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Improving Quality of Care for Mechanically Ventilated Patients in Long Term Care Through Full Compliance with the Ventilator Bundle Protocol

Tedgardo Pacal Mercene
Walden University

Walden University

College of Health Sciences

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Tedgardo Mercene

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Review Committee
Dr. Robert McWhirt, Committee Chairperson, Health Services Faculty
Dr. Cheryl Parker, Committee Member, Health Services Faculty
Dr. Sophia Brown, University Reviewer, Health Services Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
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Abstract

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by

Tedgardo P. Mercene, RN, MSN

MSN, Walden University, 2013

BSN, Far Eastern University, 1977

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

One of the most common methods used by healthcare professionals in the ventilator unit to reduce morbidity and mortality due to ventilator-associated pneumonia (VAP) is a group of best practices known as the *ventilator bundle*. However, evidence from the literature shows that all its components must be in compliance if the bundle is to be effective. The purpose of this quality improvement project was to investigate the level of compliance with the different components of the ventilator bundle protocol at the study site's nursing home and rehabilitation center, as well as to improve compliance with the bundle protocol at the site. In-depth interviews were conducted with 15 nurses from the site on their knowledge of VAP and the ventilator bundle. Those narratives were analyzed using grounded theory analysis, with the data demonstrating poor understanding of and compliance with the ventilator bundle. Posters were then mounted throughout the facility on the importance of complying fully with the bundle, using information gleaned from the interview analysis. Evidence from this project could yield a quality improvement model for long-term-care facilities and ventilator units in particular. The goal was to improve nursing staff's knowledge about VAP and the ventilator bundle, reduce VAP morbidity and mortality, and ensure that mechanically ventilated patients receive the best quality of care.

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Dedication

I dedicate this capstone project to my family and friends and, with a special feeling of gratitude, to my loving parents Mr. and Mrs. Mariano Sarmiento-Mercene, whose encouraging words have never left my ears. My siblings, Lemie, Letty, Elda, Vicky, Auggie, Gilbert, Restutle, & Alex are also very special and have never left my side. I would have been poorer for completing this capstone project if it were not for them. I also dedicate this capstone project to all my friends who have never wavered in their support throughout this process. My appreciation for all they have done, especially in proofreading my work. I give special thanks to my wonderful daughter Tara for being there throughout the entire DNP program. You have been my most valued cheerleader.

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Section 1: Overview of the Evidence-Based Project

Introduction

Long-term-care facilities (LTCFs) provide personal and medical services to individuals who cannot independently manage to live in the community. At least 3 million patients in the United States receive care every year in skilled nursing facilities and nursing homes, while another 1 million live in assisted-living facilities (Umscheid et al., 2011). The LTCF provides restorative, rehabilitative, and/or ongoing skilled nursing care to residents or patients who require assistance with the activities of daily living. Some of these LTCFs include rehabilitation facilities and nursing homes. While data on infections in LTCFs is limited, it is approximated that at least 1 to 3 million infections develops annually in these facilities (Umscheid et al., 2011). Examples include diarrheal diseases, urinary tract infections, antibiotic-resistant staphylococcus infections, and other hospital-acquired infections (HAIs). Prolonged stays in LTCFs have been identified as a particularly significant contributor to HAI morbidity and mortality, with at least 400,000 patients dying each year (Umscheid et al., 2011).

One major cause of HAIs in the LTCF is mechanical ventilation. A ventilator is used to replace or assist spontaneous breathing. Invasive mechanical ventilation involves the use of an endotracheal tube, either through the mouth or the nose, to push air into the trachea. While mechanical ventilation is normally an intervention that is only used to save a patient's life, it does come with potential complications, such as alveolar damage, airway injury, pneumothorax, oxygen toxicity, and decreased cardiac input (Bénet et al., 2012). However, ventilator-associated pneumonia (VAP) is the most common

complication arising from mechanical ventilation. In LTCFs, control of VAP has become an essential aspect of health care quality improvement (QI) strategies because of its substantial costs in terms of treatment and resources. Indeed, VAP is the second most common cause of mortality among all HAIs and the estimated cost per patient runs in excess of $30,000 (Bénet et al., 2012). This signifies how the reduction of morbidity and mortality rates from VAP has become an important aspect of health care quality for LTCFs.

VAP is defined as pneumonia that develops after 48-72 hours of endotracheal intubation, and is characterized by systemic infection symptoms like altered leukocyte count, fever, presence of progressive or new infiltrate, presence of causative agents, and alterations in sputum characteristics. Early-onset VAP develops within the first four days and is typically attributable to pathogens that are sensitive to antibiotics; while late-onset VAP develops *after* four days of intubation and is normally attributed to multidrug resistant bacteria (Dias et al., 2013). Early-onset VAP is the second most common form of nosocomial infections in the LTCF, as well as the most common for patients under mechanical ventilation. Contributing to approximately 50% of all HAI cases in LTCFs, early-onset VAP develops in about 10-30% of all patients under mechanical ventilation (Kandeel & Tantawy, 2012). Rates of VAP range between 1.2 and 8.5 cases per 1,000 days for patients under mechanical ventilation, with the mean duration of mechanical ventilation and VAP development approximated at 3.3 days (Kandeel & Tantawy, 2012). The risk attributable to VAP has decreased over the years, mostly because LTCFs and other facilities have implemented various preventive strategies. For instance, about 50%

of all antibiotics that are administered in LTCFs are for the treatment of nosocomial infections, including VAP (Kandeel & Tantawy, 2012).

Patients under prolonged mechanical ventilation in the LTCF face high healthcare costs and adverse outcomes. Some of the independent risk factors associated with VAP development are intermediate underlying disease severity, admission for trauma, and being male. Because VAP has a considerable role in increased utilization of resources and mortality, its prevention has been recognized as a critical indicator of healthcare quality and as an essential patient-safety initiative (Dias et al., 2013). Various institutions have published a number of strategies aimed at reducing and managing VAP incidence rates, including the CDC, the American Thoracic Society, the Infectious Disease Society of America, the Institute for Healthcare Improvement, and the European Task Force (Dias et al., 2013). However, due to poor strategy, implementing any of these multiple guidelines has been challenging and inconsistent. In addition, several meta-analyses and randomized control trials (RCTs) have indicated that, while some of these measures reduce VAP rates, only a few reduce length of stay, ventilation duration, and patient mortality.

The Institute for Healthcare Improvement (IHI) came up with the ventilator bundle as part of its VAP prevention concept. The goal was to facilitate the implementation of an evidence-based, preventive strategy for HAIs, including VAP (IHI, 2015). The original ventilator bundle from the IHI was made up of four elements, all of which required reliable and collective implementation: elevation of the patient's head of the bed to approximately 30°–45°, daily breaks from sedation, gastric ulcer prophylaxis, and deep vein thrombosis prophylaxis (IHI, 2015). In 2010, the IHI added oral care.

Researchers have indicated that collective implementation of all ventilator bundle components, along with other prevention measures, has a significant association with reduction in VAP rates (IHI, 2015). However, very few research and QI projects have examined associations between implementing single components of the ventilator bundle and reducing VAP morbidity and mortality. In addition, there has been little research to ascertain whether the bundle can actually be implemented collectively, and complied with, to reduce morbidity and mortality, which is the focus of this QI project.

Problem Statement

The problem addressed in this project was reducing VAP incidents by complying with all five components of the ventilator bundles. The complex interplay among immunity of the host, virulence of the invading pathogens, the presence of risk factors, and the presence of endotracheal tube largely determine the development of VAP (Lambert et al., 2013). The presence of the endotracheal tube is the most critical risk factor, especially as it results in the violation of the patient's immune mechanisms, including the cough reflex of the larynx and the glottis. These bacteria can directly access the patient's lower respiratory tract through micro-aspiration; the bacteria-laden bio-film that develops in the endotracheal tube, and trickling or pooling of secretions around the endotracheal tube's cuff, also increase the risk of developing VAP (Lambert et al., 2013). The bacteria also gain access to the lower respiratory tract because of impaired clearance of mucociliary secretions, which is dependent on gravity for mucus flow in the patient's airways (Lambert et al., 2013).

Bacteria can also collect in the nasopharynx, sinuses, stomach, and oropharynx, thus replacing normal flora with bacteria strains that are more virulent (Lambert et al., 2013). The ventilator bundle has been constructed to account for all these areas of infection. However, only the head of bed elevation, oral care with chlorhexidine, and daily sedation vacation are meant to prevent development of VAP, while DVT prophylaxis and PUD prophylaxis are used mainly in the prevention of mechanical ventilation-associated complications, such as stress ulcers and deep vein thromboses (Lambert et al., 2013). While the ventilator bundles do improve care quality for mechanically ventilated patients, there is little research on how effective is full compliance with all five elements of the bundle in preventing VAP.

Nursing Home and Rehabilitation Center

The Nursing Home and Rehabilitation Center offers a wide range of services, including adult day healthcare, long-term care, post-hospital treatment, and short-term rehabilitation. The facility, which is Medicaid- and Medicare-certified, has 250 residential health care beds and 45 ventilator-dependent beds. The onsite ventilator unit, which is equipped with most of the available technologically advanced equipment and machines, provides ventilator services for residents in need of chronic special respiratory care. The facility uses aggressive weaning protocols that enhance its ability to permanently wean patients off ventilator support. Trained and qualified respiratory therapists, are available at all times and are part of the caring team.

This project, a QI initiative at the Nursing Home and Rehabilitation Center, assessed the status of compliance with the VAP bundle protocol, after which I identified measures to improve full compliance with the ventilator bundle protocol.

Purpose, Goals, and Objectives

Purpose Statement

The purpose of this project was to investigate and improve the level of compliance with the five components of the ventilator bundle protocol at the Nursing Home and Rehabilitation Center, as well as to reach 80% compliance with the bundle protocol. To accomplish this, data on compliance was collected from the Nursing Home and Rehabilitation Center's medical records for 1 month prior to implementation of the project. Some LTCFs have published data that points to a decrease in VAP morbidity and mortality rates after implementing the bundle; thus, the focus was on improving the safety culture (IHI, 2015). Some LTCFs hypothesized that heightened attention to caring for mechanically ventilated patients created a positive chain reaction effect that reduced or prevented complications (IHI, 2015). Thus, the purpose of this QI initiative was to improve compliance with all components of the ventilator bundle, which has been shown to reduce VAP morbidity and mortality and thus improve health outcomes for mechanically ventilated patients. Increased vigilance and compliance with the bundle should also be associated with crossover effects that could result in decreased incidence of other HAIs in the LTCF.

Goals and Objectives

A QI project was conducted at the Nursing Home and Rehabilitation Center to enhance compliance with the ventilator bundle protocol. The specific goals of this project were to

- Initiate 80% compliance with all five elements of the ventilator bundle at the Nursing Home and Rehabilitation Center
- Determine the impact of compliance with all five elements of the ventilator bundle on VAP incidence
- Identify how the Nursing Home and Rehabilitation Center could improve on its ventilator bundle compliance to improve outcomes for mechanically ventilated patients

As such, the purpose of this QI initiative is to improve compliance with all components of the ventilator bundle, thus improving health outcomes for mechanically ventilated patients.

- To improve the knowledge of nursing staff at the Nursing Home and Rehabilitation Center's ventilator unit on importance of adhering to all five components of the bundle. This would be done by displaying data on VAP rates and the effect of full compliance with bundle practices on the infection control committee in the ventilator unit.
- To improve the compliance of the nursing staff with all five components of the ventilator bundle, a daily goal sheet was used.

Project Questions

The following two project questions were developed after reviewing the background of the issue:

1. At the Nursing Home and Rehabilitation Center's ventilator unit, what is the self-reported knowledge of nurses about VAP and ventilator bundle practices?
2. What is the level of compliance with the ventilator bundle by staff at the Nursing Home and Rehabilitation Center after implementation of the project?

Significance of the Project

Bundle is a term developed by the IHI faculty to describe a group of processes that are required for effective care of patients undergoing specific treatments, such as mechanical ventilation, which possess inherent risks. The idea was to combine bundle several evidence-based processes important to improving clinical outcomes. In this project, the bundle was required to be straightforward and brief (Robb et al., 2010). Most importantly, the ventilator bundle was meant to be a cohesive unit: All components were meant to be completed in order for the strategy to succeed.

The ventilator bundle has played the role of a new scoring system for healthcare facilities since its introduction by the IHI and CDC in 2005, which will increase the stakes related to reliability (Robb et al., 2010). Instead of the facility scoring itself for completing the individual *components* of the bundle, the IHI proposed that the facilities should rate themselves on a pass-fail basis for the *entire* bundle (Robb et al., 2010). This scoring system is expected to improve the level of healthcare performance, thus enhancing nursing practice and service delivery outcomes.

