INTENSIVE CARE UNIT NURSES’ CHALLENGES ON THE IMPLEMENTATION OF VENTILATOR ASSOCIATED PNEUMONIA BUNDLE AT AN ACADEMIC HOSPITAL IN GAUTENG PROVINCE

by

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DECLARATION

I, Constance Maidi Motsei hereby declare that the work outlined in this dissertation on Intensive Care Nurses’ challenges on the implementation of Ventilator Associated Pneumonia Bundle at an Academic Hospital in Gauteng Province is my own original work. It is submitted as a requirement for the Masters Degree in Nursing by Research at the Sefako Makgatho Health Sciences University. Neither the whole work nor any part of it has been, or shall be submitted for another degree at any university or institution for tertiary education or examining body. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references.

…...................................................... ...........................................................

Constance Maidi Motsei Date
DEDICATION

This work is dedicated to the ALL MIGHTY GOD, for giving me the strength, wisdom and perseverance during the whole period of my study and always. My resources alone could not have realised this dream; God truly provides. I also dedicate it to my mother; (Mrs Kgomotso Letebele), and my late father (Mr Molefe Letebele), my children; (Tshiamo, Puisano and Kgosioltile), for their support as well as my grandchildren for their patience. My sisters; (Yvonne and Loretta) together with my niece; (Mpho) and nephew; (Gomolemo) and their families, the whole family and friends for their understanding as I pursued this masters program. My uncle; (Mr Molefe Modisakeng) for a constant empowerment to always strive for excellence since youth. Lastly Mrs Mmalerata Khoboko for being there for me all the time.
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ABSTRACT

Title: Intensive care unit nurses’ challenges on the implementation of ventilator associated pneumonia bundle at an academic hospital in Gauteng Province.

The aim of this study was to understand the challenges intensive care unit (ICU) nurses’ encountered during the implementation of ventilator associated pneumonia bundle (VAPB) and propose the strategies to overcome those challenges in order to ensure patient safety.

A qualitative, explorative and descriptive research approach was followed to understand the phenomenon of VAPB implementation. The sample consisted of 30 ICU nurses. The data was collected using a semi-structured interview with the participants. An independent coder was used to code the data.

The findings of this study revealed the challenges related to; planning and the introduction of the implementation of VAPB, knowledge and understanding of the VAPB implementation process, availability of resources, adherence to infection prevention and control principles, monitoring and evaluation, as well as the motivation, supervision and support during VAPB implementation. Strategies to overcome those challenges were also identified and discussed.

In conclusion; the findings of this study may be used to remedy the ICU nurses’ challenges on the implementation of VAPB to prevent VAP.

Key Words: Challenges, Intensive Care Nurses, Ventilator Associated Pneumonia and Ventilator Associated Pneumonia Bundle.
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LIST OF ABBREVIATIONS

AACN - American Association of Critical Care Nurse.

BCA - Best Care Always.

CDC - Centres for Disease Control and Prevention.

DVT - Deep vein thrombosis.

HAI - Hospital Acquired Infection.

HOB - Head of bed elevation.

ICU - Intensive care unit.

IPC - Infection Prevention and Control.

IHI - Institute for health care improvement.

IPC - Infection Prevention and Control.

NCS - National Core Standards.

PUD - Peptic ulcer disease.

VAP - Ventilator-Associated Pneumonia.

VAPB – Ventilator Associated Pneumonia Bundle.

WHO - World Health Organisation.
CHAPTER 1

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

Health care associated infections are among the most serious adverse events that occur in about one in ten hospital admissions globally. Health care associated infections are a major problem in hospitals of developing countries compared to those in the industrialised world. Hospital acquired infections (HAIs) such as surgical site infection (SSI), ventilator associated pneumonia (VAP), catheter associated urinary tract infection (CAUTI), and central line associated bloodstream infection (CLABSI) cause considerable morbidity and mortality, as well as waste of resources. However, there is evidence that these infections can be significantly reduced, and sometimes even entirely eliminated. The National Health Minister, Dr Aaron Motsoaledi, in the Department of Health recognised the need to fast track the quality of healthcare. The minister stated that prevention of health care associated infections deserve high priority in all health systems, especially in South Africa (Kantor, Van den Bergh & Brink, 2011:3).

Ventilator associated pneumonia (VAP) is a health care associated infection which has mortality rates ranging from 24% to 76%. Therefore, the need for prevention of VAP must become the focus of patient safety initiatives and it has to be prioritised. The Institute for Health Improvement (IHI) has promoted VAP prevention and the safety of patients on mechanical ventilation by implementing the “ventilator associated pneumonia bundle” (VAPB). VAPB refers to a set of interventions or guidelines on the prevention of VAP (Arabi, Al-Shirawi, Memish & Anzueto, 2008:506). Bird, Zambuto, O’Donnell, Silva, Korn, Burke, and Agarwal conducted a study in Boston, on the adherence to ventilator associated pneumonia bundle (VAPB) and the incidence of ventilator associated pneumonia (VAP) in the surgical intensive care unit (ICU). Bird et
al (2010:1) concluded that the initiation of the VAPB showed a significantly reduced incidence of VAP and cost savings of patients with VAP in ICUs. Implementation of a VAPB protocol is an effective method for VAP reduction when compliance is maintained. Intensive care nurses should be involved in the initiation of practice guidelines of the implementation of VAPB to ensure the safety of patients who are being mechanically ventilated.

1.2 BACKGROUND OF THE STUDY

Ventilator associated pneumonia (VAP) is a nosocomial airway infection that develops within the first 48 hours after a patient has been intubated (Westwell, 2008:203). The Institute of Medicine identified VAP prevention as a priority area for national action. The Joint Commission on Accreditation of the Health Care Organisations has included hospital acquired infections including VAP in its 2006 National Patient Safety goals. They have recommended that all identified cases of unanticipated deaths or major permanent loss of function, should be managed and reported as sentinel events if they were related to health care associated infections (Arabi et al, 2008:506).

According to O'Keefe-McCarthy, Santiago and Lau (2008:195) leaders at the Institute of Health Improvement (IHI) in the United States of America created a hospital acquired infection prevention campaign whose aim was to save 100,000 lives and to reduce VAP in intensive care units (ICUs). The IHI committed itself to change and to collaborate in saving lives in 2004, using the guidelines on the prevention of VAP across the United States of America’s health care industry. The United Kingdom joined the campaign and named it “Saving Lives Campaign”, leading to the expansion of the IHI programme in 2006 to become the Protector of 5 Million Lives from Harm Campaign (Gillespie, 2009:48). Canada joined the campaign as well with the aim to improve the safety of Canada’s health care system through the adoption of the bundled practice and named their campaign “Safer Health Care Now”. A major goal of the campaign was to decrease VAP, based on the recommendations of the IHI’s campaign (O’Keefe-McCarthy et al, 2008:195).
South Africa also joined the collaboration to change campaign and named it the "Best Care Always (BCA)". This campaign was launched at the 3rd Federation of Infectious Diseases Society of Southern Africa (IDSSA) Congress held at Sun City in South Africa from the 20th to the 23rd August 2009. During the congress the BCA task force and experts endorsed the BCA infection reduction and the prevention of the majority of the hospital acquired infections, which included the VAPB interventions to prevent VAP. Currently in South Africa the BCA campaign is ongoing and the participation and input from the health care workers and the health institutions are encouraged to join and continue to save lives for the progress of this campaign (Kantor et al, 2011:3).

Gillespie (2009:48) stated that VAPB consist of a series of evidence based interventions related to ventilator care that when implemented together achieve significant better patient outcomes than when used individually. O'Keefe-McCarthy et al (2008:195) defined bundled practices as precautionary steps that can be used by practitioners to enhance positive patients’ outcomes. The VAPB evidence based practices comprise of the elevation of the head of the bed (HOB) to between 30° to 45°, daily interruption of sedation and assessment of readiness to extubate, peptic ulcer prophylaxis (PUP), deep vein thrombosis (DVT) prophylaxis and daily oral care with chlorhexidine. These practices will be discussed in chapter 2 of this study.

Dawson and Endacott (2011:119) reported that a lack of multidisciplinary team member involvement and the lack of resources diminish the adherence to bundled practices causing barriers to successful implementation of the bundled approach to care. Gurses, Murphy, Martinez, Berenholtz, and Pronovos (2009:256) reported that health care organisations are working to improve patients’ safety and quality of care, but few efforts have addressed the inadequate translation of research evidence into clinical practices such as the implementation of VAPB. The following factors namely; provider characteristics, guideline characteristics and system characteristics affect the guideline compliance to the evidence based practices. These aspects are described in the literature review in Chapter 2.
Gomes (2010) conducted a study about the knowledge of intensive care unit nurses on evidence based guidelines for the prevention of ventilator associated pneumonia in the Western Cape Province, South Africa. In this study the researcher found that more than 60% of nurses had a lack of knowledge on the mechanical ventilator. The lack of knowledge, staff shortage and the lack of necessary resources were mentioned as some of the VAPB implementation barriers. Gomes recommended that the study be extended to include other hospitals and possibly other provinces with a larger population and sample to encourage more research on the use of VAPB in nursing to prevent VAP particularly in South Africa (Gomes, 2010:134).

The researcher has observed that the implementation of VAPB to prevent VAP has commenced at one of the academic hospitals in Gauteng Province but the progress was stagnant. In view of the above comment the researcher decided to investigate the challenges the ICU nurses of the selected hospital encountered on the implementation of VAPB.

1.3 PROBLEM STATEMENT

The Best Care Always campaign is a collaboration to bring change with the aim to make a bigger impact on patient care in South Africa. The VAPB guidelines is one of the required practices to implement within the campaign (Westwell, 2008:204). While working in one of the academic hospitals in Gauteng Province the researcher observed that the implementation of VAPB has been introduced in the ICU of this hospital. The ICU nurses were aware of the VAPB implementation process with the information that they gathered from ICU congresses, unit based inductions, institutional meetings and discussions about the implementation of VAPB in the unit. The researcher noted through observations and records that ICU nurses are experiencing challenges related to the full implementation of VAPB.

This was evidenced by unavailability of the Standard Operating Procedures (SOPs) or protocols, the lack of proper selection of VAPB elements related to the implementation
of VAPB guideline and the lack of proper measurement of VAPB compliance and VAP rates. It is also realised that there is insufficient research related to the nurses’ experiences on the implementation of ventilator associated pneumonia bundle (VAPB) in South Africa, as noted in the literature. The researcher therefore conducted this study to understand the challenges ICU nurses encountered on the implementation of VAPB and to propose the strategies needed to overcome those challenges.

1.4 THE AIM OF THE STUDY

The aim of this study was to understand the challenges encountered by intensive care unit (ICU) nurses on the implementation of the ventilator associated pneumonia bundle (VAPB) and to propose the strategies needed to overcome those challenges.

1.5 OBJECTIVES OF THE STUDY

The objectives of this study were to:

- Explore and describe the intensive care unit nurses’ challenges on the implementation of a ventilator associated pneumonia bundle in an academic hospital in Gauteng Province.
- Identify and describe strategies needed to overcome those challenges.

1.6 RESEARCH QUESTIONS

The following two specific research questions arose from the research objectives:

- What are the challenges encountered by intensive care unit nurses on the implementation of a ventilator associated pneumonia bundle in an academic hospital in Gauteng Province?
- What are the needs to overcome these challenges?
1.7 DEFINITION OF TERMS

- **Challenges**
  It is an interesting but difficult task or situation. Challenges will be used interchangeably with the term barrier which is defined as something that delays an individual from making progress (Waite & Hawker; 2009:70; 141). The challenges or barriers in this study relate to those problems and difficulties that the intensive care unit (ICU) nurses encountered when implementing the ventilator associated pneumonia bundle to prevent ventilator associated pneumonia in ICU patients, who are mechanically ventilated.

- **Intensive Care Unit**
  It is as a distinct organizational and geographic entity for clinical activity and care, operating in cooperation with other departments integrated in a hospital. It is also known as a critical care unit (CCU). The objectives of an intensive care unit (ICU) are the monitoring and support of threatened or failing vital functions in critically ill patients who have illnesses with the potential to endanger life, in order to perform adequate diagnostic measures and medical or surgical therapies to improve outcome (Valentin & Ferdinande, 2011:2). In the context of this study, ICU is a specialist unit where critically ill patients are managed.

- **Intensive Care Unit Nurse**
  It is a professional nurse who was trained at an accredited nursing education institution under the SANC R212, as amended (South Africa 1993), and has successfully completed and registered for an additional qualification (post basic/graduate) for Medical and Surgical Nursing Science (Critical Care Nursing). In this study, the registered nurse refers to those nurses who either have successfully undergone special training in critical care nursing (‘ICU trained’), or are experienced to care for the critically-ill patients in the ICU, but who are not ICU trained (‘non-ICU trained’) (Matlakala, Bezuidenhout & Botha, 2014:2).
• **Implementation**
It refers to putting something into effect. Implementation will be used interchangeably with initiation which means starting a process or an action (Waite & Hawker, 2009:465; 481). In this study implementation of the ventilator associated pneumonia bundle (VAPB) means putting into effect or starting the process of VAPB on a patient who is being mechanically ventilated to prevent ventilator associated pneumonia.

• **Ventilator Associated Pneumonia Bundle**
It is a series of interventions related to ventilator care that are implemented together when a patient is being mechanically ventilated. It is noted that when they are implemented together, they will achieve significantly better outcomes than when implemented individually (Gillespie, 2009:48).

• **Strategies**
According to Muller, Bezuidenhout and Jooste (2011:569) a strategy is a plan of action that prescribes resource allocation and other activities within the environment to help the organisation to attain its goals. Strategies in this study are activities or guidelines required to empower ICU nurses in successful implementation of the VAPB to prevent VAP in critically ill patients.

**1.8 RESEARCH DESIGN**

The research design is the overall plan for gathering data in a research study (Brink, Van der Walt & Van Rensburg, 2012:217). Qualitative research is a research design which is systematic and interactive in approach that is used to describe the life experiences. In this study a qualitative, explorative and descriptive approach was used to understand the challenges of the intensive care unit (ICU) nurses on the implementation of VAPB and to propose the strategies needed to overcome those challenges in the ICU unit (Burns & Grove, 2009:22).
The exploratory approach was chosen to explore the implementation of VAPB and its manifestations. A descriptive design enabled the researcher to describe the experiences of the implementation of the VAPB and to provide an accurate description of the ICU nurses’ experiences of the VAPB (Polit & Beck, 2006:21; 59). The explorative design is used to increase the knowledge in the field of study, and is not intended for generalization as the sample size was small (Burns & Grove, 2009:696). Brink et al (2012:113) described descriptive designs as approaches concerned with gathering information from the representative sample of the accessible population. The researcher, therefore used this approach to gather information from the representative sample of ICU nurses at an academic hospital in Gauteng Province.

1.9 RESEARCH METHODOLOGY

1.9.1 Research Setting

The setting of this study was an adult intensive care unit (ICU) at an academic hospital in the Gauteng Province. It is the only ICU dealing with adult patients in the hospital and has 22 beds with bed occupancy, which is usually 70% to 100%. Approximately 100 nurses work on both day and night shifts (Burns & Grove, 2009:362). The purpose of selecting this hospital was that it has an ICU which admits adult critically ill patients who are on mechanical ventilation for 48 hours and more. The implementation of the ventilator associated bundle in this hospital had been introduced, but the ICU nurses appeared to be experiencing challenges towards its full implementation.

1.9.2 The population

The total population in this study was drawn from all the registered professional nurses, experienced and trained who were working in the adult intensive care unit (ICU), of this academic hospital when implementation of ventilator associated pneumonia Bundle was initiated. This population was accessible and could best represent the study sample (Burns & Grove, 2009:42).
1.9.3 Sampling

A non-probability sampling method, namely purposive sampling was used in this study. Non-probability sampling requires the researcher to judge and select those participants who have the best knowledge about the phenomenon being studied (Brink et al, 2012:139). Polit and Beck (2006:264) state that purposive sampling is based on the assumption that a researcher’s knowledge about the population can be used to select the cases to be included in the sample. The sampling method will be further be discussed in detail in Chapter 3.

1.9.4 Pretesting the data collection tool

After the approval of the study by the University of Limpopo; MEDUNSA Campus’ Medical Research Ethics Committee (MREC), now named the Sefako Makgatho Health Sciences University (SMU) Medical Research and Ethics Committee (SMUREC) the interview questions were pretested on a small sample of participants. The pretesting was conducted on participants similar to those who were included in the main study. Two intensive care nurses who met the criteria were interviewed. The two semi-structured questions together with probing questions were used to gather information. Refer Annexure A. On completion of the data collection and analysis of the data, it was noted that the questions were well understood and the research process went on well. The researcher added one probing question to find out about the rate of VAP in their unit since it was not indicated in the collected data tool.

1.10 DATA COLLECTION

Data collection is the process of acquiring the participants and collecting data for the study (Polit & Beck, 2006:498). Data collection took place by means of interviews with selected participants at the selected institution. An interview involves verbal communication between the researcher and the participant during which information is provided to the researcher (Burns & Grove, 2009:403). A semi-structured interview
schedule was used. Refer Annexure A. Individual semi-structured face to face interviews were conducted with the participants. The English language was used as the medium of communication and the participants preferred its use. Data collected was voice recorded with the permission of the participants. The voice recorded data was then transcribed verbatim on a hard and soft copy by the researcher herself. The voice recorded and transcribed data is kept safe, for the next 5 years in a secure place. The steps of data collection will be explained in detail in Chapter 3 where the research methodology is described.

1.11 DATA ANALYSIS

Tesch’s qualitative data method as described by Creswell (2009:186) was used in this study to analyse the data that was collected. Data was transcribed and coded. The researcher used an independent coder to assist with data analysis. Themes and categories were formulated separately by the researcher and the coder, thereafter a consensus meeting on the final codes was made. Tesch’s steps of data analysis are described in Annexure C and will be explained in detail in Chapter 3 of this study.

1.12 BIAS

Bias is defined as any influence or action in a study that distorts the findings from the true or expected (Burns & Grove 2009:220). The researcher ensured that the study was not subjected to any biases by the use of different strategies which include bracketing which will be further discussed in detail in Chapter 3.

1.13 TRUSTWORTHINESS OF THE STUDY

Trustworthiness refers to the best way to judge the quality of qualitative research. It is a factor by which the quality of research can be evaluated, and reflects the confidence the researcher can safely have in the research findings. The researcher used Guba’s model
Lincoln and Guba 1985 in Brink et al (2012:118); Polit and Beck (2010:332) of trustworthiness in qualitative research to check the truth value of this research. The researcher used four criteria proposed by the model namely; credibility, dependability, confirmability and authenticity which will be discussed in chapter 3.

1.14 ETHICAL CONSIDERATIONS

Ethics in research entails that the researcher conducts the study in the way that enhances the truth and acceptability of the study. Ethical guidelines serve as the standards and basis upon which the researchers evaluate their own conduct in research (Burns and Groove, 2009:188).

Ethical clearance to conduct the study was obtained from the University of Limpopo; School of Health Care Science Research Ethics Committee (SREC); Medical Research Ethics Committee (MREC), and Gauteng Provincial Health Department Protocol Review Committee. Consent was obtained from all the participants. The ethical aspects considered in this study are; the right to anonymity and confidentiality, the right to privacy, the right to respect and human dignity which will be discussed later in chapter 3 of this study.

1.15 ORGANISATION OF CHAPTERS

Chapter 1 – Overview of the study.
Chapter 2 – Literature review.
Chapter 3 – Research methodology.
Chapter 4 – Data analysis, findings and literature control.
Chapter 5 – Summary, limitations, recommendations and conclusion.
1.16 CONCLUSION

The introduction and background of this study has been described, which included the introduction on the importance of VAP prevention and the background history of the VAPB. The problem statement, aim and the purpose of this study on ICU nurses’ challenges on implementation of VAPB were outlined. The research design used, the research methodology, the research setting, the population and sample, the data collection and the data analysis was discussed. The trustworthiness of this study and ethical aspects considered are also indicated. The next chapter will discuss the literature review of this study.
CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Ventilator associated pneumonia is one of the most common causes of hospital morbidity and mortality, but has been poorly studied in the South African context (Behari & Kalafatis, 2015:16). Critically ill patients who are being ventilated because of their critical illness are more prone to the development of infections, especially ventilator associated pneumonia VAP (Snyder, 2011:3). In 2006, the Institute for Health Improvement (IHI) reported that many strategies have been researched intensively in the prevention of VAP. Ventilator associated pneumonia bundle (VAPB) consist of a series of interventions related to ventilator care, that when implemented together, will achieve significantly better outcomes than when implemented individually to prevent VAP. The VAPB have been implemented in many hospitals in intensive care units (ICUs) and have reported a significant decrease in VAP or of a long duration of one year, two years, or longer with no manifestations of VAP in these patients. The IHI stated that, as a result of these successes, they recommended that the implementation of the VAPB to prevent VAP should be initiated (IHI, 2015:6; Munro & Ruggiero, 2014:163). In this chapter the researcher explored literature related to VAP and VAPB.

