a result of a hospital acquired infection (CMS, 2007). Added costs have been

estimated to range from \$20,000 to \$40,000 per case (STS, 2007). In addition to costs, patients have an increased utilization of sedatives, pain medications, and antibiotics (STS, 2007). Implementation and utilization of timely interventions and protocols as well as other strategies to prevent hospital-acquired pneumonia have been long in coming. Healthcare professionals must focus on a collaborative effort to prevent nosocomial infections.

Background and Significance

Pneumonia in the mechanically ventilated patient does not represent a major portion of patients who have nosocomial pneumonia but patients are at the highest risk for acquiring the infection, resulting in prolonged length of stay and increased risk of death (Cason et al., 2007). The etiologic agent of pneumonia often remains unknown in 20% to 50% of cases and identifying new lung pathogens is a major public health goal (CDC, 2007).

The first CDC Guidelines for Prevention of Nosocomial Pneumonia were published in 1981. Guidelines addressed the main infection-control problems related to hospital acquired pneumonia at that time which was large-volume nebulizers attached to ventilators and received improper processing such as cleaning and disinfection or sterilization of respiratory-care equipment.

The Centers for Disease Control and Prevention (CDC) reported that 63% of patients admitted to an ICU already have oral colonization with a pathogen associated with VAP (Cason et al., 2007). Microbial colonization of the oropharynx is an important risk factor for Ventilator-Associated Pneumonia (Cutler & Davis, 2005).

Oral contamination includes the accumulation of dental plaque, oral microbial flora. Local oral immunity has an impact on a number of organisms that can cause VAP. Oral care interventions that prevent the accumulation of plaque and stimulates local oral immunity in the patients' early period of hospitalization may help to reduce VAP (Munro & Grap, 2004).

Oral health may become compromised by medical conditions, medications, various treatments, ICU equipment, and the inability of the patient to care for self. Individuals who are healthy have normal oral flora identified as viridans streptococci which is predominately gram positive. Normal flora has been found to change in the critically ill to a more virulent form, gram negative bacteria, responsible for VAP, and can occur within 48 hours of admission to the hospital (Munro & Grap, 2004).

There are many factors that can increase bacterial colonization of the oropharynx. Dental plaque can be a source of colonization. The endotracheal tube provides a direct pathway for bacteria to enter from the oropharynx. The endotracheal tube itself promotes colonization in combination with interfering with the patients' normal cough reflex and function of the mucociliary escalator (Munro & Grap, 2004).

The NNIS provides standardized case definitions, data collection methods, and computerized data entry and analysis. By ICU types, patients have been monitored using site-specific, risk-adjusted infection rates. During 1990-1999 risk-adjusted infection rates decreased for VAP (CDC, 2007). Ventilator-associated pneumonia rates were highest in a surgical ICU at 13.0 cases of pneumonia per 1,000 ventilator days, with the lowest in the pediatric ICU.

Weber et al. (2007) concluded from a prospective hospital wide surveillance study that the primary infecting flora in ventilator patients included gram-positive cocci (32% *Staphylococcus aureus*); gram-negative bacilli (59% *Pseudomonas aeruginosa*); *Stenotrophomonas maltophilia* 6.75%, *Acinetobacter* species 75%; and miscellaneous pathogens 9%. Patients with hospital-acquired pneumonia when compared with patients without ventilator-associated pneumonia had similar frequency of infections with oxacillin-resistant *Staphylococcus aureus* but less frequent cases of *Pseudomonas aeruginosa*, *Acinetobacter*, and *S. maltophilia* (Weber et al., 2007).

Empirical therapy for both hospital and ventilator associated pneumonia is recommended. Weber et al. 2007 defined empirical therapy as the choices of antimicrobial agents that are made on the basis of the most likely infecting flora. Therapy would be modified accordingly to time since admission, prior receipt of antibiotics, and presence of certain risk factors (e.g., residence in an extended care facility or dialysis patient). Hospital-acquired pneumonia has a higher frequency of gram-positive cocci and a lower frequency of infection with nonenteric gram negative bacilli. Understanding the causative organisms allows healthcare professionals to look at all aspects of Nosocomial VAP prevention and treatment.

Adherence to an evidenced-based weaning protocol for mechanically ventilated patients was less than 1% at a university teaching hospital in a study (McClean, Jensen, Schroeder, Gibney & Skjpadt, 2007). The authors sought to determine the effectiveness of using an implementation program, the Model for Accelerating Improvement, to improve adherence and clinical outcomes after restarting mechanical ventilation

weaning protocol. A prospective comparative design approach was utilized with before and after samples obtained. The authors reported that after the intervention the rate of unsuccessful extubations decreased and staff understanding of and adherence to the weaning protocol increased significantly. Implementing the Model for Accelerating Improvement increased understanding and adherence of protocol directed weaning and reduced the rate of unsuccessful extubations. Development and implementation of an oral care protocol could prove beneficial to the prevention of ventilator associated pneumonia.

Self-reports by nurses regarding the use of evidenced-based best practices as recommended by the CDC for prevention of ventilator-associated pneumonia are not consistently or uniformly employed (Cason et al., 2007). Nurses report hand washing at 82% but the observed rate was only 22%. The authors reported a gap between what nurses do and nurses think nurses do. The disparity between what nurses think nurses do and what is actually documented raises concerns about the reliability of documentation and consistency of practice (Cutler & Davis, 2005). Practices have also been found to vary from site to site therefore further investigation is needed.

Oral comfort and hygiene measures have always had an important impact on the critically ill individual receiving mechanical ventilation but gaps exist between what oral care interventions are indicated and the actual care received (Cutler & Davis, 2005). Prior to 2005, no comprehensive protocols or standards were in place which defined tasks, methods, and frequency of oral care required to provide optimal outcomes.

Immense variability often exists in oral care practices between and among healthcare practitioners. Oral care discrepancies often exist in documentation of medical records and self-report by nurses. As a result, microbial colonization of the oropharynx and dental plaque occurs which is associated with systemic and respiratory diseases, most notable ventilator-associated pneumonia (VAP) Cutler et al. (2005).

This study is significant as the findings will provide the evidence needed to guide clinical practice about oral care and practices that could prevent ventilator-associated pneumonia in mechanically ventilated patients.

Problem

VAP is a major complication of mechanical intubation and serious patient event. Acutely ill patients often have a depressed level of consciousness and an impaired gag reflex, leading to pooling of contaminated secretions in the posterior oropharynx (Cutler & Davis, 2005). Microaspiration of oropharyngeal secretions is a major risk factor for Nosocomial pneumonia. Placement of an endotracheal tube provides a direct pathway for organisms to enter the lungs (Cutler & Davis, 2005).

Purpose

The purpose of this partial-replication study (Cutler & Davis, 2005) is to identify current practices of oral care in patients receiving mechanical ventilation and measure compliance with an intervention of standardized oral care.

Research Questions

1. What are the current oral care practices provided by acute care nurses in patients receiving mechanical ventilation?

2. What is best practice for oral care interventions in mechanically ventilated patients?
3. Is there a difference in the compliance rate of oral care by ICU nurses following a standardized educational initiative?

Organizing Framework

Cutler and Davis (2005) developed the organizing framework utilizing the Guidelines for Preventing Healthcare Associated Pneumonia from the recommendations of the Centers for Disease Control and Prevention (2003) (CDC) and review of current literature. The CDC recommendations include the development and implementation of a comprehensive oral hygiene program (that might include the use of an antiseptic agent) for patients in acute-care settings who are at risk for the development of healthcare-associated pneumonia (CDC, 2003). This includes all mechanically intubated patients. The authors outlined steps that can be utilized to identify and adapt useful and appropriate nursing research for use in nursing practice settings.

This framework is appropriate for this study because it provides the guidance needed to ensure oral care will benefit the patient by showing a reduced incidence of Ventilator-associated pneumonia. Active ongoing surveillance for ventilator-associated pneumonia and promote to the health care providers that learning new methods of delivery of care based on research supports the care provided.

*Definition of terms**Conceptual Definitions.*

1. Oral care practices: any oral care assessment or intervention that are is provided to the mechanically ventilated patient by healthcare practitioners including tools used as well as defined tasks, methods, and frequency of care (Cutler et al., 2005).
2. Critically ill mechanically ventilated patient: any patient which requires placement of an endotracheal or tracheotomy tube in order to sustain life (Cutler et al., 2007).
3. Best practice for oral care: developed by the authors utilizing a combination of recommendations from the CDC and review of the literature (Cutler et al., 2005).
4. Compliance rate of oral care: the percent of time the oral care protocol was followed by critical care nurses caring for mechanically ventilated patients before and after an educational initiative (Cutler et al., 2005).
5. Standardized educational initiative: an educational program provided to healthcare practitioners defining appropriate oral care tasks, methods, and frequency. Education provided regarding the incidence of Ventilator-associated pneumonia, causative pathogens, prevention interventions, and care (Cutler et al., 2005, p. 393).

Operational Definitions.

1. Best Practice: developed from the Centers for Disease Control which recommends a comprehensive oral-hygiene program that might include the use of antiseptic agent for patients in the acute-care settings who are at risk of developing health-care-associated pneumonia.
2. Oral Care Data Collection Tool: an instrument developed by Cutler et al. (2005) to measure current oral care tasks performed by the healthcare providers at the bedside during the random blocks of observation. Allows data collectors to document the frequencies of oral care provided.
3. Compliance rate of oral care: The tasks of oral care will be measured through direct observation of oral care during baseline pre-intervention phase and compared measured tasks post-intervention phase after an educational initiative provided to all critical care nurses and respiratory therapists.

Limitations

The major limitations include the evaluation procedures of 4 hour blocks. This may have caused bias as each block encompassed less than an entire day. As a result, the true hourly frequency of oral care performed could not be determined. The larger the unit the more difficult the researcher may have to observe oral care. There were no hours of observations from 11pm to 5am and limited observations between 8pm and 11pm so assumptions were made during these time frames.

Assumptions

Nurses would typically not provide oral care during the hours of 11pm to 5am as the majority of nursing staff would not disturb a sleeping patient to provide oral care. There is also assumption that the same oral care frequencies and techniques were provided during the hours of non-observation. Oral care will reduce incidence of VAP.

Summary

Ventilator-associated pneumonia is a health concern for all practitioners and is a safety issue for mechanically intubated patients. Nosocomial pneumonia is one of the most common hospital-acquired infections. Care provided to patients who receive mechanical ventilation should be evidenced-based and consistent day to day. Lack of oral care has shown to have a direct impact on the outcome of mechanically ventilated patients. The purpose of this study is to determine what current oral practices exist through direct observations of oral care. An additional purpose of this study is to determine what is considered best-practice for oral care. This will occur through an extensive literature review as well as recommendations from the CDC. The purpose of this study is to determine if there is a difference in the compliance rate of oral care provided by critical care nurses after an educational intervention of a standardized oral care protocol (Cutler & Davis, 2005).

Chapter II

Literature Review

Oral care and hygiene measures are important aspects of nursing care for patients who receive mechanical ventilation. Gaps exist between what oral care measures are indicated and the actual care patients receive (Cutler & Davis, 2005). The purpose of this study is to observe current practice, define best practice, and measure compliance of a standardized comprehensive oral care protocol after an educational intervention.

The literature review consists of selected research studies that have been done on oral care interventions and practices. This chapter organizes the literature into 6 sections: (a) organizing framework, (b) meta analysis, (c) causes of ventilator associated pneumonia, (d) patients' perception of ventilation, (e) knowledge and practices of oral care, (f) interventions for VAP

Organizing Framework

Cutler and Davis developed the organizing framework based on Guidelines for Preventing Healthcare Associated Pneumonia from the recommendations of the Centers for Disease Control and Prevention (2003) (CDC) and from a review of current literature. The CDC recommendations include the development and implementation of a comprehensive oral hygiene program (that might include the use of an antiseptic agent) for patients in acute-care settings who are at risk for the development of healthcare-associated pneumonia (CDC, 2003). Guidelines include all mechanically intubated

patients. The authors outlined the steps that can be utilized to identify and adapt useful and appropriate nursing research for use in nursing practice settings. There are seven steps in the model:

1. Assessment of oral cavity upon admission and every 12 hours by the registered nurse to evaluate level of oral dysfunction and determine most appropriate care (Cutler & Davis, 2005, p. 390). Routine brushing of teeth to prevent the formation of dental plaque at least every 12 hours and prn using 1.5% hydrogen peroxide solution, brushing for at least 1 to 2 minutes using gentle pressure while moving in short horizontal or circular strokes.
2. Gently brush surface of the tongue, hard palate, apply moisture (Cutler & Davis, 2005, p. 390).
3. Oral cleansing every 2 to 4 hours and prn for every unconscious or intubated patient to promote healing and maintain the integrity of oral tissues.
4. Oropharyngeal suctioning performed every 6 hours and prn as well as prior to repositioning the tube or deflating the endotracheal cuff.
5. Application of mouth moisturizer inside mouth and on lips.
6. Use of suction swabs to clean teeth, gingival, tongue, and hard palate between brushing or instead of brushing if brushing causes discomfort or bleeding.
7. Provide oropharyngeal suction to remove secretions that have migrated down the outside of the tube using suction catheter tip.