Evidence-Based Significance of the Project

VAP has been identified as the most frequent nosocomial, device-associated infection in the LTCF setting. VAP results in longer ventilator use, excessive costs, increased LTCF stays, substantial morbidity, and a two-fold increase in mortality (Sedwick et al., 2012). The literature shows that staff's adherence to infection control procedures is not sufficient to manage VAP-related complications because of inaccessible supplies, lack of time, inadequate knowledge about the importance of complying fully with the bundle; patient safety, and care quality (Sedwick et al., 2012). The CDC and the IHI designed several packages of evidence-based guidelines (EBGs)—referred to as VAP bundles or ventilator bundles—which promote adherence to EBGs, thus eliminating or reducing VAP, in addition to enhancing clinical outcomes. These EBGs involve a combination of sedation vacations, elevation of the bed's head, daily oral care, ulcer prophylaxis, and deep vein thrombosis prophylaxis. Initiation of ventilator bundles has proven an effective method of reducing VAP, particularly where all components have been adhered to (Sedwick et al., 2012). Teaching staff about the ventilator bundle and training them on using it can enhance adherence to EBGs and thus reduce VAP incidence rates. However, various authors have argued that this bundle is inconsistently developed, implemented, and evaluated.

Definition of Terms

The following terms were used to guide this project;

Mechanically ventilated patient: This is a patient unable to breathe independently and, as a result, supported by a breathing or respiration device.

Ventilator Associated Pneumonia: VAP is defined as the presence of persistent chest infiltrate with purulent secretions, a leukocyte count of >10,000/µL, body temperature of >38.3°C, and/or isolation of etiologic agents via biopsy, bronchial brushing, and trans-tracheal aspirate (Damani, 2012).

*Ventilator Bundle***:** A series of interventions and strategies that are related to ventilator care, which achieve significantly enhanced outcomes when implemented together, rather than when implemented individually (Damani, 2012). It includes elevation of the bed's head, sedation vacations, deep venous thrombosis prophylaxis, peptic ulcer prophylaxis, and daily oral care using chlorhexidine.

Institute for Healthcare Improvement: This is a non-profit organization focused on building and motivating change in healthcare facilities, partnering with healthcare professionals and patients to test new care models, and promoting broad adoption of effective innovations and best practices.

Long-Term Care Facility: This is a collective term for assisted living facilities, skilled nursing facilities, and nursing homes that provide personal and medical care services to those who cannot manage independently in their communities.

DNP-Prepared Nurses: These are nurses who have attained a terminal doctoral degree in nursing practice, in which their degree is more practice-focused than research-focused. This nurse functions in various nursing practice roles, including research,

leadership, advocacy and policy, clinical practice, education, and integration of these roles (Collin, 2010).

Registered Nurses (RN): These are nurses working in the LTCF, such as the Nursing Home and Rehabilitation Center, who have graduated from nursing programs and received licensing and certification enabling them to work in the state (Collin, 2010).

Evidence-Based Practice (EBP): This is the judicious and explicit use of current best practices and evidence in decision making about the individual patient's care. It involves integrating clinical expertise with external clinical evidence identified from systematic research (Collin, 2010).

Compliance Rate of Interventions: This is the degree to which recommendations and guidelines provided are adhered to by the healthcare staff caring for patients under mechanical ventilation prior to and after training and educational initiatives.

Full compliance with ventilator bundle: This concept is an 'all-or-nothing' indicator, in which failure to document at least one of the five ventilator bundle elements results in the patient being considered as 0% compliant with the ventilator bundle. Therefore, patient care must include all five elements to be considered 100% compliant.

Evidence-based guidelines: These are a set of recommendations for the clinical practice that are supported by the best evidence available from clinical literature.

Assumptions

This study was based on three assumptions. (a) Statements will be considered true even when they have not been tested scientifically or statistically. (b) Nurses typically do not provide particular interventions from 11 PM to 4 AM so as not to disturb patients' sleep cycles. (c) Multiple realities will exist in this QI project from the perspective of the project leader, the individual nursing staff, and the audience who will interpret the results.

Limitations

This QI project suffered from four limitations. (a) Despite other factors being involved in caring for mechanically ventilated patients, the project did not evaluate any other outcomes apart from compliance with the ventilator bundle. (b) Observing participants could affect their behavior and my subjective perception of participants could distort the data. (c) In-depth interviews were subject to interviewees distorting information via selective perception and recall error. (d) Document analysis data were restricted to what already existed, despite the fact that some documents could have been incomplete.

Implications for Social Change

While various general and specific strategies have proven effective in the reduction of VAP-related morbidity and mortality, the effectiveness of the ventilator bundle in the LTCF has not been evaluated (Al-Dorzi et al., 2012). The problems posed by VAP in LTCFs are complex and numerous. Not only does the incidence of VAP present a set of clinical symptoms that require treatment, VAP also increases the morbidity and mortality of patients in the facility. By its nature, VAP as an HAI will tend to afflict patients whose

conditions are highly unstable. Thus, the use of ventilator bundles has been welcomed by the nursing fraternity as an effective way to prevent VAP in unstable patients. However, the data on the efficacy of the individual strategies in the bundle is limited. After studying the various strategies used to prevent VAP, Al-Dorzi et al. (2012) found that although there was a decline in ventilator days and VAP rates when ventilator bundles were used, there was little data on the efficacy of the overall bundle.

Summary

Development of the ventilator bundle and adherence to all its components collectively has been identified as a vital aspect of preventing and reducing VAP mortality and morbidity rates. Successful implementation of the ventilator bundle could contribute to an enhanced nursing knowledge base, as well as increased potential for the practice to be expanded as a more comprehensive program to other LTCFs.

In Section 2, I present a review of literature, as well as the theoretical framework, which will support use of the ventilator bundle. The first part of the review will deal with the ventilator bundle; the second part will deal with a more general review of literature on VAP, its prevention and management. The review will conclude with the application of a theoretical framework related to change and leadership.

Section 2: Review of the Scholarly Evidence

Introduction

The aim of this project was to identify the level of compliance with the ventilator bundle at the Nursing Home and Rehabilitation Center and then strive to achieve full compliance. The scholarly literature was explored to justify the need for compliance with individual components of the ventilator bundle as currently constituted by the Institute for Healthcare Improvement, so as to promote better healthcare outcomes for mechanically ventilated patients. This chapter examines the scholarly literature on VAP in the LTCF, the ventilator bundle and its components, the role of a DNP-prepared nurse in preventing VAP, and the theoretical frameworks that guided the development of the program.

Literature Search Strategy

The following databases were used in this literature review: PubMed, ProQuest, Medline, and CINAHL. Only articles published after 2010 were selected for review, with the exception of landmark research. The following keywords were used in the search: *VAP, ventilator bundle,* and *long-term care facility infections, efficacy of ventilator bundle, efficacy of ventilator bundle strategies, adherence of nurses to the ventilator bundle*, and *effect of the ventilator bundle on VAP morbidity and mortality*.

VAP and Nursing Knowledge

Causes of VAP

The development of VAP is a multidimensional process that involves an array of risk factors. For example, Burk and Grap (2012) examined VAP incidence in mechanically ventilated patients, seeking a relationship between the elevation of a patient's backrest and the time spent by the patient at a lower elevation. The study found that there was increased incidence of VAP among severely ill patients whose back-rest elevation was maintained at $<30^{\circ}$ for one day after intubation. However, the researchers could not identify any association between the development of VAP and elevation of the backrest after one day of intubation. The study was limited, however, by the small size of the sample.

Bénet et al. (2012) conducted a study to investigate the feasibility of using hospital surveillance programs to reduce the incidence of VAP, while also identifying VAP risk factors, occurrence, and prognosis. They found that aspiration before or during the course of mechanical ventilation was a significant VAP risk factor. Patients experienced an increased risk of developing VAP for every day they were ventilated. Moreover, the majority of the patients under ventilation for over 10 days contracted VAP. Hayashi et al. (2013), too, argued that a surveillance program was feasible and useful in improving care quality for patients under ventilation, and could be used as a baseline for future interventions to prevent VAP.

Nursing Staff Knowledge and Practice of VAP Guidelines

In the LTCF, VAP accounts for approximately 49% of all HAIs. Patients who develop VAP have a prolonged length of stay in the LTCF, while critically ill patients who develop VAP have an increased risk of death. The risk of developing VAP should, however, be reduced by following best nursing practices proposed by the CDC guidelines on VAP prevention. Bird et al. (2010) conducted a study to evaluate the gap between current knowledge levels and reported practice by nurses; it also investigated how well the nurses managing mechanically ventilated patients implemented best practices. The researchers found that more than 80% of nursing respondents washed their hands prior to serving another patient, while 77% reported to wearing gloves when providing oral care for the patients. However, only 36% reported to suctioning oral secretions prior to deflating the cuff, of which 32% stated that this was an intervention for respiration therapy (Bird et al., 2010). The study concluded that evidence-based practice and the guidelines were not being followed uniformly by nurses, especially wearing gloves and washing hands.

Mechanical ventilation is one of the best-known risk factors for VAP with incidence rates that are up to 26 times greater for patients under mechanical ventilation, and increasing at a rate of 1-3% for each day the patient is ventilated (Klompas, 2013). Klompas (2013) set out to identify deficits in knowledge regarding prevention of nosocomial pneumonia among nursing practitioners, as well as to determine any association between VAP knowledge and nurse characteristics. Some of these nurse characteristics include clinical judgment and reasoning, critical thinking, clinical decision-making, and skills acquired through the integration of informal and formal

experiential knowledge; as well as EBGs. They found that knowledge about VAP was at 48%, while 32% agreed that an infection control policy was required in relation to ventilator use in the LTCF (Klompas, 2013). Moreover, 54% of the nursing participants acknowledged that they had received education in infection control over the past year. Finally, they also found that 67% of the participants were knowledge deficient regarding VAP risk factors, while 43% had deficient knowledge in VAP prevention. The study concluded that VAP rates could be decreased with increased awareness of VAP prevention and risk factors.

Kandeel and Tantawy (2012) conducted a study to determine the effectiveness of educational initiatives in reducing VAP rates across a regional healthcare system, in which the results addressed the association between educational initiative compliance and VAP rates. Following training, VAP rates dropped to 7.81/1,000 ventilator days from 8.75/1,000 ventilator days during the period of training. After the educational initiative had been completed, the overall rate of VAP dropped further to 4.74/1,000 ventilator days. This was a 46% decrease in VAP rates after the educational intervention. The researchers concluded that educational interventions had a significant association with VAP rates decline in the LTCF setting, while introducing such an initiative had a higher chance of success where facility nursing staff, specifically respiratory therapist, was involved (Kandeel & Tantawy, 2012). Moreover, the rate of compliance was higher for those facilities that integrated the educational initiative into their mandatory education.

VAP prevention is mainly focused on avoiding the micro-aspiration of subglottal secretions, preventing the colonization of the oropharyngeal system by exogenous pathogens, and avoiding ventilator equipment contamination. Rosenthal et al. (2012)

conducted a study to investigate the knowledge of nurses about EBGs meant for the prevention of VAP. The findings revealed that nurses with less than 12 months of experience had less knowledge than those with a specialized nursing degree. Years of experience were identified as independently associated with enhanced levels of knowledge. The study also reported that 17% of the participants were aware of the closed system, while only 12% recognized recommendations for the weekly changing of airway humidification systems. Moreover, 60% of participants were aware that the drainage of sub-glottal secretions resulted in VAP rates decline (Rosenthal et al., 2012). The study concluded that awareness of nurses concerning guidelines on VAP was low, stressing that thorough education-based proposals and recommendations were essential. Finally, they also concluded that increased knowledge levels initiated the first step towards effective multidimensional educational initiatives, while education initiatives should involve support from EBGs.

Umscheid et al. (2011) set up a study to investigate the level of understanding possessed by nurses concerning VAP prevention using the ventilator bundle strategy, defining the ventilator bundle as steps that incorporate CDC guidelines into practices of patient care. The steps identified in the study included hand-washing prior to and after contact with the patient, changing the ventilator circuit no more than once every 48 hours, continuous drainage of subglottic secretions, and elevation of the backrest to 30˚-45˚. The study found that the nurses scored better after they had completed their educational sessions, especially showing great improvements in oral care, charting of backrest elevation, washing hands prior to and after contact with a patient, checking for residual volume in the nasogastric tube, and limiting the wearing of rings. They concluded that

nursing knowledge could be increased effectively using educational sessions, while they also report that educational sessions were effective in altering clinical practice for patients under mechanical ventilation (Umscheid et al., 2011). The researchers also recommended further research into nasogastric tube feeding and oral care in relation to nursing practice and VAP.