2.2 MECHANICAL VENTILATION

Mechanical ventilation is a method to mechanically assist or replace spontaneous breathing of a critically ill patient. This may involve a machine called a ventilator. Mechanical ventilation (MV) is termed "invasive" if it involves any instrument penetrating through the mouth such as an endotracheal tube or the skin like a tracheostomy tube. The use of artificial airway MV is essential and common life saving measure in the intensive care unit because 76% of ICU patients require ventilator support, however,
MV carries many risks and complications, the most common one being ventilator associated pneumonia (Al-Sayaghi, 2014:270). Critically ill patients are patients who are experiencing acute life threatening episode or who are believed to be in imminent danger of such episodes. The more critically ill the patient is, the more likely he or she is to be highly vulnerable, unstable and complex, thereby requiring intense and vigilant nursing care (Groenewald; 2011:9). In this study critically ill patients are those patients admitted in an intensive care unit with endotracheal tubes in situ and connected to mechanical ventilators.

2.3 VENTILATOR ASSOCIATED PNEUMONIA (VAP)

Ventilator associated pneumonia is defined as a pulmonary infection which sets in 48 hours after tracheal intubation, but with no evidence of pneumonia or infection at the time of the initial intubation. It is divided into two stages, the early onset and the late onset VAP. The early onset of VAP occurs from 48 hours to less than 5 days, while late onset VAP occurs after 5 days onwards of mechanical ventilation on critically ill patients in ICU’s (Caffery & Antle, 2008:2; Schellack & Schellack, 2015:26).

Sedwick, Lance-Smith, Reeder, and Nardi, (2012:42) described VAP as a lung infection that occur when a patient receiving mechanical ventilation has evidence of a new or progressive pulmonary infiltrate together with symptoms of fever, leucocytosis, and purulent tracheobronchial secretions. Pneumonia is considered ventilator - associated if the patient was intubated and receiving mechanical ventilation at the time of the introduction or within 48 hours before the onset of the infection. The Centers for Disease Control and Prevention (CDC) defined VAP using a combination of radiological, clinical, and laboratory criteria. VAP is suspected when a patient receiving mechanical ventilation has evidence of a new or progressive pulmonary infiltrate together with fever, leucocytosis, and purulent tracheobronchial secretions.

The microorganisms most commonly responsible for causing VAP include the Streptococcus pneumoniae, the Haemophilus influenzae, and the Moraxella catarrhalis.
Late onset VAP occurs 5 or more days after intubation. The Staphylococcus aureus, Acinetobacterbaumannii, Pseudomonas aeruginosa, Klebsiellapneumoniae, and Enterobacterare some of the most prevalent micro-organisms reported for late-onset VAP (O'Keefe-McCarthy et al, 2008:194; Behari & Kalafatis, 2015:16). The pathogens vary from unit to unit and between hospital to hospital, but in the United States of America (USA) the most common pathogens isolated from patients with VAP were the Methicillin Resistant Staphylococcus Aureus (MRSA), the Pseudomonas, Enterobacter, the Escherichia Coli and the Acinetobacter. These pathogens are also frequently isolated from patients admitted to South African critical care units as well. The Multidrug-resistant (MDR) strains of the pathogens are increasing in incidence both locally and internationally (Gillespie, 2009:45).

2.4 PATHOPHYSIOLOGY OF VAP

Ventilator associate pneumonia is a condition that occurs as a result of pulmonary aspiration of bacterial colonization in the oropharynx or gastrointestinal tract of a critically ill patient, who is being mechanically ventilated. The presence of an artificial airway impairs the pulmonary defense mechanisms of the patient, creating a direct route for the bacteria to enter the lungs, bypassing the normal filtration route in the upper airways and the natural barrier provided by the epiglottis. In VAP, the cough reflex and the mucociliary clearance of secretions are impaired, causing the stagnation or pooling of mucus within the oropharynx of the patient. Irritation and inflammation disrupts the mucus membranes of the respiratory tract. The inflamed membranes and pooled secretions encourages bacterial adherence and further stimulates colonization of the bacteria within the body of the critically ill patient. Stabilizing the endotracheal tube with a manufactured device was reported to help reduce the movement of the endotracheal tube and reduce mucosal pooling within the oropharynx of the critically ill patient (Caffery & Antle, 2008:2; Mietto, Pincioli & Patel, 2013:994).

Sedwick et al (2012:42) stated that VAP develops through the entry of micro-organisms, gaining access to the normally sterile lower portion of the respiratory tract, because of
the patients' depressed level of consciousness and an impaired gag reflex, causing the pooling of approximately 100 to 150 millilitres (ml) of contaminated secretions, within the oropharynx of the patient's body within a 24 hour period. The placement of an endotracheal tube may impede the body's natural defence against infection, by impairing the cough reflexes and reducing the mucociliary clearance of secretions. The impairment of the cough reflexes, the accumulation of contaminated secretions within the oropharynx, and the insertion of an endotracheal tube in critically ill patients, increases the risks for VAP in these patients.

2.5 RISK FACTORS OF VAP

Experts from the American Thoracic Society (2012) indicated that the insertion of an endotracheal tube in critically ill patients, treated with mechanical ventilation can potentially increase the risk of VAP from 6 fold to 20 fold (Sedwick et al, 2012:42). Schellack and Shellack (2013:26) grouped the risk factors associated with hospital-acquired pneumonia and ventilator associated pneumonia as follows:

- **Host**
  - Age > 65 years
  - Smoking
  - Malnutrition
  - General surgery
  - Prolonged antibiotic therapy
  - Endotracheal intubation
  - Dental plaque and therapies that increase gastric pH
  - Body position during ventilation
  - Enteral feeding
  - Chronic obstructive pulmonary disease and enteral nutrition
  - Prolonged hospitals stay of > 4 days (Schellack & Shellack, 2013:26).
• **Environmental**
  - Gastro-oesophageal reflux of static oral secretions from indwelling nasogastric tubes
  - Positioning of intensive care unit patients for diagnostic or surgical procedures (Schellack & Shellack, 2013:26).

• **Pharmacological**
  - Use of neuromuscular blocking agents
  - Medicines that result in an increase in the gastric pH, e.g. proton-pump inhibitors, histamine-2-receptor antagonists and miscellaneous agents, such as sucralphate (Schellack & Shellack, 2013:26).

Endotracheal intubation also interferes with the natural host mechanisms of the critically ill patients by reducing the cough effort, interfering with the mucociliary clearance and injuring the epithelial layer in the patient, thereby exposing the basement membrane. Mucus is normally produced to trap bacteria, which is then removed by mucociliary clearance in the patient. Groenewald (2011:9), describes endotracheal intubation as the introduction of a tube into the trachea to maintain or restore its patency. The endotracheal tube is a cuffed, single-use tube placed through the vocal cords, which is one way of allowing delivery of high flow oxygen and selected tidal volume to maintain adequate ventilation. The endotracheal tube is then connected to a mechanical ventilator, which pushes air into the lungs of the patient to deliver a breath to the patient manually, who is connected to the ventilator. Endotracheal tube contributes to VAP by micro-aspiration of secretions that contain pathogenic microorganisms, and secondly by biofilm formation (Singh, Bali, Singh, & Singh; 2015:737).

Endotracheal intubation may result in increased production of mucus and stagnation of mucus in the respiratory tract of the patient. These factors combined with an impaired mucociliary clearance increases the risk of VAP in the intubated patient (Gomes,
In this study, an intubated patient is the one whom the endotracheal tube was passed through the vocal cords as part of the treatment.

2.6 VAP DIAGNOSTIC CRITERIA

- **Radiographic abnormalities:**
  - New or progressive, and persistent chest radiographic opacity compatible with Pneumonia, such as infiltrates, consolidation or cavitation.

- **At least 1 of the following:**
  - White blood cells (WBC) 1 12,000 or < 4,000
  - Temperature > 38°C (Celsius) with no other cause

- **At least 2 of the following:**
  - Tracheal secretions: new onset of purulence, or change in character, or increase in volume
  - Increase in suctioning requirements
  - Inspiratory crackles (rales) or bronchial breath sounds on auscultation
  - Worsening gas exchange like O₂ (Oxygen) desaturations, which may result in an increase in the oxygenation or ventilator requirements (Best Care Always, 2009:2; Mietto et al, 2013:992).

If multiple episodes are suspected, one needs to look for the resolution of the initial infection. The additional isolation of a new pathogen alone is not indicative of a new episode of pneumonia. The full spectrum of a combination of new signs, symptoms and radiographic evidence is required to diagnose VAP (Best Care Always, 2012:2; Mietto et al, 2013:992).
2.7 VAP MORBIDITY AND MORTALITY

Ventilator associated pneumonia prevalence ranges from 10% to 25% in tertiary care hospitals, and can reach up to 76% in some settings. Ventilator associated pneumonia (VAP) is associated with substantial morbidity and excess cost, and patients with VAP have been found to be twice as likely to die as those without it. As a result ventilator associated pneumonia has become a focus of patient safety initiatives in ICUs (Arabi et al, 2008:506; Bahari & Kalafatis, 2015:16). Gillespie (2009:45) reported that VAP is associated with increased mortality and morbidity, increased duration of mechanical ventilation, prolonged ICU and hospital stay, and increased cost of hospitalisation.

In South Africa, the ICU cost of occupying a bed per day amounts to an average of R5 604 in a public sector hospital (Cheddie, Muckart, Hardcastle, Den Hollander, Cassimjee & Moodley, 2011:178). In a private hospital alone the cost is estimated at R15 446.10 (Mediclinic Southern Africa, 2015:3). VAP attributable mortality is difficult to quantify, because of the effects of associated conditions within the critically ill patients, but has been estimated to increase mortality by 30% and even twofold in critically ill patients (Gillespie, 2009:45). Among the patients treated with mechanical ventilation, mortality rates are 46% in patients with VAP and 32% in those without VAP. Additionally, patients in whom VAP develops, remain in the ICU for 4 to 19 days longer than do patients who were intubated and did not acquire VAP (Sedwick et al, 2012:41).

2.8 PREVENTION OF VAP

Blot, Lisboa, Angles, and Rello (2011:251) stated that the World Health Organisation (WHO) defines patient safety as reducing the risk of unnecessary harm associated with health care to an acceptable minimum. An acceptable minimum refers to the collective notions of given current knowledge, resources available, and the context in which the care was delivered weighed against the risk of non-treatment or any other treatment. A safer environment is generated by the prevention of errors and their adverse effects. Acknowledging the potential for errors and creating strategies for reducing errors at
every stage of clinical practice are fundamental in the safety promotion process for patient care. The importance of acknowledging potential errors is recognised in the Institute of Medicine report “To Err is Human,” which provides relevant data regarding quality of care and patient safety in the United States of America (USA). Strategies to improve outcomes in intensive care units (ICU) include safety tools, such as a rapid response team, daily goal sheet, checklists, and the development of care bundles with appropriate implementation measures (Blot, Lisboa, Angles, & Rello (2011:251)

Augustyn (2007:32) and Curtin (2011:11) reported that interventions to prevent ventilator associated pneumonia (VAP) begin at the time of intubation and should be continued until extubation. With the extreme shortage of nurses and the resultant increase in the number of less experienced nurses in the intensive care unit, education on the prevention of VAP is essential, because the occurrence of nosocomial infections is directly related to the adequacy of staff. Nurses need to understand the pathophysiology of VAP, risk factors for this type of pneumonia, and strategies that may prevent the disease. Although VAP has multiple risk factors, many nursing interventions can reduce the incidence of this disease. An autonomous nursing intervention is one where nurses can implement care against VAP independently, based on their education and knowledge. Three autonomous nursing interventions to reduce VAP are as follows:

- Maintaining endotracheal tube cuff pressure between 20 and 25 cm H2O.
- Keeping the head of the bed elevated from 30° to 45°.
- Providing mouth care every 2 or every 4 hours to the critically ill patients (Augustyn, 2007:32; Curtin, 2011:11).

Bundling the three interventions, achieved better patient outcomes, than if these same interventions had been implemented individually. Intensive care nurses are in the best position to apply the evidence based guidelines into practice, as they are at the patient’s bedside 24 hours a day, and therefore play an important role in the prevention of VAP (Curtin, 2011:11). For the purpose of this study the researcher concentrated mainly on ventilator associated pneumonia bundles (VAPB) to prevent VAP.
2.9 VENTILATOR ASSOCIATED PNEUMONIA BUNDLE

The ventilator associated pneumonia bundle consists of a small, straightforward set of evidence based practices, generally three to five that; when performed collectively and reliably, have been proven to improve patient outcomes (IHI, 2015:1). The Best Care Always (BCA) Campaign in South Africa is a national campaign working together to make a bigger impact on patient care than we could each do alone. The campaign is supporting hospitals; public and private to prevent hospital acquired infections (HAI) using evidence based practices such as VAPB to prevent VAP. To join the campaign, a hospital must be willing to:

- Implement evidence-based interventions at a faster pace.
- Share information, experiences and successes with others.
- Commit to measurement (Westwell, 2008:204).

Andrews (2015:1) stated that VAP prevention bundles were first introduced by the IHI in 2004. Key elements include elevation of the head of the bed, daily “sedation vacations” paired with assessment of readiness to wean, peptic ulcer disease prophylaxis, and deep vein thrombosis prophylaxis. Sedwick et al (2012:42) state that there is a need for the institution to select the bundle of choice out of the Institute of Health Improvement (IHI) strategies to prevent VAP. VAPB selection should be chosen based on the availability of the requirements to achieve a goal of VAP prevention.
The table below indicates the sample of ventilator associated pneumonia bundle selected by the SARI Group (2011).

**Table 2.1**

**Sample of the ventilator associated pneumonia bundle**

Adapted from Scottish Intensive Care Society Audit Group, National Services Scotland (SARI Group, 2011:13).

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sedation reviewed and, if appropriate, stopped each day.</td>
</tr>
<tr>
<td>2.</td>
<td>Patient assessed for weaning and extubation each day.</td>
</tr>
<tr>
<td>3.</td>
<td>Avoid supine position. Aim to have the head of bed elevated to at least 30°.</td>
</tr>
<tr>
<td>4.</td>
<td>Use chlorhexidine as part of daily oral care (0.12-2.0% applied 6-hourly).</td>
</tr>
<tr>
<td>5.</td>
<td>Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours.</td>
</tr>
</tbody>
</table>

The table below indicates the elements chosen by Gallagher (2012) during VAPB implementation in their study.

**Table 2.2**

**Clinical practice guidelines for ventilator associated pneumonia bundle implementation.**

Adapted from (Gallagher, 2012:379).

- Hand washing
- Head of bed elevated 30°
- Condensation in ventilator tubing checked
- Daily assessment of readiness to wean
- Daily sedation vacation
- Daily spontaneous-breathing trials
- Deep vein thrombosis prophylaxis
- Oral care every 4 hours with chlorhexidine gluconate 0.12%
- Peptic ulcer disease prophylaxis
For the purpose of this study the researcher will concentrate on the 2010 bundled practices which include five VAPB elements which are as follows:

- **Head of bed elevation unless contraindicated**

This is a simple cost-free intervention that is proven to reduce the risk of ventilator associated pneumonia (VAP). Patients are at increased risk of aspiration of gastric contents when they lie in the supine position. Patients are only made to lie flat for venous access device insertion or removal, position changes or if sitting head up are contraindicated. Early mobilization of patients is also encouraged, making patients sit out of bed as soon as they are fully conscious and complaint. The increased compliance with keeping the head of bed (HOB) elevated ≥30° led to a decrease in rates of ventilator-associated pneumonia (Westwell, 2008:204; Metheny & Franz, 2013:55).

Sedwick et al (2012:43) cited that Grap, Munro, Hummel, Elswick, and McKinney, (2005) conducted a descriptive study of 66 patients treated with mechanical ventilation in a medical ICU to determine the relationship between backrest elevation and the development of VAP. Data were obtained from laboratory results and medical records from the start of mechanical ventilation up to day 7 of mechanical ventilation. The backrest elevation was continuously monitored by using a transducer system. Backrest elevations were less than 30° longer period of the time and less than 10° for lesser period of the time. The mean backrest elevation for the entire study period was 21.7°. The study was conducted with the focus on a backrest elevation less than 30° and severity of illness which affected the incidence of VAP.

Sedwick et al (2012:43) further reported that in a randomized clinical trial conducted by Drakulovic, Torres, Bauer, Nicolas, Nogué, Ferrer (1999) among patients receiving mechanical ventilation, the patients in a semi-recumbent body position had a lower frequency and risk for nosocomial pneumonia than those put in a supine position.
• **Daily interruption of sedation**

This intervention is also known as sedation holding, sedation vacation, or sedation holiday, with the aim to assess the readiness to extubate the patient. It has been described as the discontinuation of sedative infusion, until the patients are awake on a daily basis. The sedation is held to assess the readiness for weaning the patient off from mechanical ventilation. Over sedation or prolonged use of continuous infusion of a sedative agent is known to be associated with the increased duration of ventilation, prolonged ICU stays, an increase in morbidity and mortality and a possible increase in psychological distress (Westwell, 2008: 204; Munro & Ruggiero, 2014:170).

Several methods of assessing readiness for extubation exist. These include T-piece trials, weaning intermittent mandatory ventilation, and pressure-support ventilation. Daily interruptions of sedation and daily assessment of readiness for extubation are other integral elements of the ventilator bundle. Traditionally, critical care physicians attempted to minimize the duration of mechanical ventilation, by manipulating ventilator modes and slowly decreasing ventilator support. However, research has revealed that the management of sedation can have a more profound effect on the duration of mechanical ventilation and the other patient outcomes, than can manipulating ventilator modes (Sedwick et al, 2012:43).

Sedwick et al (2012:43) further indicated that in a multicenter, randomized control trial described by Gigard and Ely (2008), they compared the wake-up-and-breathe protocol with daily spontaneous awakening trials (interruption of sedation) and found that daily spontaneous breathing trials resulted in better outcomes for patients receiving mechanical ventilation than the wake up and breathe protocol. A total of 336 patients at 4 tertiary care hospitals who were treated with mechanical ventilation, were included in the study. Of these, 168 had daily spontaneous awakening trials followed by a spontaneous breathing trial, the other 168 patients, the control group, had sedation per usual care plus a daily spontaneous breathing trial. The primary study end point was time breathing without assistance. Patients in the intervention group spent more days
breathing without assistance during the 28 day study period, than the patients in the control group.

- **Peptic ulcer disease prophylaxis**
  It is also known as gastric ulcer prophylaxis. The prevention of gastric ulceration in mechanically ventilated patients is absolutely necessary, because of the high risk of mortality, if complications occur. It is stated that the risk of death secondary to significant gastrointestinal bleeding in critically ill patients is 48.5% than those who require mechanical ventilation and have a coagulopathy. Early enteral feeding can significantly reduce the risk of gastric ulceration. Enteral feeding is encouraged within the first 6 hours of admitting an intubated patient. This is further reinforced within the integrated care pathway for ventilated patients, to ensure the prescription of gastric ulcer prophylaxis (Westwell, 2008:204).

- **Deep vein thrombosis prophylaxis**
  Arabi et al (2008:506) reported that studies have shown that between 22% and 88% of critically ill patients will develop a deep venous thrombosis (DVT), leading to increased morbidity and mortality if DVT prophylaxis are not used. It is essential that such a high-risk complications of critically ill patients are addressed. Low molecular weight heparin such as clexane must be used for these patients to prevent DVT. This decreases the incidence of DVT by 50% in comparison with unfractionated heparin, which reduces the incidence by 20%.

- **Oral care by use of chlorhexidine**
  Snyder (2011:6) indicated that the majority of mechanically ventilated patients may have equipment or devices, such as endotracheal tubes in place which keep the oropharyngeal and nasopharyngeal cavities continuously open. Other contributors to the dry mouth are psychological factors such as anxiety, stress, pharmacological agents, and physiological contributors such as dehydration associated with fluid imbalances. Oral hygiene care is another nursing domain that can affect the progression of VAP. The oropharynx is colonized with potential pathogens such as
Staphylococcus aureus, Streptococcus pneumonia, Prevotella species, Bacteroides fragilis, and more than 700 other microbes, many of which have not been identified yet (Munro & Ruggiero, 2014:168).