This framework will lend itself well to this study as it provides the steps necessary to guide healthcare practitioners in providing oral care, potentially reducing plaque development therefore reducing the incidence of ventilator-associated pneumonia.

Meta Analysis

Two important, but different interventions aimed at decreasing oral bacterial load, thus decreasing ventilator associated pneumonia, include selective decontamination of the digestive tract by administration of non-absorbable antibiotics by mouth and through the nasogastric tube, and oral decontamination which is applied topically (Chan, Ruest, O Meade, & Cook, 2007). Significant reductions in the rates of ventilator associated pneumonia have been found through previous meta-analyses of selective decontamination of the digestive tract. The purpose of this study was to conduct a systematic review and meta-analysis to estimate the effects of oral decontamination using topical antibiotics or antiseptics on ventilator associated pneumonia and mortality in mechanically ventilated adults (Chan, et al. 2007).

The literature consisted of studies with relevant randomized controlled trials. Previous meta-analyses were also screened. The literature review included analyses that were published and unpublished randomized controlled trials testing the effect of oral decontamination. Trials on selective decontamination of the digestive tract, observational studies, editorials and commentaries were excluded (Chan et al., 2007).

Trials were grouped according to specified prophylaxis agents used for oral decontamination. Oral antibiotics were tested against no prophylaxis and oral antiseptics were tested against no prophylaxis. The primary outcome was the incidence of ventilator

associated pneumonia and mortality. Secondary outcomes were mean duration of mechanical ventilation and stay in the intensive care unit. A total of 11 randomized controlled trials totaling 3,242 patients qualified for the inclusion criteria. Four trials (1,098 patients) assessed the effectiveness of antibiotic oral decontamination whereas seven (2,144 patients) evaluated the effectiveness of antiseptic oral decontamination (Chan et al., 2007).

The primary outcome of ventilator associated pneumonia came from the results of 11 trials (3,242 patients). Four of the trials (1,098 patients) tested antibiotic oral decontamination but did not show any statistically significant reduction in the incidence of ventilator associated pneumonia. Pooled analysis of seven trials (2,144 patients) tested the effects of antiseptic oral decontamination on VAP and showed a significant reduction in incidence. All trials combined favored oral decontamination. Fourteen patients would need to receive oral decontamination with one of the methods to prevent one case of ventilator associated pneumonia. Post hoc subgroup analysis on diagnostic criteria for VAP compared the subgroups only in antibiotic trials. Trials that utilized quantitative cultures of bronchoalveolar lavage fluid showed a trend toward greater treatment effects compared with trials that relied on less invasive diagnostic measures (Chan et al., 2007).

The overall mortality results from the 11 trials found that four trials that tested antibiotic prophylaxis found no effect on overall mortality. Pooled analysis of seven antiseptic trials (2,144 patients) also showed no effects on mortality. Duration of mechanical ventilation was an additional outcome measured.

Of seven trials (1,760 patients), neither the pooled mean difference for prophylaxis using antibiotics or antiseptics showed an effect on duration of mechanical ventilation.

For the overall duration of stay in the ICU eight trials (with 2,113 patients), found that treatments had no influence on the length of stay. Chan et al. (2007) found that prophylactic antiseptic oral decontamination to prevent pneumonia in patients receiving mechanical ventilation was effective. Antiseptic oral decontamination is effective at preventing ventilator associated pneumonia. More evidence is recommended before firm conclusions can be made about antibiotic decontamination. Overall mortality, duration of mechanical ventilation, or duration of stay in the intensive care were not influenced by the treatment to prevent ventilator associated pneumonia. The authors suggested that oral antiseptic prophylaxis alone can significantly reduce the incidence of ventilator associated pneumonia but not mortality.

The role of oral hygiene has been established in maintaining health and well being in patients who are hospitalized in intensive care units. The relationship between oral hygiene and the reduction of oropharyngeal colonization with pathogenic organisms is often less recognized (Berry, Furr, Carrico, & McCurren, 2007). Interventions and strategies that improve patients' outcomes must be examined.

The purpose of this meta-analysis was to evaluate peer-reviewed publications to determine the best available evidence for providing oral care to ICU patients receiving mechanical ventilation and document a research agenda to improve patients' outcomes (Berry et al., 2007). The authors reviewed studies that included intubated patients within

the ICU receiving mechanical ventilation. The focus was on interventions that were designed to affect dental plaque specifically and oral hygiene in general.

Multiple designs were included in the studies as well as a broad range of articles that focused on specific oral care tools and solutions utilized for the seriously ill (Berry et al., 2007). A focus on studies that proposed a link between oral hygiene and systemic diseases were included. Additional research of interest was studies designed to affect dental plaque specifically and oral hygiene in general (Berry et al., 2007). Outcome measures were considered with a focus on indicators of oral health such as microbial counts, plaque indices, oral assessment scores, and validation of tools used in the provision of oral care (Berry et al., 2007).

The classification structure of the Scottish Intercollegiate Guidelines Network was utilized to rate the studies as this rating method uses categorization of levels of evidence. A number of references for the provision of oral hygiene were found in the management of oncology and other medical patients.

Berry et al. (2007) reviewed the use of oral hygiene solutions and equipment and found that a range of oral rinse solutions and equipment were used. Chlorhexidine gluconate mouthwash is an anti-plaque agent with potent antimicrobial activity that does not cause resistance of oral bacterial in low concentrations. The oral spray or rinse was effective at reducing oral colonization of gram-negative organisms. The frequency of use and its relationship to the reduction of VAP incidence requires further research (Berry et al., 2007).

The use of Chlorhexidine was recommended as a B grade showing a body of evidence including studies rated as directly applicable to the target population and demonstrating overall consistency of results.

Sodium bicarbonate mouth rinse helps to dissolve mucus and loosen oral debris. Listerine essential oil mouth rinse was used in only one study and was not recommended for critically ill patients. Hydrogen peroxide mouth wash rinse has been reportedly used for many years with ICU patients. Significant mucosal abnormalities were found in patients treated with hydrogen peroxide mouth rinse. Physiological salt solution (normal saline) test was found to cause drying. In a small study 47 participants did not tolerate the use of physiological salt solution as a mouth rinse. Both uses were categorized as insufficient evidence with no consensus about its efficacy (Berry et al., 2007). Tap water was found to be a source of nosocomial infections in hospitals and its use in this setting is not recommended. Sterile water was found to be cost effective but its use was not rigorously tested and therefore no research data could provide enough evidence or consensus about its efficacy.

Use of toothbrushes and toothpaste was recommended by several authors and the toothbrush with toothpaste is more effective than foam swabs to remove plaque. The use of a small, soft-bristled toothbrush is recommended because it reaches most of the posterior aspects of the mouth and is useful in cleaning the tongue; however its use is to be used with caution with anyone who is immunocompromised. An additional finding was that toothbrushes could be a source of contamination, so a thorough cleaning is recommended, and protection during storage mandatory.

Berry et al. (2007) recommended a category D where non-analytic studies were found, such as case reports and expert opinions (Berry et al., 2007).

Foam and cotton swabs were not found to be effective for removing debris and plaque and even swabs soaked in chlorhexidine were inappropriate and lacked sufficient evidence or consensus. This evidence was also found when using swabs impregnated with lemon and glycerol that were found to contribute to xerostomia and decalcification of tooth enamel.

There was no published report describing a comparison between the multitudes of suction devices used to provide oral hygiene. The devices were only found to remove secretions from the oral cavity. However the importance of removing secretions from the subglottic area is well documented. Suction devices alone were a level D recommendation, insufficient body of evidence.

Oral health assessment strategies were also examined. Reliable and valid assessment tools are needed to document nurses' assessment of the oral cavity and the outcome of the procedure. Although there is limited information of oral assessment tools used, one author included assessments of oral components such as dental plaque, inflammation, salivary flow, bleeding, candidiasis, purulent matter, calculus, staining, and caries (Berry et al., 2007). The scores of assessment tools were compared with scores of dental hygienists and indicated that nurses who use the tools were proficient at detecting changes within the oral cavity.

Berry et al. (2007) concluded that while there is an absence of evidence based on guidelines to direct best oral care practices there is a relationship between poor oral

hygiene and the incidence of VAP. It is vital that adequately powered randomized, controlled clinical trials be undertaken to develop and evaluate oral hygiene practices and inform evidence-based practices. Nurses' perception about the importance of oral care needs further exploration. Few studies have addressed nurses' perception of oral hygiene and discover the barriers that exist to provide and adhere to evidence-based practice guidelines.

Causes of Ventilator Associated Pneumonia

To define what constitutes best practice researchers conducted a comprehensive literature review to gather information about factors that cause VAP (Sole, Byers, Ludy, & Zhang, 2003). The CDC grouped risk factors for nosocomial pneumonia into five categories: host factors, surgery, medications, invasive devices, and respiratory equipment. Most instances of VAP are due to aspiration of bacteria from the oropharynx, so oral care management directly influences the development of VAP. The purpose of this prospective descriptive study was to identify pathogens associated with ventilator-associated pneumonia in oral and endotracheal aspirates and to evaluate bacterial growth on oral and endotracheal suctioning equipment.

The sample included 20 patients who were in an intensive care unit (medical, neurosurgical, or surgical-trauma) of a tertiary care facility in Southeastern United States. A power analysis indicated that a sample size of 20 would allow the detection of pathogens on equipment. Inclusion criteria were that all patients were 18 years or older and were orally intubated for at least 24 hours.

Exclusion criteria were: documented presence of a pneumonia or sinusitis at the time of the study, reintubation at any time during hospitalization, diagnosis of HIV or TB, and presence of facial fractures (Sole et al., 2003).

At 24 hours after enrollment, oral and endotracheal aspirates were collected. Eighteen of the 20 were included as one patient died and one was extubated. Interrater reliability was established. Samples were collected by one investigator upon enrollment. Oral secretions and endotracheal aspirates were collected utilizing aseptic technique. Samples were collected again at 24 and 48 hours after enrollment. All specimens were taken to a microbiology research laboratory at a University in Central Florida (Sole et al., 2003).

The findings revealed that at the time of enrollment 17 subjects (94%) had potential pathogens for VAP in oral secretions and 11 (61%) had potential pathogens for VAP in the sputum. The potential pathogens were present in oral secretions in all patients and sputum 67% of time (Sole et al., 2003). Potential pathogens for VAP were identified on suction devices after 24 hours. The devices included: tonsil suction (94%), suction tubing (83%), and distal connection of in-line suction catheter (61%). Gram-positive bacteria were the most common organism found. Storage of tonsil suction from 47 observations was located on a shelf near the patient's bedside (66%). Tonsil suction was free hanging (21%). Devices (13%) were located in the patient's bed and most of the time was left uncovered (51%) (Sole et al., 2003).

Potential pathogens which cause VAP were found in the mouth, endotracheal specimens, and on suctioning devices (Sole et al., 2003). Although this does not imply

all patients will get VAP, the potential is there due to the possibility of micro-aspiration. Many of the organisms are endogenous to the mouth but when aspirated into the lower part of the respirator tract infection may occur (Sole et al., 2003).

The authors concluded that contamination of equipment, such as oral suctioning devices and endotracheal suctioning equipment can become colonized with potential pathogens within 24 hours. Rinsing of in-line equipment could potentially reduce the numbers of pathogens present on equipment thus decreasing the risk of aspiration of the colonized equipment bacteria (Sole et al., 2003). Equipment may be a source of cross-contamination and is often overlooked as a potential contributor. The CDC recommends rinsing non-critical equipment such as tonsil suctioning devices and then placing them on a paper toweling to dry.