The Ventilator Bundle

This section will review the levels of evidence that support every component of the ventilator bundle as recommended by the Institute of Healthcare Improvement.

Elevation of the Backrest to 30°-45°

Elevating the backrest of the bed into a semi-recumbent position has been identified as an integral component of the ventilator bundle (Ballew et al., 2011). The semi-recumbent position could decrease incidences of AVP through the reduction of gastroesophageal reflux, as well as the subsequent aspiration of nasopharyngeal, oropharyngeal, and gastro-intestinal secretions. Schallom et al. (2015), while arguing that guidelines recommending HOB elevation >30° in order to prevent VAP conflict with pressure ulcers prevention guidelines that recommend HOB elevation <30°, note that elevation above 30° is preferable and feasible for reducing oral secretion reflux, secretion, and aspiration. This is possible without the development of pressure ulcers in gastric-fed, mechanically ventilated patients. In addition, patients who are more deeply sedated could benefit from increased head of bed elevations.

Wolken et al. (2012) similarly begin by hypothesizing that continuous assessment and monitoring of HOB elevation to ensure elevation is always above 30° should increase

compliance by about 15%, while also noting that this reduces oral secretion aspiration that is a significant contributor to VAP. However, it is also noted that intermittent checks of the mechanically ventilated patient's HOB elevation might overestimate compliance, which could increase the likelihood of the patient developing VAP (Wolken, 2012).

Harbrecht (2012) sets out to investigate the effectiveness of placing mechanically-ventilated patients in semirecumbent positions of >30˚ in the reduction of VAP incidence, as well as the feasibility of keeping patients in such a position of HOB elevation. The study's findings indicate that majority of facilities that care for mechanically ventilated patients do not comply with HOB elevation guidelines, while also showing that increased compliance with HOB elevation guidelines requiring elevation of between 30˚ and 45˚ decreased the incidence of VAP. A similar study by Metheny and Frantz (2013) found that in facilities caring for critically ill patients under mechanical ventilation, the semi-recumbent position was only achieved for <30% for patients under mechanical ventilation. The aforementioned was despite the presence of a comprehensive VAP-intervention program meant to combine nursing education, and a systemic addition of orders standardized to ensure patients were lying in a semi-recumbent position.

Lin et al. (2014) concurred, writing that aspiration of colonized oral secretions and gastrointestinal contents is generally the cause for developing VAP in mechanically ventilated patients. They note that this becomes more likely if the patient's HOB elevation is below 30˚. In addition, Liu et al. (2013) identified the increased presence of *Staphylococcus aureus* and *Pseudomonas aureginosa* in the pharynx and endobronchial samples of patients lying in a supine position as compared to those with a HOB elevation of over 30˚. Similarly, the researchers also noted that the size and presence of the

nasogastric tube are significant factors that influence the frequency of aspiration in mechanically ventilated patients, specifically because they might compromise the efficiency of the lower sphincter's activity within the esophagus (Liu et al., 2013). Patients who are laid in a supine body position have a higher likelihood of having a nasogastric tube with a larger bore, ultimately leading to a higher status of VAP development.

Therefore, the question that arises from these studies regards the ideal elevation of the head for patients under mechanical ventilation that should be incorporated into the ventilator bundle. While evidence suggests that the supine position significantly increases incidents of VAP in mechanically-ventilated patients, particularly those undergoing enteral feeding via nasogastric tubes, more studies are needed to compare the proposed 30-45° position recommended in the bundle to the more feasible 10-30° position that is achievable in the long term care facility.

Daily Sedation Vacation and Assessment of Extubation Readiness

Robb et al. (2010) also carried out a study using the standardized weaning protocol in order to assess resulting reductions in the days patients spent under mechanical ventilation. The results of the study showed that using the standardized protocol led to a reduction in ventilator days/LTCF days to 0.33 from 0.47, while also reporting that VAP rates were reduced to 5% of the protocol group compared to 15% in the control group (Robb et al., 2010). In this case, they also reported that using a peer

network in implementing a spontaneous breathing trial that was standardized and evidence-based provided essential information for the sedation strategy. The research study found that peer networks were effective in the implementation and promotion of evidence-based practices, while best practice implementation was necessary for liberating the patient from mechanical ventilation but was insufficient by itself for achieving timely and consistent liberation (Robb et al., 2010).

In conducting a study to explore the effectiveness of pairing daily sedative interruptions or spontaneous awakening trials and spontaneous breathing trial, Jones et al. (2014) randomly assigned mechanically ventilated patients with a daily spontaneous awakening trial, which was followed by sedation or a spontaneous breathing trial, while the breathing without assistance was the primary endpoint. Those patients assigned to the intervention group spent 14.7 days breathing sans assistance over the study period, while those in the control group spent 11.6 days sans assisted breathing with the former being released earlier from a hospital. The study came to the conclusion that more patients in the intervention group attempted or succeeded in extubating themselves, despite the fact that the number of mechanically ventilated patients, who needed subsequent re-intubation, as well as the total number of cases requiring re-intubation, was similar. Dankers et al. (2013), on their part, find that mechanical ventilator weaning protocols do improve clinical outcomes, although this is dependent on the staffing, structure, and acceptability of the protocols by physicians in the ICU.

These findings suggest that pairing sedation interruption (spontaneous awakening trials) with spontaneous breathing trials led to improved healthcare outcomes for patients under mechanical ventilation, compared to current approaches, recommending that it

should be made standard practice. Based on this evidence, it can be inferred that the daily sedation vacation and assessment of extubation readiness component of the ventilator bundle should be modified to advocate for daily spontaneous breathing trials and spontaneous awakening trials for patients under mechanical ventilation.

Peptic Ulcer Prophylaxis

While this component has been identified by the IHI as being part of the ventilator bundle, it is not a strategy that is specific to the prevention of VAP. Al-Dorzi et al. (2012) conducted a study to evaluate probable risk factors in mechanically ventilated patients for stress ulceration, while documenting instances of gastrointestinal bleeding of clinical importance. Gastrointestinal bleeding was defined as overt bleeding associated with blood transfusion requirements or hemodynamic compromise. They found that 1.5% of the patients in the study had bleeding that was clinically important, while also identifying coagulopathy and respiratory failure as independent bleeding risk factors. For patients with either one or both risk factors, 3.7% had clinically-significant bleeding, while 0.1% of patients without any of the two risk factors had clinically significant bleeding (Al-Dorzi et al., 2012). The study concluded that stress ulcer prophylaxis is warranted by the need for mechanical ventilation and coagulopathy. This evidence shows that, although not related to prevention of VAP, this component should be retained.

Deep Venous Thrombosis Prophylaxis

Halpern et al. (2012) argued that although their study fails to find a clear association between deep venous thrombosis prophylaxis and incidence of VAP, application of this component as an intervention package in ventilator care decreases the

incidence of VAP compared to when it is omitted. As a result, deep venous thrombosis prophylaxis is an essential part of the standard care for mechanically ventilated, sedated patients. As with stress ulcer prophylaxis, this component is yet to be proven to reduce incident rates of VAP. However, it remains as an essential component of the ventilator bundle to reduce or prevent other complications of a serious nature that risk increasing the mortality and morbidity of these patients.

Oral Care with Chlorhexidine Antiseptic

Recent evidence-based ventilator-associated prevention guidelines for clinical practice have advocated for the use of chlorhexidine gluconate as an oral antiseptic for mechanically ventilated patients, although this has been a latter-day addition to the IHI-proposed ventilator bundle (Shi et al., 2013). In addition, the cost, feasibility, and safety considerations have all been favorable for this intervention. Roberts and Moule (2011) conducted a meta-analytical and systematic study to assess the impact of oral decontamination using chlorhexidine antiseptic on incidence rates of VAP, as well as mortality, for patients under mechanical ventilation. After conducting seven trials, they found that this component of the ventilator bundle reduced VAP incidence significantly, although it was not associated with decreased length of stay, mechanical ventilation duration, or mortality rates (Roberts & Moule, 2011). The study concluded that use of chlorhexidine for oral decontamination prevented VAP, particularly for patients who had undergone cardiac surgery.

Literature on the Theoretical Framework

The John Hopkins Nursing Evidence-Based Practice Model (JHNEP)

EBP plays an essential role in professional development, patient safety, and education of nursing students, and it has increasingly emerged as the foundation for policies and procedures in the healthcare sector. The School of Nursing at John Hopkins Hospital, along with the faculty and John Hopkins Hospital developed the JHNEP, which seeks to enhance the attainability of EBP, specifically for nursing professionals. The model identifies three essential foundations for professional nursing, which are nursing practice, nursing research, and nursing education; while also identifying the basic element of all nursing activities as nursing practice, through which nursing care is provided to patients (Dearholt et al., 2012). This approach is useful in decision making in problem solving, as well as being specifically created to help in the identification and satisfaction of practicing nurses' needs. Nursing practice as identified in the JHNEP model refers to the means through which nursing care is provided to patients, which makes it a critical component of nursing, while education refers to acquiring skills and knowledge in nursing required for competence and proficiency. Finally, research acts as a source of new knowledge, enabling the development of practice on the basis of scientific evidence (Dearholt et al., 2012).

Nursing research as a foundation of JHNEP

While common understanding holds that nursing best practices are conducted on the basis of decisions that are validated by scientifically sound evidence, the rate of translation of research into nursing practice has been identified as being particularly slow.

Majority of nurses in the current healthcare environment are to some degree influenced by knowledge creep, which is descriptive of slow diffusion of findings and results from research into the clinician's mind and practice (Philbrick, 2013). The JHNEP seeks to foster an environment where professional and research-based nursing practice is facilitated. The nursing research utilizes both quantitative and qualitative methods, as well as an evidence-based approach meant for studying and improving patient outcomes, care, and care systems. In the healthcare environment, the organization provides the needed infrastructure for achievement of nursing research excellence and EBP through computer access, financial support, skill-building programs, mentors, and research consultative service referrals (Philbrick, 2013). Finally, nursing leadership encourages and supports the use of nursing research in informing practice and generating new knowledge. Using EBP and research leads to enhanced patient outcomes since decision-making is based on the best evidence.

Nursing Education as a Foundation of JHNEP

The second foundation of the JHNEP framework is nursing education. Generally, nursing education starts with basic education, such as baccalaureate or associate degrees, where they learn attitudes, behaviors, professional values, behavioral and natural sciences, and fundamental knowledge and skills in nursing (Newhouse et al., 2014). On the other hand, doctorate or master's degrees form part of advanced education for nurses and refines practice, expands knowledge, and normally results in nursing specialization in particular areas of practice. This latter form of education integrates enhanced emphasis on research application, as well as other forms of evidence to either change or influence

nursing practice. Moreover, ongoing education such as in-services, workshops, seminars, and conferences is needed for the nurse to stay up-to-date with new skills, technologies, and knowledge, as well as to establish ongoing and initial competencies. Nurses also gain education from experience and practice, which results in the nurses enhancing their ability to make effective decisions and judgments concerning patient care and develop their critical thinking skills (Newhouse et al., 2014). Apart from formal education, nurses need to commit to ongoing education, while also incorporating new evidence based knowledge, to realize their aim of providing safe, quality, and cutting edge patient care.

Nursing Practice as a Foundation of JHNEP

The third and final foundation of the JHNEP framework is nursing practice. Schaffer et al. (2013) identify the most significant aspects of nursing practice as practice standards or professional standards, nursing care standards or procedures and protocol, and the nursing process. Nursing practice has been based on historic practice and expert opinion and, even currently, identifiable nursing interventions have minimal research that supports the nursing practice, as well as their significance in comparison to other strategies or interventions. However, current practice and the need for evidence-based practice changes can be validated by using an organizational approach meant for nurses to question nursing practice. Moreover, Frank (2014) notes that giving nurses the opportunity to operate in a multidisciplinary team setting in the evaluation of evidence, development of evidence-based practice questions, and effecting practice changes aids in the promotion of professional development and development of critical thinking skills. When nursing professionals take part in the evidence-based practice process, they are

more likely to perceive enhanced autonomy, as well as feel more satisfied due to their contributions to nursing practice changes.