Within 48 hours after a patient is admitted to the ICU, the flora of the oral cavity undergoes a transformation to predominantly gram-negative microbes, which can be more virulent. Oral hygiene care methods, includes mouthwashes, use of gel, toothbrush, or combination techniques, have been used to combat possibly the spread of pathogenic flora (Munro & Ruggiero, 2014:168). Chlorhexidine is a cationic chlorophenylbis-biguanide antiseptic agent. Chlorhexidine has been used as an oral disinfectant in mechanically ventilated patients, because of its ability to bind to oral tissues with subsequent slow release of antiseptic properties, and thus a long period of antibacterial action (Scannapieco, Raghavendran, Vacanti, Owens, Wood, & Mylotte, 2009:2).

A study was conducted by Snyder (2011:19) in South Africa to evaluate the evidence on the effectiveness of chlorhexidine in the prevention of VAP in critically ill, adult patients, chlorhexidine proved to be beneficial for the prevention of ventilator-associated pneumonia. It is recommended that more studies be done on the optimal concentration, administration procedures, dosage and cost-effectiveness of chlorhexidine use, as a focus of future more rigorously designed trials. Unlike the chlorhexidine effect on the incidence of VAP, the evidence on mortality did not show any effect with the use of chlorhexidine. Chlorhexidine was also found to be a cost effective, safe treatment in the prevention of VAP. The use of 2% chlorhexidine may be more effective in reducing the incidence of VAP but further research is recommended on its value. The use of chlorhexidine in South Africa is not routine and needs to be studied with the South African populations (Snyder, 2011:19).

This is supported by Sedwick et al (2012:44) who stated that microbes colonising the mouth markedly increase the risk for VAP. Pathogens linked to VAP in orally intubated patients become colonized in dental plaque and in the oral mucosa. Within 48 hours of
admission to an ICU, patients have changes in the oral flora, which predominantly include gram-negative and other virulent organisms. In addition, dental plaque can provide an environment for respiratory pathogens such as methicillin-resistant Staphylococcus Aureus and Pseudomonas Aeruginosa. Results from a meta-analysis of 11 trials that included 3242 patients receiving mechanical ventilation, who were treated with oral application of antibiotics or antiseptics or with placebo or standard oral care alone indicated that the incidence of VAP was significantly reduced, by the use of oral antiseptics, such as chlorhexidine but not by oral applications of antibiotics (Sedwick et al; 2012:44).

2.10 ICU NURSES’ KNOWLEDGE ON THE VAPB

Understanding the importance of recommended practices such as ventilator associated pneumonia bundle (VAPB) increases the likelihood of adherence, and may overcome barriers to implementation. Nurses who do not have enough knowledge on measures proven to decrease ventilator associated pneumonia (VAP) rates may not have the necessary confidence to take action and make decisions regarding such practices. Patient recovery may be delayed and other risks of complications from mechanical ventilation can be prevented (Gomes, 2010:10).

In the study conducted by Biancofiore, Barsotti, Catalani, Landi, Bindi, Urbani, Desimone, Stefanini, Sansevero, and Filipponi (2007:129) and Ali (2013:69) they stated that, prevention and control of VAP are dependent on education and awareness of ICU staff members, towards the problem and on the application of evidence based strategies. Adherence to the evidence based guidelines on the prevention of VAP will occur once staff involved directly with the patient’s care has knowledge of such guidelines and can apply them into practice. Data from their study indicated that nurses tended to apply measures automatically by simply following protocols and instructions given by physicians or colleagues, without being fully aware of what and why they actually do so. Preventive strategies are widely applied by nurses, but sometimes not in a responsible and informed manner. This study demonstrated the importance of
education and continuous career development and update, so as for the nurses to be able to rationalise their actions taken.

Ali (2013:69) conducted a study on the critical care nurses' knowledge and compliance with ventilator associated pneumonia bundle at Cairo University Hospitals. The author indicated that the findings revealed that all critical care nurses with different educational levels, irrespective of their years of experience or area of work had unexpectedly unsatisfactory knowledge scores about ventilator associated pneumonia (VAP) and VAPB preventive measures. It has been suggested by a study that nurses usually lack the knowledge of the research and the evidence for the prevention of VAP. This study finding is consistent with that of Blot and Labeau (2007) and Gomes (2010) who conducted a study about the knowledge among intensive care nurses on evidence based guidelines for the prevention of ventilator associated pneumonia, and the findings revealed that the overall knowledge results were poor.

2.11 VAPB IMPLEMENTATION PROCESS

Al-Tawfiq and Abed (2010:553) conducted a pre interventional and post interventional study to compare the rates of VAP on a monthly basis from January to December 2006. In 1st year period before initiation of VAPB on decreasing VAP in an adult intensive care unit (ICU) using the Institute for healthcare Improvement (IHI) bundle, implementation process was done by taking multiple steps to implement the ventilator associated pneumonia bundle and included staff education, development of an audit tool, data collection, and tracking of the measures. They indicated that there is a need for an institution to select the VAPB of choice out of all the Institute of Health Improvement (IHI) strategies to prevent VAP. Bundle selection can therefore be done based on the availability of requirements to achieve a goal of VAP prevention. A team approach to drive and maintain the initiative was developed and included the following; infection control practitioners, critical care nurses, respiratory therapists, intensivists, and the chairman of the infection control committee. A protocol was developed for sedation
vacation and assessment to extubate the patient (Al-Tawfiq & Abed, 2010:553; Sedwick et al, 2012:42).

Gigard and Ely (2008:250) reported that the protocol driven ventilator weaning has the potential to improve clinical outcomes, by increasing the use of efficacious weaning methods, such as daily weaning screens from the ventilator and spontaneous breathing trials. The author indicated the “wake up and breathe” protocol, represents a new generation of weaning that pairs the management of the ventilator together with sedation to achieve superior outcomes. Clinical trials have demonstrated that protocols for weaning the patient off the ventilator, whether non-physician healthcare professionals or closed-loop computer systems driven, can reduce the duration of mechanical ventilation and can lead to earlier ICU discharge. The benefits of weaning protocols may not be universal, and factors such as patient population, ICU design, staffing and the use of other decisions or support tools must be considered, when deciding where and how to implement specific protocol.
Below is an example of mechanical ventilation weaning protocol.

![Mechanical ventilation weaning protocol](image)

**Figure 2.1  Mechanical ventilation weaning protocol.**

The mechanical weaning protocol above indicate that on daily basis the ICU nurse does the screening on a mechanically ventilated patients to assess the readiness to extubate. The patients to be screened must present with the following; fraction oxygen delivery of less than 50%, positive end expiratory pressure of less than 5cmH2O, no vasopressor or sedative infusions, and must be able to answer to simple orders. If so the spontaneous breathing trial can be started. Patient can then be put on a T-piece
connected to the oxygen for 90 minutes and if not so the patient should be left on mechanical ventilation meaning that he or she is not ready for mechanical weaning process. After 90 minutes if the patient present with decreased peripheral saturation (SpO2) of less than 90%, respiratory rate of above 35 beats per minute, variation of heart rate and arterial systolic pressure of above 20% from the initial reading before the trial and agitation, the patient must be put back to mechanical ventilation. Lastly the physician approval is needed to either extubate the patient or to put him or her back to mechanical ventilation (Tonnelier et al, 2005:85).

Patient eligibility for the weaning procedure was identified by daily screening by nurses. Screening was deemed to start immediately after ICU admission. The eligibility criteria for a SBT were the following: fractional inspired oxygen <50%; positive end-expiratory pressure <5 cmH2O; no vasopressor infusion; no sedative agent infusion; and response to simple orders. Physician approval for initiation of SBT was not required. A planned SBT duration of 90 min was employed, and SBTs were always performed using a T-piece. The SBT was terminated before 90 min had elapsed and considered a failure if any of the following criteria was satisfied: pulse oximetry < 90%, a respiratory rate > 35 breaths/min, a heart rate or a systolic arterial pressure variation >20%, or occurrence of patient agitation. All of these criteria for failure were specifically recorded. A SBT was considered to be successful when the patient could breathe spontaneously for 90 min. Physicians were asked to approve discontinuation of MV following a successful SBT (Tonnelier et al, 2005:85).

Extubation was therefore performed if cough was subjectively considered efficient, and if a leak test was considered positive (inspiratory and/or expiratory air leaks after cuff deflation). If the SBT was not well tolerated, then the failure criteria were specifically recorded and the patient returned to their prior ventilator settings and mode. Such patients were then subjected to screening the following day. Refer figure 2.2

Hillier, Wilson, Chamberlain and King (2013:58) in their study on preventing VAP through oral care, product selection, and application method: a literature review in
America. They indicated that implementation of an oral care protocol, ongoing nurse education, and evaluation, were important in reducing the incidence of VAP.

Below is the example of an oral care protocol.

**Table 2.3 Oral care protocol**
Adapted from (Cutler, & Davis, 2005:391).

<table>
<thead>
<tr>
<th>Purpose</th>
</tr>
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<tbody>
<tr>
<td>Bacteria causing lower respiratory tract infections colonize the mouth, oropharynx, and dental plaque. Protecting the oral cavity from outside contaminants may reduce infections, and frequent and aggressive oral and dental care has been identified as preventive measures against acquiring ventilator-associated pneumonia (VAP).</td>
</tr>
</tbody>
</table>

| Policy: |
| 1. The oral cavity is assessed initially and every 12 hours by the registered nurse. |
| 2. Teeth are brushed every 12 hours and PRN. |
| 3. Unconscious or intubated patients are provided oral cleansing every 2 hours and PRN. |
| 4. Oropharyngeal suctioning is performed every 6 hours and PRN as well as prior to repositioning the tube or deflating the cuff. |
| 5. Yankauer and compete care system are changed every 24 hours. |
| 6. Suction canisters, tubing, and inline deep suction lines are changed per unit policy. |

| Procedure: |
| 1. General |
| 1.1. Wash hands and put on gloves. |
| 1.2. Set up suction equipment – suction canister with Y-connector for dedicated oral care line. |
| 1.3. Position patient’s head to the side or place in semi-fowlers. |
| 1.4. Use covered Yankauer to suction mouth at every cleaning and as needed |
| 1.4.1. Suction oral cavity by pushing suction knob on handle to “ON” position. |

| 2. Brushing: Every 12 hours and PRN |
| 2.1. Brush teeth using suction toothbrush and 1.5% hydrogen peroxide solution. |
| 2.1.1. Ensure suction handle is in the “OFF” position. |
| 2.1.2. Brush for approximately one to two minutes. |
| 2.1.3. Exert gentle pressure while moving in short horizontal or circular strokes. |
| 2.1.4. For edentulous patients, brush gingiva. |
| 2.2. Gently brush the surface of the tongue. |
| 2.3. Gently brush the hard palate. |
| 2.4. Suction excess cleansing solution by pushing suction knob on handle to “ON” position. |
| 2.5. Apply mouth moisturiser inside mouth and on lips. |

| 3. Swabbing: Every 2 hours and PRN |
| 3.1. Use suction swab to clean the teeth, gingiva, tongue, and hard palate between brushing or instead of brushing if brushing causes discomfort or bleeding. |
| 3.1.1. Ensure suction handle is in the “OFF” position. |
| 3.1.2. Place swab perpendicular to gum line, applying gentle mechanical action for one to two minutes. |
| 3.1.3. Exert gentle pressure while moving in short horizontal or circular strokes |
3.1.4. Turn swab in clockwise rotation to remove mucous and debris
3.1.5. For edentulous patients, brush gingiva
3.2. Gently swab the surface of the tongue.
3.3. Gently swab the hard palate.
3.4. Suction excess cleansing solution by pushing suction knob on handle to “ON” position.
3.5. Apply mouth moisturiser inside mouth and on lips.

4. Oropharyngeal Suctioning Procedure: Every 6 hours.
4.1. Provide oropharyngeal suction to remove secretions that have migrated down the outside of the tube using suction catheter tip.

2.12 COMPLIANCE WITH VAPB IMPLEMENTATION

Gillespie (2009:50) stated that a team approach is essential for the successful implementation of a quality improvement initiative such as ventilator associated pneumonia bundle (VAPB). The support of medical directors, nursing managers, administrators and ancillary services such as the health service laboratory, together with staff involvement, are key factors to success. Craven (2006:256) conducted a study in United State of America (USA) on preventing ventilator associated pneumonia (VAP) in Adults* Sowing Seeds of Change and concluded by indicating that the multidisciplinary prevention team is recommended to implement VAPB for VAP prevention in order to ensure compliance.
The figure below indicates Craven’s representation of multidisciplinary team model.

**Figure 2.2: Multidisciplinary team Model representation**
Adapted from: (Craven, 2006:256).

In a study conducted by Sedwick et al (2012:44) the implementation of evidence based practice to prevent ventilator associated pneumonia (VAP) at Lankenau Medical Center’s ICU in Philadelphia was initiated. The process of reducing the number of cases of VAP in the ICUs began in July 2008. An interdisciplinary team consisting of nurses, physicians, and respiratory therapists, shared roles and responsibilities for implementing the project. The members of the staff were educated about each aspect of the VAP bundle. The nurses, physicians, and therapists were given fact sheets describing the VAP bundle and the importance of VAP, as it related to the patients’ outcomes and the cost of care. “ZAP VAP” signage was placed at every patient bedside.
Sedwick et al (2012:44) stated that compliance data was collected from October 2008 through December 2009. The compliance audits were done by personnel from the quality control department. The decision to use these personnel was based on 2 factors. Firstly, the interdisciplinary team thought that having an auditor from outside the nursing department would help eliminate bias in reporting audit findings. Secondly, the team did not want to disrupt patient care by having nurses being removed from the patients' bedside to conduct compliance audits. Members of the nursing department were collaborating with members of other departments to address VAP, the team was able to negotiate with the quality department, and a member of that department’s existing staff conducted the audits.

Sedwick et al (2012:44) stated that in order to increase the likelihood of success, the SMART approach described by Kollef (2008) was used. The SMART approach includes specific, measurable, achievable, relevant, and time-bound approaches to address hospital acquired infections (HAIs). Kollef (2008) recommended that nurses and other involved care providers choose specific objectives that precisely define and quantify the desired outcomes, such as reducing the rate of hospital acquired infections (HAIs) in an ICU by 25%. The authors indicated that the managers should monitor staff adherence to infection prevention protocols, and provide feedback about how well the staff members complied with the established guidelines.

It is important to have adequate resources to support the team and ongoing communication to reinforce educational tactics. The implementation of the SMART approach included providing specific directions to all the personnel on the steps needed to implement each aspect of the VAP bundle. The interdisciplinary team established measurable goals for success: to achieve 100% compliance with the VAP bundle and to reduce the rate of VAP to 0. In order to meet the goals, the staff members were provided with resources such as checklists, flagged order sheets, and consistent feedback. Finally, the team decided that the time allowed to meet the goals would be 1 year. Interdisciplinary collaboration is imperative when addressing issues such as VAP. Each member of the health care team must be willing to share in the responsibility for
developing strategies, to address the problems in patient care and to take an active role in implementing the plan (Sedwick et al, 2012:49).

Figure below illustrates the checklist for the VAPB compliance rate

<table>
<thead>
<tr>
<th>Patient: __________________</th>
<th>File No</th>
<th>Admit Date: _____________</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU Days1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1. Head of the Bed 30°</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Daily sedative interruption and daily assessment of readiness to extubate</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. PUD Prophylaxis</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. DVT Prophylaxis</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Daily Oral Care with Chlorhexidine</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**Figure 2.3 Checklist to measure VAPB compliance rate**
Adapted from: (IHI: 2015:2).

### 2.13 MEASUREMENT OF VAPB COMPLIANCE AND VAP RATES

The SARI Group (2011:15) state that the compliance with the VAPB is defined as the percentage of mechanically ventilated patients, for whom all five elements of the bundle are documented on the daily record, or elsewhere in the medical record. The compliance with the bundle is an ‘all or nothing’ measure; a case is not in compliance unless all of the elements of the care bundle have been documented. Compliance should be audited regularly, at least weekly. On the day of the VAPB compliance audit, all the patients who are being mechanically ventilated are assessed for compliance with the bundle. If an element is contraindicated in a particular patient, and this has been documented in the daily record or in the medical record, then the patient can be regarded as compliant with that intervention. Only those patients with all five elements of the bundle documented are to be considered compliant. When there are seven
ventilated patients and six have all the five elements of the bundle completed, then the compliance is 86% (6 divided by 7). However, if all seven were missing; even one component, then the compliance rate is zero percent (0 divided by 7) (SARI Group, 2011:15).

Adherence to the guidelines and protocols should be monitored regularly to ensure compliance and to address any deficits identified (SARI Group; 2011:2). The Institute for Health Improvement (2015:1) indicated that compliance rate measurement is an all-or-nothing indicator. If any of elements chosen as a bundle to prevent VAP are not indicated on any patient, then the patient must not be included on the numerator. If the bundle element is contraindicated for a particular patient, and this is documented appropriately in the medical record, then the patient is considered compliant.

To implement ventilator associated pneumonia bundle, a goal has to be set, for example to decrease the ventilator associated pneumonia rate by 45% in one year. The compliance rate is calculated by firstly determining a goal, such as 95% of patients who are mechanically ventilated and should receive all 5 or 7 depending on the chosen elements of the bundle (Best Care Always, 2012:1).

Calculation of the VAPB compliance rate is determined by using the total number of patients receiving all 5 elements of the VAPB divided by the total number of patients sampled which is as follows:

\[
\text{VAPB compliance rate} = \frac{\text{No of patients receiving all 5 elements of the VAP bundle}}{\text{No of patients sampled}}
\]

(Best Care Always, 2012:1).
Ventilator associated pneumonia (VAP) rate is determined by using the total number of cases of VAP divided by the total number of ventilator days multiplied by 1000 which is calculated as follows:

\[
\text{VAP rate} = \frac{\text{No of cases of Ventilator Associated Pneumonia}}{\text{No of ventilator days}} \times 1000
\]

(Best Care Always, 2012:1).

The following figure illustrates the graphic representation of the relationship of VAPB compliance and VAP rates.

![Figure 2.4 Graphic representations of VAPB compliance and VAP rates](image)

Adapted from (Alsadat, Al-Bardan, Mazloum, Shamah, Eltayeb, Marie, Dakkak, Naes, Esber, Betelmal, & Kherallah, 2012:81).

The relationship of the VAPB compliance and VAP rates is such that when the VAPB compliance rate increases, VAP rate decrease. Refer Figure 2.4.
2.14 VAPB EFFECTIVENESS

The introduction of ventilator associated pneumonia bundle has shown to decrease ventilator associated pneumonia rates. In a study of 35 intensive care units (ICUs), ventilator associated pneumonia (VAP) rates had an average reduction of 44.5% after the implementation of the VAPB. Similar benefits were seen in the study of two 20-bed ICUs in which rates decreased from 6.1 to 2.7 per 1000 ventilator-days in one unit, and from 2.66 to 0 per 1000 ventilator-days in the other unit (O'Keefe-McCarthy et al, 2008:201). Nurses need to be encouraged to search answers for questions regarding nursing care, not only with senior colleagues, but also and on electronic resources and recent journal articles. Therefore, there is a need that nurses become familiar with such modern databases and resources. Cason, Tyner, Saunders and Broome (2007:35) recommended that all hospitals institute educational training programmes for their staff to heighten their awareness of VAP prevention and to improve adherence by using the VAPB evidence based guidelines. They also recommended that the hospitals should encourage staff involvement in educational advancement and performance improvement projects.

Various measures to prevent VAP have been reported in the literature in general. However, there are very few data concerning the nurse’s knowledge of VAP prevention strategies and the degree of adherence to them, as well as to the factors that may influence their application at the bedside. While knowledge may not ensure adherence to evidence based guidelines, a lack of knowledge may be a barrier to adherence. Understanding the importance of recommended practices, increases the likelihood of adherence and barriers to overcome VAPB implementation challenges such as lack of knowledge (Labeau, Vandijck, Claes, Van Aken, & Blot, 2007:272). Hockenberry, Wilson and Barera (2006:372) stated that it is extremely important that intensive care nurses have knowledge of the strategies to prevent VAP, and are able to implement evidence based nursing in the intensive care units, aiming at achieving high quality care as well as optimal outcomes for their patients.
2.15 CHALLENGES AND BARRIERS TO VAPB IMPLEMENTATION

2.15.1 General challenges and barriers encountered during VAPB implementation

Patients at risk for Ventilator Associated Pneumonia (VAP) present a unique challenge to critical care nurses. To prevent VAP, nurses must develop strategies to incorporate evidence-based practices into the daily care provided to their patients receiving mechanical ventilation (Sedwick et al, 2012:42). In a qualitative study conducted by Sinuff, Cook, Giacomini, Heyland, & Dodek (2007:2088) the participants identified the important strategies needed to overcome potential barriers to clinician adherence to VAPB guidelines. The strategies were the presence of effective leaders to promote adoption of the guideline and its adherence, education tailored to the learning preferences of different professional groups, and repeated educational interventions, reminders, audits and feedback on the VAPB implementation. The participants suggested that the use of strategies to select and prioritise guidelines, simple guideline formats, and electronic media to implement guidelines may further contribute to successful guideline programs.