Multiple studies have concluded that the prevalence of nosocomial and Gram-negative enteric bacilli pathogens are higher in institutionalized elderly patients with severe pneumonia (El-Solh et al., 2004). Poor dental hygiene has been linked to respiratory pathogen colonization in residents of long-term care facilities, and dental plaque may serve as the reservoir for these virulent pathogens, especially in high-risk patients with poor oral hygiene (El-Solh et al., 2004). The purpose of this study was to examine the relationship between dental plaque pathogens and lower respiratory tract infections in hospitalized institutionalized elderly individuals who have developed hospital-acquired pneumonia during mechanical ventilation (El-Solh et al., 2004).

The hypothesis was “The colonization of dental plaque with aerobic respiratory pathogens acts as the reservoir for lower respiratory tract infections in patients requiring

hospitalization” (El-Solh et al., 2004, p. 1576). The authors utilized a prospective design to assess the prevalence of plaque colonization of hospitalized critically ill elderly patients by aerobic respiratory pathogens. The authors sought to describe a relationship between the pathogens from the lower respiratory tract of individuals who have developed hospital-acquired pneumonia.

The sample included all nursing home patients requiring mechanical ventilation at a University hospital critical care unit. Data collection included demographic (APACHE II), age, gender, ADL score, comorbid illnesses, and Charlson index scores. Oral examinations with microbiological sampling were completed upon admission by a single examiner. This provided a plaque index score and enumeration of the number of remaining teeth. The Plaque index is a measure of the debris deposited around and between the teeth and was performed in six deliberate teeth (El-Solh et al., 2004).

The culture was described as positive if any of the following organisms were cultured: *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Klebsiella pneumoniae*, *Serratia marcescens*, *Proteus mirabilis*, *Escherichia coli*, *Enterobacter cloacae*, or *Pseudomonas aeruginosa* (El-Solh et al., 2004). Dental plaque was considered to be colonized if $\geq 1.0\%$ of the total cultivable flora were identified as respiratory pathogens.

Assessments of lower respiratory tract infections were also measured and surveillance was performed daily. Criteria for suspected pneumonia followed the CDC guidelines which included: development of new radiographic infiltrate compatible with pneumonia and the presence of two or more parameters:

(a) purulent endotracheal aspirates; (b) temperature of > 38 degrees C or < 35.5 degrees C; or (c) a WBC count of $> 12,000$ cells/uL, and/or left shift or leucopenia of $< 3,000$ cells/uL (El-Solh et al., 2004). Additional data included isolation of the chromosomal DNA bacterial isolates that were isolated from each of the samples.

The findings resulted in 49 institutionalized elderly patients requiring mechanical ventilation, 22 male patients (45%) and 27 female patients (55%). Admission diagnosis varied for all patients. Findings were that colonization of dental plaque with aerobic respiratory pathogens is highly prevalent in institutionalized critically ill elderly patients. The most frequent colonized respiratory organisms found included *Staphylococcus aureus* and Gram negative enteric bacilli. Dental plaque can be a reservoir of respiratory pathogens responsible for Hospital Acquired Pneumonia in the elderly patient (El-Solh et al., 2004).

El-Solh et al.'s (2004) findings were consistent with the trend toward a higher incidence of pneumonia in patients with poor dental hygiene. The findings confirmed the association between the colonization of dental plaque and lower respiratory infections in institutionalized patients using molecular genotyping. The relationship between colonization of dental plaque and respiratory pathogens causing lower respiratory tract infection is evident. Active programs should be instituted by all healthcare practitioners to enhance dental care and improve daily oral hygiene.

Patients often develop changes in normal oral flora within 48 hours of admission to the intensive care unit. Normal flora rapidly changes to gram-negative rods which are more virulent organisms. The aim of this non-experimental, longitudinal, descriptive

design study was to describe the relationship between oral health status and the development of VAP. Munro et al. (2006) examined the relationship between oral health through assessment, cultures of oral specimens, salivary immune components, and the development of VAP as indicated by the Clinical Pulmonary Infection Score (CPIS). In addition, Munro et al. (2006) sought to determine if changes in oral health during the first 7 days of mechanical ventilation and the relationship between microbial colonization of the oropharynx and colonization of the trachea over time.

The sample included patients from a medical respiratory ICU at the Virginia Commonwealth University Health Systems where approximately 50% of the patients admitted received mechanical ventilation. Data were obtained during a 7 day period or until extubation. Exclusion criteria were patients who had already been intubated during the current hospitalization. Data on VAP and oral health were collected on day 1 (baseline), 4, and day 7 (Munro et al., 2006).

A visual analog scale (VAS) was utilized to assess components of the oral health status. The scale was developed in collaboration with a dental hygienist faculty member and a biostatistician. The components measured included: (a) baseline count of decayed, missing, and filled teeth, (b) assessment of oral cavity, (c) cultures of an oral specimen, (d) measurement of salivary volume, and (e) analysis of two salivary immune components; immunoglobulin A and lactoferrin. The identical scale was utilized to obtain an assessment of: (a) dental plaque, (b) inflammation, (c) bleeding, (d) purulence, (e) candidiasis, (f) calculus, (g) stains, (h) caries, and (i) salivary flow (observed salivary volume).

Development of VAP was determined by using the CPIS points which include: (a) body temperature, (b) white blood count, (c) tracheal secretions, (d) oxygenation, (e) findings on chest radiograph, and (f) cultures of tracheal aspirates (Munro et al., 2006). Points were given for each variable of the CPIS with a resulting summed score that was used to describe the risk of VAP. Other risk factors contributed to the development of VAP and included demographics and severity of illness scores (APACHE) II. Data were collected from the time of enrollment through day 7 of the intubation or extubation. Oral health status and CPIS were determined 3 times during the study and data related to other risk factors were collected daily (Munro et al., 2006).

Munro et al. (2006) found that baseline oral health status of critically ill patients is often compromised on admission and deteriorates over time. When compromised, a relationship exists between oral health and ventilator associated pneumonia. The results support a link between an increase in dental plaque and the development of VAP. The link was not significant but influenced by interactions among dental plaque, baseline severity of illness and baseline pulmonary infection status (Munro et al., 2006). The effect of increased plaque was most predictive of pneumonia in patients with high APACHE scores and lower baseline CPIS (Munro et al., 2006).

Munro et al. (2006) also found an association between dental plaque scores and risk for VAP. Dental plaque may potentially harbor pathogens responsible for VAP. Potential organisms found included *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Lower baseline salivary volumes were associated with increased day 4 CPIS (Munro et al., 2006). Salivary flow functions in mechanical removal of oral organisms.

A reduction in salivary flow over time contributed to the increased risk of VAP. Multiple factors, frequently medications, affected the distribution of salivary volumes and include benzodiazepines, haloperidol, and meperidine. Methods to increase oral mucosal hydration may potentially help (Munro et al., 2006).

The authors concluded that salivary lactoferrin and immunoglobulin A were found to change during critical illness (Munro et al., 2006). Dental plaque and salivary volume can be determined by the bedside clinician and are associated with a risk of VAP. Oral care interventions that help to prevent the accumulation of dental plaque and stimulate oral immunity during the early phase of mechanical ventilation may help reduce the incidence of VAP (Munro et al., 2006).

Patients' Perceptions of Ventilation

Some individuals suffer from chronic and persistent alveolar hypoventilation require mechanical ventilation at home (Sandman & Rasmussen, 2005). This type of patient often requires frequent visits to outpatient departments or hospital E.D's. Home care requiring mechanical ventilation may result in social isolation (Sandman & Rasmussen, 2005). The purpose of this study was to explore the meaning and expectations of becoming dependent upon mechanical ventilation. A phenomenological-hermeneutic approach was used.

The study took place in Sweden and utilized a purposive sample of 13 adults who were about to be started or already had started mechanical ventilation treatments at home. The sample was selected through an initial invitation to the study made by various clinicians involved in differing aspects of respiratory care services.

This was to enhance the various aspects of respiratory failure, a variety of reasons for treatment of mechanical ventilation, age and gender.

Data were analyzed using a phenomenological-hermeneutic approach (Sandman & Rasmussen, 2005). Three phases included: naïve interpretation, structural analysis, and comprehensive interpretation (Sandman, & Rasmussen, 2005). In the naïve interpretation phase, individuals believed that initially becoming dependent on a ventilator is a life-changing event. Life is handed over to an unfamiliar life-sustaining machine. This situation has contrasting meanings in that it is both an unburdening and a burdening occurrence. The unburdening occurrence is there is relief from dyspnea and patients has a chance to recapture a more active lifestyle. Burdening occurs when the ventilator is seen as a symbol of death and illness. Fear is also ever present at the thought of the treatment ever failing (Sandman & Rasmussen, 2005).

In the structural analysis phase there were two aspects of focus. The first part was disclosed structure. In this phase the transcripts were divided into different narrative passages and given a category name. A common structure of eight categories was revealed. The common structures included: (a) "Framing/situating yourself and your story," (b) "Experiences of illness," (c) "Decision-making," (d) "Relations to ventilator" (e) "Relationships," (f) "My home and on leaving my home," (g) "Existential thoughts," and (h) "The future" (Sandman & Rasmussen, 2005, p. 40).

The second structural analysis focus revealed the meaning of becoming dependent upon a ventilator based on the themes. Themes were evaluated in relation to burden or not a burden. The findings from this analysis were that the individual initially

gradually lost energy, the ability to breath, and handed themselves over to the healthcare professionals. The initial response can be described as "alien bodily atmosphere."

Healthcare providers were considered to be a jigsaw puzzle, trying to place all the pieces together. The ventilator was described as the final piece or solution to the puzzle. Long periods of struggling to breath, sleep deprivation, and enormous fatigue were key factors in the interpretations (Sandman & Rasmussen, 2005).

Two composite stories emerged from the data (Sandman & Rasmussen, 2005). In the first Composite story, "To get ones breath," data described how the individuals truly felt. The first thoughts were that the work of breathing, which used to be all consuming, was alleviated. Patients developed a relationship with the ventilator and a feeling of faith and confidence in the machine while feeling healed. Being out of the hospital gave individuals a feeling of power. Sexual relationships were no longer considered important. What was important was that the spouse was finally able to get sleep without ensuring the patient was still breathing.

The second composite story was called "To hold one's breath," and included thoughts of the body decaying (Sandman & Rasmussen, 2005). The treatment was not considered helpful or of any relief. There was a lack of motivation to keep up the fight. Getting off of the ventilator was all consuming in thought. There was anger directed at how much control the ventilator had over life. Worry was constant, especially about not being able to participate in life. Going home was good, but was accompanied with fear and uncertainty. Having to rely on personal assistants was frightening. Being around friends caused anxiousness, not only for the vent dependent, but also for friends.

Some healthcare professionals offered faith, courage, and time which gave spiritual energy, while others insulted and took away rights. Refusing treatment was seriously considered.

The conclusions were that starting home mechanical ventilation is a life changing event and influences every aspect of life situations, the body, and spirit (Sandman & Rasmussen, 2005). There are many variations in meanings of lived experiences of becoming dependent upon home mechanical ventilation. There was a need for professionals to be open and sensitive to a patient's description of experiences of illness and health (Sandman & Rasmussen, 2005).

Knowledge and Practices of Oral Care

Oral airways, endotracheal tubes, and oral feeding tubes keep the patients mouth open continually. Defining current oral care practices is essential in determining best practice of oral care in the prevention of Ventilator Associated Pneumonia. Defining best practice can occur by assessing the oral care practices of other disciplines, such as dental hygienists. The authors sought to discover the oral status of patients in an intensive care unit, evaluate the effects of a defined oral care protocol on the oral health status of patients in an intensive care unit, and compare oral assessments of a dental hygienist with intensive care nurses (Fitch, Munro, Glass, & Pellegrini, 1999).

Fitch et al. (1999) used a 12-bed MRICU in a large teaching hospital to conduct the study in Richmond Virginia. About half of the patents (50%) required mechanical ventilation. Inclusion criteria were being 18 years or older and having been hospitalized in the MRICU longer than 48 hours. Exclusion criteria were neck/head surgery,

irradiation, or chemotherapy in the 6 weeks prior to intubation. A total of 60 patient participated, with 30 in the comparison group and 30 in the treatment group.

The authors used a nonequivalent comparison group and longitudinal design which consisted of 3 phases. In phase 1, the oral assessment data on the comparison group were collected by a dental hygienist. In phase 2, nurses were instructed in oral assessment and given an oral care protocol developed by a dental hygienist. During this phase an educational program was provided including a slide presentation and a self-paced instructional book. In phase 3, the oral care protocol was implemented in the treatment group, and oral assessment data for the group was collected separately by the dental hygienist and by the ICU nurses.