Summary

This literature review has focused on the causes of VAP, nursing knowledge of VAP guidelines, and the efficacy of individual components of the ventilator bundle. This section identified the JHNEP framework, which was discussed in order to provide a contextual understanding of professional roles in development of VAP best practice in the LTCF. In reducing VAP incidence rates, research supports the unique capabilities of elevating the patient's head-rest to 30-45°, as well as daily sedation vacation and assessment of extubation readiness. However, the other three components of the ventilator bundle require additional research in order to ascertain their efficacy in reducing VAP-related morbidity and mortality in the LTCF. Nevertheless, there is ample evidence that complying with the latter three components along with the previous two components significantly reduces VAP morbidity and mortality in mechanically ventilated patients.

Section 3 describes the approach to be used for the QI initiative: implementing compliance with all five elements of the ventilator bundle, to reduce VAP incidence in the ventilator unit.

Section 3: Approach

Introduction

I sought to improve the quality of care for mechanically ventilated patients by achieving full compliance with the ventilator bundle at the Nursing Home and Rehabilitation Center. In the process, I investigated the knowledge of nurses at the Nursing Home and Rehabilitation Center's ventilator unit about the use of the ventilator bundle proposed by IHI to reduce the incidence of VAP, as well as the level of compliance with each component of the ventilator bundle. I then sought to improve compliance with the ventilator bundle for each component of the bundle. In this QI project, the project leader took a leading role in directing various activities within the process.

Potential Gap in Practice Requiring Improvement

In spite of implementing the IHI ventilator bundle prevention measures, the Nursing Home and Rehabilitation Center has continued to report significant rates of VAP. Given that previous research have shown that the collective bundle, as well as its individual elements,, reduce VAP rates, the problem facing the Nursing Home and Rehabilitation Center was potentially poor compliance with all five elements of the bundle protocol. Nursing knowledge of the importance of complying with all five elements could be to blame for this outcome for ventilated patients. As such, I sought to initiate full compliance with all five ventilator bundle practices by improving the knowledge of nursing staff on the Nursing Home and Rehabilitation Center's ventilator

unit. I did this by posting data on VAP rates in the ventilator unit and near the nurses' break rooms.

I also sought to improve the nursing staff's compliance with all five components of the ventilator bundle by using daily goal sheets. This was expected to improve overall care for mechanically ventilated patients and thus reduce VAP morbidity and mortality rates. The main reason for suspecting poor compliance as the cause for this gap in practice is that the Nursing Home and Rehabilitation Center does not use daily goal sheets to ensure that all five elements are used with mechanically ventilated patients. This was suspected because the lack of daily goal sheet assessment limits the tracking of daily completion of all bundle practices. In addition, although the bundle has been present for a few years, it was suspected that the nursing staff in the ventilator unit had poor understanding of what the individual elements added to the care of mechanically ventilated patients. These were the two main hypotheses for the persistence of VAP rates in the Nursing Home and Rehabilitation Center.

Confirming the Gap in Practice

In order to confirm this gap in practice, I began by identifying the number of patients at the Nursing Home and Rehabilitation Center's ventilator unit for whom all five components of the bundle have been implemented and documented in the medical records. Thus, medical records going back one month prior to beginning the project were assessed using an all-or-none indicator for the five components. This also allowed for documentation of patients for whom some or even all of the bundle elements had not been implemented. Compliance with the bundle, i.e. all-or-none, was then compared to

the self-reported compliance with the ventilator bundle. Compliance with the ventilator bundle before the QI project's implementation was derived from interviews with the nurses, which were conducted prior to implementation. This will serve as the project's baseline, after which data on compliance was collected using daily goal sheets and the data collated to provide weekly data, which was compared with the baseline data.

Implementing the Intervention

This intervention was implemented to fix the identified gap in practice at the Nursing Home and Rehabilitation Center, which is poor compliance, by enhancing compliance with all five components of the ventilator bundle. The intervention involved improving the knowledge of nursing staff at the Nursing Home and Rehabilitation Center's ventilator unit on the ventilator bundle practices, specifically by posting data on VAP rates and the effect of complying with the ventilator bundle on reduced VAP rates. In addition, the plan also involved improving compliance of the nursing staff with all five elements of the ventilator bundle. This was done using daily goal sheets, which track compliance with the five bundle practices, to ensure that each patient's care complied with all five elements of the bundle. Data collected on compliance rates were then be compared with the baseline data to ascertain whether the gap in practice had been significantly narrowed. Ventilator bundle compliance was assessed by calculating the percentage of patients in the ventilator unit on mechanical ventilators that have all five bundle practices adhered to, with the data being extracted from the daily goal sheets.

Evaluation of the Intervention

To ensure that the implementation plan was working and that practice had improved, I used formative evaluation, which was carried out during the course of the QI project. The expected outcomes of this formative evaluation were enhanced compliance with ventilator bundle, as well as improved knowledge on the importance of complying with the ventilator bundle. Therefore, data on compliance with all five bundle components was collated weekly based on the daily goal sheets, participant observation, and medical records and compared to the baseline data. Compliance data was also expected to help identify the need for improvements in ensuring full use of the five bundle components. By comparing the weekly evaluative data with the baseline data, the research could then determine whether knowledge on the effectiveness of the ventilator bundle in providing quality care for mechanically ventilated patients had improved, as well as whether this had resulted in narrowing of the gap in practice (lack of compliance with ventilator bundle).

Project Design/Methods

A qualitative project paradigm was adopted for this QI project. As stated, the main purpose for the project was to identify the knowledge of nurses on the importance of complying with the bundle protocol and the level of compliance with the ventilator bundle protocol by nurses at the Nursing Home and Rehabilitation Center. After identifying the level of compliance, I sought to achieving 80% compliance with all five practices of the ventilator bundle. A qualitative approach was a good fit for this project since it revealed the range of perceptions and behavior that drove the target audience in

following the ventilator bundle guidelines. Moreover, by using in-depth studies of small participant groups to support and guide theory construction, the qualitative approach allowed for descriptive results (Hoskins & Mariano, 2014). In addition, a qualitative approach enabled the project designer to describe complex phenomena, such as compliance which has numerous variables involved. Using the qualitative approach also allowed me to investigate why nurses complied or failed to comply with the ventilator bundle strategies, as well as how they make decisions in caring for mechanically ventilated patients in the LTCF (Hoskins & Mariano, 2014).

In fulfilling the objectives of the QI project, a QI project design was used. This primarily involves continuous and systematic actions that result in measurable healthcare service and health status improvements in a targeted population of patients (Hoskins & Mariano, 2014). In this case, the continuous and systematic actions were enhanced compliance with the ventilator bundle, while the health status improvement involves improved quality of care for mechanically ventilated patients at the Nursing Home and Rehabilitation Center's ventilator unit. Quality in this project design was a direct association between levels of enhanced health status or services, and desired outcomes of patient populations (Hoskins & Mariano, 2014). The current system in this QI design was defined as how the Nursing Home and Rehabilitation Center's ventilator unit is caring for ventilated patients currently, while healthcare performance was defined as the unit's care outcome and efficiency. In order to attain a different performance level in relation to results of healthcare and improve healthcare, the QI design required that the Nursing Home and Rehabilitation Center's current compliance system should change.

Population and Sampling

According to LoBiondo-Wood and Haber (2012), successful statistical practice depends on defining the population from which the sample will be drawn, which aids in creating a more focused definition of the project problem. The current project drew its sample from the Nursing Home and Rehabilitation Center in Brooklyn, New York. This Nursing Home and Rehabilitation Center is a premier facility that provides high quality medical care to its residents, including long-term care for patients, although it also provides post-hospital treatment, short-term rehabilitation, and adult day healthcare services. For the purposes of this project, the target population was ventilator unit nurses caring for mechanically ventilated patients. The Nursing Home and Rehabilitation Center is a LTCF that provides health-related services to ventilator-dependent patients, among others and out of the 270 certified beds at the facility, of which 45 are used by mechanically ventilated patients. Moreover, the ventilator unit has 15 dedicated nurses who care for the mechanically ventilated patients.

Because this project was bounded by workforce, money, and time; it was not be possible to sample the entire population of nurses randomly, which meant that a non-probability sampling technique was used. Moreover, since this is a QI project, there was no fixed population of interest from which the project can select a sample randomly (Perla et al., 2013). Thus, judgment sampling was used, which involved selection of the study sample on the basis of the project leader's subjective judgment drawing on theory and practice (Perla et al., 2013). Since the QI project uses the qualitative approach, a judgment sample allowed for study of different variables and intricacies within the selected sample in relation to caring for mechanically ventilated patients by improving

compliance with the ventilator bundle protocol. The specific mode of judgment sampling to be used for the QI project was purposive and snowball sampling. In purposive sampling, selection of the sample is based on variables linked to the project question (Gerrish & Lacey, 2012).

Therefore, the judgment sample was selected from only those nurses caring for mechanically-ventilated patients in the ventilator unit, as well as the occupied patient beds in the ventilator unit. Purposive sampling will result in the selection of the (n = 45) beds in the ventilator unit, although this sample size fluctuated since all the beds were not occupied during the QI project. In relation to the nursing staff in the ventilator unit, judgment sampling was used to select only those nurses who have worked in the ventilator unit for more than six months and have direct contact with the mechanically - ventilated patients. The proposed sample size was 15, but since fewer than half of this size was recruited in the beginning, snowball sampling was incorporated. The following selection criteria were used: the candidates must have worked in the ventilator unit for at least 500 hours in the last year, and must have been involved in directly caring for mechanically ventilated patients for at least one year.

Snowball sampling is a form of purposive sampling (Gerrish & Lacey, 2012). I recruited 10 participants and then they, in turn, helped recruit other candidates among the other nurses in the ventilator unit. Two of the nurses included in the snowball sample were selected from float nurses, who were not specifically tasked with caring for mechanically ventilated patients but were part of the collaborative team caring for these patients. These float nurses, however, needed to have several competencies for working in the ventilator unit, including the ability to assess ventilator equipment and conduct

safety checks on the patients and equipment. Their competencies were assumed based on their qualifications and particular roles they performed in the ventilator unit, as well as their ability use and practice skills safely and apply their knowledge to ventilator unit-related clinical situations.

Data Collection

The QI project collected both primary and secondary data in order to answer the identified project questions. Secondary data was collected through the use of desk research. In desk research, information and data searches was conducted using statistical reports, analytical reports, journal articles, and white papers (Fawcett & Garity, 2012). The Walden University library was used in identifying sources that are relevant to the five strategies under the ventilator bundle guidelines by the IHI, both in terms of the individual strategies and the overall bundle. Searches were conducted for all studies published in English between 2010 and 2014. Those studies that evaluated strategies for reduction of HAIs) in the LTCF were included, specifically where the aim of the QI project was related to reduction of HAI morbidity and mortality.

Primary qualitative data was collected through the use in-depth interviews, participant observation, and document studies. In order to answer the project question on the knowledge of nurses at the Nursing Home and Rehabilitation Center's ventilator unit about the ventilator bundle, the project leader used in-depth interviews, which were administered to the selected sample of nurses. The in-depth interview was designed for nurses working in the LTCF's ventilator unit. Briefly, the in-depth interview was developed from the questionnaire utilized in the "Study on the Efficacy of Nosocomial

Infection Control" (Weber & Kelley, 2013). This questionnaire was used in a study of staffing programs for infection control in American hospitals and was specifically aimed at reviewing the intensity of control, prevention, and surveillance activities (Weber & Kelley, 2013). The respondents were asked about LTCF-specific practices, along with ventilator bundle compliance in the ventilator unit. Information from the in-depth interview was collected through note-taking and tape recordings.

To answer the question on whether staffs at the Nursing Home and Rehabilitation Center's ventilator unit comply with all five elements of the ventilator bundle after its implementation, the project leader used participant observation. In participant observation, the project leader observed the nursing staff in the ventilator unit as they cared for mechanically-ventilated patients, while also recording the observed activity. The project leader became part of the environment in which the study occurs (Henderson, 2012), with the aim of gaining an close familiarity with the nurses at the Nursing Home and Rehabilitation Center, as well as their practices in relation to observing full compliance with the ventilator bundle protocol. In this case, the project leader used the ventilator bundle checklist and took notes on the activity of nurses to record observations on whether the nurses fully comply with the ventilator bundle. The ventilator bundle checklist helped in tracking the Nursing Home and Rehabilitation Center's compliance with each bundle element; which are elevation of the head of the bed, daily sedation vacations, oral care with chlorhexidine, peptic ulcer prophylaxis, and deep venous thrombosis prophylaxis (Malouf-Todaro et al., 2013). Full compliance with the ventilator bundle was only indicated by 100% compliance, i.e. the use of all five elements of the

bundle. Where even one element is missing, compliance was considered to be 0%, while the implementation of all five elements constituted 100% compliance.