Lack of knowledge was indicated as a barrier for adherence to evidence based practice. Although knowledge does not ensure adherence, misconceptions about effective prevention strategies can be important in decision making. The reduction in the rates of hospital acquired infection that occurred after educational programs on strategies to prevent infection provide indirect evidence for the value of knowledge (Labeau et al, 2007:372).

Gurses et al (2009:527) reported that health care organisations are working to improve patient safety and quality of care, but few efforts have addressed the inadequate translation of research evidence into clinical practices. The barrier identification and mitigation (BIM) tool illustrated by Gurse et al (2009) provides a practical and interdisciplinary approach to identifying barriers to guideline compliance and to implementing actions to eliminate or mitigate the effect of these barriers. More reliable
delivery of recommended care can improve the quality of health care and patient outcomes. Despite, the major efforts to improve patient safety, a significant number of patients continue to suffer preventable harm. Much of this harm results from a failure to standardize care processes to ensure that patients receive evidence-based interventions. Guidelines summarize evidence to help ensure that the patients receive recommended interventions. However, the compliance with evidence-based guidelines varies from 20% to 100%.

Gurses et al (2009:529) reported that barriers to complying with evidence based guidelines emerge from the following three major characteristics and their interactions:

- **Providers characteristics;** may involve inadequate knowledge or awareness about the guideline, disagreement with the guideline, and reluctance of care providers to change their current practice habits.

- **Guideline characteristics** may include guidelines not relevant for a particular patient population, inadequacies in the level of scientific evidence to support the guideline, and ambiguity of tasks and roles in the guideline.

- **System characteristics** may involve problems related to the tasks performed, tools and technologies used, physical environment, and organizational structure and culture (Gurses et al, 2009:529).

Gomes (2010:5) reported that in the South African context where there is shortage of nursing staff; skilled and knowledgeable nurses are extremely important and needed to make appropriate decisions in patient care and minimize risks to patients. Knowledge on evidence based practices should assist intensive care nurses to have confidence, when making decisions and to prevent poor outcomes in the recovery of mechanically ventilated patients. Unfortunately, little is known about the degree of nursing knowledge on evidence based guidelines, for the prevention of ventilator associated pneumonia (VAP), and about factors that can contribute or represent barriers to their
implementation. Gomes (2010:5) further reported that understanding the importance of recommended practices increases the likelihood of adherence, and may overcome barriers to implementation. If the nurse does not have enough knowledge on measures proven to decrease VAP rates, he or she may not have the necessary confidence to take action and make decisions regarding such practices. Therefore, patient recovery may be delayed and other risks of complications from mechanical ventilation can be prevented.

Caffery and Antle (2008:4) indicated that although extensive evidence supported the many interventions described towards the prevention of ventilator-associated pneumonia (VAP), it is often difficult to convince the ICU staff to implement them. The mentioned authors found that ongoing education, concurrent monitoring, and data reporting helped to improve the compliance with mechanical ventilator protocols. Many of the interventions are part of routine nursing care. Education for all healthcare providers should focus on the risk factors for VAP and on its preventive measures. In order to further decrease the incidence of VAP, protocols and monitoring tools must be developed. VAP is not a new diagnosis, but education and research on the prevention of this life-threatening problem are ongoing and necessary (Augustyn, 2007:39).

2.15.2 Barriers to the use of nursing research

Hodge, Kochie, Larsen and Santiago (2003:262); Shifaza, Evans, and Bradley (2014:1), indicated that barriers to the use of research in clinical practice have been frequently reported. Studies have investigated possible barriers to the adoption of evidence based practice (EBP) by nurses. These studies have identified the common barriers across a number of different countries, and that although research in nursing dates to Florence Nightingale’s days, nurses have historically relied on sources of knowledge other than research to guide practice. Despite the endeavors of Nightingale, nursing research has evolved slowly. It was not until the 1970s that nursing research began to focus primarily on clinical practice and the improvement of patient care. Notwithstanding, the improvements in clinical nursing research, and the high priority placed on using the
findings to improve clinical practice, the implementation of the findings at the bedside have been limited. Finding ways to implement research findings within the service setting is difficult, and several barriers to the use of research findings exist which are as follows:

- Lack of knowledge about nursing research; practitioners do not know how to apply research findings.
- Lack of institutional support such as lack of adequate library facilities, including access to nursing research journals, time for staff nurses to read research and attend research conferences, as well as responsibility and accountability for nurses to change nursing practice.
- Administrative support, including financial assistance for meetings, committee work, and attending conferences.
- Limited research findings applicable to nursing practice
- Research findings are generally communicated via research journals rather than practice journals and may not be readily accessible to practitioners.
- Research findings are also communicated to other researchers, not to practitioners.
- Findings often cannot be used in clinical practice.
- Findings are not expressed in terms understood by practitioners.

Hodge et al (2003:262); Wang, Jiang, Wang, Wang and Bai (2013:1) in their studies reported that overcoming the barriers to research is an essential first step for integrating research into the practice setting.

### 2.16 CONCLUSION

This chapter started by introducing the background of patient safety related to evidence based guidelines on ventilator bundle campaign globally. Ventilator Associated Pneumonia (VAP) was defined as well as its pathophysiology, risk factors and the diagnostic criteria. The incidence of VAP and the general strategies to prevent VAP,
and Ventilator Associated Pneumonia Bundle (VAPB) was described. The knowledge levels of nurses on evidence based guidelines for the prevention of VAP using ventilator VAPB was also included. VAP implementation process, success requirements and its effectiveness when implemented were also discussed. The challenges and barriers of the intensive care nurses experience on the implementation of these guidelines according to the literature were also described. The following chapter will discuss the research methodology used in this study.
CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter will address the research methodology of the study which refers to the process or plan for conducting the specific steps of the study (Burns & Grove, 2009:719). The research design and the methods used in this study on the nurses’ challenges on the implementation of ventilator associated pneumonia (VAPB) in a hospital in Gauteng Province will be elaborated.

3.2 RESEARCH DESIGN

The research design is a blueprint for conducting a research study. It guides the researcher in planning and implementing the study to achieve the intended goal and includes specifications for enhancing the integrity of the study (Burns & Grove, 2009:236). In this study, a qualitative approach was used to understand the intensive care unit (ICU) nurses experiences, on the implementation of VAPB, and to propose the strategies needed to overcome those challenges. Polit and Beck (2006:59) state that the quality of the research findings is directly dependent on the methodology followed in the study. The objective of the qualitative research is to gain a detailed understanding of the challenges of the phenomenon being studied and therefore a qualitative research was the chosen method of exploring these challenges. The ICU nurses experiences related to the challenges during implementation of VAPB to prevent VAP were explored.

In this qualitative study, the researcher followed an explorative and descriptive research design, to focus on the challenges encountered by the intensive care nurses (ICU) on the implementation of the VAPB, as well as identifying and describing the strategies that can be used to overcome those challenges.
3.2.1 Qualitative approach

Qualitative researchers aim to gather an in-depth understanding of human behaviours and the reasons that govern such behaviours. It is used to gain an insight into people’s attitudes, behaviours, value systems, concerns, motivations, aspirations, culture and lifestyles. This method of research was therefore chosen by the researcher to investigate the challenges encountered by the ICU nurses on the implementation of VAPB (Burns & Grove, 2009:696).

3.2.2 Exploratory research

The researcher observed that the ICU at the academic hospital implemented the VAP prevention by the use of VAPB, but the progress to this effect was too slow and unclear, and therefore the researcher sought to understand more about it. An exploratory research is an attempt to lay the groundwork to lead to future research studies and to future investigations. This research was chosen because the researcher preferred to investigate the implementation of VAPB. The researcher explored the participants’ lived experiences to understand the expressions of the implementation of VAPB. The research was conducted to increase the knowledge of the field of study and to remedy the challenges, experienced by ICU nurses on the implementation of VAPB. (Burns & Grove, 2009:696).

3.2.3 Descriptive research

The researcher selected this design, as it is used in studies where more information is required in a particular field, through the provision of a picture of the phenomenon, as it is naturally occurring (Brink, 2006:23). This study aimed to understand the challenges encountered by intensive care unit (ICU) nurses on the implementation of the ventilator associated pneumonia bundle (VAPB) and to propose the strategies needed to overcome those challenges. It enabled the researcher to describe the ICU nurses
challenges of the implementation of VAPB at the academic hospital in Gauteng Province.

Creswell (2009:4) indicated that the descriptive research design permits the researcher to engage with the target population and the study participants. It allowed the researcher to concentrate on the particular meaning and significance of their situation of their experiences, during the implementation of VAPB to prevent VAP. This understanding assisted the researcher in making recommendations to contribute to the existing body of knowledge regarding implementation of VAPB (Burns & Grove, 2009:51).

3.3 RESEARCH METHOD

3.3.1 Research setting

The setting of a research study is defined by Polit and Beck (2008:766), as “the physical location, and the conditions in which the data collection takes place”. This study is contextual in nature as it is conducted within a specific context, which can be described as a “small scale world” such as an intensive care unit (ICU). The setting was an ICU of the academic hospital in the Gauteng Province. This unit is multidisciplinary, admitting medical, surgical, cardiology, cardio-thoracic, gynaecology, obstetrics, trauma, neurology and neurosurgical patients. It is the only adult ICU in the hospital and consists of 22 beds with a bed occupancy rate from 70% to 100%.

Occasionally, paediatric patients are also admitted and mechanically ventilated in this unit, since the hospital does not have a paediatric ICU. About 100 nurses work in this unit on the day and night shifts. The purpose of selecting this academic hospital is that it has an ICU, which admits adult critically ill patients who are treated on mechanical ventilation for more than 48 hours. VAPB in this hospital ICU has been initiated, but the implementation process was not clear. This was evidenced by the unavailability of some records such as compliance and VAP rates.
3.3.2 The population

The total accessible population in this study was drawn from all the registered, experienced and trained professional ICU nurses, who are working in the adult ICU of the selected hospital. The target population was all the nurses with expert knowledge in the field of intensive care nursing. These nurses were also chosen as they were involved almost daily on the implementation VAPB in the units, and were regarded to have more knowledge on ventilator bundle (Burns & Grove, 2009:42).

3.3.3 Sampling

Sampling is the process of selecting subjects, events, behaviours, or elements for participation in the study (Burns & Grove, 2009:35). Sampling was done immediately after the approval of the protocol by the University of Limpopo; Medunsa Campus Medical Research Ethics Committee (MREC). Purposive sampling was used in this study where ICU nurses of this academic hospital were selected to participate in the study. The ICU operational manager announced the commencement of the project. The researcher contacted the staff members in groups of four, two groups in day duty and two groups in night duty to explain the intention of the study. Request of all interested participants who meet the criteria from a total of 100 nurses was made, with the assistance of the operational manager and shift leaders, to either telephone or make verbal notes to the researcher.

Majority of the nurses were reluctant to come forward which delayed the data collection. The researcher then contacted and asked the participants who met the criteria individually to make appointments. Meetings with several staff members were held, and the researcher purposely selected 30 information rich participants. These participants were willing to express themselves to give the researcher access to their experiences of the implementation of VAPB (Polit & Beck, 2010:271). The advantage of purposive sampling was that it allowed the researcher to hand-pick the participants. The disadvantages of purposive sampling included potential sampling bias, not
representative of the population and generalisability difficulties and limitations (Brink, 2006:134).

In this qualitative research, the exact size of the sample constituted 30 participants, but the data gathering terminated when data saturation was achieved. Data saturation means when the content of the transcripts become repetitive and redundant and no new information emerges. Data saturation occurred with the 11th participant where data became repetitive and redundant. The researcher then stopped collecting data and the remaining participants were verbally informed about the end of data collection and the reason related to it (Polit & Beck, 2010:71; Burns & Grove, 2009:42:361).

3.3.4 Inclusion and Exclusion Criteria

Selecting a sample of a study requires an inclusion and exclusion criteria (Burns & Grove, 2009:345). The sampling criteria define who may be included and excluded in the accessible population of the research study. The inclusion criteria specifies the population characteristics, while the exclusion criteria defines the characteristics that participants do not possess (Polit & Beck, 2008:338). In terms of the inclusion criteria, the researcher identified the participants who would provide rich experiences according to the objectives and the research questions of the study (Wilkund-Gustin, 2010:33). Burns and Grove, (2009:345) defined the exclusion criteria, as those characteristics that excludes the participants from participating in the study.

In this study the participants who met the inclusion criteria were:

- Categories were ICU professional nurses who gave consent.
- Professional nurses with more than two years’ experience.
- Nurses who cared for mechanically ventilated patients who were nursed on the ventilator for more than 48 hours.
- Nurses who were present in the ICU when the VAPB was implemented.
The exclusion criteria were as follows:

- Categories of nurses, other than ICU professional nurses.
- Professional nurses with less than two years’ experience.
- Nurses who have not cared for mechanically ventilated patients who were nursed on the ventilator for more than 48 hours.
- Nurses who were not present in the ICU when the VAPB was implemented.

### 3.3.5 Pretesting the data collection tool

Pre-testing is done to check the data collection tool and the research process prior to the main study (Rebar, Gersch, Macnee, & McCabe, 2011:395). The interview questions were pre-tested to check if participants understood the interview questions. Pre-testing was conducted on two participants with similar characteristics to those who were included in the study. The first two intensive care nurses who met the criteria were interviewed. The researcher audiotaped the information, as shared by the participants with their permission. Informed changes were made on the interview schedule involved adding one more probing question.

The probing questions addressed finding out the participants’ knowledge on the rate of ventilator associated pneumonia (VAP) in the unit because it is vital to measure the VAP rates when implementing VAPB in order to measure the performance (Burns & Grove, 2009:333). Refer Annexure A. The participants understood the interview schedule and the extra probe question was used on the second participant which was found to be necessary. Data collected from the second participant was informative and beneficial and was used during the data analysis process. This participant was then labelled participant 1 during data transcriptions.
3.3.6 Data collection

Data collection is the process of selecting the participants and collecting data from those participants. The data may be collected on the participants by observing, testing, measuring, questioning, recording, or any combination of these methods (Burns & Grove, 2009:441). In this study semi-structured interviews were conducted where questioning, recording, and communication skills were used. Refer (Annexure A) on semi-structured interview schedule. This type of interview is used when researchers wish to focus on the specific set of aspects that need to be probed (Polit & Beck, 2008:394). The researcher asked two main questions with additional probing questions to clarify and to obtain detailed information (Smal, 2013:42).

The participants were asked the following two main questions:

- What are the challenges you encountered on the implementation of VAPB?
- What are the needs to overcome these challenges?

The data was collected from 11 ICU nurses who were the participants from the adult ICU at the hospital. These ICU nurses have been working in this unit for 5 to 15 years and have cared for patients who were intubated and mechanically ventilated for more than 48 hours. They were also present in the unit when the implementation of VAPB was initiated. They participated voluntarily and were assigned unique codes which were used for recordings and anonymity purposes, such as participant number 1 (Participant 1). Data of participant 2 pre-testing was set aside since it had more information needed by the researcher. The information from pre-tested participant number 2 was therefore labelled (Participant 1) during data collection. The first candidate during data collection was then labelled participant number 2 (Participant 2). The interview dates and times were arranged with the participants prior to data collection. Individual interviews of the 11 participants were conducted in private offices, within the hospital complex. The total number of the participants interviewed were therefore 12.
Some interviews were conducted during the day and some at night while the participants were on duty. Permission was requested from the unit operational manager and shift leaders and the participants themselves. The participants preferred to be interviewed whilst at work because it was difficult to meet them during their time off. They indicated their busy personal schedule after work. It was also not easy to conduct interviews whilst the participants were on duty in the ICU, as they were always busy. According to the researcher’s observations the unit is always too busy, hence the researcher volunteered to conduct some interviews even whilst they were on night duty. The probing questions were very useful and were used on most of the participants because of the insufficient information the researcher was collecting. Each interviewee was provided with written consent form and was made aware of her rights as a participant. Refer Annexure B (Brink et al, 2012:158).

The researcher wrote notes of the interviews and the main concepts and ideas mentioned by the participants regarding their challenges during and after each interview. The field notes and the observations were recorded by the researcher as she conducted the interviews. The researcher encouraged the participants to talk freely about all the topics on the guide and reminded them that ethical consideration, anonymity and confidentiality will be maintained at all times. The individual semi-structured interview was audio recorded with the permission of each participant.

The interviews were transcribed verbatim after listening from the audio taped data soon as possible after the interview was done. The data collection continued until the content of the interviews reached a point of saturation, which was with participant number 11. The interviews to be analysed were therefore 12 in total. The interview took forty to forty five minutes per participant. The English language was used as the participants are professionals trained in English which is the medium of communication in this hospital (Burns & Grove, 2009:405; 441). The transcripts are kept safe by the researcher.
3.3.7 Challenges experienced by the researcher during the interviews

Several challenges were encountered by the researcher during the interviews namely:

- Majority of the nurses were reluctant to come forward for the interviews which delayed the data collection until the researcher contacted the one by one.
- The difficulty in accessing the participants when they were off duty from work. They indicated that they had busy schedules during their day off.
- There was also difficulty in accessing some of the participants while they were on duty, as they indicated the busy schedule during the day.
- Most of participants were interviewed while on duty, with the permission of the unit manager and the shift leaders.
- The researcher had to allocate time and make appointments at night in the Intensive Care Unit (ICU) unit to interview some of interested participants who were doing night shift.
- There were few interruptions on the interviews at night, but only occurred when the other nurses wanted items such as, a storeroom key which was kept in the office, which the researcher was using.
- Few participants could not stick to the English language as indicated during interview.

3.4 DATA ANALYSIS

Data analysis in this study used Tesch’s 8 steps of open coding process as described by Creswell (2009:186). The researcher carefully listened to the audiotaped interviews and read the transcripts that were transcribed on hard copies, to ensure that the transcription was accurate and complete (Rebar et al, 2011:227). Tesch’s 8 steps were as follows; the researcher re-read and listened to all the transcripts to get the sense of the whole meaning from what was said by participants. The researcher’s identified ideas and concepts were written on the margin of each transcript as she was reading, and
colour coding them. A list of all topics identified from the transcripts were identified and then grouped into clusters, common ideas, themes and categories.

The researcher coded the data from the transcriptions collected and analysed it herself first. She then arranged and sent the raw data to an independent coder for a separate coding and for consensus of the findings and the codes. The researcher compared both the coded information done by herself and the coder, and then made an appointment with the independent coder to discuss the formulated codes, themes and categories. Finally, a telephonic discussion was made with the independent coder and an agreement was reached on seven identified themes. The detailed description of how data was analysed and the description of the themes are discussed in full in chapter 4.

3.5 BIAS

Bias is defined as any influence or action in a study that distorts the findings from the true or expected (Burns & Grove 2009:220). The researcher ensured that the study was not subjected to any biases by the use of different strategies which include bracketing. Bracketing is a technique used in a phenomenological inquiry that requires the researcher to intentionally set aside her one’s own belief about the phenomenon under investigation or what she already knows about the subject prior to and throughout the study (Carpenter, 2007:76). Chan, Fung, and Chien (2013:1; 3) defined bracketing as holding in abeyance those elements that define the limits of an experience when the nurse is uncovering, by excluding a phenomenon about which she knows a great deal. The adoption of this attitude is unique to the phenomenological approach. Therefore, the researcher made efforts to put aside her own experiences in order to accurately describe participants’ life experiences on the implementation of VAPB. Bracketing was maintained throughout the data collection and analysis process.
3.6 TRUSTWORTHINESS OF THE STUDY

Trustworthiness refers to the best way to judge the quality of qualitative research. It is a factor by which the quality of research can be evaluated, and reflects the confidence the practitioners can safely have in the research findings. To ensure trustworthiness, the researcher used Guba’s model (Lincoln & Guba 1985 in Brink et al, 2012:118; Polit & Beck 2010:332) of trustworthiness in qualitative research. The researcher used the following three criteria as proposed by the model: credibility, dependability and confirmability.

- **Credibility**
  This ensures confidence in the truth of the data and the interpretation thereof, whereby the investigation that was done is in such a way that the reader will trust them. The researcher utilised the following credibility techniques in this study:

  - Prolonged engagement - The researcher spent more time with participants, during the recruitment of the participants where she introduced the intention to conduct a study. She visited the unit frequently to make sure that all the Intensive Care Unit (ICU) nurses were familiar with her. At the same time she gained an in-depth understanding of the ventilator bundle use, as well as of the participant’s perception of views, culture and experiences. This was possible since the researcher is working around the same setting of the study. This ensured trust between the researcher and the participants which she needed in the gathering of rich data (Brink et al, 2012:172). The researcher conducted all the interviews herself, in order to obtain first-hand information. Since the researcher is a critical care nurse, this made it easy to be accepted by the participants, as prolonged engagement allows the participants to be accustomed to the researcher (Matlakala, 2012:97).