The oral assessment tool was developed by the dental hygienist and had face and content validity. The tool addressed multiple components including: dental plaque, inflammation, salivary flow, bleeding, candidiasis, purulent matter, calculus, stain, and caries. The oral assessment tool was a 100-mm visual analog scale for each component. The standardized tool for assessment was developed in conjunction with a member of the dental hygiene faculty and a biostatistician. The validity was ensured through expert review by three members of the dental hygiene faculty.

Fitch et al. (1999) found that the mean inflammatory score was significantly lower ($p = .03$) in the treatment group (mean, 3.9; SEM, 3.0) than in the comparison group (mean, 12.4; SEM, 2.2). Although not significant, the mean scores of the treatment group were lower than the comparison group on the scales of candidiasis, purulence, bleeding, and plaque. Correlations between scores for oral care assessments done by the

nurses with assessments done by the dental hygienist were positive. Nurses were able to appropriately assess the oral status of the critically ill in all areas (Fitch et al., 1999).

Other findings were that nurses were able to appropriately assess oral status in all categories. In multiple longitudinal observations made by the dental hygienist, variability was noted in scores for salivary flow, purulence, plaque, and candidiasis. The scores were expected to change over the 3-day observation period. Scores for caries, stain, and calculus, which were expected to remain constant, did not vary.

Finding from this study showed a positive relationship practice of Dental Hygienists and Nurses on oral care to indicate that nurses appropriately assess oral status in the categories of salivary flow, purulence, plaque and candidiasis. Recommendations included the implementation of a well developed oral care protocol delivered by nurses Fitch et al. (1999). A collaborative interaction with a dental hygienist could improve the nurses' knowledge and abilities. Nurses were able to significantly lower plaque in the experimental group which has been found as the reservoir for the pathogens for VAP.

Grap, Munro, Ashtiani, and Bryant (2003) believed oral care was not being delivered appropriately in hospitals. Oral care interventions to some practitioners are seen as comfort measures and given low priority in times of high acuity. The purposes of this study were to describe oral care interventions reported by nurses and determine how often oral care interventions were documented (Grap et al., 2003). Information regarding documented oral care practices could guide practitioners in the development of a protocol that could improve patient outcomes (Grap et al., 2003).

The study took place in a large southeastern academic medical center. The sample was drawn from the medical respiratory, surgical trauma, and neuroscience Intensive Care Units. Two types of subjects were included: nursing care providers in the ICU, and critically ill patients. ICU nursing staff participated through completion of a survey. The total number of nursing staff employed (including registered nurses, licensed practical nurses, and patient care technicians) was obtained from the nurse manager for each unit with a total of 170 nursing care providers surveyed. The sample of critically ill patients was drawn from ICU; the sample was approximately 60% male and 40% female and ethnically diverse (approximately 48% African American, 47% white, and 5% of other ethnic heritage). All patients were 18 years old or older and present in the units on five randomly selected data collection days during a 1 month period. Data from the critically ill were obtained from their medical records (Grap et al., 2003).

An Oral Care Survey was designed by the researchers and placed in the mailboxes of each staff member, with a description of the study. Large envelopes were placed in each unit for return. One week later a second survey was placed in the staffs' mailboxes. Demographic data were included. The survey asked pertinent questions about nurses' performance of oral care (Grap et al., 2003). The survey asked how often oral care was generally performed for nonintubated patients and intubated patients. The frequency of using toothbrushes, toothettes, mouthwash, isotonic sodium chloride solution, toothpaste, peroxide mixture, chlorahexidine or other products were used in provision of oral care for non-intubated and intubated patients utilizing an 100-mm analog scale (with the origin representing 0% of the time and the endpoint representing 100% of the time).

Respondents were also asked to respond to a 100-mm analog scale. The question was, “Considering all interventions you complete for critically ill patients, rate the priority of oral care on a scale of 1-100 (1 being low priority, and 100 being highest priority)” (Grap et al., 2003, p. 533). Space was provided for respondents to write comments.

Responses to the questions about frequency of oral care were tabulated and responses to questions about frequency of oral care products were quantified by measuring the distance in millimeters from the origin of the response line to respondent’s mark. The frequency of documented interventions at five randomly selected times were drawn prospectively from a pool of dates during a 1-month period. Oral care interventions were recorded from the ICU flow sheet in the medical records for the previous 24 hours. Demographic data were also collected on the patients. Inclusion criteria included were all patients who were 18 years or older and in the ICU at the time (Grap et al., 2003).

The findings of the oral care survey were that 75% of nurses reported providing oral care 2-3 times /day for non-intubated patients and 72% provided care 5 times/day or more for intubated patients (Grap et al., 2003). In response to the question of using toothpaste and toothbrush, nurses used toothbrushes more often in the non-intubated patients than the intubated patients. Foam swabs were primarily used for intubated patients. Oral care priority was reported at 53.9% (1=lowest/100=highest). The authors discovered marked variance from the nurses self-reports to what was actually found in the medical record documentation.

Oral care found on the flow sheets for the 70 ICU patients during the previous 24 hours were identified 205 times with a mean of 1.2 times per patient (Grap et al., 2003).

The authors concluded that data collected from the medical record indicated that documentation of oral care was not congruent with nurses' self-reports of oral care practices. The authors believed the reasons ICU nurses are reluctant to provide oral care to intubated patients was fear of endotracheal tubes, limited access, and fear of displacement or dislodgement of tube. Other comments included that the perceptions of oral care contribute less to health and well-being or have lower priority than other interventions, patient acuity, and staffing levels (Grap et al., 2003).

The barriers that impact whether nurses have the ability to perform oral care may define best practice. There are multiple factors that influence oral care including; education, sufficient time to provide oral care, prioritizing oral care, and not viewing oral care as unpleasant. Oral care is a significant nursing procedure that could reduce VAP (Furr, Binkley, McCurren, & Carrico, 2004). The purpose of this study was to assess nurses' attitudes and practices of oral care. A second purpose was to determine predictors of quality oral care.

The units were selected using a systematic interval technique. The total sample size was 556 nurses (82%). Exclusion criteria were all military installation, USA territories, ICU's that had closed, or an ICU that was no longer a separate unit (Furr et al., 2004).

The dependent variable was an indexed item which represented the quality of the provisions of oral care by nurses to ICU patients (Furr et al., 2004). A quality of care score was developed by how often techniques were used.

A hospital trained dentist ranked the quality of oral care techniques. The techniques were ranked with higher scores reflective of superior hygienic quality. “Seven independent variables were used and clustered into three conceptual groups: experience and education, nurses’ perception of hospital’s facility and support for providing oral care, and nurse’s attitudes toward oral care practices” (Furr et al., 2004, p. 457). Nurses’ experiences and education were recorded. Nurses’ perceptions of hospital support for oral care was measured by responses to three 5-point Likert-scaled statements. Two Likert-scale items addressed attitudes to provisions of oral care.

The findings of the bivariate analysis indicated that education, having sufficient time, seeing oral care as a priority, and not viewing oral care as unpleasant were all predictors associated with higher quality care (Furr et al., 2004). Correlation coefficients for variables used in analysis supported the authors hypothesis that: (a) the more education in oral care, the better the oral care practice will be [$p = 0.120$] (b) if nurses have sufficient time to provide oral care, the better the oral care practice [$p = 0.149$]; (c) the more priority given to oral care, the better the oral care practice [$p = 0.166$]; and (d) the more unpleasant oral care is to provide, the lower the level of oral care practice [$p = -0.121$] (Furr et al., 2004, p. 458).

Furr et al. (2004) concluded that oral care is a multi-tired process. In order to improve oral hygiene in ICUs it is recommended that institutional factors must be

addressed which include the adequate time. The authors recommended continuing education for staff to increase prioritizing oral care and to reduce perceptions of it being unpleasant thus reducing nosocomial infection.

Two nursing interventions that have been recommended to decrease the risk of aspiration pneumonia in hospitalized patients are oral care and elevation of the head of the bed to 30 degrees (Hanneman & Gusick, 2005). Gastric or oropharyngeal contents can become aspirated into the lungs when the head of the bed is not above or at 30 degrees. This is a major contributor to the development of nosocomial pneumonia. The objectives of the replication study were to: (a) describe oral care and practices for positioning the head of the bed as self-reported by nursing personnel in the adult ICU's, (b) estimate reliability of the survey instrument, (c) compare the frequency with which oral care is documented in the medical record with self-reported frequencies, and (d) compare direct observations of positioning of the head of the bed with self-reported practices (Hanneman & Gusick, 2005).

In the original study completed by Grap et al. (2003), 77 healthcare practitioners were surveyed in three ICU's to determine self-reports of oral care products used, methods used, and frequency of oral care provided. Hanneman & Gusick (2005) extracted information from the medical records of 170 ICU patients on the frequency of oral care and the types of products used. Findings were that oral care was documented less often (mean 1.2 times per 24 hours) than reported in the survey (2.5 times per 24 hours for nonintubated patients and > 5 times per 24 hours for intubated patients).

Two types of data were collected: survey and bedside observation. The survey recorded usual oral care and practices, and position of head of the bed practices of both the intubated and nonintubated patients. Bedside data consisted of oral care documentation for the previous 24 hours and observations of the position of the head of bed. The survey data were retrieved from registered nurses and patient care assistants in nine adult ICUs in a 946-bed, nonprofit, university-affiliated hospital (Hanneman & Gusick, 2005).

Bedside data were collected from the very same units 4 to 8 weeks after completion of the survey. The survey was modified to include the time frames in several questions. A visual analog scale was used to format the responses for multiple questions. Evidence of instrument reliability was established (Hanneman & Gusick, 2005).

Bedside observation procedures were conducted by a total of nine members of the Research Committee and Journal club after training was provided in bedside data collection (Hanneman & Gusick, 2005). Evidence of interrater reliability was established. The frequency of oral care and type of procedures used were retrieved from the ICU flow sheet from the previous 24 hours for all ICU patients. Elevation of the head of bed was estimated by visualization of the protractor angle reading on each bed. Demographic data were also obtained from the medical records.

Frequencies were tabulated for all the variables. The t-test was used to compare differences in documentation frequency and observed positioning of the head of bed. Analysis of the surveys revealed a 47% response rate which was equivalent to the

response rates in the study by authors (Hanneman & Gusick, 2005). The majority of the returned surveys were from registered nurses.

Hanneman and Gusick (2005) found outcomes were consistent with the findings from Grap et al (2003). Documentation of oral care was lower for both nonintubated patients (1.8 times per 24 hours) than reported in the survey (3 times per 24 hours and 4.2 times per 24 hours, respectively). Use of higher elevation of head of the bed in nonintubated than in intubated patients was confirmed with bedside observations. An important finding from this replication study was that sample size was larger than the original sample.

Other findings were comparable in the two samples with the exception of the priority assigned to oral care. Higher priority ratings were assigned in the second study when compared to the original study (71% vs. 54%). This may be due to the fact that the replication study site was a magnet hospital and had active programs on continuous quality monitoring and research translation which could explain the higher priority to oral care (Hanneman & Gusick, 2005).

Hanneman and Gusick (2005) concluded that findings were comparable to results of the original study by Grap et al. (2003), nurses reported more frequent oral care than was documented. Nurses provided oral care more frequently for intubated patients than for nonintubated patients. Nurses reported using toothpaste and toothbrushes more often for oral care for nonintubated patients than for intubated patients, reported using sodium chloride, hydrogen peroxide mixture, chlorhexidine, and toothette swabs more often for oral care for intubated patients than for nonintubated patients. This patient population

should have a moderate-to-high priority for oral care. The heads of bed was in accordance with self-reports.

Microaspiration of oropharyngeal secretions is considered a major risk factor for the development of ventilator associated pneumonia. Secretions and plaque are often colonized up to 65% with harmful respiratory pathogens in critically ill intensive care patients (Binkly, Furr, Carrico, McCurren, 2004). Prevention strategies may reduce oral respiratory colonization and respiratory infections. Multiple strategies are thought to help reduce oral colonization and include: selective oropharyngeal decontamination with topically applied antibiotics, application of antimicrobial chlorhexidine gluconate, and tooth brushing combined with dental prophylaxis.