Finally, to answer the question about the extent to which full compliance with the ventilator bundle is achieved, the project leader used document studies to collect data on bundle protocol compliance before and after implementation. Documents in this case referred to written material about the compliance with the bundle protocol prior to and after implementation of the ventilator bundle (Henderson, 2012). Weekly compliance rates were noted from ventilator unit medical records for the one month leading up to the implementation, based on the weekly number of patients who had all five elements complied with. The aforementioned served as the project's baseline, after which data ventilator bundle compliance was collected using daily goal sheets and the data collated to provide weekly data, which was compared with the baseline data. Every weekday for two months after implementation, during the daily round, all ventilated patients were assessed for compliance with the bundle and where any component was missing, the case was considered as non-compliance. The sample included all ventilated patients in the Nursing Home and Rehabilitation Center's ventilator unit, where patients with all elements in place are considered fully compliant, which was the weekly prevalence measure. Again, data collection from the daily goal sheets, medical records, and participant observation was conducted over a two month period.

Data Analysis

In analyzing data from the in-depth interviews, participant observation, and document studies, I sought to use grounded theory analysis, in which a theory on the impact of the ventilator bundle was developed beginning from the initial collection of the data. Once the project leader had collected and transcribed all data, I moved on to creating a system of indexing for this data (Charmaz, 2012). To begin with, the project leader identified anchors or codes that enabled the gathering of key data points. This step built up several relevant topics about the ventilator bundle and compliance from the interviews and participant observation, which, as noted, was coded. These codes were then grouped through the collection of codes possessing similar content into concepts, reducing the codes into several concepts. Further, the project leader analyzed these broad groups of concepts to identify similar concepts, which were grouped together to form categories of data (Charmaz, 2012). Finally, these categories were used to generate a theory about the improvement of care quality for mechanically ventilated patients through achievement of 80% compliance with the ventilator bundle protocol.

Project Evaluation Plan

The outcomes expected as a result of the project are reductions of VAP-related costs, the reduction of VAP-associated morbidity and mortality rates, reduction of length of stay in the LTCF as a result of VAP, and to achieve an overall improvement of care for mechanically ventilated patients. In evaluating these outcomes, various measures were used, including metrics from one month prior to implementation of the project two months after implementation of the project respectively (Goutier et al., 2014). The

infection control team at the Nursing Home and Rehabilitation Center was asked to provide data for pre-implementation evaluation, specifically for metrics related to the five bundle elements. These metrics were as follows:

- Head of the patient's bed stays elevated at least 30˚ at any time, in which a retrospective chart review will be used
- The patient's oral care will be documented after every shift, and a retrospective chart review will be used for this
- Protocol for sedation weaning will be conducted at least once for every shift and, again, retrospective chart review will be used
- Deep vein thrombosis prophylaxis is to be initiated after every eight hours of patients being mechanically ventilated.
- Peptic ulcer disease prophylaxis is to be initiated after every eight hours of patients being mechanically ventilated.
- Ventilator dependent days will be counted through the maintenance of a running total using an Excel sheet maintained by the long term facility's educator

Data from the pre-implementation stage were collated using a retrospective paper chart review, which made use of audit forms. Post-implementation, similar metrics were collected using the electronic healthcare reporting system that was done in conjunction with the infection control department at the Nursing Home and Rehabilitation Center (Songwathana et al., 2011). Following this, data from the pre-implementation and post-implementation period were evaluated.

Summary

Reducing the incidence of VAP in mechanically ventilated patients is a benchmark for the quality of nursing care in a LTCF that can be addressed best using the five components of the ventilator bundle. A project such as the ventilator bundle is required to enhance the care given to mechanically ventilated patients to reduce VAP morbidity and mortality. In addition, this approach section identified the methods of participant recruitment at the Nursing Home and Rehabilitation Center, as well as the methods of data collection and analysis. This section has addressed how the project design was developed, as well as how it was implemented. In addition, this section has also addressed how data for evaluation of the project was collected and used. The following section provides a discussion of the results of the participant in-depth interviews, as well as the implications of these findings for nursing practice in the ventilator unit.

Section 4: Discussion and Implications

Introduction

The main purpose of this QI initiative was to investigate the level of compliance with the different components of the ventilator bundle protocol at the Nursing Home and Rehabilitation Center, and then to increase compliance. The two secondary purposes were as follows: (a) determine the compliance with all five elements of the ventilator bundle following implementation of the QI initiative; (b) identify how the Nursing Home and Rehabilitation Center could improve on its compliance to improve outcomes for mechanically ventilated patients. However, since the project is yet to be implemented, Chapter 4 can't discuss the results but it will discuss the possibility of applying the results in evidence-based nursing practice.

Summary and Evaluation of Findings

Out of the 15 interviewees, 11 were Licensed Practical Nurses and 4 were Registered Nurses. In addition, 1 participant had worked in the ventilator unit for 8 years, 2 for 7 years, 1 for 6 years, 4 for 5 years, and the rest 7 had worked in the ventilator unit for less than 5 years. Moreover, thirteen reported that they were aware of the Nursing Home and Rehabilitation Center's infection control committee; 10 reported that they had participated in the committee's activities. The two participants who reported not being aware of the committee were registered nurses, whereas those who reported not having taken part in the committee's activities had worked in the ventilator unit for more than 5 years.

Furthermore, 6 of the participants did not have an answer for how often they participated in the committee's activities, of which 4 were those who never took part and 2 took part but failed to give an answer on regularity. Nine of the participants believed that VAP was the most common hospital-acquired infection at the Nursing Home and Rehabilitation Center s, whereas 5 did not consider this to be the case. Of those who did not believe VAP to be the most common HAI, 3 were registered nurses; while 4 did not take part in the infection control committee's activities. However, 12 of the participants reported that they considered the Nursing Home and Rehabilitation Center to be doing enough towards controlling VAP in the ventilator unit, while the remaining 3 who felt that not enough was being done to prevent VAP also reported no involvement in the activities of the infection control committee.

Participants disagreed in their perceptions about transmitting VAP to mechanically ventilated patients. Almost all participants 12 reported faithful compliance with the five bundle elements, while 10 said that they received information on how to prevent VAP in the ventilator unit. In relation to attending courses on VAP prevention, 9 reported having attending at least one course, with 6 saying they had never attended training or educational course on VAP prevention. Finally, almost all participants thirteen said that they felt a need for additional information on VAP prevention at the Nursing Home and Rehabilitation Center's ventilator unit. The 2 participants who said they did not need additional information on VAP prevention also reported that they were not involved in the infection control committee's activities.

Despite the implementation of the ventilator bundle at the Nursing Home and Rehabilitation Center's ventilator unit, and 12 of the participants reporting faithful

compliance with the ventilator bundle, the unit continues to report significant levels of VAP prevalence and incidence. According to the systematic review by Goutier et al. (2014), since majority of previous studies indicated that the individual ventilator bundle elements each possess a positive impact on VAP incidence reduction, I concluded that the main problem facing the Nursing Home and Rehabilitation Center's ventilator unit was a lack of compliance with all five elements. Thus, the QI project sought to initiate full compliance with all five ventilator bundle practices by improving the knowledge of nursing staff at the Nursing Home and Rehabilitation Center s' ventilator unit on importance of adhering to all five components of the ventilator bundle. Results of the participant interviews showed that a significant number of participants had not attended any education course on the use of ventilator bundles and reduction of VAP incidence, which could explain the discrepancy between reported compliance and actual compliance. Thus, the QI initiative set out to introduce the use of daily goal sheets to ascertain bundle compliance.

Indeed, one of the major reasons why the QI initiative suspected lack of compliance was that the ventilator unit did not use daily goal sheets to ensure that the nurses complied with all five ventilator bundle elements. Introduction of the daily goal sheets, therefore, tracked compliance with the five bundle elements via documentation and will continue to help in assessment of daily bundle practice completion (Bénet et al., 2012). In spite of having the bundle implemented, the fact that the participants reported to not having any education courses on ventilator bundle use and also said they needed more information on using the ventilator bundle shows that they have poor understanding on the importance of complying with each bundle element. These results provided evidence

on the need to implement the QI initiative with the aim of fixing this existing gap in practice, specifically to enhance the participants' knowledge on the importance of each ventilator bundle element. Hence, these results indicated the need for a QI initiative to improve compliance of the nursing staff at the LTCF with all five elements of the ventilator bundle practices. This was done using daily goal sheets, which track compliance with the five bundle practices, specifically through documentation of compliance with each practice every day, to ensure that each mechanically ventilated patient's care complies with all five elements of the bundle (Damani, 2012).

Discussion of Findings

Data from various studies has shown significant and positive effects of implementing the ventilator bundle on the care outcomes of mechanically ventilated patients. Indeed, numerous EBGs from a variety of healthcare organizations across the globe include all five elements of the ventilator bundle, with substantial evidence showing that nursing knowledge and education on the ventilator bundle approach have a high level of effectiveness in bundle compliance (Halpern et al., 2012). This QI initiative was conducted in one LTCF with the participants selected through non-probability sampling and, as such, it is difficult for the project to generalize the data and results. Whereas previous research studies have determined an average of 59.9% for nurses' knowledge on the ventilator bundle, the current QI initiative found reported knowledge of the ventilator bundle through provision of regular information at 66.7% (10 against 5). This difference in knowledge and education levels may be the result of healthcare delivery model differences, as well as differences in local guidelines, routine nursing

duties, presence of a consistent VAP policy, and differences in perspectives on good practice (Lambert et al., 2013).

This QI initiative found, as several other research projects have found, that nurses with more experience tend to perform significantly better in knowledge and education on the ventilator bundle than less experienced nurses. In this case, nurses with more than five years of experience had all attended a training or educational course on prevention of VAP including on the use of the ventilator bundle, while all participants who reported not attending these courses had experience of less than 3 years (n = 5). Bird et al. (2010) argued that the difference in knowledge and education between various groups is not significant, and that most studies find such differences due to the inclusion of nursing assistants as participants to enlarge their sample. However, while this is true in a majority of cases, this QI initiative only sampled Licensed Practical Nurses and Registered Nurses Thus, there is a reason to believe that the experience of nurses in this case has a significant influence on their knowledge of ventilator bundle implementation and use (Kandeel & Tantawy, 2012).

Klompas (2013) emphasizes the importance of assessing nursing knowledge and beliefs about current ventilator bundle practices, specifically to enhance current practices and patient outcomes. According to the results, almost all nurses reported that they were knowledgeable on the activities of Nursing Home and Rehabilitation Center's infection control committee, but a significant minority reported that they did not take part in these activities. This could be one of the reasons for the stubbornly high levels of VAP in the ventilator unit despite having implemented the ventilator bundle, and may help explain why the nurses do not comply fully with all elements of the ventilator bundle. Some

important aspects of infection control, such as oral hygiene, are also part of the ventilator bundle and compliance may have been low for those nurses who were not involved in the infection control committee's activities. In fact, Rosenthal et al. (2012) state that nurse's gain a reasonable level of knowledge on the ventilator bundle and the importance of full compliance due to improved provision of information on infection control that is then implemented. Interestingly, the oral hygiene element of the ventilator bundle was the one element that was least complied with at the Center.

While the infection control team and infection control measures do not constitute a part of the ventilator bundle, Umscheid et al. (2011) note that it has an important role to play in reducing VAP and implementation of important aspects of the ventilator bundle. Oral hygiene is becoming increasingly recognized as a cornerstone of care for mechanically ventilated patients, and is actually a late addition to the ventilator bundle. However, various studies have identified this bundle component as the least complied with and this is the case at the Nursing Home and Rehabilitation Center. This phenomenon can be explained by several factors, on top of the nurse's lack of participation in infection control committee activities. Indeed, even for those participants who reported taking part in the infection control committee's activities, more than half of them only took part once a year. Moreover, the hand hygiene aspect of infection control is an essential part of VAP control and is, in fact, the cornerstone of infection control (Lerma et al., 2014).

