



**Arab American University  
Faculty of Graduate Studies**

**Critical Care Nurse's Knowledge and Adherence to  
Evidence-Base Guidelines for Prevention of Ventilator  
Associated Pneumonia in Palestine Hospitals.**

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**This thesis was submitted in partial fulfillment of the  
requirements for the Master`s degree in critical care  
Nursing**

**October/2022**

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# "Approval Form"

**Thesis Title**

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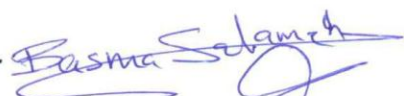
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This thesis was submitted in partial fulfillment of the requirements for the Master's degree in critical care Nursing

October/2022

## **Declaration**

I certify that, unless otherwise noted, the thesis I submitted for my master's degree in intensive care nursing at the Arab American University is the product of my own research, and that this work (or any portion of it) has not previously been submitted to another university for a higher degree.

**Signature:** *Ismael A. AL-Nawaja'a*

**Date:** *August 11, 2022*

### ***Dedication***

I dedicate this work to my father and mother, whom God has blessed them with recovery after being infected with the Covid 19 virus, especially my father, whose injury was severe, who entered the intensive care unit, and overcame it with his strength and will, as well as by the grace of God.

To my beautiful family, which is the source of love.

To my dear friends from the medical field in hospitals who are on the job, who are doing the impossible to save a person's life, and to all those who helped me to accomplish this work.

For those who are always in my heart and who give me strength to continue my path of success.

To all the martyrs and injuries in Palestine, and to all the stationed cities of Palestine, from the city of Jenin Al-Qassam to the city of Gaza Hashem.

And finally, to everyone who helped me finish this work.

***Ismael A. AL-Nawaja'a***

### *Acknowledgments*

First and foremost, I want to thank Allah. He was, is, and always will be the most important source of support and direction. Through numerous disappointments, His assistance kept me going, and when my frustrations tended to lead me astray, His direction helped me get back on track.

I want to appreciate unique folks who always gave me everything I needed or asked for. They always found the time, no matter what the work was or how busy they were. These appreciations are sent to my parents, who provided the most assistance in making this effort a success.

I'd like also to thank Arab American University represented by Dr. Ali Zaiden.

Special thanks for Dean of the College of Graduate Studies Dr. Nouar Qutob, the great leader. And I'd like to extend my sincere gratitude to the thesis' advisor, Dr. Bassma Salameh, for her efforts and support during the writing of this thesis. Her expertise and unending assistance were a terrific asset from which I gained a lot of knowledge. She expressed great enthusiasm for the thesis, which encouraged me to keep working hard.

Next, I'd like to thanks Dr. Stijn Blot from the University of Queensland, Australia, and Dr. Auxillia Madhuvu from Monash University, Australia, for their efforts to help me and give me their experiences in their research similar to the thesis and allow me to use their questionnaires in the thesis and develop it.

It is challenging to list everyone who contributed to the creation of this thesis by name. Nevertheless, despite how simple it may have been, I appreciate their assistance.

Finally, I owe a huge debt of gratitude to my coworkers and friends for helping me get through college and making those years the happiest of my life.

## Abstract

**Background:** Ventilator associated pneumonia (VAP) is a common complication for patients who connected on mechanical ventilator (MV) in the intensive care units (ICUs), approximately 90% of pneumonia developed on ICU was observed on patient who connected by MV, those who have been intubated for more than 24 hours are at a 6 to 21 times higher risk of getting VAP than patients who have only been on mechanical ventilation for a short period of time. For that, the aim of current study to assess critical care nurses' knowledge and adherence to evidence base guidelines (EBGs) for prevent the occurrence of VAP.

**Methodology:** The study was applied in all Palestinian governmental ICUs in 2022, quantitative data was collected using self-questionnaire completed by the participant nurses (n=213) were selected from 13 hospitals (all governmental ICUs) with a response rate 84.9%. Descriptive and inferential statistic were used to assess ICU nurse's knowledge and adherence to the EBGs for prevention VAP.

**Result:** The study results revealed that ICU nurses' mean knowledge scores according to all hospitals was (50.8%). Overall, our findings demonstrate that nurses' knowledge of VAP guidelines is average, and there was a significant difference ( $p$ -value = 0.049) in the knowledge level of respondents based on qualification. The study found that nurses' adherence to evidence-based guidelines was an acceptable (mean = 8.3, 69.2%) and no substantial differences in adherence level were found based on respondent's characteristics. Moreover, the coefficient of determination ( $R^2$ ) value of 0.03 suggests that the variation in the mean adherence scores is 3% explained by the knowledge level.