  - Persistent observation - The researcher observed and also took field notes to gather information which helped to select relevant issues of the study each
time she visited the unit. She identified issues such as the availability of ventilator weaning and the compliance measurement protocols, as well as the unit records of the ventilator associated pneumonia (VAP) (Polit & Beck, 2010:332). Persistent observation is important to identify those elements in the situation that are most relevant to the issue being pursued; thus focusing on them in detail. In this study, the researcher informally requested information from the critical care nurses, with regard to the implementation of ventilator associated pneumonia bundle (VAPB) and the needs of the critical care nurses thereof. This information was obtained during casual visits to the ICUs on a regular basis (Matlakala, 2012:83).

- Member checking - Brink et al (2012:172) stated that member checking is done to assess the intentionality of the participants, to correct obvious errors and to provide additional information. The data from the transcribed verbatim notes were shared with the participants, so as to verify and confirm the accuracy of information captured, and the meanings that the critical care nurses wished to impart, regarding their challenges on the implementation of ventilator associated pneumonia bundle. After the data was analysed, the emerging findings were brought back to the original participants, to seek their inputs concerning the accuracy, completeness, and interpretation of data and to ensure that the facts have not been misconstrued (Polit & Beck, 2010:332).

- Referral adequacy - The researcher utilised multiple resources available to support the findings; a variety of text books, journals and articles were used. Refer references (Brink et al, 2012:172).

- Dependability
The independent coder was used independently to separately code data which was compared with the researcher’s to find out if they shared the similar meanings. The study was also taken to be edited the editor to determine whether processes and
procedures used by the researcher in this study are acceptable (Brink, 2006:119). Brink et al (2012:172) indicated that dependability is one of the standards for judging qualitative studies and refers to the stability or consistency of the inquiry processes used over a specific time. To check the dependability of a qualitative study, the researcher assessed to check for careless or made mistakes in conceptualizing the study, collecting the data, interpreting the findings and reporting the results. It also indicates the stability of data over time, and the provision of evidence in the event that the study was to be repeated with similar participants in the same or different context. An audit is required to determine whether the procedures used are acceptable and dependable. In this study, the inquiry audit was followed where the supervisor was used to examine the process of logic and technique of investigating the ICU nurses challenges on the implementation of ventilator associated pneumonia (VAPB).

- **Confirmability**

Confirmability is where the researcher confirms the research findings of the participants on the implementation of VAPB to prevent VAP. Conclusions and recommendations are supported by the data (Brink, 2006:119). Verification of the interpretation of data was done by the participants during data collection.

### 3.7 ETHICAL CONSIDERATIONS IN DATA COLLECTION

Ethics in research entails that the researcher conducts the study in the way that enhances the truth and acceptability of the study. Ethical guidelines serve as the standards and basis upon which the researchers evaluate their own conduct in research (Burns and Groove, 2009:188). The ethical aspects considered in this study were as follows:

- Ethical clearance to conduct the study was obtained from the University of Limpopo; Medunsa Campus’ School of Health Care Science Research Ethics Committee (SREC), Medical Research Ethics Committee (MREC), now the Sefako Makgatho Health Sciences University Medical Research Ethics
Committee (SMUREC), and Gauteng Provincial Health Department Protocol Review Committee.

- Consent was obtained from all the participants.

Permission to conduct the study was granted from several stakeholders of the Health institutions namely:

- Application to access the institution to conduct the study was requested from the Clinical Executive Director and Deputy Director Nursing of the academic hospital in writing as well as from the Provincial Protocol Review Committee. Refer to annexure E, F & H.
- Permission letters from the above mentioned departments are attached. Refer to Annexure G & I.
- The intensive care unit (ICU) operational manager from the academic hospital also provided the researcher with verbal permission to collect data from the selected ICU nurses, after accepting the permission letter from the hospital Clinical Executive Director and Deputy Director Nursing.

- The right to anonymity and confidentiality
The participants were guaranteed anonymity and confidentiality throughout the study. The following aspects were ensured:

- To ensure confidentiality and anonymity of the participants, no names were used during the data collection and reporting processes. Consent forms and the questionnaires were separated at the time of data collection, to maintain anonymity of the participants.
- The participants were given unique code numbers, e.g. Participant 1, 2, etc.
- Confidentiality was maintained between the researcher and the independent coder during the research processes. The only people who have access to the questionnaires and responses are the researcher and her supervisor.
- The data is kept safe in a locked cupboard and will be kept securely for 5 years by the researcher (Rebar et al, 2011:133).

- **The right to privacy**
  This principle entails that the participants’ right to privacy should be maintained throughout the study period. The participant’s information should not be shared with others against their will such as their attitudes, beliefs, behaviour and opinions. In this study the face to face interviews was conducted in the office with the participants alone. The researcher conducted the interviews on her own and the information was shared only with the supervisor and the independent coder (Burns & Groove, 2009:194).

- **The right to self-determination**
  The participants were informed about their autonomy, and their right to make a knowledgeable, voluntary decision, that is free from coercion as to whether or not to participate in the research. They were made aware that they could withdraw from the study, if they wish without any consequences or influence on their job performance, as the researcher is a colleague of the participants. All the participants were allowed to ask questions if they were not clear of the procedure (Rebar et al, 2011:133). Refer Annexure B. The other ethical aspect considered was:

- **Informed consent**
  Informed consent was obtained from all the nurse participants who were willing to participate in the research study. They were requested to sign an informed consent form, which indicated the title and their rights as participants. They were not forced to indicate their names on the consent form. The researcher also informed the participants of the study’s purpose, method of data collection and analysis to participants during interviews (Rebar et al, 2011:133). Refer Annexure B.
3.8 CONCLUSION

In this chapter the research methodology of the study was described in detail. The research design used together with the population and sample, the inclusion and exclusion criteria, as well as the data collection processes were explained. Bracketing, trustworthiness and ethical considerations of the study was maintained and was also discussed. The challenges that the researcher experienced during the data collection was briefly outlined. The next chapter will describe the data analysis, findings and literature control.
CHAPTER 4

DATA ANALYSIS, FINDINGS AND LITERATURE CONTROL

4.1 INTRODUCTION

This chapter addresses the data analysis, findings and the literature control of this study. The aim of this study was to understand the challenges encountered by intensive care unit (ICU) nurses on the implementation of ventilator associated pneumonia bundle (VAPB) and to propose the strategies needed to overcome those challenges. The participants were asked to describe the challenges they experienced during implementation of VAPB, and to recommend the needs to overcome those challenges.

The two main research questions were:

- What are the challenges you encountered on the implementation of ventilator associated pneumonia bundle?
- What are the needs to overcome these challenges?

4.2 DATA ANALYSIS

The data analysis, organisation, and interpretation of the data collection, was undertaken using Tesch’s steps of open coding method of data analysis for qualitative research (Creswell, 2009:186). The researcher listened to the audiotapes to get the sense of all the interviews. The interviews were recorded and transcripts were made. All the transcripts were read carefully, writing down ideas from the tapes and the transcripts as they arose. Some ideas were jotted down as they came to mind. The documents were re-read one by one writing down the ideas on the transcripts in the margin of each transcript. A list of all topics identified was made and similar topics were grouped together. The most descriptive wording for the identified topics was made. The
researcher rechecked the overall topics to look for ways to reduce the total list by grouping topics that relate to each other through a process of reduction (Creswell, 2009:186).

Similar topics were grouped together and the themes which were relevant to those topics were assigned to them. Refer Annexure C on Tesch’s steps. Seven main themes emerged from this research study. From each theme, a number of categories also emerged. An independent, qualitative coder was used to also analyse data. The transcripts were first sent to the coder for coding. The coded data was sent back to the researcher and an appointment was made shortly thereafter to discuss the findings. A final agreement and some alterations were made after a telephonic discussion with the coder (Creswell, 2009:186). Six main themes and twenty five categories emerged from the findings. The first six themes answered the first question of the study while the seventh one answered the second question. The table of themes and categories will be illustrated in the section that follows.

4.3 DATA FINDINGS AND LITERATURE CONTROL

Table 4.1 is a schematic representation of the themes, and the categories that emerged from the data collected from the participants about the challenges experienced and the needs to overcome the challenges on the implementation of ventilator associated pneumonia bundle (VAPB) in an academic hospital in Gauteng Province.

**Table 4.1 Themes and categories**

<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.1. Planning and the introduction of the implementation of ventilator associated pneumonia bundle(VAPB)</td>
<td>4.3.1.1 Lack of a coordinator and the team members</td>
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<td></td>
<td>4.3.1.2 Absence of the proper selection of VAPB elements</td>
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<td></td>
<td>4.3.1.3 Lack of multidisciplinary team involvement</td>
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<td></td>
<td>4.3.1.4 Unavailability of standards or protocols</td>
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<tr>
<td>Themes</td>
<td>Categories</td>
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<tr>
<td>4.3.2 Knowledge and understanding of the VAPB implementation process</td>
<td>4.3.2.1 Inadequate in-service training</td>
</tr>
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<td></td>
<td>4.3.2.2 Lack of proper orientation of new and rotating staff members in ICU</td>
</tr>
<tr>
<td>4.3.3 Availability of human and material resources during the implementation of VAPB</td>
<td>4.3.3.1 Shortage of staff</td>
</tr>
<tr>
<td></td>
<td>4.3.3.2 Shortage of stock</td>
</tr>
<tr>
<td></td>
<td>4.3.3.3 Scarcity of equipment</td>
</tr>
<tr>
<td>4.3.4 Adherence to infection, prevention and control principles to implement VAPB</td>
<td>4.3.4.1 Poor hand washing</td>
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<td></td>
<td>4.3.4.2 Lack of ventilator circuit changing</td>
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<tr>
<td></td>
<td>4.3.4.3 Inability to isolate infectious patients</td>
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<td></td>
<td>4.3.4.4 Incorrect performance of the suction procedure</td>
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<tr>
<td>4.3.5 Monitoring and evaluation of the process of VAPB implementation</td>
<td>4.3.5.1 Inappropriate monitoring of the infection baseline investigations</td>
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<td>4.3.5.2 Non-compliance to VAPB implementation</td>
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<td></td>
<td>4.3.5.3 Inaccurate VAP rate measurement</td>
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<td>4.3.6 Motivation, supervision and support during VAPB implementation</td>
<td>4.3.6.1 Lack of the hospital managerial motivation, supervision and support</td>
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<td>4.3.6.2 Lack of ICU staff members’ interest</td>
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<td>4.3.6.3 Lack of continuity of the implementation of VAPB</td>
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<tr>
<td>4.3.7 Suggested needs to overcome the challenges of VAPB implementation</td>
<td>4.3.7.1 Ensuring proper planning and the introduction of the implementation of VAPB</td>
</tr>
<tr>
<td></td>
<td>4.3.7.2 Provision of adequate knowledge and understanding</td>
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<td>4.3.7.3 Provision of adequate human and material resources</td>
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<td></td>
<td>4.3.7.4 Adherence to infection prevention and control principles</td>
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<td>4.3.7.5 Instituting monitoring and evaluation</td>
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<td></td>
<td>4.3.7.6 Provision of motivation, supervision and support</td>
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</table>
Each of the themes and categories above are discussed in the sections that follow. The relevant quotations from the participants’ interviews and the relevant literature are cited as a literature control to support or disapprove the findings of this study.

4.3.1. Theme 1: Planning and the introduction of the implementation of ventilator associated pneumonia bundle

The participants raised the challenge related to the planning and the introduction of the implementation of ventilator associated pneumonia bundle (VAPB). Four categories emerged from this theme.

4.3.1.1 Lack of a coordinator and the team members

The participants were concerned about the lack of the selection of a coordinator and the team members to lead the VAPB implementation process.

Some of the participants stated that:

**Participant 6:** “……..we never appointed anyone or just a few in the team to check whether those bundles or those measures that we have set or that we took from the bundle, really, that everyone is sticking to them so, that is the other thing, so everybody was doing his or her own things at any time”.

**Participant 4:** “And then secondly, the challenges there were only a group of people who were involved in that ventilator associated pneumonia and they were doing it you know occasionally (with emphasis)………..”

**Participant 5:** “You know the challenges I would say, this was introduced to us, it was a matter of presentation and then from there; there was no like active implementation. You know we knew that there was; what is it that is expected of
Participant 1: “Ok! Pause <Yaaa> we really started because we had challenges with this eee VAP with our patients, so we started that; with the help of our Head of Department and he sort of allocated somebody like one of our doctors at that time; that doctor was like a house Doctor in ICU so that to follow it up. ………….he was sort of spearheading it (name of the Doctor mentioned); so he was telling us what to do, what specimen to take, when to take it, something like that………………………………………. the other thing is that doctor was sort of had his own reasons to leave the ward that I wouldn’t know how and why he left the ward and from there it sort of collapsed. Nobody was following it specifically”.

A coordinator is someone who brings the elements of something together so that it works well. Team members are two or more people working together to achieve a goal (Waite & Hawker, 2009:198;953). For the purpose of this study a coordinator is used interchangeably with a team leader and it is one of the staff members responsible to facilitate the implementation of the VAPB. The team members are a group of ICU staff members who are delegated to work together with the coordinator to ensure appropriate implementation of VAPB to prevent VAP.

The findings from the above quotes indicate that there was no appointment of the coordinator and team members to facilitate the implementation of VAPB. One participant stated that there was a team leader who used to guide them, but left the unit before the completion of the VAPB implementation. The reason for leaving was not known. Thereafter, there was no one appointed to continue as a coordinator.

In support of the findings Alsadat et al (2012:81) conducted a study in Syria on the use of ventilator associated pneumonia bundle (VAPB) and the statistical process control chart used to decrease the VAP rate. Alsadat et al (2012) reported that the team
leaders were selected based on work experiences, knowledge and commitment. They were instructed to set up regular scheduled meetings with the team members to discuss the progress, the barriers, and way forward in the implementation process. The study demonstrated that if no VAPB was implemented, it was obvious that the VAP rates would continue to remain high. This indicates the importance of someone and a team to direct the process of the implementation of VAP.

4.3.1.2. Absence of the proper selection of VAPB elements

The participants were asked to explain what they understood by VAPB in order to identify the understanding of the concept and which bundle elements were selected during the implementation process.

The participants explained as follows:

**Participant 12:** “<Ya> simply, combination of activities which will help to reduce pneumonia. Activities related to reduction of this VAP. This is a bundle; it all depends on the institution which ones they use, but the simplest is this one of sedation, mouth wash, prevention of ulcers and etc. I can’t remember all”.

**Participant 4:** “To me VAP is acquired hospital infection and then VAPB are measures that are in place to make sure that the hospital is having nil free, measures that are used in the hospital to prevent VAP in the hospital, measures in place. That’s how I understand it”.

**Participant 6:** “I understand in this way that it is the prevention or monitoring of infection the patient, maybe might have or might receive from the hospital so, it is a way of preventing more infection for the patient to have its just only measures that we implement to prevent the infection, to prevent the patient from acquiring infection which is in the hospital, or which is caused by nurses or doctors or cleaners or professors that’s what I understand”.
Participant 1: “Ok bundles is like; what can I call them; is like key points or elements that are brought together or like care that is a bundle as it is said is a bundle; is like grouped together, if you can use one, two, three, together it will at the end prevent VAP”.

The findings indicate that the participants could not describe meaning of VAPB, but very few had ideas of what it entailed. There were no clear VAPB elements chosen in the unit to follow during the implementation process. Even though finding out which bundle was chosen for the implementation of ventilator associated pneumonia bundle (VAPB) was not within the purpose of the study, Sedwick, Lance-Smith, Reeder, and Nardi (2012:42) state that there is a need for the institution to select the bundle of choice out of the Institute of Health Improvement (IHI) strategies to prevent VAP. VAPB selection should be chosen based on the availability of the requirements to achieve a goal of VAP prevention.

Munro and Ruggiero (2014:163) indicated that the IHI VAPB consist of a series of interventions related to ventilator care, that when implemented together, will achieve significantly better outcomes than when implemented individually. O’Keefe-McCarthy et al (2008:195) define bundled practices as precautionary steps that practitioners can reliably and collectively implement, to enhance positive patient outcome. The SARI Group (2011:13) indicate the importance of designing the VAPB elements of choice depending on the availability of resources needed during the implementation of VAPB. Refer Table 2.1 in chapter 2.

Eom, Lee, Chun, Choi, Jung, Kim, Yoon, Kwak, Oh, Jeon, Park, Koo, Ju, and Lee (2014:35) conducted a study in Korea on the impact of a ventilator bundle on the prevention of ventilator associated pneumonia (VAP). Eom et al (2014) indicated that their VAPB comprised of; the head of bed elevation, peptic ulcer disease prophylaxis, deep venous thrombosis prophylaxis and the oral decontamination with chlorhexidine 0.12%. The continuous aspiration of subglottic secretions (CASS) was used as optional
treatment, because it required a specific endotracheal tube which was expensive and in short supply in Korea.

4.3.1.3 Lack of multidisciplinary team involvement

The participants reported the lack of multidisciplinary team involvement as one of the challenges noted in the implementation of VAPB.

The participants stated the following:

**Participant 7:** “……and then only few people were selected to do it. It was not like a collective effort for a multidisciplinary health team”.

**Participant 11:** “We were not working as a team. <Ehh> involving multidisciplinary team when we go for workshops……”

The findings imply that there was lack of multidisciplinary involvement, not all staff members were involved on the implementation of the ventilator associated pneumonia bundle (VAPB) such as; nurses, physicians, physiotherapists, infection control practitioners and the quality department personnel representatives within the hospital. Refer Figure 2.2.

In support of the findings Sedwick et al (2012:48;49) stated that interdisciplinary collaboration is essential when addressing issues such as VAP. Each member of the health care team must be willing to share the responsibility for developing strategies to address problems in patient care, and to take an active role in implementing the plan. Interdisciplinary team involvement in the project can influence the VAP rates. Nurses, physicians, respiratory therapists, quality department personnel, and information technology specialists play a key role in the successful implementation of the VAPB. Refer figure 2.2.
Gillespie (2009:50) supports Sedwick et al (2012) by stating that a team approach is essential for the successful implementation of a quality improvement initiative such as VAPB. The support of medical directors, nursing managers, administrators and ancillary services such as the health service laboratory, together with staff involvement, are key factors to success of the implementation of VAPB.

4.3.1.4 Unavailability of standards or protocols

The participants raised the challenge related to the unavailability of VAPB implementation standards or protocols for the implementation of VAPB. Some participants said:

**Participant 7**: “The other thing is that there were no standards in place or protocols that should be followed on how to implement this VAP, so there was no adherence”.

**Participant 2**: “.....it’s just that for pain rest we discussed it lengthily because the doctor must prescribe it. You will find that most of the doctors do not prescribe it and we can’t have pain rest when it is not prescribed. Mostly they prescribe it when they want to assess the Glasgow coma scale of the patient but if not you will find that it’s not prescribed that’s why most of the time it is not done…… and we must see to it that oral hygiene of the patient is done”.

The findings show that there were no standard operating procedures (SOPs) or protocols in the ICU of this academic hospital, which are useful to provide guidance and ensure success of the implementation of VAPB to prevent VAP.

The SARI Group (2011:2) support the findings by revealing that clinical guidelines and care protocols for the prevention of VAP, should be developed and implemented in the critical care setting. Augustyn (2007:36) stated that outcome managers must be responsible for ensuring that protocols to prevent VAP and other complications of
intubation and mechanical ventilation are developed and are being followed appropriately. The use of ventilator pathways or protocols with pre-printed order sets can also lead to improved outcomes for patients. The protocols are needed when dealing with ventilated patients in an attempt to reduce VAP such as; oral care and ventilator weaning.

In a study conducted by Gilliepse (2009:48) in the United Kingdom (UK), on the prevention and management of the ventilator associated pneumonia bundle (VAPB) approach, structured oral care and weaning protocols were used. Daily goal worksheets, checklists, and audit tools were available to facilitate the implementation process. Cutler and Davis (2005:394) in their study in America on improving oral care in patients receiving mechanical ventilation, they reported that implementing a standardised oral care protocol and providing appropriate tools at the bedside, will increase the frequency and comprehensiveness of the provision of oral care. The authors support the importance of clinical guidelines and care protocols during the implementation of VAPB. Refer Table 2.3 for an oral care protocol and Figure 2.1 for a mechanical weaning protocol.