The results show that more than half (n = 10) of the participants did not perceive any risk of transmitting VAP to the mechanically ventilated patient, which could indicate another level of knowledge limitation that keeps VAP levels high despite implementing

the ventilator bundle. This would be consistent with the CDC's (2012) report that poor hand hygiene is linked with poor infection control practices and could negate the effectiveness of the ventilator bundle to some extent, especially in reducing VAP incidence and prevalence. This is further supported by Danckers et al. (2013), who found that there was no difference in VAP prevalence rates after implementation of the ventilator bundle in cases where the infection control team was not involved in the implementation. The infection control team in this case plays a critical role in educating the nurses on the importance of compliance with hand hygiene, without which the ventilator bundle's efficiency in reducing VAP is significantly reduced. However, the finding that (n = 13) of the participants considered additional knowledge on VAP and the ventilator bundle as important means that the QI initiative had a significant opportunity to educate the participants on infection control and the ventilator bundle to reduce VAP rates.

This QI initiative used the John Hopkins Nursing Evidence-Based Practice Model (JHNEP). This framework/model contends that evidence-based practice plays an essential role in professional development, patient safety, and education of nursing students, and it has increasingly emerged as the foundation for policies and procedures in the healthcare sector. The model identifies three essential foundations for professional nursing, which are nursing practice, nursing research, and nursing education, while also identifying the basic element of all nursing activities as nursing practice, through which nursing care is provided to patients (Dearholt et al., 2012). The results of this QI initiative encouraged and supported the use of nursing research in informing practice and generating new knowledge, especially in relation to the nurses' reports that they needed more evidence-

based information on the ventilator bundle. This flows into the second aspect of this model, which is nursing research. In this case, apart from formal education, the results showed a need for nurses need to commit to ongoing education, while also incorporating new evidence based knowledge, to realize their aim of providing safe, quality, and cutting edge patient care (Frank, 2014). Finally, the third aspect of this model was nursing practice. Here, by taking part in the evidence-based QI initiative, the nursing staff was more likely to perceive enhanced autonomy, as well as feel more satisfied due to their contributions to nursing practice changes.

Implications

VAP has been identified as the most frequent nosocomial, device-associated infection in the LTCF setting, resulting in an increase in rates of mortality, substantial morbidity, excessive costs and longer ventilator user, and increased LTCF stays (Sedwick et al., 2012). Research literature shows that adherence of healthcare staff to infection control measures is not sufficient because of inaccessible supplies, lack of time, and lack of adequate knowledge, jeopardizing patients' safety and care quality. The ventilator bundle will provide EBGs, which seek to promote compliance with VAP-reduction measures; eliminating or reducing VAP and enhancing clinical outcomes. These EBGs involve combining sedation vacations, head of bed elevation, daily oral care, ulcer prophylaxis, and deep vein thrombosis prophylaxis. Initiation of ventilator bundles has proven an effective method to reduce VAP, particularly where adherence to all its components has been maintained (Sedwick et al., 2012). Ventilator bundle education and training should enhance compliance, in turn reducing VAP incidence rates.

Implementing this QI initiative to improve compliance with the ventilator bundle to 80% will potentially reduce the VAP morbidity and mortality rates significantly at the Nursing Home and Rehabilitation Center, while also reducing costs associated with treating VAP and the length of hospital stay for mechanically ventilated patients. This step is positive as a step towards social change since it will decrease patient morbidity and mortality and patient costs, while also improving the quality of care for patients in obvious discomfort (Malouf-Todaro et al., 2013). With regard to policy, the QI initiative determined that Nursing Home and Rehabilitation Center and similar healthcare institutions require procedures and protocols that are aligned with advances in evidence-based practice; such as including infection control measures as part of their VAP guidelines alongside the ventilator bundle. Moreover, the QI initiative determined that having policies, procedures, and protocols in place is not sufficient, and that nursing staff and should be trained and educated on the scientific basis and rationale behind the ventilator bundle and infection control measure changes to ensure that the QI measures are long-lasting. Such long-term effects will be beneficial to the society by reducing overall costs of treating VAP (Malouf-Todaro et al., 2013).

While various general and specific strategies have proven effective in the reduction of VAP-related morbidity and mortality, the evaluation of ventilator bundle effectiveness in the long-term facility has not been fully undertaken. Indeed, Al-Dorzi et al. (2012) state that, while nursing professionals have widely accepted the use of ventilator bundles, little evidence exists about how effective the individual strategies are in actually reducing incident rates of VAP. The problems posed by VAP in LTCFs are complex and numerous. Not only does VAP incidence make up a selection of clinical

symptoms requiring treatment, but it also increases the morbidity and mortality of patients in the facility. By its very nature, VAP as an HAI will tend to afflict patients in conditions that are highly unstable (Hayashi et al., 2013). Thus, the use of ventilator bundles has been welcomed by the nursing fraternity as an effective way to prevent this.

In relation to this QI initiative's implications for practice, the project was intended to provide the nursing staff at the Nursing Home and Rehabilitation Center with the capacity to make clinical decisions based on existing evidence, as well as to monitor their compliance with all five components of the ventilator bundle. Scholar-practitioners have the responsibility to provide healthcare practitioners with evidence-based practices that seeks to improve the outcomes of care for patients (Dias et al., 2013). The QI initiative created posters with information on VAP and the ventilator bundle, which were placed in the ventilator unit to improve the nurses' knowledge on VAP prevention best practices. There are various implications of this initiative for practice, which will prove beneficial. To begin with, the ventilator bundle is an evidence-based intervention for reducing VAP morbidity and mortality and this will provide cost reduction benefits for the Nursing Home and Rehabilitation Center because the CMS considers VAP a preventable condition and does not reimburse costs. In addition, the patients will have shorter ventilator days and subsequently, this will decrease their length of hospital stay (Dias et al., 2013). Finally, this initiative is expected to increase nursing satisfaction with their VAP and ventilator bundle knowledge due to increased focus on the role of infection control and the educational posters.

The ventilator bundle, which was developed by the IHI, describes a group of processes that are required in caring for mechanically ventilated patients at higher risk of

contracting HAIs, such as VAP, because of the invasive nature of ventilation. The concept behind this was to bundle several components with scientific grounding important to improving clinical outcomes. In this case, the bundle is required to be straightforward and relatively small (Robb et al., 2010). Most importantly, the ventilator bundle presented a cohesive unit of measures each of which was meant to be complied with in order for the QI initiative to succeed. The daily goal sheet will now play a vital role as a new scoring system for the Nursing Home and Rehabilitation Center, which should increase compliance with the ventilator bundle and also increase reliability. Instead of the Nursing Home and Rehabilitation Center scoring itself for completing the individual components in the bundle for mechanically ventilated patients, the QI initiative proposes that the Nursing Home and Rehabilitation Center should rate themselves on the basis of pass-fail for the entire bundle (Robb et al., 2010). This bundled scoring system should improve the expected level of healthcare performance, enhancing nursing practice and service delivery outcomes.

Project Strengths and Limitations

This QI initiative had several strengths, one of which was that it was based on widely accepted evidence-based standards of care for mechanically ventilated patients. The ventilator bundle guideline as proposed by the Institute of Healthcare Improvement is a widely used protocol for preventing VAP, with numerous published research findings finding it to be effective in the reduction of VAP morbidity and mortality rates. Thus, it was easier to introduce this QI initiative to the participants and create educational posters on the initiative since it was based on evidence and could be generalized across different

healthcare facilities. The QI initiative also has a second strength in that it is focused on providing educational interventions for the ventilator unit's nursing staff through educational posters, which will provide an opportunity for the nurses to be involved in improvement of care quality. This will ensure that the implementation and sustenance of the QI initiative will be long-term in nature, specifically because of the collaborative nature of the initiative that will recognize each member's contribution and develop shared outcome responsibility.

However, this QI initiative also had several limitations, the most serious of which was that even though it will entail participant observation that should help in confirming the credibility and reliability of documentations made in the data goal sheets, it was not possible to observe all the important aspects of care. Moreover, the participant observation protocol will make the participants aware of the observation taking place, which may result in them performing differently in comparison to periods when they are not being observed. Thus, there is a risk in that the participant observation results will not reflect the nurses' actual practice accurately. Another limitation of the QI project was that it did not evaluate any other outcomes apart from compliance with the ventilator bundle, despite mechanical ventilation also requiring other protocols like hand hygiene to reduce VAP morbidity and mortality. In addition, participant observation could affect participant behavior, while selective project leader perception of participants could distort data. The use of in-depth interviews faces limitations in which the interviewee could distort information via selective perceptions and recall error. Finally, document analysis data is restricted to what exists already, in which case some documents could be incomplete.

Analysis of Self

As a DNP-prepared nurse, the main roles played are those of change agent, scholar, and clinician; specifically as part of promoting advanced nursing practice. In this case, the QI initiative and its grounding in evidence-based practice should be considered as the product of knowledge garnered during the study program, as well as the practical application of this knowledge in this clinical practicum. An important part of the DNP essentials requires the DNP-prepared nurse to apply data analysis and clinical scholarship in the design of evidence-based programs and interventions. Thus, one of the most important roles of the DNP-prepared nurse is the translation of evidence into clinical practice, providing a critical opportunity to improve care outcomes for the mechanically ventilated patient and overall outcomes for the Nursing Home and Rehabilitation Center. By conducting an in-depth study of the important clinical areas of mechanical ventilation, VAP, and the ventilator bundle, the QI initiative took a scholarly approach to the problem of compliance with the ventilator bundle and employed the DNP nurse's leadership skills to implement organizational change at the Nursing Home and Rehabilitation Center. I have been generally successful in accomplishing this DNP essential, with major improvements in scholarly research analysis along the way.

Further, the DNP essentials guideline provides for the improvement of APN competencies in the DNP-prepared nurse, specifically through the development of specialized expertise in different practice areas by applying the knowledge in social and physical sciences. The competencies developed under this DNP essential involved the capacity for evidence-based care evaluation using the systems view, while also mentoring and educating the nursing staff to promote optimal outcomes of patient care. I have

generally achieved these goals through this DNP project by learning how to analyze research literature to identify best practices, as well as translating this evidence into improving nursing care. Moreover, this DNP project has also aided me in incorporating the mentoring and teaching of the ventilator unit's nursing staff with the aim of ensuring they can sustain the changes to compliance with the ventilator bundle. This project has also developed my leadership skills and abilities by driving me to take responsibility for setting the ground and the tone needed for implementing the change, while also providing the overall vision of change.

With regards to project management, I am not able to specifically report on any improvements in this area since the project's implementation is yet to be conducted. As a result, I wait to see how successful my project management skills and abilities are, as well as how the DNP project will improve them. Although some important steps in the implementation process have been undertaken, such as conducting the interviews and making the educational posters, which have been successful so far, there remains a lot of work to be done in this area. Generally, successful project management and planning requires adaptability and flexibility; specifically through the inclusion of all major stakeholders from the planning phase. I am glad to report that the medical director and the Nursing Home and Rehabilitation Center's administration have supported me from the start and I intend to maintain their support by providing regular updates on the QI initiative's evaluation report. Moreover, I will also include their input once the implementation begins in full so that they recognize their value towards the successful implementation and sustenance of the QI initiative.

Summary and Conclusions

The goals of this QI initiative were to investigate the level of compliance with the different components of the ventilator bundle protocol at the Nursing Home and Rehabilitation Center and to improve the compliance with the ventilator bundle protocol to 80%. While the project is yet to be implemented, results from the participant interviews showed that although majority were aware of the importance of the ventilator bundle in preventing VAP and received information about VAP and the ventilator bundle, they felt the need for more information. This was construed as evidence that an educational poster program was required, and that the nursing staff would appreciate the effort to improve their knowledge about the bundle. Compliance was the most important issue, particularly in relation to the oral care component of the ventilator bundle; which the QI initiative proposes can be remedied by increased participation in the infection control committee's activities.

Section 5: Scholarly Product for Dissemination

Project Summary

Introduction

VAP is a complication arising from mechanical ventilation in healthcare, which produces avoidable but excessive treatment costs and use of resources. One of the most common methods used to reduce VAP morbidity and mortality is the ventilator bundle, which is a grouping of best practices used together to reduce the development of VAP. The purpose of this QI initiative was to investigate the level of compliance with the different components of the ventilator bundle protocol at the Nursing Home and Rehabilitation Center, as well as to improve the compliance with the bundle protocol to 80%. The QI initiative was conducted at the Nursing Home and Rehabilitation Center with the aim of enhancing compliance with the ventilator bundle protocol, which has been shown to reduce VAP morbidity and mortality rates. The specific goal of this project is to initiate enhanced compliance with all five elements of the ventilator bundle at the Nursing Home and Rehabilitation Center. The results from this QI initiative will be used as a model for LTCFs and ventilator units in particular, to improve nursing staff's knowledge about VAP and the ventilator bundle, and improve compliance with all five components of the ventilator bundle.