The purpose of this research was to determine the types and frequencies of oral care in ICUs around the United States and the attitudes, beliefs, and knowledge of health care workers about oral care (Binkley et al., 2004). A 2-stage cluster sampling method was utilized to obtain a national sample of nurses. This technique was used to target a population that is geographically dispersed and a sampling frame not immediately accessible or determinable. A random sample of 421 ICUs was chosen. Directors were asked to volunteer in the study.

A 27-item questionnaire was designed to collect data related to current oral care practices, training, and attitudes (Binkly et al., 2004, p. 39). The tool was developed by a research team based on the research questions and literature review. Research questions included: (a) what is the type and frequency of oral care provided to ICU patients? (b)

What are the attitudes and belief of ICU health care workers regarding oral care? and (c) How is ICU health care workers trained in oral care?

A packet of questionnaires was delivered to the directors of the units who participated. The total sample size was 556 nurses with an 83% return rate. Classifications of the hospitals ranged from university hospitals, private for-profit hospitals, and federal hospitals (Binkly et al., 2004). The types of intensive care units also varied from Trauma, Surgical, and Neurological units.

A 5-point Likert scale was utilized to measure attitudes and beliefs about oral care practices. Types and frequency of oral care provided were ascertained through checking for any of the following oral care equipment: foam swabs, manual toothbrushes, electric toothbrushes, moisture agents, toothpaste, and mouthwash. The nurses were asked to identify the type of mouthwash used as over-the-counter, alcohol-free, chlorhexidine, normal saline, peroxide, povidone-iodine, or other (Binkley et al., 2004). Oral care training was assessed by two items addressed on the survey. Three questions about attitudes regarding additional oral care training were also included. Likert-scaled questions were used to identify hospital support, supplies, equipment and time given to oral care.

Findings regarding attitudes, beliefs, and knowledge about oral care were perceived as a very high priority for mechanically ventilated patients. Cleaning the oral cavity was found to be difficult or unpleasant by almost 63% of respondents (Binkley et al., 2004). Some actually found oral care unpleasant. Over half the nurses found that the longer the patient was on the ventilator the more difficult it was to provide oral care.

There were no significant differences found by type of hospital with the exception that nurses reported oral care to be a higher priority in not for-profit hospitals than for-profit hospitals. No significant differences in attitudes and beliefs regarding oral care existed between the bachelors' and masters' prepared nurses.

To assess whether the current evidence regarding incidence of ventilator associated pneumonia has been disseminated, a case scenario was presented to the nursing staff. The author determined from the responses that nurses do recognize the mechanism of transmission of bacteria into the lungs of ventilated patient (Binkley et al., 2004). Approximated 88% of the nurses had received adequate training. Nursing education was the primary source of training, but some were self-taught. Only 21% were provided continuing education courses. Some respondents had in-service training provided during the course of providing nursing care.

The authors also reported that nurses who learned about oral care practices through self-instruction were more likely to find oral care unpleasant than nurses who received instruction during training. It was also found that nurses who were self-taught utilized differing types of oral care methods significantly less frequently than nurses who were formally taught (Binkley et al., 2004). Additional findings were that nursing schools were found to focus attention on more advanced technical skills while basic skills are taught from other basic programming. This could be an additional link to some of the voids in knowledge about oral care and ventilator associated pneumonia.

The authors concluded that nurses were aware of the most likely mechanism of transmission of bacteria into the lungs resulting in ventilator associated pneumonia.

The predominant tools used for oral care were foam swabs, moistures, and alcohol-free mouthwashes. A majority of the respondents reported noting a decline in oral status among mechanically ventilated patients for a prolonged period of time indicating current oral care efforts are ineffective. The authors also concluded that the creation of an accepted oral health assessment tool could potentially be useful as a bedside instrument to facilitate oral health assessment and care (Binkley et al., 2004).

Prolonged intubation was defined as requiring mechanical intubation for more than 3 days (McLean, Jensen, Schroeder, Gibney, & Skjpd, 2006). Prolonged intubation has risks including: increased mortality, ventilator-associated pneumonia (VAP), airway trauma from re-intubation, increased need for sedation, and decreased satisfaction among staff, patients, and patient's families (McLean et al., 2006) Mechanical ventilation can potentially be unsafe for patients, however premature discontinuation of mechanical ventilation also has risks which cause potential harm. Re-intubation rates range from 4% to 33% and cause potential harm from airway trauma, gastric aspiration, acute lung injury, cardiovascular compromise, and hypoxia.

The purpose of this study was to describe staffs' knowledge about mechanical weaning protocol and to assess the effectiveness of using an implementation program, the Model for Accelerating Improvement, to improve protocol adherence and clinical outcomes before and after restarting a mechanical ventilation weaning protocol (McLean et al., 2006). The protocol had been in place but adherence was less than 1%.

The authors hypothesized that engaging a multidisciplinary team in making change using the Model for Accelerating Improvement would improve adherence to the protocol and clinical outcomes (McLean et al., 2006).

The sample consisted of 203 critically ill adult patients (103 before intervention and 100 after intervention) drawn from an ICU at a University Hospital in Edmonton, Alberta. McLean et al. (2006) utilized a prospective comparative design. The staff of the Intensive Care unit was allowed to voluntarily participate in focus group sessions, complete two surveys, and take part in a learning session. This content analysis was used to make the necessary changes to the protocol. A total of 112 staff members took part in the focus sessions.

The results of the content analysis were broken down into four categories: awareness, strengths, limitations, and suggestions for improvements. The protocol was then updated. After 5 weeks of meeting with the focus group, the staff was provided the opportunity to take part in a learning session. A total of 101 healthcare professionals participated and provided information regarding the definition of VAP, predictors of successful weaning from mechanical ventilation, the rationale for protocol directed care, interpretation of how to use the weaning protocol, and a summary of what the protocol was trying to accomplish (McLean et al., 2006).

Clinical outcome data included: number of unsuccessful extubations defined by the total number of reintubations within 48 hours of extubations; Ventilator-associated pneumonia as defined by the CDC criteria; and duration of mechanical ventilation and measured in consecutive minutes. Practice outcomes data were evaluated by the Protocol-

Directed Weaning Survey, the Safety Climate Survey, and adherence of the protocol. The Protocol-Directed Weaning Survey was designed to test the staff's understanding of the protocol, measured by three questions with five possible answers with a total possible score of 15. The Climate Survey consisted of 19 questions and used a 6-point scale. This survey measured culture of safety within the organization which would be reflected by such things as having available resources or offering staff incentives and rewards for good outcomes. Safety climate refers to a culture of safety that encourages data collection and reporting, reducing blame, involving leaders, or focusing on systems (McLean et al., 2006).

The authors found that for the Clinical Outcomes of unsuccessful extubations, VAPs, and duration of mechanical ventilation, there was a significant decline in parameters post educational intervention. This reduction was significant in that there could potentially be a reduction in length of stay in the ICU as well as the reduced risks associated with mechanical ventilation. The understanding of protocol-directed weaning increased significantly also after the intervention. Adherence to the weaning protocol increased with implementation of the Model for Accelerating Improvement. Adherence rates ranged from 1% prior to the study to 66% after the interventions (McLean et al., 2006).

McLean et al. (2006) revealed that the use of The Model for Accelerating Improvement, which is a process used to guide healthcare teams in making procedural changes, was beneficial to transferring a protocol with limited adherence to one of strong adherence thus resulting in positive clinical outcomes such as reduced mechanical

ventilation, reduced reintubations, and reduced cases of Ventilator-Associated Pneumonia. Engaging the multidisciplinary team in a process of making a procedural change would improve and translate to practice was confirmed. There was a reduction in the rate of unsuccessful extubations: improved rate of VAP, and reduced rate of mechanical ventilation, which resulted in constructing a culture of safety. Protocol-Directed Weaning is an effective strategy in the management of caring for critically ill mechanically ventilation patients.

Hospitalized patients with head trauma cannot provide oral care. Xerostomia (dry mouth) causes local tissues to become inflamed leading to decreased saliva production and a decreased clearance of debris (Cohn & Fulton, 2006). Any break in the mucosal lining allows for the entry of bacteria into surrounding tissues and possible local or systemic infection. The purpose of this descriptive study was to identify oral care interventions practiced by nurses and unlicensed personnel caring for the neuroscience patient population with self-care deficits. Empirical evidence suggests that oral care varies by provider and reflects differences in knowledge, education, and experience (Cohn & Fulton, 2006).

The sample was obtained from a 700-bed tertiary hospital in a Midwestern metropolitan area (Cohn & Fulton, 2006). This facility is a Level 1 trauma center and is the leading referral center in the state for stroke, cerebral aneurysm, and central nervous system conditions. The sample was taken from patients in the 25 bed neuroscience acute care unit and a 36 bed non-acute neuroscience unit.

A survey technique was used and its goal was to gather information by direct questioning regarding activities, beliefs, preferences, and attitudes of the participant.

There were two questionnaires, one for the RN's and another for unlicensed personnel. The questionnaires were slightly different and reflected the different practice responsibilities of each provider. Both questionnaires were composed of 25 questions and were broken down into categories. Questions were directed towards: identifying products utilized to deliver oral care; frequency and timing of care and documentation; ranking the frequency of complications and problems encountered; and system issues encountered that contributed to problems in delivery of routine oral care (Cohn & Fulton, 2006). Nurse Managers distributed the questionnaires to the staff with a cover letter explaining the purpose of the project. Participation was voluntary and anonymous and to encourage staff to complete the survey a U.S. dollar bill was attached to the invitation for participating.

The outcome of this study was that RNs and unlicensed personnel do not provide oral care the same way. RNs were found to use toothbrushes and toothpaste whereas unlicensed personnel used foam swabs and mouthwash. The discrepancy of care between the RNs and unlicensed healthcare providers could have resulted from lack of availability or knowledge about oral care and its importance (Cohn & Fulton, 2006).

Both groups reported dry mouth as a frequently encountered problem and utilized moisturizer to combat dry mouth. Both groups also reported that care was given twice daily, every morning and evening. This was found to follow other care practices within

the institution. According to the American Dental Association, twice a day care is the minimal standard for an active person consuming a healthy diet.

The authors concluded that this patient population could benefit from evidence-based guidelines to address the specific risk factors that contribute to poor oral health (Cohn & Fulton, 2006). It would be necessary to evaluate the outcomes and monitor the effectiveness of care, reinforce the importance of care, identify gaps in knowledge, and justify system-level changes in order to promote proper oral health of this patient population.

Healthcare costs escalation fuels the desires of providers and consumers to undertake treatments that prove benefit to the patient. Trust in this arena can be fostered by ensuring interventions are credible and will produce consistent and effective results (Halter et al., 2006). The authors of this study described an evidence-based practice that was implemented in a Medical Intensive Care Unit.

The authors employed change theory to guide the project as the use of a theory would more closely link processes with outcomes (Halter et al., 2006). The Cognitive Theory of Planned Behavior was used and suggests that individual behavior is influenced by beliefs about the value of the particular behavior (new), the social norms established within the peer group, and perceived control of the ability to perform the specific behavior (Halter et al., 2006).

The study took place in a tertiary hospital in Arizona. Halter et al. chose the Intensive Care Unit to implement evidenced-based practice because the area accounts for 30% of hospital expenses with an annual cost of \$180 billion. Ventilator Associated

Pneumonia and Catheter Blood Stream infection prevention measures were chosen to study and the issues were more likely to receive support in the hospital environment (Halter et al., 2006).

The setting was the MICU at a medical center in Arizona. The sample was derived from the eight bed unit staffed by 19 registered nurses, 3 unit secretaries, and 2 non-licensed assistive personnel. The sample had a variety of conditions and diagnoses including acute respiratory failure, diabetic ketoacidosis, and congestive heart failure.

Halter et al. (2006) derived the interventions from a facility-specific path rather than an exact replication from another source as this method would be more readily accepted by the healthcare providers (Halter et al., 2006). A multidisciplinary team was utilized. A rapid-cycle approach was found to increase the flexibility of implementing change.

The intervention consisted of providing a clear and detailed explanation of new expectations and included the rationale for change (Halter et al., 2006). Expected activities were personally administered to each nurse and were posted in each patient's room. Rounds were led by the unit supervisor which helped establish adherence. Rounding itself followed a specific format and involved discussion with each nurse about the patient's goal for the day, resources needed to achieve the goal, and identification of any barriers to carry out the desired goal (Halter et al., 2006). To maintain and reinforce the behavior, thank you notes and movie tickets were given to nurses to help draw attention and foster the change. An important aspect of keeping the motivation came from the communication strategies used that highlighted the progress and outcomes.