Shay (2015:12) indicated the importance of using effective ventilator weaning strategies to prevent ventilator associated pneumonia (VAP). Weaning reduces mechanical ventilation days, because the VAP risk increases from 1% to 3% on every day that the patient remains on the mechanical ventilator. The effective strategies to promote weaning can indirectly lower the risk of VAP. Nurse or therapist driven weaning protocols that include daily assessment for readiness to wean from the ventilator, lead to shorter mechanical ventilation periods.
4.3.2 Theme 2: Knowledge and understanding of the VAPB implementation process

The participants reflected the challenge on how the knowledge on the implementation of VAPB was disseminated to them for understanding. Two categories emerged from this theme.

4.3.2.1 Inadequate in-service training

The participants stated concern regarding inadequate in-service training on the implementation of VAPB.

The participants stated:

**Participant 11:** “…..a few of us were sent for training and I wouldn’t call it, training because it was just a one day workshop where you were given information. Even in that workshop we were like, we went with people who were there before, who knew exactly what was VAP, why best care always, so people were coming with feedback whereas I was the first time in that workshop so for me coming back into the department and saying this is what we were supposed to do was like, it was something difficult for people in the department”.

**Participant 10:** “Hai! not yet, I received once; there was our colleague talking about it, but you know the way we were so busy I did not receive much because I was listening to her and then sometimes going to the patient to do this and that and coming back you will find that she has maybe talked about so many things I did not get. So I am not so much well trained about this”.

**Participant 1:** “I gather this information when I attend workshops, congresses and all that but there was no specific in-service or training that was given by my organisation because I attend this; I just pick up all these things when I attend
workshops on my own”. Staff didn’t know exactly what VAPB is. They know that there is ventilator associated pneumonia but what is a bundle and they have never used it anywhere and there was no specific like training that we can use Bundle and what is this Bundle specifically. I think that was the challenge because if you want to help somebody with something you really have to understand. So I think that was the main problem”

The findings imply that adequate in-service training was not offered to the participants, in order to build their confidence on the implementation of the ventilator associated pneumonia (VAPB) bundle to prevent ventilator associated pneumonia (VAP). Some participants indicated that they could not attend the whole presentation session. The other participants indicated that they made efforts to attend workshops on their own.

In support of the findings, Sedwick et al (2012:44) conducted a study in Colombia on using evidence based practice to prevent ventilator associated pneumonia which indicated the importance of the staff knowledge and understanding of the implementation of VAPB. Sedwick et al (2012) stated that in their study prior to the initiation of implementation of VAPB, the members of the staff were educated about each aspect of the VAPB. Nurses, physicians, and therapists were given fact sheets describing the VAP and the importance of VAPB to the patients’ outcomes and to the cost of care. “ZAP VAP” signage was placed at every patient bedside.

Understanding the importance of the recommended practices increases the likelihood of adherence and may overcome barriers to the implementation of VAPB. If the nurse does not have enough knowledge on the measures to decrease the VAP rates, she may not have the necessary confidence to take action and to make decisions, regarding such practices. Patient recovery may be delayed and the risks of complications from mechanical ventilation can be prevented and halted, if the recommended practices can be adhered to (Gomes, 2010:10).
Gomes (2007:32) also support the findings by reporting that the interventions to prevent VAP should begin at the time of intubation and should be continued until extubation. With the extreme shortage of nurses and the resultant increase in the number of less experienced nurses in the intensive care unit, education on the prevention of VAP is essential, because the occurrence of nosocomial infections is directly related to the adequacy of staff. Nurses need to understand the pathophysiology of VAP, risk factors for this type of pneumonia, and strategies that may prevent the disease (Augustyn, 2007:32).

Klompas, Branson, Eichenwald, Greene, Howel, Lee, Magill, Maragakis, Priebe, Speck, Yokoe, and Berenholtz (2014:15) in their study in America on strategies to prevent VAP in acute care hospitals stated that education is the key to preventing VAP. Klompas et al (2014) also indicated that studies at teaching hospitals revealed that VAP rates decrease significantly when nurses complete an education program about the risk factors and the preventative strategies of VAP. However, this is the responsibility of senior management to ensure that healthcare personnel, including licensed and non-licensed personnel, are adequately trained and competent to perform their job responsibly.

4.3.2.2 Lack of proper orientation of new and rotating staff members in ICU

The participants reported the challenge regarding the orientation of new and rotating staff members joining their team in ICU while implementing VAPB.

Here forth are examples of quotes from participants:

Participant 7: “Even the doctors that were rotating were new, they were not even orientated about the VAP so they did not start the feeds or gastrointestinal tract (GIT) protection on most of the patients”.

Participant 5: “It is a challenge for us because you know we have a lot of new personnel in the unit who are not conversant with how ICU patients are to be nursed. So you will find that they lack supervision, and because of sharing patients; we experience a lot of problems in implementing the programme”.

The findings denote that proper orientation of the new and rotating staff members were not properly done in the ICU at this hospital to acquaint them on the implementation of VAPB. The lack of supervision of new staff members, resulting in challenges to continue with the VAPB implementation was also identified.

According to Mayhew (2015:1) an orientation is the essential first step in establishing the framework for a positive work environment. It is also the foundation for building a productive workforce that adheres to company policies and enables a better understanding of the company’s expectations. In support of the findings states that supervision cannot be overlooked since it is a major tool for staff performance (Osae-Apenteng, 2012:74).

4.3.3 Theme 3: Availability of human and material resources during the implementation of VAPB

The participants stated the challenge on the availability of human and material resources required on the implementation of VAPB. Three categories emerged from this theme.

4.3.3.1 Shortage of staff

The participants reported the concern on shortage of human resource during the implementation of VAPB.
The participants cited the following:

**Participant 3:** “Another thing is shortage of staff again; you will find that the patient is an admission and he does not have a nurse. We have to share that patient and there are other patients there”.

**Participant 8:** “Another was shortage of staff because we had to nurse two patients and in between there is a problem of cross infection…………and again we don’t have physiotherapists maybe like after hours. We have them only in the mornings, so there is nobody even to assist you to do proper physio (physiotherapy). You are alone, you are sterile and you mess up everything. So those are the things that made us not to go on with this bundle. I think those were the most that I have seen”.

**Participant 5:** “It is a challenge for us because you know we have a lot of new personnel in the unit who are not conversant with how ICU patients are to be nursed. So you will find that they lack supervision, and because of sharing patients; we experience a lot of problems in implementing the programme”.

**Participant 7:** “Even the doctors that were rotating were new, they were not even orientated about the VAP so they did not start the feeds or GIT protection on most of the patients”.

The findings show that there was shortage of ICU nurses in the ICU of the selected hospital to provide adequate patient care and prevent nosocomial infections, such as VAP. The rotating doctors were left to manage ventilated patients alone and forgot to order gastrointestinal (GIT) prophylaxis which is part of the implementation of VAPB. There was no full time physiotherapist allocated in the unit to ensure to the chest physiotherapy of mechanically ventilated patients and assist with suctioning.
In view of shortage of staff, Augustyn (2007:32) and Gomes (2010:10) support the findings by indicating that with the extreme shortage of nurses and the resultant increase in the number of less experienced nurses in the ICUs, education on the prevention of VAP is essential, because the occurrence of nosocomial infections is directly related to the adequacy of staff. Kochanek, BöllShimabukuro-Vornhagen, Michels, Barbara, Hansen, Hallek, Fätkenheuer, and Von Bergwelt-Baildon (2015:136) in their study in Germany, on staffing needs of an intensive care unit on applicable hygiene guidelines, they concluded that hygiene guidelines plays an important role in preventing nosocomial infections. Their results showed that a nurse to patient ratio of (1:1) will be necessary to meet those requirements.

The SARI Group (2011:6) stated that a systematic review of physician staffing in intensive care units was found that high intensity staffing, is associated with reduced hospital and ICU mortality as well as shorter lengths of stay. Augustyn (2007); Kochanek et al (2015) and the SARI Group (2011) agree with the challenges stated by the participants by emphasising that occurrence of nosocomial infections is directly related to the adequacy of staff.

4.3.3.2 Shortage of stock

Shortage of stock during the implementation of VAPB in the ICU of the selected hospital was reported by the participants as a concern.

The following are some of the stated statements:

**Participant 2:** “If the patient has Colgate and toothbrush we use it but if not we use the mouth care solution but most of the time you will find that it is not there in the hospital and the patient who are at bed rest we must not wait for the prescription because we know we must do it even if it’s not prescribed”.
Participant 12: “Whenever you are running short of a resource like chlorhexine or whatever, anything, you always consult with them and they will give you, that’s the support I can say they were giving…………………

Participant 10: “The other thing is suction catheters. We are using one suction catheter for almost 24 hours because you will find that the catheter been soaked for you and there is no other suction catheter. You have size 8 and you cannot use a size 8 or 6 or even 10 to adult patients”.

Participant 8: “At some stages after you discharge a patient from that ventilator the proper thing is to remove that ventilator filter but due to the shortage of equipment you had to admit another patient on the same filter because there was no something to replace the filter with. So those were the draw backs that we encountered”.

Participant 9: “……..even though you say that the patient must have DVT prophylaxis, some of us even if it is prescribed on the chart like pneumatic pumps, or elastic stockings you will find that the person who is nursing the patient is not even bothered to go and just find out where are those prophylaxis”.

These findings reveal that there was shortage stock, such as chlorhexidine mouth wash solution, correct suction catheter sizes, ventilator filters, and DVT prophylaxis such as clexane and compression stockings. It is indicated shortage of stock sometimes forced them to re-use some of the stock items such as suction catheters and ventilator filters. The other participants felt that stock was not a problem, as long as the proper consultation with management was done.

In support of the findings related to the need of adequate stock; Alotaibi, Alshayiqi and Ramalingam (2014: 921) stated that almost 65% of critically ill intubated patients have been found to harbor pathogens responsible for VAP in their oral mucosa and dental plaque. Genuit et al (2011) reported a 75% reduction in the rate of VAP and a 43%
reduction in mortality among the intensive care unit (ICU) patients after an oral care intervention. Mechanically ventilated patients are completely reliant on the nurses for their oral care needs, signifying the importance of nursing personnel in reducing the morbidity and mortality caused by VAP. Chlorhexidine is a cationic chlorophenylbiguanide antiseptic agent. Chlorhexidine has been used as an oral disinfectant in mechanically ventilated patients, because it has an ability to bind oral tissues with a subsequent slow release of antiseptic properties, and with a long period of antibacterial action (Scannapieco et al, 2009:2).

Westwell (2008:204); Arabi et al (2008:506) reported that without deep venous thrombosis (DVT) prophylaxis, studies have shown that between 22% and 88% of critically ill mechanically ventilated patients will develop a DVT, leading to increased morbidity and mortality. It is essential that such a high risk complication of being critically ill is addressed. Low molecular weight heparin (clexane) has been used for many years. This decreases the incidence of DVT by 50%, in comparison with unfractionated heparin, which reduces the incidence by 20%.

Alotaibi et al (2014); Westwell (2008) and Arabi et al (2008) indicated the importance of having chlorhexine mouth wash and DVT prophylaxis in the prevention of VAP. All stock items mentioned by the participants which are chlorhexidine mouth wash, suction catheters, ventilator filters and compression stockings form part of the implementation of VAPB requirements.

**4.3.3.3 Scarcity of equipment**

The participants addressed challenge related to the scarcity of equipment in ICU during the period of implementation of VAPB.
Some participants said:

**Participant 7:** “…..the other challenges I think it was because of the equipment or the resources, we never had enough resources to start, you know when you have to look for the resources you take an hour at least to look for it and it puts strains psychologically to you so it was one of the things….”

**Participant 9:** “….I said the bed elevation, is the problem here as I said our beds are not measured, we are just estimating…………………………..The support we did receive, because I remember at some stage they were using this cocky pen to label the bed. If they say from here to here is 35 then label at the head end of the wall so that you can see that up to that mark then you know that is 45 or maybe on that mark is 35, so really it’s an effort. People from works came to mark the wall in order that we can see whether is 35 or 45”.

**Participant 3:** “Okay one of the challenges is shortage of resources………immediately after disconnecting the patient from; maybe the patient is transferred to the ward, on the very same ventilator is not cleaned then immediately we just change the circuits and connect another patient because of the business of the ward

**Participant 4:** “…..and then thirdly the pneumatic pump system, they were less, they didn’t afford for all the patients which we were supposed to give them all those pump system and then even the devices they were not there even now we still have that challenges”

The findings indicate the shortage of equipment such as, lack of proper beds for head of bed (HOB) elevation, ventilator machines and pneumatic pumps for DVT prevention. The other participants felt that there were measures done to improvise the activities, like HOB such as lines marked on the wall in the ICU, to indicate that if a bed is elevated up to that level it means 30° to 45° HOB elevation is maintained.
In support of the findings, Westwell (2008:204) stated that ventilated patients are at an increased risk of aspirating gastric contents when they lie supine. Mechanically ventilated (MV) patients are should lie with HOB elevated at 30° to 45°. MV patients are only made to lay flat for venous access device insertion or removal, for position changing or if sitting head up are contraindicated. The early mobilisations of patients are also encouraged, allowing patients to sit out of bed, as soon as they are fully conscious and compliant. This is a simple cost-free intervention that has proven to reduce the risk of VAP.

Metheny and Frantz (2013:63) reported that another possible reason for non-compliance with an elevated HOB position is the difficulty in making accurate visual estimates of an HOB angle. For example, Hiner Kasuya, Cottingham and Whitney (2010:166) instructed 175 clinicians to estimate a simulated HOB angle of 30°; the angle was perceived accurate by 50% of 89 nurses and 53% of 39 physicians; a higher percentage 86% of 21 respiratory therapists identified the angle accurate. These findings are significant because some hospital beds do not have built in electronic devices to determine the bed’s angle, therefore this would be accurate if the hospital had proper build in electronic beds.

Institute for Clinical Systems Improvement (2011:11) in support of the findings state that ICU patients are at high risk for developing DVT and pulmonary embolism. During an intensive care unit stay, different types of thrombo-prophylaxis might be appropriate at different times, including, at times, combined therapies of an anticoagulant medication (heparins) and intermittent compression devices. Mechanical methods of prophylaxis should be considered for all patients with high bleeding risks. Pneumatic compression devices increase the venous outflow and reduce stasis within the leg veins. This plays an important factor in the prevention of VAP.
4.3.4 Theme 4: Adherence to infection, prevention and control principles to implement VAPB

The participants mentioned the challenge regarding the adherence of infection prevention and control (IPC) principles on the implementation VAPB. Four categories emerged from this theme.

4.3.4.1 Poor hand washing

The participants raised a concern about some of IPC activities, such as poor hand washing during the implementation of VAPB.

The following statements were expressed by some of the participants:

**Participant 8:** “Another was shortage of staff because we had to nurse two patients and in between there is a problem of cross infection because at times you wash your hands but moving from one patient to the other sometimes you just forget; you just spray your hands and you don’t even remember whether you have your apron on or you don’t have it………”

**Participant 10:** “First of all challenges that we encountered is shortage of staff. You will find that one nurse nursing two to three patients so cross infection is too much in the ward. You are trying to wash hands when you are attending to the patient but it is not enough. We are trying to change the aprons but it is also not enough”.

The findings point out that the ICU nurses did not have enough time to wash their hands, when they move from one patient to the other due to their increased workload and the shortage of staff.
In support of the importance of proper hand washing, Kleinpell, Munro, and Giuliano (2008:572-578) indicated that hand hygiene is an essential component of hospital associated pneumonia reduction programme. Adherence to hand hygiene programs is considered one of the most important preventive measures of healthcare associated infection, and is also not expensive. The Center for Disease Prevention and Control Guideline for hand hygiene in health care settings analysed data from observational studies, concluding that the percentage of health professionals who implement the recommended procedures for hand hygiene is highly variable, with an overall average of 40%. In order to reduce poor adherence, training of health professionals and assessment of their performance, distribution of information leaflets and lectures are suggested to make them more complaint (Oliveira, Zagalo, & Cavaco-Silva, 2014:156).

4.3.4.2 Lack of ventilator circuits changing

The participant was concerned about the ventilator circuit changing on mechanically ventilated patients during the implementation of VAPB.

The following statement was expressed:

**Participant 10:** “The second thing is that we do not have enough circuits so circuits are not changed after seven days. They stay there for a very long time or until the patient is extubated or weaned off the ventilator”.

The finding implies that there was shortage of ventilator circuits to change after every seven days of patients’ stay on mechanical ventilation.

In disagreeing with the above findings Han and Liu (2010:473) conducted a study in China on the effect of ventilator circuit changes on ventilator associated pneumonia (VAP). The results showed that, when comparing patients who received circuit changes every 7 days, and those who received circuit changes every 2 days, they have a higher risk of infection compared to those with no routine circuit change. Han and Liu (2010)
reported that ventilator circuits should not be changed in adult mechanically ventilated patients unless the circuit is soiled or damaged. Hospital infection control policies and bedside practitioners should translate this evidence into clinical practice.

Klompas et al (2014:14) supported Han and Liu (2010) findings in their study in America on the strategies to prevent VAP in acute care hospitals by reporting that ventilator circuits should be changed only if they are visibly soiled or are malfunctioning. Changing the ventilator circuit as needed rather than on a fixed schedule, has been noted to have no impact on VAP rates or patient outcomes but decreases costs.

4.3.4.3 Inability to isolate infectious patients

The participants expressed challenge of isolation of infectious patients to prevent cross infection while they were implementing VAPB.

The following participants stated:

**Participant 7:** “Sorry to add on that; infection control, we could not adhere to infection control principles because of the unit structure, you cannot isolate patients; you end up nursing adults and children in the same unit and sometimes infectious patients; infection control principles could not be adhered to”.

**Participant 3:** “We do not get enough time to clean our areas even in for an example in the sideward; a patient become discharged now and without a thorough cleaning of the walls you find that there is an admission coming urgently now”.

The above quotes by the participants imply that the structure of the unit does not allow proper isolation measures to prevent infection, and thus raises a concern about the prevention of nosocomial infections, such as VAP.
In support of the findings, Apisarnthanarak, Pinitchai, Thongphubeth, Yuekyen, Warren, Zack, Warachan, and Fraser (2007:706) stated that standard precautions and contact isolation are used to prevent nosocomial transmission of drug-resistant microorganisms. If an outbreak due to multidrug-resistant gram-positive or gram-negative bacteria occurs, additional interventions, including environmental cleaning with disinfectants and active surveillance for the particular drug-resistant micro-organism are implemented, as recommended by the hospital infection control unit.

4.3.4.4 Incorrect performance of the suction procedure

Some participants brought up a concern related to correct performance of the suctioning procedure.

Some of the participants indicated that:

**Participant 8**: “………and again we don’t have physiotherapists maybe like after hours. We have them only in the mornings, so there is nobody even to assist you to do proper physio (physiotherapy). You are alone, you are sterile and you mess up everything. So those are the things that made us not to go on with this bundle. I think those were the most that I have seen”.

**Participant 10**: “The other thing is suction catheters. We are using one suction catheter for almost 24 hours because you will find that the catheter been soaked for you and there is no other suction catheter. You have size 8 and you cannot use a size 8 or 6 or even 10 to adult patients”

**Participant 6**: “…………ultimately you end up with staff that do not come on duty because of burn out and as a result you become more short staffed and when you have to suction with somebody there is no time to suction with somebody else. Those are the challenges we experience; it does not mean we do not want to; we want to, but you can understand the burden of teaching but at the same
The findings denote that the suctioning procedure was not done correctly, by following the principles of aseptic technique.

Morton and Fontaine (2013:119) support the findings by indicating that suctioning endotracheal and tracheostomy is a sterile procedure based on the Centers for Disease Control and Prevention recommendations. They reported that suctioning is without risks such as introduction of nosocomial infection to ventilated patients. Magnuson (2000:1) described deep tracheal suctioning, as a sterile procedure which is performed to mobilize secretions from the patient's airway, by aspiration through a suction catheter placed proximal to the secretions. Airway suctioning removes excess secretions and promotes the cough reflex to help in maintaining a clear airway. Morton and Fontaine (2013) stated that, to adhere to the correct principles of infection prevention and control, performing an effective suction procedure requires two people, in order to prevent contamination which may lead to VAP.

The goal of infection control is to prevent cross transmission of pathogens, which has been shown to play an important role in the development of nosocomial infections, including VAP. An effective strategy should target infection control from several vantage points, such as; education of the medical team, universal hand hygiene, use of personal protective equipment and a protocol for microbiological surveillance. All the healthcare providers involved in the care of the patients requiring mechanical ventilation, who are well informed and are serious about infection control measures, are more successful in VAP prevention (Keyt, Faverio, & Restrepo, 2014:80).