Project Purpose and Outcomes

The purpose of this QI initiative was to investigate the level of compliance with the different components of the ventilator bundle protocol at the Nursing Home and Rehabilitation Center, as well as to improve the compliance with the bundle protocol to

80%. In order to accomplish this purpose, data on compliance with the ventilator bundle was collected from the Nursing Home and Rehabilitation Center using medical records from one month prior to implementation of the project. Some LTCFs have published data that points to the decrease in VAP morbidity and mortality rates after implementing the bundle, in which the main focus has been on improving safety culture, while some have hypothesized that heightened attention to caring for mechanically ventilated patients has a positive chain reaction effect that reduce or prevent complications. As such, it was expected that improving quality in this area should also lead to improvements in other aspects of service delivery in the healthcare environment. In such a case, increased vigilance and compliance with the bundle should also be associated with crossover effects that could result in decreased incidence of other HAIs in the LTCF.

The specific goals of this project included determination of compliance with all five elements of the ventilator bundle, initiation of full compliance with all five elements of the ventilator bundle at the Nursing Home and Rehabilitation Center, and identification of how the Nursing Home and Rehabilitation Center can improve on their ventilator bundle compliance to improve outcomes for mechanically ventilated patients. As such, the purpose of this QI initiative was to improve the knowledge of nursing staff at the Nursing Home and Rehabilitation Center's ventilator unit on importance of adhering to all five components of the ventilator bundle by displaying data on VAP rates and the effect of full compliance with bundle practices on special boards in the ventilator unit. In addition, it also sought to improve compliance of the nursing staff with all five components of the ventilator bundle through the use of daily goal sheets, which are meant to ascertain compliance with the ventilator bundle components.

Plans for Dissemination

Disseminating the outcomes of this QI initiative is a fundamental aspect of DNP education. The outcomes of this QI initiative in improving compliance with the ventilator bundle at the Center will be disseminated using poster presentations. As proposed by Forsyth et al. (2010), this presentation of outcomes will have a clear focus, a consistent message, and a logical and aesthetically attractive format. Effective presentations are critical for disseminating scholarly knowledge identified in the DNP scholarly research. Depending on the audience, the presentations will be customized to present the information that specific stakeholders are most interested in. For instance, in presenting the outcomes to the clinicians at the Nursing Home and Rehabilitation Center, the poster presentations will focus on the research evidence used to support improvements in practice, a brief introduction and overview of the literature review, and the manner in which the QI initiative's outcomes were measured and arrived at. For this group of stakeholders that is specifically involved in the implementation and sustenance of the evidence-based changes, information on research and practice evidence is critical (Forsyth et al., 2010).

On the other hand, in making poster presentations to the administration at the Nursing Home and Rehabilitation Center, the dissemination process, Forsyth et al. (2010) propose an added emphasis on the project's cost analyses, utility information, project-guiding regulations, and the benefits of implementing the project. Thus, the presentations to this specific stakeholder will be brief and provide a financial basis for implementing the project and its sustainability with the aim of advocating for relevant and evidence-based changes to ventilator unit policy. Moreover, presentations made to the Nursing

Home and Rehabilitation Center's administrators will include in-depth information about findings of the evaluation process. Presentations made to the nursing staff at the Nursing Home and Rehabilitation Center's ventilator unit will specifically focus on the benefits of adoptions and the process through which the EBP changes will be adopted and implemented. In this case, Forsyth et al. (2010) argue that presentations to this stakeholder should have a clearly and concisely stated purpose, particularly in relation to the clinical significance of improving compliance with the ventilator bundle. Further, presentations to the nursing staff will seek to link the implications of improved compliance with the bundle with the process of synthesizing evidence in support of complying with the ventilator bundle.

Once the outcomes of implementing and evaluating the QI initiative are presented to the relevant stakeholders, they can also be disseminated wider at a nursing conference, during which a summary of the project's purpose, methodology, and outcomes will be presented using poster boards. Information disseminated on this platform will particularly focus on the results of data analysis following implementation of the project, which is, however, yet to get underway. However, once that aspect of the project is completed, the outcomes will be presented at the American Nurses Credentialing Center Pathway to Excellence Conference in 2017. This nursing conference is mainly attended by hospital administrators, Directors of Nursing, Chief Nursing Officers, licensed practice nurses, Nursing Case Managers, and Nurse managers from different types of healthcare organizations. Therefore, the poster boards would have to be significantly summarized to fit in information relevant to the largest proportion of these attendees. This year's conference has a session on creating and sustaining collaboration through a

multidisciplinary team approach, which is a major aspect of this QI initiative and would be a good platform to deliver the poster presentation next year.

After presentation at a nursing conference, submissions may also be made to nursing journals such as *American Journal of Infection Control, Critical Care Nurse* with the aim of securing publication of the QI project and its outcomes. This approach will ensure that the QI initiative imparts a wider impact towards the aim of enhancing the use of evidence-based as required under the DNP essentials, specifically via clinical scholarship. In using this dissemination platform, original findings will be presented along with their applications in nursing practice with clear articulation of the project purpose and questions, methodology, findings, and conclusions. Since the decision to publish these findings is based on the evaluations of editors and peer-reviewers, it is important to ensure that the material is presented in a manner that highlights nursing applications of the findings on ventilator bundle compliance. The paper presented for publication will particularly address methodological techniques and issues, specifically those that are important to nurses interested in clinical research. Finally, the manuscript will also emphasize on recommendations based on the results of implementing and evaluating the QI initiative.

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Appendices

Appendix A: Daily Goals Sheet

Patient Bed Number _____ Room Number_____
Date_____/_____/_____

---Initial as goals are reviewed ----

GOAL	NOTES	**7:00 AM-3:00 PM**	**3:00 PM-11:00 PM**	**11:00 PM-7:00 AM**
What needs to be done for the patient to be discharged from the long term facility?				
What is this patient's greatest safety risk?				
Ventilator Bundle: HOB 30 degrees or greater				
Sedation Vacation and Assessment of Readiness to Extubate				
PUD Prophylaxis				
DVT Prophylaxis				
Oral care with chlorhexidine				
Medication changes (Can any be discontinued?)				
Attending up to date? (Do the nurses conduct the rounds on time?)				
Family Updated?				
Any social issues to address?				
Parameters for calling MD				

Appendix B: Systematic Review for Desk Research

Data and information from desk research will be collected, appraised, selected, and synthesized using a systematic review; with the aim of synthesizing relevant research evidence for the project questions.

Research Evidence Process

The PICO format is used to frame an effective literature search by designing a searchable clinical question, and a literature search conducted to identify the best evidence for clinical questions. The results are then rated for evidence level, as well as given general classification codes like VAP management, VAP prevention, VAP evaluation, ventilator bundle assessment, and ventilator bundle outcomes.

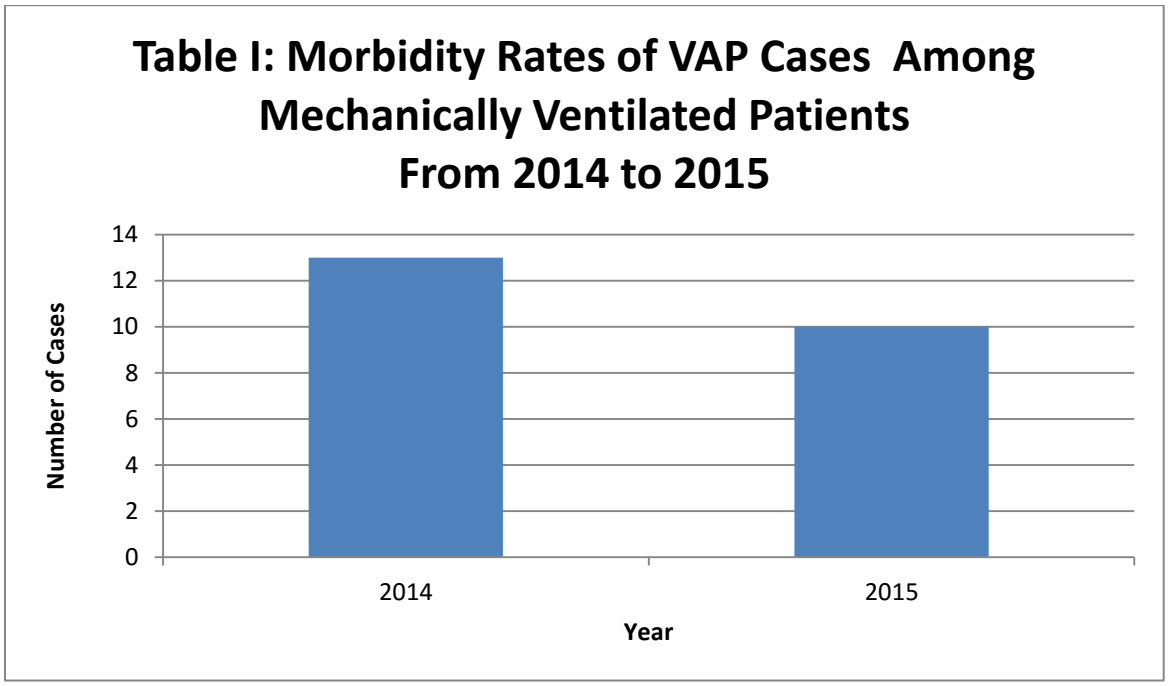
Developing a Search Strategy

The systematic review develops a search strategy that captures the best available evidence, beginning with selection and translation of databases. The tool identified three main databases that produced the best evidence in answer to the search terms designed from the clinical questions; Medline, CINAHL, and Cochrane Database of Systematic Reviews. The database architecture is also exploited in order to limit the search and increase evidence relevance, in this case filtering by evidence linked only to long term care facilities. The evidence is then analyzed using a review of published meta-analyses and systematic reviews.

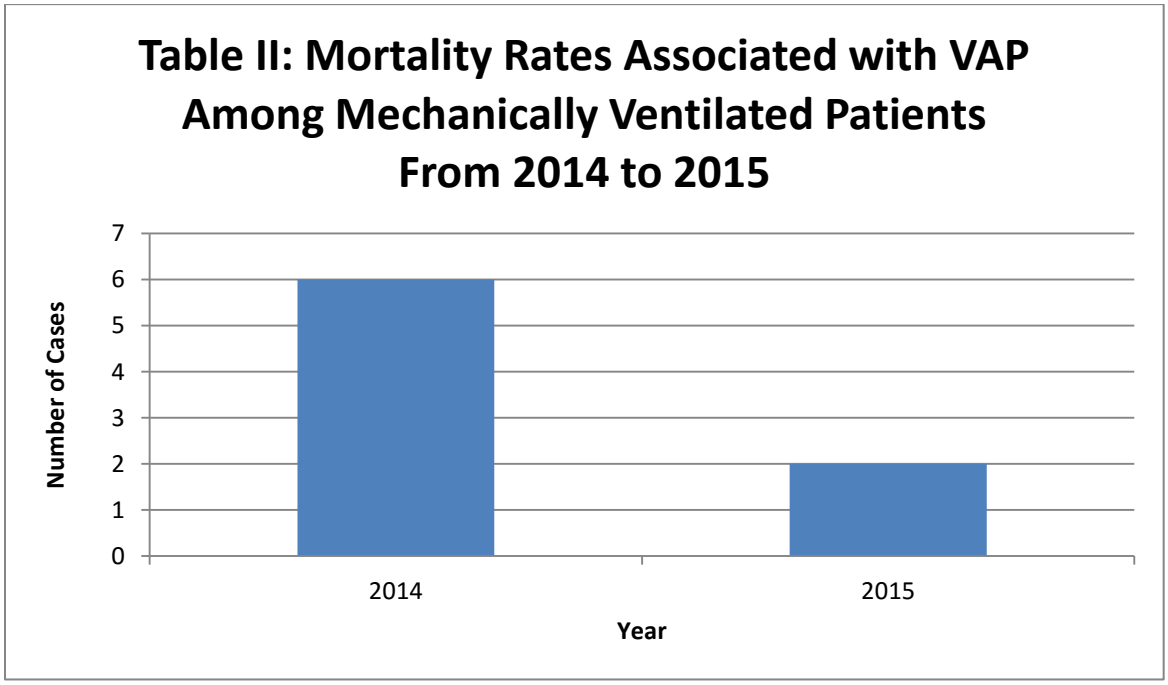
Appendix C: Interview Questionnaires

1. What is your professional role in the ventilator unit?
2. How long have you worked in the ventilator unit?
3. Does the Center have an infection control committee? Have you participated in this committee's activities and if so, how often?
4. In your opinion, which is the most common hospital-acquired infection (HAI) in the ventilator unit?
5. In your opinion, is enough being done to control this HAI?
6. How do you perceive your personal risk of transmitting this infection to the patients when working in the ventilator unit?
7. In your opinion, how would you rate your application of the ventilator bundle procedures and guidelines?
8. Do you receive information about how to prevent VAP in the ventilator unit on a regular basis?
9. Have you attended any training or educational course about prevention of VAP in the ventilator unit?
10. In your opinion, do you feel a need for additional information about prevention of VAP in the ventilator unit?