**Conclusion:**

ICU nurses have average knowledge to EBGs for prevention VAP and acceptable level of adherence to evidence-based guidelines.

**Key words:** VAP, ICUs, Knowledge, Adherence, EBGs.

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## List of Abbreviations

**HAP:** hospital acquired pneumonia

**CDC:** Centers for Disease Control and Prevention

**VAE:** ventilator associated event

**VAP:** ventilator associated pneumonia

**MV:** mechanical ventilator

**ICU:** intensive care unit

**LOS:** length of stay

**WBCs:** white blood cell's

**°C:** Celsius

**EBGs:** evidence base guidelines

**ARDS:** respiratory distress syndrome

**HAI:** hospital acquired infection

**HCWs:** health care workers

**PMH:** Palestinian Ministry of Health

**PMC:** Palestine Medical Complex

## **Chapter One: Introduction**

### **1.1 Background of the Study**

Hospital acquired pneumonia (HAP) develops from the hospital environment, which is one of the important health problems in the world, although it can be avoided and preventing it. Annually, 1.7 million patients are infected with HAP related to health care, and according to data from the United States Center for Disease Prevention and Control(CDC), more than 98,000 of these patients die(Aysegul et al., 2020).

Endotracheal intubation and invasive mechanical ventilation are life-saving procedures for critical ill patients in intensive care unit (ICU)(Al-Sayaghi, 2021), ventilator associated event (VAE) an umbrella term related to “a group of cases, which lead to significant and persistent deteriorated patient oxygenation, these include infectious conditions such as ventilator-associated pneumonia (VAP) and sepsis, and non-infectious cases such as barotrauma, pulmonary edema, pulmonary embolism, and acute respiratory distress syndrome”(Aslam et al., 2016).

While ventilator associated pneumonia (VAP) a subgroup of nosocomial pneumonia, is “a complication contagious pneumonia among patients in intensive care units who were treated with mechanical ventilation for 48 hours or more, with no prior signs or symptoms of lower respiratory tract infection prior to intubation and treated with mechanical ventilation (MV). Thus, resulting in a significant increase in hospital costs and length of stay for patients”(Fattah & Mohammed, n.d.).

VAP occurs in 28 % of patients who received on MV, as the rate of occurrence varies according to the MV period (Rao & Cheema, 2019), the rate of VAE occurrence varies according to the type of intensive care unit that ranges from 5.8 to 16.0 events per 1000

mechanical ventilation days with Less percentage in heart units, medical units and higher in trauma patients(Madhuvu et al., 2020).

VAP is a common complication for patients who connected on MV in the ICUs, as the incidence rate of VAP infection ranges between 9-67%, while the mortality rate ranges between 13-94%, and these rates are considered very high. Approximately 90% of pneumonia developed on ICU was observed on patient who connected by MV, the incidence rate of VAP increase for patients who are intubated from 6 to 21 compared to other patients, as it increases as the patient's ventilation period increases on the MV (Aysegul et al., 2020; Özen & Armutçu, 2018).

VAP development risk factors can be differentiate as preventable risk factors and this is (oral hygiene, supine position, inadequate subglottic aspiration, enteral nutrition) or non-preventable risk factors as (gender, age, underlying disorder). Controlling avoidable risk factors can significantly reduce VAP development than managing the disease itself, study had reported that the incidence of VAP is reduced by adherence and knowledge related to evidence base guidelines(EBGs) for prevention VAP(Aysegul et al., 2020).

Intensive care nurses play a major role in reducing the incidence of VAP, by practicing working with patients connected to the ventilator on scientific bases based on the evidence base guideline to prevent the occurrence of VAP, and accordingly, nursing practices must be monitored with patients placed on a endotracheal tube, which reduces the complications of infection, reduces the patient's stay in the hospital, and thus reduces the cost of available treatment(Aysegul et al., 2020; Yapa, 2015).

The American Thoracic Society, the Center for Disease Control and Prevention, and the Institute for Health Care Improvement published EBGs for the prevention of VAP in order to improve the quality of care, but it is still unclear whether nurses follow these

recommendations. Additionally, it is unclear to what extent nurses' compliance affects the rate of VAP (Aloush, 2018).

Preventing the occurrence of VAP will positively affect the patient's treatment plan, whether on the cost of hospitalization or the duration of treatment, and thus provide safety for the patient, diagnostic criteria for VAP include developed of infiltration on chest X-ray that is associated with at least two signs of the following: increase of body temperature  $>38^{\circ}\text{C}$ , increase white blood cells (WBCs)  $>12\,000/\text{mL}^3$ , decrease WBCs  $<4000/\text{mL}^3$ , purulent pulmonary secretion, and increase in minimal fraction of inspired oxygen to  $>10\%$  (Aloush, 2018).