4.3.5 Theme 5: Monitoring and evaluation of the process VAPB implementation

Monitoring and evaluation of the process VAPB was cited by some participants as one of the challenges. Four categories emerged from this theme.
4.3.5.1 Inappropriate monitoring of the infection baseline investigations

Participants raised the challenge of appropriate monitoring of baseline infection investigations of mechanically ventilated patients.

This is what some participants said:

**Participant 5:** “......one of our infection control personnel; co-ordinator she came up with this good idea of doing our own baseline, take our own baseline data to check whether our patients did they come with this or did they pick up this problem from our unit. So what happened; it was done initially but from nowhere everything just stopped..................our (the name of the doctor mentioned) was saying that it was not necessary because you remember, our sputum collection was done on weekly basis if I am not wrong. He said that it is expensive it should be done once when the patient is admitted from there when necessary maybe when there is any sign that the patient is picking any sign of infection, so that stopped. So I think if maybe we could <aaa> change our approach, put more effort in that, maybe we will see what will come out of implementation”

**Participant 10:** “Sometimes we do not collect the sputum on patients on admission because you are nursing so many patients, maybe two patients; these patients need too much attention. So you forget, sometimes you do not have time”

The findings demonstrate that the proper monitoring of the baseline infection investigations was not done on admission of patients who required mechanical ventilation. It is indicated that sometimes the ICU staff members forgot to collect the sputum on admission as the baseline data, due to work overload.
Waite and Hawker (2009:597;318) define monitoring as keeping something under observation and evaluation as forming an idea of the number or value. In this study monitoring and evaluation involve observing and rating the process of the implementation of VAPB. In view of monitoring and evaluation process during the implementation of VAPB, Sera and Beaudry (2007:1) reported that monitoring and evaluation are important management tools to track progress and facilitate decision making.

In support of the findings on taking and monitoring of the baseline investigations, August (2007:32) cited that every patient who is intubated and receiving ventilator support is at risk for VAP. Therefore, making an accurate diagnosis of this disease and starting treatment is critical. Diagnosing VAP remains difficult and controversial. The diagnosis can be made on the basis of radiographic findings, clinical findings, results of microbiological tests of sputum, or invasive testing such as bronchoscopy. The diagnosis is most often based on the visualisation of a new or progressive infiltrate on chest radiographs. However, findings on chest radiographs are not reproducible, and should not be used as the only diagnostic tool.

Augustyn (2007:39) stated that the likelihood of VAP increases if a patient has clinical signs and symptoms, such as fever, leucocytosis, and purulent sputum in addition to abnormal findings on chest radiographs. The results of microbiological tests of sputum specimens obtained by either invasive or non-invasive methods, are not sufficient for the diagnosis of VAP, but culture and sensitivity results can be helpful for choosing an antibiotic.

Alsadat et al (2012:78) support Augustyn (2007:39) by indicating that pneumonia can be identified by using a combination of radiological, clinical, and laboratory criteria. In the study conducted by Augustyn (2007) in Colombia on ventilator associated pneumonia: Risk factors and prevention, VAP was clinically diagnosed based on the progressive infiltrate within the chest X-rays, the presence of leucocytosis, recording of pyrexia
above 38.5°C, observations of purulent secretions, and audibility of crepitation in the lungs.

4.3.5.2 Non-compliance to VAPB implementation

The participants reported the challenge related to compliance during the implementation of VAPB.

Some participants stated that:

**Participant 7:** “The other thing is that there were no standards in place or protocols that should be followed on how to implement this VAP, so there was no adherence”.

The finding from the above participant implies that there was no adherence to implementation of VAPB which could be monitored by measuring VAPB compliance rate. Refer Figure 2.4.

Alsadat et al (2012:80) support the findings in the study on the use of ventilator associated pneumonia bundle and statistical process control chart to decrease VAP rate in Syria. It was reported that as soon as the project started, there was a need to measure the compliance rates, to check whether all the staff members understood the concept, and to ensure continuity in order to achieve the expected results. This should be done so that the results of the project are compared with the compliance. It was also indicated that regular daily rounds were conducted on all the ventilated patients, and recorded compliance with all the five elements of the VAPB. The unit leaders were instructed to set up regular, scheduled meetings with the teams to discuss the progress, the barriers and the way forward of the project. Compliance with each aspect of the VAPB was monitored and reported monthly.
Eom et al (2014:35) support Alsadat et al (2012) by stating that in their study on the impact of a ventilator bundle in preventing VAP to measure the compliance rate an infection control practitioner evaluated each patient in each ICU daily, to check for the compliance with each bundle component. The head of the bed elevation (HOB) was checked every 4 hours and considered done if checked “yes” for all 6 times. Peptic ulcer disease prophylaxis was considered done if an H1 blocker, proton pump inhibitor, or sucralfate was given daily. Deep venous thrombosis prophylaxis was considered done, if a low dose heparin, compression stocking application, or pneumatic compression was provided daily. Oral decontamination with chlorhexidine 0.12% was verified every 8 hours, and considered done if checked “yes” for all 3 times. Refer Figure 2.3 for the checklist to measure VAPB compliance rate.

Gurses et al (2009:529) indicated that research has identified many types of barriers to guide the compliance, related to providers (for example, unfamiliarity with a guideline, disagreement with guidelines), specific guideline characteristics (ease of complying with a particular guideline, level of evidence that supports a particular guideline), and system characteristics (systems ambiguity, ineffective communication, high work load, lack of necessary supplies and equipment). The aim of the care bundle is to guide the tasks into a cohesive unit that should be performed for every patient. All the tasks are necessary and must all occur in a specified period and place. Compliance with the bundle should be audited regularly (SARI Group, 2011:9). The system characteristics were relevant to the ICU of this hospital in this research context, as the participants described the high work load, lack of necessary supplies and equipment.

4.3.5.3 Inaccurate VAP rate measurement

The participants were asked a question to find out whether they knew the VAP rate in their ICU, which indicated part of their understanding of implementation VAPB.
The participants stated:

**Participant 11:** “No I will be lying I don’t know because we did not have any measuring tool and according to the information that we got when we went for that workshop was that when we come and start we need to have like the baseline to say when we implement now this is the rate so that whatever we implement we work towards reducing the rate. So, we did not even have an idea of how are we are supposed to measure the rate of VAP”.

**Participant 8:** “The other thing patients were not screened on admission because of funds. The laboratory complained and the (name of the doctor mentioned) stopped us to do lukis (tracheal aspirates) on patients. So some of the patients, we admitted and discharged not knowing whether their pneumonia was a nosocomial or community acquired pneumonia. …………………… No, because we do not keep stats, there is no statistic for that”.

The findings imply that the participants lack knowledge of the accurate VAP rates measurement in their unit. It was revealed that there was no VAP rate statistic to differentiate the nosocomial pneumonia from the community acquired one.

In support of the above findings, Kanto et al (2011:3) reported that a crucial aspect of hospital associated infection (HAI) prevention is to integrate the measurement of infection rates, and other significant adverse events into daily practice. This should not be done just for epidemiological studies that languish in academic journals, or for facility data that are unused are contained in the administrative databases, but rather used to guide health improvement oriented changes. An important tool for improvement is the simple checklist. The purpose of checklists is not just to “tick the boxes”. They act as a safeguard against inevitable errors that occur when seemingly mundane tasks, (e.g. hand-washing or sterile draping) are performed (or forgotten), in stressful, interruption prone hospital environments. Al-Tawfiq and Abed (2010:553), in their study reported
that multiple steps were taken to implement the VAPB and include staff education development of an audit tool, data collection, and the tracking of the control measures.

Sedwick et al (2012:48) stated that in a 38-month study in Colombia in a surgical ICU Bird et al (2010) compared the VAP rates before and after the initiation of the IHI bundle. Before the use of the bundle, the VAP rate was 10.2 cases per 1000 ventilator days. During the study period, the rate decreased to 3.4 cases per 1000 ventilator days. The study concluded that the use of a VAP bundle was an effective method for reducing VAP rates, when compliance of the protocols was maintained. Strict adherence to VAPB practices, enhancing accountability for initiating protocols by using a feedback system, and interdisciplinary collaboration, are likely to improve the patients’ outcomes, and could produce enormous costs savings for the hospitals concerned. This is supported by Alsadat et al (2012:81) in Syria on their study on the use of ventilator associated pneumonia and statistical process control chart to decrease VAP rate.

In a study conducted by Sedwick et al (2012:49) in America on the use of evidence based practice to prevent ventilator associated pneumonia (VAP). They reported that the real time feedback on staff compliance with the VAP protocol had the most important effect on VAP rates. Feedback sessions were used to give staff members a positive feedback for their efforts, and to increase staff accountability for the implementation of best practices. Accountability for daily patient care was a key component to improving the patients’ outcomes. Through the use of a feedback system, using daily monitoring and trend reports, ICU nurses can remain abreast of their compliance with care protocols, and may also develop strategies to improve patient care.

4.3.6 Theme 6: Motivation, supervision and support during VAPB implementation

Some participants raised the challenge related to the motivation, supervision, and support of the ICU staff members during the implementation of VAPB. This theme revealed three categories.
4.3.6.1 Lack of the hospital managerial motivation, supervision and support

Some participants indicated the concern regarding lack of the hospital managerial motivation, supervision and support of ICU staff members.

The following statements were reported:

Participant 5: “….but really following the bundle per se; I would say maybe if we had some form of motivation; some form of follow up; maybe something could have come out of that………….The other thing is that I think even the aseptic technique is not being maintained because we have a lot of new personnel in the unit; you will find that proper supervision is not been done on them………….”

Participant 4: “……there must be competition in whole hospital so that the ward that does not have this infection, there must be a complement somehow so that the whole hospital is motivated, and then, management must learn to complement, to appreciate staff and then the staff as well must have love to their patients”.

Participant 2: “It can be a no and a yes answer because if I am going to say no it will be like I am penalising people who are trying because people in infection control department; they really try you see, I’m not going to mention names but there are people in infection control department that they come and do that, even last week; two weeks they were here telling us about hand wash and all those things so they are trying but still it’s not really a complete support about that ………is my part of a no”.

Participant 7: “There was no support because there was no induction of people, even hospital management; I think they were not even aware of the study”.
Participant 12: “Well I wouldn’t blame the hospital management as such because I wonder if the hospital was aware that we want to run such a project because you have to bring people to board to say that I want to run this project to get the support. So the hospital management all they can do is to provide you with the resources, especially material resources and it has been their responsibility all along to do so. Whenever you are running short of a resource like chlorhexine or whatever, anything, you always consult with them and they will give you, that’s the support I can say they were giving, but in as far as the project is concerned, I am not very sure whether they were aware that there is such a project”.

These findings indicate that there was no motivation, supervision and support from the hospital management, to encourage the ICU nurses to continue with the implementation of VAPB. It was also indicated the possibility that the hospital management might not have been aware of the project on the implementation of VAPB in the ICU.

Chilembwe and Baluti (2014:1) stated that Daschler and Ninemeter (1989) described motivation as a state or force within an individual that makes the employee act in away designed to achieve some goal. Supervision implies expert overseeing of subordinates at work in order to guide and regulate their efforts. Taking this broad definition of motivation to the context of supervision in the hospitality operation, motivation is what the supervisor does to encourage and influence other people to take necessary action. It is an internally generated force or drive within the individual. Waite and Hawker (2009:303; 488) define support as encouragement in a state of wanting to know about something. In the context of this study managerial motivation, supervision and support is needed to encourage ICU nurses of this hospital to implement the VAPB in order to prevent VAP.

Klompas et al (2014:15;16) support the above findings by stating that hospital senior management is responsible for ensuring that the healthcare system, supports an infection prevention and control (IPC) program, that effectively prevent healthcare
associated infections (HAIs) and the transmission of epidemiologically important pathogens. Providing feedback to staff members help them to appreciate their efforts in improving their own performance rates and patients’ outcomes. This helps to maintain staff motivation and can boost their compliance to new processes and projects. Sedwick et al (2012:490) support Klompas et al (2014) by reporting that nurses need to be consistently appraised on patient safety issues, and need to be provided with ongoing support to deliver high quality care.

4.3.6.2 Lack of ICU staff members’ interest

The lack ICU staff members’ interest during the process of the implementation of VAPB was raised as a concern by some of the participants.

Some participants reported that:

**Participant 4:**“……there were only a group of people who were involved in that ventilator associated pneumonia and they were doing it you know occasionally (with emphasis) as a result it was not a continuous thing that was emphasised in the unit, perhaps that is why most of the staff members they lack you know interest in that issue”.

**Participant 5:**“…… I think maybe from there, we lacked motivation. If something is new and we don’t have somebody or maybe people who are that interested in that implementation of those bundles <neh> and you end up that; even if you were interested you give up on that. You say no; this was introduced yes, I understand; but where to from here I don’t know. You will try to do whatever you have learnt regarding prevention of VAP implementation of that yes, but really following the bundle per se; I would say maybe if we had some form of motivation; some form of follow up; maybe something could have come out of that”
The findings denote the lack of the ICU staff members’ interest from active participation on the implementation VAPB. The reason indicated was because there was no guidance in what was supposed to be done to implement VAPB.

Gallagher (2012:378) supports the lack of ICU staff interest by reporting that encouraging the ICU nursing staff to take an interest and active part in expanding their knowledge base will empower them. Recommendations to follow the evidence based medicine provide a reduction in the incidence of VAP. Gallagher (2012) further stated in addition the provision of encouragement; the ICU nurses should also have the responsibility to understand VAPB.

Gomes (2010:117) conducted a study in Gauteng Province on the knowledge of intensive care nurses on evidence based guidelines for prevention of ventilator associated pneumonia. It was indicated that many nurses are unaware of the current recommended best practices in nursing care. Creativity must be used to create programmes that encourage nurses to seek knowledge and update their skills in scientific nursing such as continuous professional development (CPD).

4.3.6.3 Lack of continuity of the implementation VAPB

The participants brought up the challenge regarding the lack of continuity on the implementation of VAPB.

The following are examples of cited notations:

Participant 1: “....the other thing is that; that doctor (the name of the doctor mentioned) was sort of had his own reasons to leave the ward that I wouldn’t know how and why he left the ward and from there it sort of collapsed. Nobody was following it specifically”.
Participant 5: “………even the reports that we were getting was like once; if there was an outbreak of some or one of the infections its then that you will find that certain precautions are being taken or are being said verbally and then from there we leave it like that nothing is being done, no follow up is been done”.

The findings denote that there was a lack of continuity on the implementation of VAPB. There was the indication that there was no one who was following up the implementation process which resulted in its collapse.

In support of the above findings, Alsadat et al (2012:80) cited that as soon as the project of the VAPB implementation started, there was a need to measure the compliance rates, to check whether all the staff members understood the concept, and to ensure continuity in order to achieve the expected results. This should be done so that the results of the project are compared with the compliance.

The National Core Standard (NCS) for Health Establishment in South Africa (2011:35) domain number 5, describes leadership and governance. This domain discusses the strategic direction that health senior management must provide through proactive leadership planning and risk management, supported by the hospital board, clinic committee, as well as the relevant supervisory support structures, which includes the strategic functions of communication and quality improvement. The leadership and governance domain; sub-domain 5.6; explains that staff should be involved in improving services and should always be kept informed about these efforts. A communication strategy must be in place that ensures that staff is informed about all relevant issues that affects the health establishment. Staff must actively participate in decisions about quality within the health establishment. The NCS for Health establishment in South Africa document emphasises the importance of staff involvement in improving services.
4.3.7 Theme 7: Suggested needs to overcome the challenges of VAPB implementation

The 7th theme identified, provided solutions to the 2nd objective and the 2nd research question of this research study. The six categories that emerged from the collected data of this theme were classified as the needs to overcome the challenges experienced by intensive care unit (ICU) nurses on implementation of ventilator associated pneumonia bundle (VAPB).

The 2nd main research objective was:

- To identify and describe the strategies needed to overcome those challenges.

The 2nd research question was:

- What are the needs to overcome these challenges?

Coppadoro, Bittner and Berra (2012:6) reported that many factors contributed to the development of ventilator associated pneumonia (VAP). A number of strategies have been proposed for VAP prevention; however, only a few have been demonstrated to be effective, and many others still need evaluation in large randomised clinical trials, before definitive recommendations can be made.

Patients at risk for ventilator associated pneumonia (VAP) present a unique challenge to critical care nurses. To prevent VAP, ICU nurses must develop strategies to incorporate evidence based practices into the daily care, provided to patients receiving mechanical ventilation (Sedwick, 2012:42). This is supported by Hockenberry et al (2006:372) who stated that it is extremely important, that ICU nurses have knowledge of such strategies, and are able to implement evidence based nursing in the ICUs, aiming at achieving high quality care as well as optimal outcomes for their patients.
The following section presents six suggested needs that emerged from this theme. The relevant quotations from the participants’ interviews and the relevant literature are cited as a literature control to support or disapprove the findings of this section of the study.

4.3.7.1 Ensuring proper planning and the introduction of the implementation of VAPB

Participants indicated the need for the proper plan of the introduction of the implementation of VAPB to ICU staff members involved.

The following are supporting statements indicated:

**Participant 9**: “I think in the unit if they can have this person responsible for this VAPB related. If they can specify that this person will be responsible for this bundle in the unit, I think we can reach a goal or go somewhere because he or she will be knowing that this is my responsibility or my job, so I must just run after these people to check whether they comply with those bundles…..”

**Participant 11**: “……….maybe have; I would call a team that would champion the whole situation that consist of the multidisciplinary team, so that when we come and sell the information or the idea to the functional level, we are a group of all people representing all patient care areas, all the people who are involved in patient care”

The above quotes from the participants indicate the findings that there is a need for the team leader, and the team members to take a lead and coordinate the implementation of ventilator associated pneumonia bundle (VAPB), to ensure its success. The importance of multidisciplinary team involvement was also indicated.

Gillespie (2009:50) supports the findings by stating that the initiative of the implementation of VAPB requires a champion that will drive the process, written
guidelines, user friendly tools and regular feedback, regarding the process as well as on-going reviews of the programme. In a study conducted by Alsadat et al (2012:83) it is asserted that when they initiated the project on VAPB implementation a multidisciplinary team was formed at every hospital, and included 1 - 2 physicians and 1 - 2 nurses, with a team leader who was selected based on experience, knowledge and commitment.

Critical factors that should be taken into consideration for the success of this type of quality improvement project, include creating organisational alignment, having the organisations executive leadership fully engaged in the project, coordination by an experienced and effective project leader and manager, collaboration by multidisciplinary project teams, and promoting transparency of results across the staff members implementing VAPB and the organization (Alsadat et al, 2012:83).

Gallagher (2012:379) used a set of practices as the bundle of choice in the study on the implementation of ventilator associated pneumonia prevention: clinical guidelines. The SARI group (2011) also reported the necessity of selecting the bundle of choice when implementing VAPB.

Crofts (2006:362) also supports the findings by indicating that the importance of protocols when implementing VAPB. It is stated that the lack of protocols and guidelines contribute to the problems in the ICUs, as a result of a lack of directives to manage the patients in the absence of the doctors, which leads to errors occurring. According to Vincent and Singer (2010:1358) computerised, nurse-run protocols have been recommended, as directives in coping with insufficient numbers of physicians. Therefore, an increase in the numbers of nursing personnel will be necessary to cope with the extra workload. An ideal ICU should have protocols and policies in place.

**4.3.7.2 Provision of adequate knowledge and understanding**

This need by the participants relates to the provision of adequate knowledge and understanding of the ICU staff members involved on the implementation of VAPB.
The participants stated:

**Participant 10:** “First of all we want to be trained. We need in-service”.

**Participant 1:** “There was supposed to be an in-service about that, so that people can be aware of this thing and if you are aware of a thing you know how it will also help you……..Ok let our department or head of the department or our managers organise an in-service concerning this and let’s have somebody who is going to like lead this. I just want to say people need to know about this and they need to know that if we can practice this we can eliminate a lot of problems and we can really eliminate this VAP. So everybody needs to know but how? That is the other thing. So the knowledge that is my point, people need to know about this”.

**Participant 11:** “All like your physiotherapists, people who come into contact with the patients like I would say people like the radiographers or should I put it multidisciplinary; they should be involved in this…..”

**Participant 9:** “Proper induction of staff. Involvement of all the multidisciplinary team. Proper orientation of new personnel in the ward so that they know what to do”.

The findings indicate that all multidisciplinary team members should be involved in in-service training. The proper orientation program of new personnel working in the ICU regarding the implementation of VAPB needs to be instituted to ensure successful implementation of VAPB.