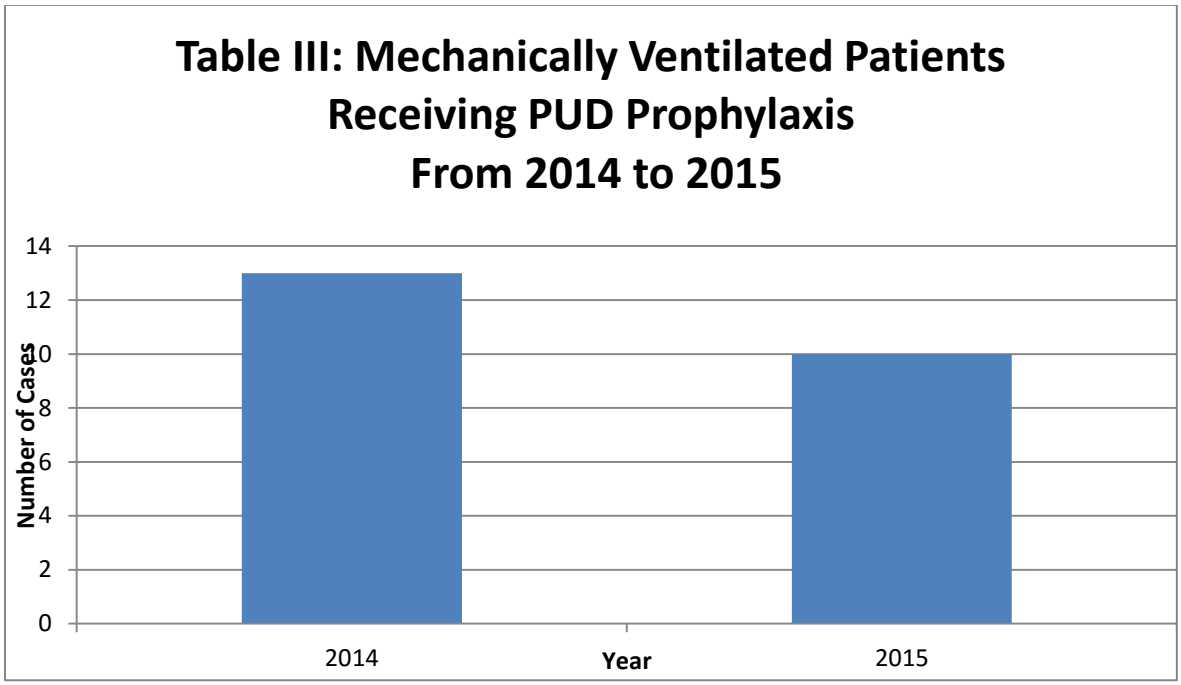
Appendix D: The Center's Medical Records Analysis



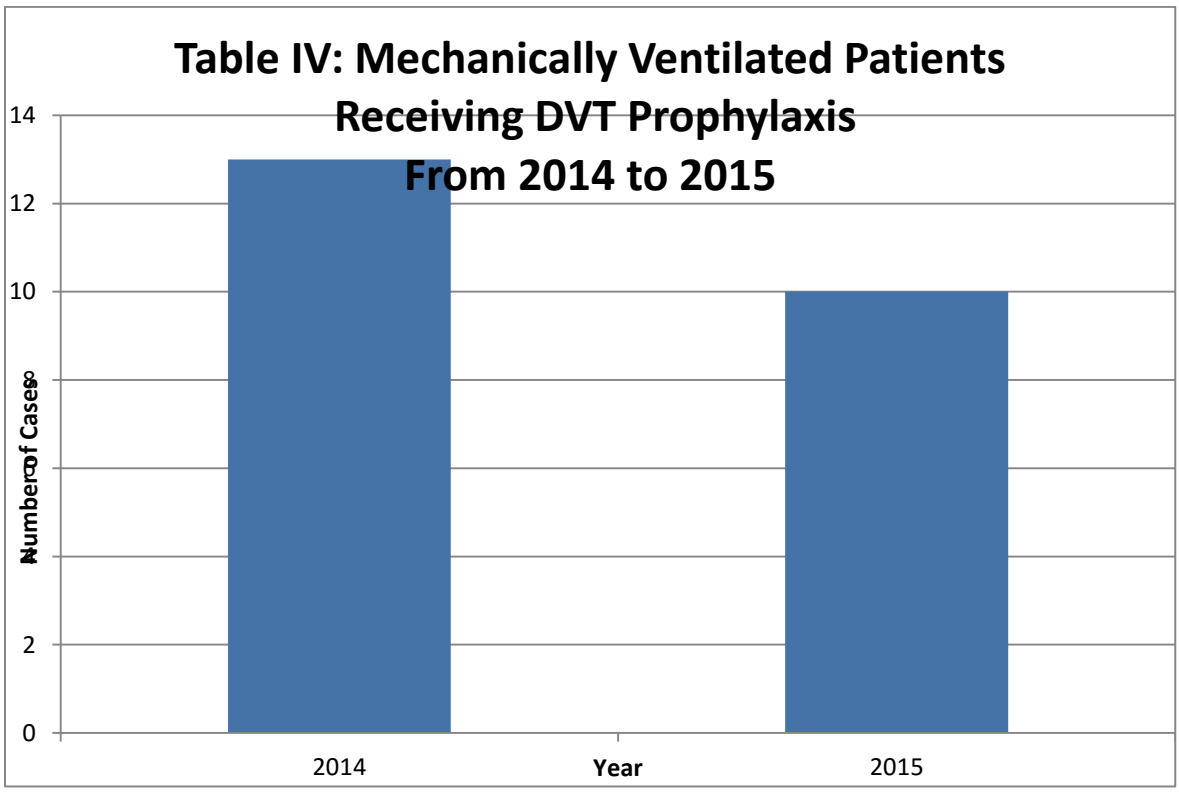
*2015 Cases reflect January to September, 2015 data.



*2015 Cases reflect January to September, 2015 data.



*2015 Cases reflect January to September, 2015 data.



*2015 Cases reflect January to September 2015 data.

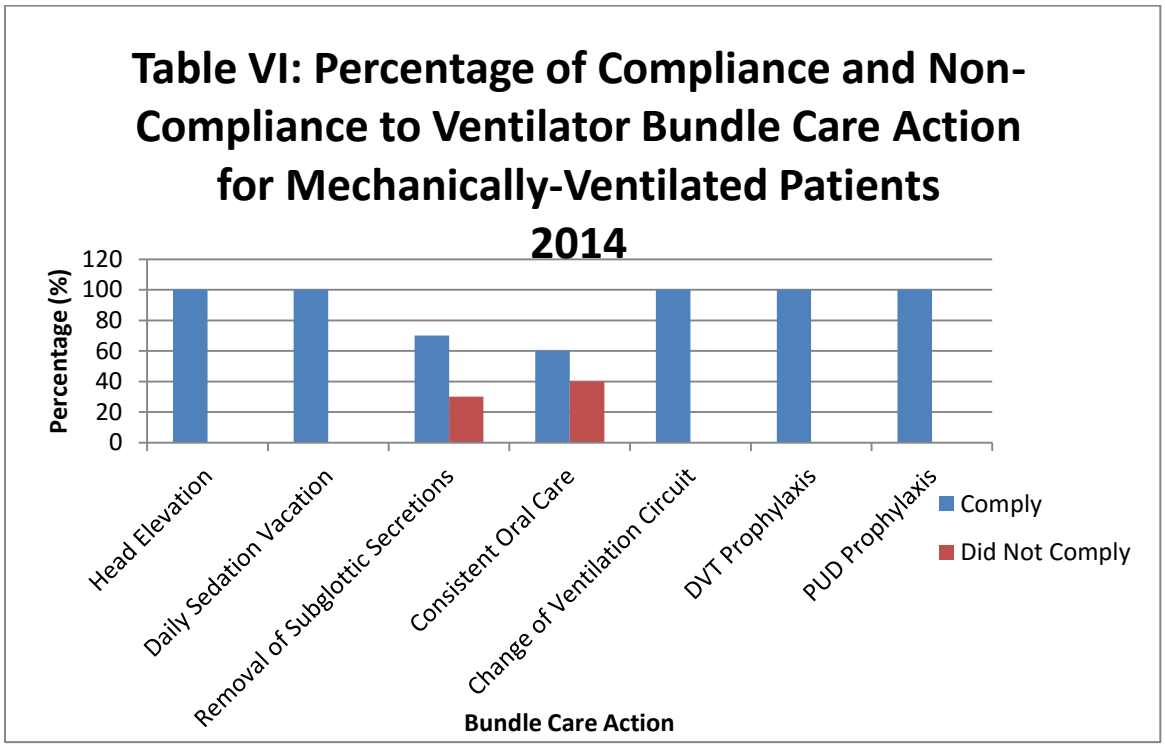


Table VI: Percentage of Compliance and Non-Compliance to Ventilator Bundle Care Action for Mechanically-Ventilated Patients 2014
Percentage (%)
120
100
80
60
40
20
0
Head Elevation
Daily Sedation Vacation
Removal of Subglottic Secretions
Consistent Oral Care
Change of Ventilation Circuit
DVT Prophylaxis
PUD Prophylaxis
Comply
Did Not Comply
Bundle Care Action

Appendix E

February 29, 2016

Ms. Floremar Dulinayan RN
Director of Nursing
Four Seasons Nursing Home & Rehabilitation Center
Brooklyn, NY 11236

RE: PERMISSION to Conduct DNP Project Study Quality Improvement Initiative

Dear Madam,

I am writing to you to request permission to conduct a quality improvement initiative project study at your facility, Four Seasons Nursing Home & Rehabilitation Center. I am currently enrolled in the Doctor of Nursing Practice at Walden University in Minneapolis, Minnesota and in the process of writing my Doctoral Project Study entitled "Improving the Quality of Care for Mechanically Ventilated Patients in Long Term Care Through Full Compliance of Ventilator Bundle Protocol".

I hope that the facility administration will allow me to recruit 15 participants, mostly nurses who worked in the ventilator unit for a number of years, to anonymously complete the interview questionnaire (copy enclosed). Interested nurses who volunteer to participate will be given a consent form to be signed by the participants and returned to the primary researcher at the beginning of the interview process.

If approval is granted, participants will complete the interview questionnaire in the facility or a quiet setting on the facility during their free time hours. The interview process should take no longer than an hour or less. The results of the interview process will be pooled for the project study and individual results of the study will remain absolutely confidential and anonymous. Should this project study be published, only pooled results will be documented. Either your facility or individual participants will incur no costs.

Your approval to conduct a project study will be highly appreciated. I will follow up with a telephone call this week and would be happy to answer any questions or concerns that you may have at that time. You may contact me at my email tedmercenern@yahoo.com.

If you agree, you can kindly sign below and return the signed form in the enclosed envelope. Alternatively, you can submit a signed letter of permission on your facility's letterhead acknowledging your consent and permission to conduct this quality improvement initiative project at your facility.

Sincerely,

Mr. Tedgardo P. Mercene RN, MSN
Project Study Researcher – Walden University

Enclosures: Copy of Interview Questionnaire, Informed Consent

Appendix F

FOUR SEASONS
Nursing & Rehabilitation Center

March 1, 2016

International Research Board
Walden University
Minneapolis, Minnesota
USA

To Whom It May Concern:

I have the honor and privilege to approve Mr. Tedgardo Mercene DNP student at Walden University to conduct a quality improvement initiative project study in our facility, Four Seasons Nursing Home & Rehabilitation Center entitled "Improving Quality of Care for Mechanically Ventilated Patients in Long Term Care Through Full Compliance with Ventilator Bundle Protocol."

I hope that this quality improvement initiative project study will benefit the facility and will help improve patient outcomes.

Agreed and Accepted by:

Floremar Dulinayan, RN
Director of Nursing

1555 Rockaway Parkway • Brooklyn, New York 11236 • Tel: 718.927.6300 • Fax: 718.927.6301