Posting of weekly results on staff bulletin boards were also used to spread the outcome news.

Baseline data were established for VAP's and CR-BSI's. Routine infection control surveillance was used to collect project data. The criterion for diagnosis of VAP's and CR-BSI's was drawn from the Centers for Disease Control and Prevention. The outcome revealed that initial adherence to the ventilator bundle was 73% and after the intervention adherence increased to 98.6%. The rate of VAP pre-intervention was 11.4% and post-intervention rate was 5.3% within 12 months for a 54% reduction. The pre-intervention rate of CR-BSI's was 12.8% and post-intervention rate after 12 months was 2.88% for a 78% reduction. Other significant findings included the median length of stay was also impacted from the interventions in this study as the pre-intervention length of stay was reduced to 3.59 days as compared to the initial mean of 4.40 days for an 18% reduction (Halter et al., 2006).

Halter et al. (2006) reported the positive outcomes of this study were a result of clear communications, structure and flexibility of methods that were used. Preparing the staff in advance led to successful administration of the techniques. The advanced preparation also allowed staff to ask questions and resolve concerns regarding the actions. Structure such as regular time for daily rounds, forms for daily rounds, and posting expected activities in the rooms increased the manageability of the change behaviors (Halter et al., 2006). Findings demonstrated that the use of evidence-based activities could produce cost savings as well as life savings outcomes to the patients and

organization. Staff recruitment and retention was an additional positive finding as a result of this research.

Ventilator Associated Pneumonia is the most common infectious complication among all critically ill patients as it accounts for up to 47% of all infections. This may result in a prolonged length of stay and an increased risk of death (Cason, Tyner, Saunders & Broome, 2007). The purpose of this study was to evaluate the extent to which nurses working in intensive care units implement best practices when managing adult patients receiving mechanical ventilation (Cason et al., 2007). Three study objectives included: (a) describe the extent to which nurses report care practices that match the CDC guidelines for the prevention of VAP, (b) in areas in which the evidence is not sufficient or strong to support recommendations, describe nurses' prevailing care practices and, (c) explore the relationships among care practices and the demographic characteristics of the nurse respondents. The authors utilized a cross-sectional survey design.

The population of interest was Critical Care Nurses who attended either the 2005 American Association of Critical-Care Nurses National Teaching Institute (NTI) or selected training programs offered by Barbara Clark Mims Associates (BCMA) who provide care for adult patients receiving mechanical ventilation. Inclusion criteria were nurses who worked in the United States in an acute care setting. The sample included 1,285 nurses who returned surveys for a return rate of 81% (Cason et al., 2007).

The Oral Care of Ventilated Patients Questionnaire was the tool designed and used by the investigators. The information gathered included information on current care

practices for adult patients receiving mechanical ventilation and demographics (Cason et al., 2007). Some questions were to obtain information about the CDC guidelines: frequency of hand washing, knowledge of VAP rates and organisms, wearing gloves, subglottic suctioning, elevation of the head of the bed, presence of oral care protocols, and use of oral chlorhexidine gluconate rinse. Content validation was obtained using a panel of three persons: an infection control nurse, an infection control physician, and a nationally recognized nurse with expertise in pulmonary and ventilator care (Cason et al., 2007). The survey was then distributed to nine nurses to evaluate readability and time to complete. All the nurses were able to complete the survey within 5 minutes. The survey was redistributed 1 week later and the responses were similar first time responses.

Cason et al.'s (2007) findings were that nurses were not always washing hands between patients (23%), and nurses' self-reports, evidence-based and best practices as recommended in the CDC guidelines for the prevention of VAP, were not consistently and uniformly implemented (18%). Approximately 23% reported not using gloves when providing oral care. Providing subglottic suction was only performed 69% of the time by both nurses and respiratory therapists. Head of the bed was found to be elevated about 52% of the time.

The authors concluded that the gap between what is known to be best practice for the patient and the way nurses practice continues to be larger than desired (Cason et al., 2007). The results suggested that having an oral care protocol in place improves care provided by nurses. Further educational programs for the staff would heighten awareness of VAP prevention and improve adherence to the evidenced-based guidelines

(Cason et al., 2007). Placement and use of alternative to antimicrobial soap could help in improving hand-washing rates and evaluating the effects on VAP rates. Unit based studies that identify circumstances and situation in which hand-washing rates increase and decrease also make the staff aware. Finally, performance review that includes rates of hand washing could also help compliance. Having an oral hygiene protocol in place based on the best available research could reduce the incidence of VAP.

A comprehensive oral hygiene program theoretically helps to reduce the number of microorganisms in the mouth and reduces the pool of organism available for translocation to and colonization of the lung (Cason et al., 2007). Oral care interventions play a role in the prevention of VAP.

Pneumonia is one of the most clinically significant infections among hospitalized patients and in particular the Intensive Care Unit (Brozek, McDonald, Clarke, Gosse, et al., 2007). The type of pneumonia occurring in hospitalized patients varies as wide as the treatment. Critically ill patients may have “community-acquired pneumonia” or “nosocomial pneumonia.” Nosocomial pneumonia occurs while in the hospital and is associated with a mortality risk of up to 30% (Brozek et al., 2007).

Nosocomial pneumonia has several classifications with Ventilator Associated Pneumonia, the most serious type developing more than 48 hours after intubation in patients who are receiving mechanical ventilation (Brozek et al., 2007). There have been multiple quality improvement initiatives to focus on and understand the incidence of pneumonia prevention and management. Brozek et al. hypothesized that under usual practice circumstances, the incidence of pneumonia would actually be higher than that

observed in the national study due to diverse diagnostic testing and suboptimal antibiotic prescribing. The authors set out to characterize the treatment of patients with presumed pneumonia in a tertiary care ICU.

A blinded, prospective, observational, single-center cohort study was conducted. The sample consisted of all consecutive critically ill patients admitted to a closed, university-affiliated medical-surgical ICU in Ontario during a 3-month period. Inclusion criteria were an affirmation from the attending physician to the question “are you treating this patient for pneumonia?” Exclusion criteria included patients who died within 24 hours of admission or that had confirmed colonized with an organism that could cause the pneumonia (Brozek et al., 2007).

A trained research coordinator screened all ICU patients. Patients treated for presumed pneumonia were identified daily. Data included demographics, admission and discharge dates, APACHE scores, reason for admission, location before admission to ICU, cultures of endotracheal aspirate (ETA) and bronchoalveolar lavage (BAL), pleural fluid, or blood work completed at the time of pneumonia diagnosis and 48 hours before initiation of treatment. The organism isolated was also documented in the case of microbial growth (Brozek et al., 2007). All antibiotics administered from 48 hours before the initiation of treatment throughout the entire pneumonia treatment period were also documented.

After the data collection was completed the patients were classified as having community-acquired pneumonia, hospital-acquired pneumonia, ICU-acquired

pneumonia, early VAP, or late VAP. In circumstances which the diagnosis was unclear, two investigators reviewed the chart.

Brozek et al. reported that more than one third of the patients were treated for presumed pneumonia at some stage of the ICU stay, usually community-acquired pneumonia. The most common causative isolate was identified as gram-positive cocci. A median of three antibiotics were administered per patient. Repeatedly patients were found not to have cultures, ETA or blood, obtained in 30% of the patients treated for presumed pneumonia. This could in part be due to errors of omission, inadequate collection, or decisions to not test as the patient was already on antibiotics (Brozek et al., 2007).

The significance of the findings provided multiple areas of quality improvement initiatives. As a result the authors changed antibiotic usage. It was determined that every antibiotic would be reviewed and its use rationalized by the intensivist-led multidisciplinary team. Insufficient attention was paid to the appropriateness of prescribing antibiotic therapy to treat pneumonia. Secondly, Brozek et al. reported that during rounds each patient's nurse would be responsible for reporting to the multidisciplinary team the date, time, and results of all cultures during the past week. Nurses would also be responsible for ensuring required samples for cultures were obtained as it was found often times this was omitted.

The third outcome led to reconciling drug choices by a pharmacist with microbiological isolates and sensitivities to the isolates. There was a clear lack of disciplinary responsibility for following up on antimicrobial sensitivities before this

discovery. Finally, the clinical information system was redesigned to incorporate displayed data on specimens ordered and obtained for microbiological tests. This helped to enhance timely decisions about the care the pneumonia patients received. The quality initiatives that resulted from the findings of this study proved successful and provided a clear ongoing commitment of the entire interdisciplinary ICU team and improvement of the care with patients who have pneumonia. Four quality improvement strategies were implemented and were beneficial to the outcomes of patients receiving mechanical ventilation potentially impacting the incidence of ventilator associated pneumonia (Brozek et al., 2007).

Recent research suggests that evidence-based protocols elicit best-practice performance from healthcare practitioners and improve patient outcomes (Plost & Nelson, 2007). Low compliance rates with protocols remain an issue. The purpose of this study was to obtain a baseline compliance range from a sample of nine protocols. The sample consisted of 35 charts that were audited in an adult intensive care unit.

An ICU interdisciplinary management team at a Medical Center in Tulsa, Oklahoma attempted the traditional approach to obtain compliance with nine protocols through education provided by nurse educators. A return demonstration was required in order to pass. The Intensive Care Medical Director provided instructional presentations for hospital physicians in all sections of medicine. Information and order sheets were placed directly within the charting area. After extensive education and emphasis of the importance of protocols observations of these practices found physicians did not utilize the protocols consistently (Plost & Nelson, 2007).

Researchers sought more definitive information on the level of protocol inconsistencies since the initial educational roll out proved unsuccessful. There was an in depth data analysis of the charts audited that compared the number of times each protocol was implemented with the number of times the protocols should have been implemented. A baseline compliance rate was established and ranged from 62% to 77% (Plost & Nelson, 2007).

After obtaining baseline information, there was an attempt to improve the compliance problem by having the ICU nursing staff take the lead. Nurses were to do this through recommendations to the physicians. The authors concluded that nurses were the experts in patients' care and were a constant presence in the ICU, could utilize critical thinking skills to determine when a protocol should be implemented, and understood the evidence underlying the protocols. This attempt failed and in fact, physicians were immediately resistant to the educational efforts by the nurses and were very negative. While nurses are accustomed to managing patient care, nurses were not experienced taking the lead in implementing change.

After this failed attempt, the ICU management team considered behavioral approaches patterned after a reinforcement method. This theory grouped clinicians into four learning categories: seekers, receptives, traditionalists, and pragmatists (Plost & Nelson, 2007). The authors concluded that 97.5% of clinicians require some type of behavior-oriented change strategy in addition to knowledge-oriented change strategies for meaningful change to occur (Plost & Nelson, 2007).

A directive strategy to empower the ICU nurses to enact change was devised using positive reinforcement was utilized to offset the negative reinforcement nurses received from the medical staff. Rewards were given to each staff member for any adult ICU with a 90% compliance rate for nine selected protocols after 4 months. Rewards ranged from catered dinner parties for the entire ICU staff, drawings for individual awards, and a grand prize given to a nurse selected from each ICU consisting of a trip valued at \$3000 each.

Plost and Nelson (2007) found that positive rewards helped the staff become more assertive. The nurses and secretaries placed protocols on all appropriate patients' charts for physicians. Nurses also took active measures to obtain physician compliance including handing the protocol directly to the physician. Nurses even followed the physician when leaving the unit to discuss protocol use.

After 1 month, the baseline audit tool was used again with a 100% sampling of charts tracking the nine protocols. The compliance after a month increased from 62% up to 85% to 92%. After the 4th month, compliance improved to 94% to 99% (Plost & Nelson, 2007). The rewards program ended but the same audit tool was used to track compliance yearly to determine if the improvement was sustained. Compliance rates continued to be high (91%-95%) 1 year and 2 years post study period (Plost & Nelson, 2007).

Plost and Nelson (2007) concluded that increased use of protocols lead to higher survival rates for patients and decreased ICU costs. This was confirmed by Project IMPACT critical care database. This organization uses methods reported by Rapoport et

al. to benchmark national ICU outcomes. Project IMPACT confirmed a sustained cost reduction of \$350,000 per bed year for ICU. Short-term, extrinsic rewards elicit a desired change in behavior. Compliance rate of the protocols were obtained and sustained utilizing rewards. The critical care nurses discovered untapped self-confidence, strength, and autonomy which were found to continue the compliance rate.