In support of the findings, Augustyn (2007:32) reported that nurses need to understand the pathophysiology, the risk factors of pneumonia and strategies that may prevent VAP. In-service education is therefore important. Aldasat et al (2014:78) indicated that interventions to implement VAPB in their study included an initial educational workshop
for the stakeholders from different participating hospitals, with the emphasis on the standards of practice, nursing support and physician leadership, participation, and collaboration. Staff education with bedside mentoring and skills competency documentation, was done for all the nurses and physicians in the specific unit.

Labeau et al (2007:372) reported that while knowledge may not ensure adherence to evidence based guidelines, a lack of knowledge may be a barrier to adherence. Lack of knowledge is a huge barrier to the implementation of evidence based guidelines for VAP prevention if resources are available, and when nurses are not aware of the importance of such interventions. Understanding the importance of recommended practices, increases the likelihood of adherence. Hockenberry et al (2006:372) also supported the findings by stating that it is extremely important that ICU nurses have knowledge of strategies to implement evidence based nursing, whilst aiming at achieving high quality care with optimal outcomes for their patients.

4.3.7.3 Provision of adequate human and material resources

The participants reported the need for provision of adequate human and material resources for the implementation of VAPB.

The participants verbalised:

**Participant 4:** “.........and the resources, I mean they must improve; you know this thing of shortage of resources is a very serious problem because the other hospitals, there is not such shortage of resources. Resources must be there.........”

**Participant 10:** “There should be equipment in each unit. These equipment need to be serviced at all times. We must get working ventilators and monitors because presently we are not, and we are short of ventilators in the unit. Otherwise that is that!”
Participant 9: “……if we can get that bed that has the degrees so that we can comply so that if I elevate up to this much is 35°, 45° or 30°. Compliance and resources we will go far if we are not struggling to get other things that are related to the study”.

The findings imply that the availability of the resources, both human and material is important for a successful implementation of VAPB.

Branson et al (2014:14) support the findings by highlighting that senior leadership is expected to provide adequate resources for the effective implementation of hospital acquired infection (HAI) prevention programmes. These resources include adequate personnel (clinical and nonclinical), education, and equipment.

4.3.7.4 Adherence to infection, prevention and control principles

The participants mentioned the necessity of adherence to infection, prevention and control (IPC) principles on the implementation of VAPB.

The participants stated:

Participant 2: “For us nurses or all the staff; washing of hands it’s very, very much important”.

Participant 7: “Try to isolate patients that are infectious. Try to adhere to the principles of Infection Control”.

Participant 8: “Suctioning is also important; we must help one another so that we can maintain sterility during suctioning. You must wear mask, wear gloves and wash or spray your hands”.

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The findings highlight the importance of adherence to IPC principles, such as hand washing, isolation of infectious patients and maintaining sterility during suctioning of patients during the implementation of VAPB.

Singh et al (2015:737) support the findings by reporting that the strategy for infection control in ICU, should focus on the education of health care providers, use of personal protective equipment, hand hygiene and microbial surveillance. Education of all health care providers on infection, prevention and control principles results in the prevention of VAP, if measures are applied appropriately. Craven (2006:253) supports Singh et al (2015) by highlighting that infection control programs if effective reduce infection rates and control the spread of organisms. Staff education on infection control and prevention principles must be reinforced frequently. There must be adequate staffing to allow for optimal patient care and to comply with essential infection control practices. Special attention must be directed to include staff, students, volunteers, and visitors in regular scheduled infection control educational programs.

Improper hand washing resulting in the cross-contamination of patients is the biggest personnel related risk factor for VAP. Patients who are intubated and receiving mechanical ventilation often need interventions such as suctioning. These interventions increase the likelihood of cross contamination between patients, if staff does not use proper hand washing techniques. Failure to wash hands and change gloves between contaminated patients has been associated with an increased incidence of VAP. In addition, the failure of staff to wear proper personal protective equipment, when antibiotic resistant organisms have been identified, increases the risk of cross contamination between patients (Augustyn, 2007:34).

4.3.7.5 Instituting monitoring and evaluation

The participants indicated the need to institute monitoring and evaluation during the implementation of VAPB process.
This is what the participants said:

**Participant 5:** “…..training must be instituted and then after that also follow ups after the in-service to see how people are complying to what they have gained from that and the improvement checking on the improvement after this has been implemented to see whether <ana> (whether) are we winning or not”.

**Participant 2:** “……we must all have the baseline for all the patients on admission like taking the luki, (tracheal aspirate) so we are taking the baseline we know that so many patients have been admitted without a Pneumonia then maybe after a month or a week we take another specimen then we see that on admission the results were like this; the patient had no pneumonia then after a week we say pneumonia and we go back and check where did we not comply”.

**Participant 12:** “……Monitor and evaluate, like compliance rate; it is very important, people have to comply then you have to keep on giving people the information about the rate of whatever they do, the results of what is happening at least you have to get the baseline data that you are starting from this number and whether you are improving or not that is still monitoring and evaluation”.

**Participant 7:** “I would like to see the statistics; we should keep a stats and to see ventilator related infections in the unit”.

The findings from the above quotes indicate the importance of instituting monitoring and evaluation during the implementation of VAPB. The value of taking baseline data of patients, to determine whether the patient was admitted with an infection prior intubation or not, is reported. The participants also mentioned the need of monitoring and evaluation of the compliance rates to measure the progress of the VAPB implementation.
International Federation of Red Cross and Red Crescent Societies, Geneva (2011:6) support the findings by stating that it is very important to monitor and evaluate a project such as the implementation of VAPB. A well-functioning monitoring and evaluation system is a critical part of good project management and accountability.

Timely and reliable monitoring and evaluation provides information to:

- Support project implementation with accurate, evidence based reporting that informs management and decision-making, to guide and improve project performance.
- Contribute to organizational learning and knowledge sharing, by reflecting upon and sharing experiences and lessons, so that the full benefit from the project is achieved.
- Uphold accountability and compliance by demonstrating whether or not work has been carried out, as agreed and as in compliance with established standards.
- Provide opportunities for stakeholder feedback, especially beneficiaries, to provide input into and perceptions of the work done, modelling openness to criticism, and willingness to learn from experiences, and to adapt to changing needs.
- Promote and celebrate work completed, by highlighting accomplishments and achievements, building morale and contributing to resource mobilisation.

Alsadat et al (2014:80) reported that VAPB monitoring and compliance in their study was done by teams, which conducted regular daily rounds on all the ventilated patients, and recorded the compliance with the five elements of the VAP bundle. Leaders were instructed to setup regularly scheduled meetings with teams, to hear about the progress, barriers and next steps. Alsadat et al (2012) further stated that VAP rates were calculated based on occurrences per 1000 ventilator days and monitored monthly, throughout the project period.
Data was collected daily and plotted on the statistical control chart (SPC) on a weekly basis, was analysed at the project manager level monthly, with a progress report being generated, which included up to date results and recommendations. These reports were communicated directly to the members of the team, and charts were posted in the specific unit. Regular monthly follow-up meetings and frequent staff education sessions in individual units were held, to ensure the quality of the implementation process by using the progress report and the feedback from the different units. Statistical process control chart was used to monitor the process of compliance with the individual bundle elements, as well as with the whole bundle (Alsadat et al, 2014:80).

4.3.7.6 Provision of motivation, supervision and support

This need by the participants relates to the provision of motivation, supervision and support of the ICU staff members during the implementation of VAPB.

The following was indicated by some participants:

**Participant 7:** “…..you know if maybe all of us are interested in this, all of us put an effort in this I think there may be change in preventing this VAP or implementing VAPB. I think active participation is the most important thing and of which at the moment is none is like nobody is interested in doing that”.

**Participant 4:** “There must be continuity, and must not stop abruptly or it must not be introduced just without the staff not being aware. I think if there can be commitment there will be some changes”.

**Participant 11:**“…..and we should get enough support from the hospital management. If it means them arranging workshop for these people, they should arrange and even when as a team that leads with our champion they should also continuously support the people who are trying to implement the project in the department. I think that can work for us”.
The findings indicate the importance of all staff members in having interest on the VAPB implementation. The value of the continuity of the project, the hospital management and the team leader to support of the ICU staff members in order to ensure success of VAPB implementation is also noted.

In support of the findings, Gillepsie (2009:47) stated that prevention of VAP requires the concerted efforts of the hospital administration, physicians and the ICU personnel. The program must be evidence based, maintained, and accepted by the ICU personnel. Monitoring and the collection of data should be structured, objective, and transparent. A team approach is essential for the successful implementation of a quality improvement initiative. The support of medical directors, nursing managers, administrators and ancillary services, such as the laboratory, together with staff involvement, are key factors to success on the prevention of VAP. Elmenshawy, Elbadawy, Abu khaber, Hafez, Fayed, and Ibrahim (2014:33) support Gillepsie by stating that the top management support and availability of supplies are considered crucial for a successful VAPB implementation.

Sylvia, Nascimento and Salles (2012:838) stated that applying protocols in care practices are challenging. Studies suggest that the protocols should be dynamic and put in practice together with the health care team, so that all stakeholders are motivated, permitting the continuous assessment of care delivery and the creation of clear therapeutic measures.

Gillepsie (2009:50) reported that the strategies to prevent VAP need to be specific and dynamic to the ICU environment, the multidisciplinary team, the organisational climate and the culture of the ICU. Gillepsie (2009) stated that Sinuff et al (2007) found that a leading ICU team with common goals and agreement with a purpose, and a guideline may facilitate the benefits of guideline adherence. Behaviour change theory can provide a framework within which to initiate the change process. Critical elements of the strategy include effective leadership, a collaborative team, continued education programme, an effective communication system and an audit-feedback system.
4.4 CONCLUSION.

This chapter presented the findings of the data analysis and the discussion of the transcripts from the 12 participants. Seven (7) central themes and twenty five (25) categories that emerged from coded data are presented, discussed and integrated with existing literature. Six (6) themes illustrated the challenges ICU staff members encountered on the implementation of VAPB. The seventh theme described the suggested needs to overcome those challenges. The following final chapter will be on the summary, limitations, recommendations and conclusion.
CHAPTER 5

SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

Prevention involves planting a tree, nurturing it, pruning it, and watching it grow and spreading seeds for more trees in keeping with the strategies of VAPB to reduce VAP. Investing in the prevention of VAP can pay great dividends, in terms of reaching improvements in the quality of life, morbidity, and mortality rates by applying VAPB to patients who are mechanically ventilated. In addition, the prevention of VAP can have a huge impact in reducing the length of the hospital stay and health care costs, during the acute care of the mechanically ventilated patients. Spreading the seeds of VAP prevention into the long-term care, and the rehabilitation facilities of the patient who is being mechanically ventilated, is also vitally needed and is important in improving patient outcomes (Craven, 2006:258). The prevention of VAP using the VAPB is therefore the cornerstone of the patients’ risk reduction against VAP.

5.2 AIM OF THIS STUDY

The aim of this study was to understand the challenges encountered by intensive care unit (ICU) nurses on the implementation of the ventilator associated pneumonia bundle (VAPB) and to propose the strategies needed to overcome those challenges.
5.3 OBJECTIVES OF THE STUDY

The objectives of this study were to:

- Explore and describe the intensive care unit nurses’ challenges on the implementation of a ventilator associated pneumonia bundle in an academic hospital in the Gauteng Province.
- Identify and describe strategies needed to overcome those challenges.

5.4 SUMMARY OF FINDINGS

Six themes and nineteen categories were identified as the challenges encountered by the ICU nurses on the implementation of ventilator associated pneumonia bundle (VAPB). The seventh theme with six categories that emerged were identified as strategies to overcome those challenges. The questions were understood and well expressed by the participants, which assisted in meeting the objectives of this research study.

The ICU nurses of the hospital in this study encountered multifaceted challenges, which led to problems regarding the successful implementation of the VAPB. The researcher agrees with the report of Gurses et al (2009:527) which stated that health care organisations are working towards improving patient safety and the quality of care, but need to place more emphasis on addressing the adequate translation of research evidence into clinical practice. The next section describes the findings related to the two objectives of this study.

5.4.1 ICU nurses challenges on the implementation of VAPB.

The challenges encountered by the participants are summarised from each theme as follows:
• **Theme 1** - Planning of the introduction of the implementation of the VAPB which include:

  ➢ Lack of formal appointment of the VAPB implementation coordinator and the team members to lead the implementation of VAPB.
  ➢ Absence of the proper selection of VAPB elements to be used in the ICU.
  ➢ Lack of multidisciplinary team involvement during the VAPB implementation process.
  ➢ Unavailability of standards or protocols, to direct the VAPB implementation process, such as head of bed elevation, oral care, as well as sedation vacation to assess the patient readiness to wean from the mechanical ventilator.

• **Theme 2** - Knowledge and the understanding of VAPB implementation process which involve:

  ➢ Inadequate in-service training on the implementation of VAPB to all the multidisciplinary team members involved in the ICU.
  ➢ Lack of proper orientation of the new and rotating staff in the ICU on VAPB implementation.

• **Theme 3** - Availability of human and material resources for the successful implementation of VAPB which entail:

  ➢ Shortage of staff such as experienced ICU nurses, doctors, physiotherapists for proper implementation of VAPB.
  ➢ Shortage of stock for such as, chlorhexidine mouth wash solution, proper sizes of suction catheters, ventilator filters, peptic ulcer prophylaxis, and DVT prophylaxis (Medication, compression stockings).
Scarcity of equipment during the implementation of VAPB such as mechanical ventilators and pneumatic pumps for deep venous thrombosis (DVT) prevention.

- **Theme 4** - Adhere to infection, prevention and control principles which comprise:
  
  - Poor hand washing techniques due to work overload and the shortage of experienced staff.
  
  - Lack of ventilator circuits changing in the prevention of ventilator associated pneumonia bundle (VAPB) was disapproved by Klompas et al (2014); Han and Liu (2010). Refer page 81.
  
  - Inability to isolate infectious patients adequately to prevent cross infection which could result to VAP.
  
  - Incorrect performance of suctioning procedure of the mechanically ventilated patients at times due to staff shortage.

- **Theme 5** - Monitoring and evaluation of the implementation process of VAPB involving:
  
  - Inappropriate monitoring of the baseline infection investigations on admission of the mechanically ventilated patients, in order to be able to identify VAP from that of community acquired one.
  
  - Non-compliance to VAPB implementation activities by measuring the VAPB compliance rates.
  
  - Inaccurate measurement and knowledge of VAP rate in the ICU during the implementation of VAPB.

- **Theme 6** - Motivation, supervision and support of the ICU staff members during the implementation of VAPB to stimulate their interest and ensure continuity include:
- Lack of the hospital and ICU managerial motivation, supervision and support during the implementation of VAPB.
- Lack of interest of the ICU nurses on the VAPB implementation process.
- Lack of continuity of the implementation of VAPB to motivate the ICU staff members involved.

5.4.2 The strategies to overcome the challenges

The following suggested needs to overcome the challenges of VAPB implementation described by the participants are tabulated as the strategies to overcome the ICU nurses challenges during the implementation VAPB:

- The hospital and ICU management should institute a proper plan of the introduction of the implementation of VAPB to all the ICU staff members, who will be involved in the implementation of VAPB.
- Adequate knowledge and understanding of the implementation of VAPB, should be provided to all the multidisciplinary team members involved, on the implementation of VAPB in the form of proper and continuous in-service training.
- Provision of adequate supply of human and material resources to be ensured by the hospital and ICU management for proper implementation of VAPB.
- All the multidisciplinary team members involved in the implementation of VAPB should adhere to principles of infection, prevention and control to prevent VAP.
- The proper monitoring and evaluation of the implementation of VAPB, should be done by the hospital and ICU management together with staff members involved, during the implementation of VAPB.
- Ensuring ICU staff members’ support, motivation and supervision to increase their commitment as well as interest which may result in continuity and the successful implementation of VAPB.

These strategies have been extensively discussed in chapter four, supported by the relevant literature.
5.5 LIMITATIONS OF THE STUDY

This study was limited to an adult intensive care unit (ICU) at an academic hospital in Gauteng Province. It includes ICU nurses’ experiences in one hospital only therefore the findings cannot be generalised to other hospitals. However these findings might be applicable for other facilities, especially those institutions that have not yet joined the campaign to prevent hospital acquired infections such VAP (Elmenshawy et al, 2014:40).

5.6 RECOMMENDATIONS

In this chapter the following recommendations are made with reference to nursing practice, nursing education and nursing research.

5.6.1 Nursing Practice

The researcher recommends the following:

- The hospital and ICU management should provide support and supervision to the multidisciplinary team involved in the ICUs on the implementation of VAPB guidelines.
- The hospitals should fast track the initiation of a clinical teaching department (CTD) which will concentrate more on-the-job training, to ensure adequate training of the nursing staff members in the units on the implementation of VAPB.
- The journal clubs should be established in institutions to assist staff members in understanding the evidence based practice interventions.
- The research findings should be communicated to the health practitioners, expressed in terms that they can understand, so that they can use the strategies in clinical practice.
- Ongoing in-service training should be introduced into the hospitals and ICUs, to improve the knowledge on the prevention of VAP, which is a common nosocomial infection in the ICUs.
- The night duty staff members should also be involved in ongoing on-the-job training.
- The orientation of new staff members in ICU’s should include education on the strategies for the prevention of VAP.
- The reinforcement of compulsory continuous professional development (CPD) to ensure and highlight the importance of self-development, especially of ICU staff members is needed.
- The creation of time and the supply of resources needed in ICU areas to implement evidence based guidelines, such as the use of bundles, in improving patients’ safety is important.
- ICU management should employ systems of adequate supervision, follow up, evaluation and written reports of all initiated patient care systems such as implementation of VAPB to prevent VAP.
- The regular review and updates of unit protocols should be implemented by ICU management, since new evidence for best practice are constantly emerging.
- Hospital management should provide financial assistance for the health practitioners, to attend meetings, committee work, and conferences to gain new knowledge related to on-going changes, in terms of nursing practice in the ICUs.
- The health practitioners particularly ICU nurses should take responsibility and accountability, to bring changes in nursing practice in the ICUs.
- Research articles, journals and electronic resources, such as computers and internet should be made accessible in the ICU units for staff members, in order keep themselves updated with the current issues in nursing practice like VAPB.
- Articles on the prevention of VAP should be discussed in the ICU unit meetings, as part of staff education on the improvement of quality patient care.
- Competency tests should be instituted in hospitals and performed annually to encourage ICU staff members to keep themselves updated with the latest issues related to improvement of provision of quality patient care.
5.6.2 Nursing education

The following recommendations are made for nursing education:

- Nurse educators, specialising in ICU nursing, should raise the ICU nursing student’s interest in research, so as to keep themselves updated with current practices.
- ICU training programmes should include compulsory modules on evidence based guidelines for the prevention of VAP.
- Continuing professional development (CPD) programmes must be seriously followed up in ICU settings and colleges, since it has been made compulsory for nurses, so as to motivate them to participate in attending lectures, congresses and other programmes, with the aim to increase their knowledge levels.
- The nursing lecturers and clinical facilitators in CTD should incorporate evidence based measures in nursing, to prevent VAP daily in ICU’s and to use learning opportunities in the ICU units, to raise health topic such as VAPB.

5.6.3 Nursing research

The following recommendations are made for nursing research:

- This study should be replicated to include other hospitals and possibly other provinces in South Africa, to explore the challenges of the ICU nurses experiences on the implementation of VAPB.
- More research should be conducted to test the knowledge levels of the ICU nurses, prior to and after educational programmes, on evidence based guidelines for prevention of VAP, and to assess if the nurses gained knowledge after exposure to educational programmes.
- The protocols used nationally and their inclusion of evidence based guidelines on the prevention of VAP, should be widely studied and reviewed to evaluate the South African hospitals context, to the adherence of the VAPB guidelines.
• ICU units in South Africa are fundamentally different from that of developed countries; therefore it is essential that clinical studies be conducted within the South African population, to develop evidence based guidelines, for the prevention of VAP using VAPB in this country.

5.7 CONCLUSION

This final chapter discussed the findings, limitations, and recommendations of this research study. The findings provide a feedback to the intensive care nurses, managers of critical care units and the hospitals, as well as the Infection Prevention and Control teams, regarding the implementation of ventilator associated pneumonia bundle (VAPB) to prevent ventilator associated pneumonia (VAP). VAP prevention is a patient safety strategy which is needed in all the different intensive care units. It is one of the critical domains, as a vital measure among the National Core Standards of the Department of Health, and is monitored by the Office of Health Standard Compliance in South Africa.

This study was successful in achieving its aim and objectives, as well as in using the research protocol, and completing the research process effectively. Suggestions to the selected institution to re-implement the guidelines and to measure the VAP and VAPB implementation compliance rates utilising the strategies is encouraged, for better patient outcomes of mechanically ventilated patients. Further research is also required, particularly in other hospitals in South Africa on the experiences of ICU nurses and the use of ventilator bundle in clinical practice.
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