Interventions for VAP

The CDC has developed guidelines for prevention of Healthcare Related Aspiration Pneumonia for oral care. The risk of aspiration of oropharyngeal or gastric contents places all mechanically ventilated patients at risk for the development of the most common nosocomial infection (Babcock et al., 2004). The purpose of this pre-intervention and post-intervention observational study was to determine whether education initiatives would decrease the incidence of Ventilator-Associated Pneumonia. The framework was developed from the Centers for Disease Control and Prevention Guideline's for prevention of nosocomial pneumonia.

The setting included four hospitals in a single health system in the Midwestern United States (Babcock et al., 2004). The types of hospitals included: an adult teaching hospital, pediatric teaching hospital, and two community hospitals. The participants were 792 nurses and 239 respiratory therapists from all four hospitals.

The intervention was a 10 page self-study module developed by a multidisciplinary task force consisting of two physicians using current literature review and recommendations from the Centers for Disease Control and Prevention for Ventilator Associated Pneumonia. Information on the following topics were included: (a)

epidemiology and scope of problem, (b) risk factors, (c) etiology, (d) definitions, (e) methods to decrease risk, (f) procedures for suctioning and, (g) and clinical and economic outcomes influencing ventilator-associated pneumonia. Posters, fact sheets, and multiple in-services were also provided by infection control on nursing measures to prevent VAP (Babcock et al., 2004).

The method of data collection Babcock et al. (2004) utilized consisted of two phases defined as pre-intervention and post-intervention. Phase one, pre-intervention, occurred 1 year before the intervention was introduced. Phase two, post-intervention, occurred 18 months after the intervention was completed by all facilities. The authors chose this period to minimize the influence of early changes that are associated with the introduction of an education program (Babcock et al., 2004).

At each of the hospitals, Ventilator Associated pneumonia was tracked by control specialists of the facility through prospective surveillance (Babcock et al., 2004). The definition of VAP was developed by the Center for Disease Control and Prevention National Nosocomial Infection Surveillance definitions. Rates were reported as VAPs per 1,000 ventilator days and episodes of VAP were reported to a common database.

The findings of the compliance results were that 80.1% of nurses and 89.9% of respiratory therapists completed the educational module. The hospitals with the highest rate of completion 100% by nurses worked at the pediatric hospital and at community hospital #1 (98.9%). The results of the other hospitals were lower with the teaching hospital at 65% and community hospital #2 at 44% compliance. Respiratory therapists had the highest rate at the adult teaching hospital and community hospital #2, both

reported 100%. The lowest compliance was at community hospital #1, with 56% of therapists completing the module (Babcock et al., 2004).

Findings indicated that the overall rate of VAP prior to the educational intervention was 8.75/1,000 ventilator days at all the hospitals. The rate of VAP during the implementation of the educational program did not change significantly, with that rate being 7.81/1,000 ventilator days, $p=0.161$. For the 18 months after the educational intervention the overall rate of VAPs dropped significantly to 4.74/1,000 ventilator days ($p < 0.001$). It was also found that the microbiology of the infection did not change, only its incidence (Babcock et al., 2004).

Three of four hospitals had a statistically significant drop in VAP from pre-intervention to the post-intervention period. Community hospital #2 dropped the VAP rate by 61%. The adult hospital reduced its rate of VAP by 53%. The pediatric teaching hospital dropped by 38%. Community hospital #1 had no significant changes in rate of VAP. The rate of module completion was very high for the nurses at this hospital but for the respiratory therapists it was the lowest of the four hospitals (Babcock et al., 2004).

The findings confirmed that an educational program for respiratory care practitioners and ICU nurses decreased the frequency of VAP at three of the four hospitals (Babcock et al., 2004). Rates ranged from 38-61%. The authors recommendation was that participation in a self-study module should be mandatory for nurses and respiratory therapists to help reduce the incidence of VAP as both professionals are influential at reducing VAP. The utilization of evidenced-based interventions assists in its incidence.

Ventilator-associated pneumonia is the leading cause of nosocomial infections, an adverse patient event in the critically ill patient around the world exceeding CR-BSI's and UTI's (Abbot, Dremse, Stewart, Mark, & Swift, 2006). The purpose of this study was to implement and measure strategies that would facilitate the adoption of clinical practice guidelines developed to decrease VAP rates. The authors utilized a multidisciplinary education team to develop a self-learning packet, educational materials and storyboards for the staff as a way of disseminating the information. There were also e-mails, one-on-one teaching with clinicians, and feedback on guideline adoption and VAP rates.

The authors utilized the Star Model framework project as it is used to systematically guide and implement EBP processes. The Star Model is a simple 5-point star showing five major stages of knowledge transformation: (a) knowledge discovery, (b) evidence summary, (c) translation into practice recommendations, (d) integration into practice, and (e) evaluation (Abbot et al., 2006). Each point on the star represents a different stage of knowledge transformation (Abbot et al., 2006). Knowledge transformation was defined as the exchange of research finding from primary research results through a series of stages of knowledge conversion.

Abbot et al. (2006) used an observational, prospective, quasi-experimental design. The sample included 106 mechanically ventilated patients, ventilated for greater than 48 hours, who did not make the NNIS criteria for VAP. Observations were conducted for a total of 12 weeks: 6 weeks before the education intervention and 6 weeks after the

intervention at each of the facilities. ICUs that participated included a Burn ICU, Medical ICU, Surgical ICU, and a Trauma ICU. Measurements came from five sources: (a) adoption observation data, (b) demographic patient survey, (c) environmental facilitators and barrier survey, (d) VAP rate, and (e) acute physiology and chronic health evaluation tool (APACHE II).

The adoption observational data collection tool was developed from a literature review and contained five elements of the VAP the protocol which included; (a) head-of-bed elevation, (b) oral care, (c) emptying condensate from ventilator tubing, (d) hand washing, and (e) glove use. Observational data was collected on all hospital staff that entered the room including the nurses, respiratory therapists, physicians. Data were collected pre-intervention and compared to post-intervention. Demographic data were included to describe the sample and adjust for risk (APACHE II) (Abbot et al., 2006).

The findings revealed that in the Burn ICU, there was a sharp decline in the VAP rate after the initiation of the evidenced based initiative. Although after several quarters, there was a trend of increasing VAPs. In the Medical ICU, the VAP rates declined sharply after the VAP protocol initiative and remained below the NNIS for several quarters. Again there was an increased trend in VAPs. The Surgical VAP rates declined slowly initially but continue to remain above the national benchmark for three quarters. In the final quarter of the study the rate dropped below the NNIS benchmark. Finally, in the Trauma ICU the VAP rates were erratic before and after the VAP initiative. Prior to the initiative the rates were above the national benchmark but after the initiative they decreased below but then when up again sharply.

The overall changes in the rates of VAP were seen following the institution of the evidenced-based protocol initiative but rates were not sustained, however rates did remain below the national NNIS benchmark. Abbot et al. (2006) noted that the standard of care clinical practices varied widely among the units. Some units improved while others did not. Hand washing and oral care had a low adoption rate at both of the facilities. The determination of VAP rates during the pre and post-intervention periods were distributed evenly. During the pre-intervention time frame most of the patients were from the surgical and burn ICU. During the post-intervention period the patients who developed VAP the most were located on the burn unit.

An additional aim of the EBP was to assess cost savings. Hospital one saved approximately \$40,000. While the other hospitals did not directly save money as a result of the initiative, it reduced VAP rates from 31 per 1,000 ventilator days to 20 per 1,000 ventilator days over the 2 year course of the study resulting in an estimated cost savings of \$23,000.

Significant barriers were found that could have impacted the results including: lack of time, turnover of key leaders and staff members, availability of the clinical nurse specialist, and availability of equipment. Differences in mechanical ventilation, respiratory equipment, antibiotic therapy across all units and sites were found to affect the outcome. Weaning protocol differences also may have had an impact on the outcome. The study was conducted at two different sites which also may have affected the results. The authors also concluded that the amount of time allowed for the education intervention may not have been enough to solidify change in behavior.

Abbot et al. (2006) established that there was a reduction in length of stay for patients who did not acquire VAP from 9 days to 5 days respectively. The length of ventilator stay also was reduced in patients who did not acquire VAP, although the rates between the two hospitals fluctuated. Adoption of the VAP protocol was slower than anticipated and thought to be related to a change in key leadership in both institutions. In particular, adoption of oral care improved significantly in one unit during this study from 21% to 67%. This was found to be due to special oral care equipment which was added to the hospital inventory along with the addition of a dentist and dental hygienist to the team.

Adoption of the VAP clinical practice guidelines was found to be inconsistent and short-lived. As a result, the authors were unable to determine if adoption of the protocol actually affected VAP rate or if the drop in rates were related to another phenomenon. Difficulties in sustaining behavior changes are common in evidenced-based initiatives. The discovery of different approaches is recommended to sustain change in behavior. This requires nurse administrators, nurse educators, and clinical nurse specialists to discover new approaches to facilitate and sustain the change necessary to change behavior (Abbot et al., 2006).

Nosocomial pneumonia is the leading cause of mortality attributed to nosocomial infections but there is limited data regarding the etiologic agents of hospital-acquired pneumonia (HAP). The choice of antibiotics is made on the most likely cause, prior use of antibiotics, and presence of risk factors such as residing in an extended care facility or dialysis unit. The infecting flora of VAP has been well defined. Only limited

information is available regarding the infecting flora of HAP. The purpose of this study was to validate the use of the same empirical therapy for VAP and HAP by evaluating infecting flora at a university hospital. A prospective design for this study was utilized (Weber, Rutala, Sickbert-Bennett, Samsa, Brown, Niederman, 2007).

The sample consisted of all patients admitted from 2000 through 2003. The final sample was 309 patients with VAP and 247 with HAP. Defining criteria for hospital-acquired Pneumonia (HAP) is a pneumonia that develops 48 hours or more after admission and was not incubating at the time of admission (Weber et al., 2007). Defining criteria for ventilator-associated pneumonia (VAP) is a pneumonia that develops more than 48 hours after endotracheal intubation. Exclusion criteria included patients having a diagnosis of community acquired pneumonia (CAP) or healthcare associated pneumonia (HCAP). Specimens collection criteria included those that were collected in one of the following three types: bronchoscopically, expectorated sputum, or tracheal aspirates. Infection control surveillance was conducted by specialists using the Centers for Disease Control and Prevention (CDC) criteria.

Weber et al. (2007) found that the most common gram-positive pathogen in both non-ventilated and ventilated patients were *Staphylococcus aureus* and approximately two-thirds were oxacillin resistant in the ventilated patients and 60% in the non-ventilated patients. Gram-negative isolates in the ventilated population were principally non-Enterobacteriaceae bacilli two-thirds where as in the non-ventilated population were non-Enterobacteriaceae pneumonia in non-ventilated patients was approximately less than half.

The authors concluded that for both VAP and HAP early-onset infections were most likely to be caused by *Streptococcus pneumoniae*, oxacillin-susceptible *Staphylococcus aureus*, and *H. influenzae*, whereas in late-onset infections the most likely causative organisms are caused by oxacillin-resistant *S. aureus*, *Acinetobacter* species, *S. maltophilia*, and *P. aeruginosa*. HAP infections compared with VAP infections less commonly acquired nonenteric bacteria the overall frequency of infections was sufficient enough to continue empirical therapy. Weber et al., 2007 concluded that the bacterial etiology of VAP and HAP differed quantitatively, but were qualitatively similar. The frequency being clinically high enough to warrant the use of antibiotics indicating the recommended current ATS/IDSA guidelines are appropriate for treating patients with either VAP or HAP.

Weber et al. (2007) concluded that the overall incidence of nosocomial pneumonia was 0.37%. More than 90% of VAP cases occurred in patients within the ICU. Sixty-seven percent of HAP occurred in patients' outside the critical care. The epidemiology of VAP onset occurred 14.4% of the time and 20.9% of the time for HAP within 4 days of hospitalization. Weber et al. (2007) found that the most common gram-positive pathogen in both non-ventilated and ventilated patients was *Staphylococcus aureus* and approximately two-thirds were oxacillin resistant in the ventilated patients and 60% in the non-ventilated patients. Gram-negative isolates in the ventilated population were primarily non-Enterobacteriaceae bacilli and in the non-ventilated population were approximately less than half (Weber et al., (2007).

The authors concluded that for both VAP and HAP early-onset infections were most likely to be caused by *Streptococcus pneumoniae*, oxacillin-susceptible *Staphylococcus aureus*, and *H. influenzae*, whereas in late-onset infections were most likely to be caused by oxacillin-resistant *S. aureus*, *Acinetobacter* species, *S. maltophilia*, and *P. aeruginosa*. Although HAP infections compared with VAP infections less commonly acquired nonenteric bacteria the overall frequency of infections was sufficient enough to continue empirical therapy. Weber et al., 2007 concluded that the bacterial etiology of VAP and HAP differed quantitatively, but were qualitatively similar. The frequency being clinically high enough to warrant the use of antibiotics indicating the recommended current ATS/IDSA guidelines are appropriate for treating patients with either VAP or HAP.

Summary

Meta Analysis.

Acquiring ventilator-associated pneumonia is considered an adverse event for critically ill patients. Oral care has been shown to help reduce the incidence of ventilator associated pneumonia. Chan et al. (2007) found that prophylactic antiseptic oral decontamination to prevent pneumonia in patients receiving mechanical ventilation was effective through antiseptic oral decontamination. More evidence was recommended before firm conclusions can be made about antibiotic decontamination.

Berry et al. (2007) found that reliable and valid assessment tools are needed to assist nurses in documenting assessments of the oral cavity and outcome of the

procedure. A relationship between poor oral hygiene and incidence of Ventilator-associated pneumonia (VAP) does exist and it is vital to have randomized controlled clinical trials to help determine the exact relationship. Nurses' perceptions of oral hygiene should be studied to determine the barriers that exist to providing or adhering to evidenced-based practices.

Causes of Ventilator Associated Pneumonia.

Understanding causes of VAP will potentially help discover the best prevention methods that should be used to eliminate VAP. Sole et al. (2003) concluded that contamination of equipment, such as oral suctioning devices and endotracheal suctioning equipment can become colonized with potential causative pathogens within 24 hours. The authors recommended rinsing in-line equipment helping to reduce the numbers of pathogens present and risk for aspiration of colonized equipment. Equipment may be a potential source of cross-contamination.

El-Solh et al. (2004) found that colonization of dental plaque with aerobic respiratory pathogens is highly prevalent in institutionalized critically ill patients. Dental plaque can be the reservoir for pathogens that are often responsible for Hospital Acquired Pneumonia in the elderly. Many individuals who become critically ill and require mechanical ventilation have poor dental hygiene making patients at risk for the development of VAP. Munro et al. (2006) identified that patients who are admitted to the Intensive Care Unit have changes in the normal oral flora within 48 hours. The findings from this study revealed that baseline oral health status of critically ill patients are often compromised upon admission and only deteriorates over time.

A scale was developed to quantify oral health status and found that an association does exist between dental plaque scores and risk for VAP.

Patients' perceptions of ventilation.

Sandman and Rasmussen (2005) revealed in their qualitative study that starting home mechanical ventilation is a life changing event which influences every aspect of life, situation, body and spirit. For individuals with multiple co-morbidities, becoming mechanically ventilated could mean a life long sentence. The authors concluded that professionals need to be open and sensitive to patients' descriptions of experiences of illness and health.

Knowledge and Practices of Oral Care.

Fitch et al. (1999) found a positive correlation between Dental Hygienists and Nurses oral care assessment scores in the categories of salivary flow, purulence, plaque and candidiasis. Implementation of a well developed oral care protocol delivered by nurses could significantly lower plaque in mechanically ventilated patients thus reducing the incidence of VAP. Oral care that is not delivered appropriately can have an impact on the incidence of Ventilator-associated pneumonia. Grap et al. (2003) found that ICU nurses are reluctant at times to provide oral care to intubated patients out of fear of the endotracheal tubes and fear of dislodging those tubes. Oral care documentation was not congruent with nurses' self-reports of oral care practices.

Barriers to providing oral care include nurses' attitudes towards the relevance of its importance. Other barriers that impact oral care include education and sufficient time

to provide oral care, prioritizing oral care, and viewing oral care as unpleasant. Furr et al. (2004) concluded that the more education and priority given to oral care by nurses the better the oral care practice. Institutions must provide the time necessary to do oral care as well as continuing education. Understanding which methods, products, and frequency of oral care are used was surveyed by Henneman and Gusick (2005). The findings from this study showed that documentation of oral care was lower for both non-intubated and intubated patients. Nurses provided oral care more frequently for intubated patients than for non-intubated but the use of treatments such as toothpaste and tooth brush, were utilized more often for non-intubated patients than intubated patient.

Microaspiration of oropharyngeal secretions is considered a major risk factor for the development of ventilator associated pneumonia. Binkly et al. (2004) found that nurses had perceived oral care as a high priority for patients who are mechanically ventilated but cleaning difficult or actually an unpleasant task. Tools most often used included: foam swabs, moistures, and alcohol-free mouthwashes. Creation of an accepted oral health assessment tool could potentially be useful as a bedside instrument to facilitate oral health assessment and care. McLean et al. (2006) conducted a mechanical weaning protocol to assess the effectiveness of using an implementation program, Model for Accelerating Improvement, to improve protocol adherence and clinical outcomes.

The authors concluded that clinical outcomes such as VAP, unsuccessful extubations, and ventilator length of stay did decline with an educational intervention.

Understanding of protocol-directed care could guide healthcare teams in making procedural changes such as oral care which could have an impact on ventilator-associated pneumonia.

Cohn and Fulton (2006) found that in hospitalized patients, head trauma is often a barrier to receiving oral care. Xerostomia (dry mouth) can cause local tissues to become inflamed leading to a decreased saliva production as well as a decrease in clearance of debris. The authors found that head injured patients could benefit from an evidenced-based guideline to address the specific risk factors that contribute to poor oral health. Halter et al. (2006) utilized the Cognitive Theory of Planned Behavior to guide implementation of an oral care protocol. Halter et al. (2006) found that the use of evidence-based activities could produce cost savings as well as life savings outcomes to patients and the organization.

Evaluating the extent to which nurses working in the intensive care utilized best practice when managing adult patients receiving mechanical ventilation is helpful in the prevention of VAP. Cason et al. (2007) found that nurses were not uniformly utilizing best practices such as recommended in the CDC guidelines for the prevention of VAP. There is a gap between what is known to be best practice and the way nurses practice. Having an oral care protocol in place can improve care provided. Education training programs for staff can heighten awareness of VAP prevention.

Providing the correct treatment regimen is imperative in the prevention of VAP and often insufficient attention is paid to the appropriateness of prescribing antibiotic therapy to treat pneumonia. Brozek et al. (2007) found that evidence-based protocols

elicit best-practice performance from healthcare providers and improve patient outcomes. Plost and Nelson (2007) found similar findings in their study. Use of protocols led to higher survival rates for patients and decreased ICU costs.

Interventions for VAP.

Education about oral care and VAP causes has been found to decrease the incidence of VAP. Babcock et al. (2004) found that an education program for respiratory care practitioners and ICU nurses decreased the frequency of VAP at multiple hospitals. Adopting VAP clinical guidelines was found to be inconsistent (Abbot et al., 2006) as it was discovered that there are difficulties in sustaining behavior changes. Different approaches are recommended to sustain change in behaviors and should be a collaborative effort between nurse administrators, nurse educators, and clinical nurse specialists. Weber et al. (2007) also found that the use of current antibiotic recommendations from the ATS/IDSA is appropriate for treating patients with either VAP or HAP.

Chapter III

Methodology and Procedures

Introduction

Microbial colonization of the oropharynx has been related to ventilator-associated pneumonia (Cutler & Davis, 2005). Ventilator-associated pneumonia affects a significant number of all mechanically ventilated patients with a high mortality rate. Reducing the risk of micro-aspiration can potentially reduce the incidence of VAP. The purpose of this partial-replication study (Cutler et al., 2005) is to identify current practices of oral care in patients receiving mechanical ventilation, determine what is best-practice by a literature review and recommendations from the Centers for Disease Control and Prevention as well as with measuring compliance of standardized oral care using a pre-post educational intervention. This chapter presents the population, sample, methodology, and procedures that will be utilized for this study.

Research Questions

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

Population, Sample, and Setting

The population for this study will include all patients in the Medical and Surgical Intensive Care Units in a 250-bed acute care hospital located in Valparaiso, Indiana. All mechanically ventilated patients who agree to participate will be invited. A convenience sample of 150 patients is anticipated. All full-time and part-time registered nurses and all respiratory care practitioners will be included (n=150). Criteria for inclusion will be current employees working at least part-time for at least 6 months. Exclusion criterion will be no previous experience with an oral care protocol.

Protection of Human Subjects

This study will be submitted for approval to the Institutional Review Boards of Ball State University and the participating hospital. Patients and family members will be informed about the study with a cover letter. Consent is assumed by completing a questionnaire. Confidentiality will be maintained. No risks have been identified with the study. Benefits will include the opportunity for the nurses and respiratory therapists to contribute to the acquisition of information which may help in the development of updated oral care protocols and decrease the incidence of ventilator-associated pneumonia.

Procedures

After Institutional Review Board approvals, a letter will be sent to the Vice-President of Nursing requesting a meeting. The meeting will discuss the outline and purpose of the study, inclusion and exclusion criteria, and request for RN and Respiratory

therapist participation in the study. Subsequent meetings will be held with the Unit Managers and staff to discuss the study criteria.

The ICU staff members will not be informed as to when the observers would be present in the unit or why. Specially trained researchers will observe any oral care interventions at random blocks of 4 hours that will include early morning through evening shifts. Evidence of interrater reliability will be tested with 50 patients randomly selected from the study units. The evaluations of interrater reliability will consist of the percentage agreement from cross-tabulations of rater by variable. Interrater reliability will then be retested before collection of bedside data and intermittently thereafter. Data collectors will become certified.

All mechanically ventilated patients will be used during the time frames of this study. Exclusion criteria include any patient less than 18 years of age or any patient receiving intracranial pressure monitoring. Both study units do not have an oral cleansing protocol with defined frequency and tool for patient receiving mechanical ventilation (Cutler & Davis, 2005).

Instrumentation

The Oral Care Data Collection Tool was specially designed by Cutlet et al. (2005) on the basis of the standardized comprehensive oral-cleansing protocol. This tool allows the trained observers to document frequency, tasks, and tools used for oral care during the randomized 4-hour time blocks by walking around the unit and watching nurses and respiratory care personnel performed the tasks. Types of oral care cleaning products located at the bedside will be documented as well as tasks performed when sounds of

suctioning come from the room (Cutler & Davis, 2005). All staff members will be monitored including; nurses and respiratory therapists.

Data that will be documented includes: oral cavity assessment; teeth brushing; lips and mouth moisturized; suction swab of teeth and mouth; suctioning of mouth and pharynx; suctioning of oropharynx; suction tubing changed; other care; and types of oral care products used at the bedside.

Design

This study will utilize a Pre-test Post-test design to determine oral care practices delivered to mechanically intubated patients in an ICU at baseline and after an education intervention. This study will examine the differences as occurs naturally in the setting (Burns & Grove, 2005, p. 234).

The study will consist of three phases: baseline, educational, and intervention. The baseline phase will last 4 months. Baseline data collection will include observation of current practice of oral care in patients receiving mechanical ventilation. Data will be collected on the types of oral care products used, methods used to provide care, and frequency of oral care provided.

An educational intervention will be offered to the personnel and will include all needed information necessary for oral cleansing protocol. The education intervention period will last 4 months. There are approximately 150 health care practitioners. A mandatory 1 hour in-service will be provided for all practitioners within the two units. Certified dental hygienists will provide “hands on” demonstration of the components of a comprehensive oral care assessment. Return demonstration will be required with a pass

rate of 85 %. Specially designed 24-hour oral care kits will be available on the wall near each patient's bedside. The kit will provide all necessary tools to perform oral care tasks outline in the protocol.

Intended Method for Data Analysis

Descriptive statistics will be used for continuous data and numbers and percentages for categorical data will be used to calculate all variables recorded. Variables that will be recorded include; types of tools utilized for oral care, defined tasks and methods, and frequency of oral care. This method is often used to record physiological dimensions of patient status. Direct measurement is more valid compared with indirect (Burns & Grove, 2005).

Summary

There are multiple variable affecting patients who are mechanically intubated. Reducing the risk of aspiration of secretions colonized with pathogens that could potentially cause ventilator-associated pneumonia is an important dimension in the domain of critical care nursing practice. Nurses and Respiratory Therapists will receive oral care practice education in a Pre-test Post-test design. If healthcare providers are to make serious advances in preventing Nosocomial pneumonia, they must practice according to the best evidence. Further studies in this area would facilitate the knowledge needed to conquer this deadly adverse patient event.

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