## **1.2 Problem Statement**

VAP is a common complication for patients who connected on MV in the ICUs, as the incidence rate of VAP infection ranges between 9-67%, while the mortality rate ranges between 13-94%, and these rates are considered very high, approximately 90% of pneumonia developed on ICU was observed on patient who connected by MV (Aysegül et al., 2020; Özen & Armutçu, 2018).

To decrease the likelihood of MV complications, the Institute for Healthcare Improvement (2012) and Respiratory Care (2019) suggested using the ventilation bundle (Kallet, 2019; Madhuvu et al., 2020). Previous research has found that critical care nurses' awareness of EBGs for preventing VAP in the ICU is lacking (Aloush, 2018).

A study published by (Elliott et al., 2015) aimed to assess VAP incidence for patients on MV and after physician assessment and found rates from 25.9% to 26.7% per one thousand ventilators, this study result same to those reported worldwide that VAP is

most common health care giver infection (Acun, 2021; Madhuvu et al., 2020). A quasi-experimental, retrospective study conducted by (Branco et al., 2020) to evaluate nursing adherence to the VAP prevention bundle and the incidence rate before and after continuing education in adult ICU of a large hospital in Porto Alegre/RS, Brazil, this study showed decrease incidence rate for VAP after education (Incidence density was 7.99 for 4.28 infections/1000 ventilators per day) compare by incidence rate before education, and the evidence guideline application and education made increase adherence and decrease VAE.

Also previous research studies found that VAP causes prolong period to use mechanical ventilators, more use of antimicrobial, increase mortality risk, and increase in cost during of hospitalization (Abdulrahman et al., 2022; Alkhazali et al., 2021).

Moreover, (Peña-López et al., 2018) scientific research emphasized the need to use the EBGs to reduce the incidence of VAP for patients receive MVs, and Scientific Journal respiratory care (2019) recommended to use of the ventilation bundle to reduce the risk of MV complications.

In addition to the lack of scientific research on this subject in Palestine, and due to the large number of patients in intensive care units who received on mechanical ventilator related to respiratory disease.

### **1.3 Significance of the Study**

The significance of this study is determining and assessing the extent to which ICU nurses use the EBGs in working with patients who under MV, to decrease the incidence of VAP, which VAP makes the patient stay longer on the ventilator and puts his life at greater risk. Also, the results of the study will give an impression of the work of nurses

in the ICUs, which will help in increasing their awareness, knowledge and adhere to EBGs for prevent VAP later through recommendations that will be attached to the study.

The study also shows the extent of nurse's knowledge of the evidence base guideline that limits the incidence of VAP which clearly negatively affects patients and their lives, and also reflects the importance of continuing education in hospitals and its impact on ICUs nurses.

And the importance of this study lies in knowing whether the level of the scientific degree in nursing affects the extent to which adhere the evidence base guideline and positive outcome for patients in the intensive care unit.

According to the results of this research study, recommendations were attached to the hospitals that were included in the research to raise the cognitive efficiency of the evidence base to prevent the occurrence of VAP for their nursing staff, which reduces the resources used in treatment and obtains a treatment period with fewer complications for the patient.

#### **1.4 Research Aim**

The study main aim to assess critical care nurses' adherence of EBGs to prevent the occurrence of VAP for patients on MV during treatment plan, in addition, this study further assesses intensive care nurse's knowledge regarding ventilator association pneumonia, in Palestine governmental hospitals.

### **1.5 Research Objectives**

The study aimed to:

1. Determine the relationship between ICUs nurses' sociodemographic characteristics and adherence to EBGs for prevent VAP.
2. Determine the association between critical care nurses' sociodemographic characteristics and knowledge regarding EBGs for prevent VAP.

### **1.6 Research Question**

1. What is the level of knowledge of EBGs to prevent VAP among critical care nurses?
2. What is the critical care nurses' level of adherence to the EBGs for prevent occur VAP?
3. What is the deference's between ICU nurses' sociodemographic characteristics and adherence to EBGs to prevent VAP?
4. What is the deference's between ICU nurses' sociodemographic characteristics and knowledge regarding EBGs to prevent VAP?
5. What are the predictors of knowledge regarding EBGs to prevent VAP among critical care nurses in Palestine?
6. What are the predictors of adherence to EBGs to prevent VAP among critical care nurses in Palestine?

### **1.7 Conceptual Definition**

VAE: an umbrella term related to “a group of cases, which lead to significant and persistent deteriorated patient oxygenation (CDCP, 2018). These include infectious conditions such as ventilator-associated pneumonia (VAP) and sepsis, and non-

infectious cases such as barotrauma, pulmonary edema, pulmonary embolism, and acute respiratory distress syndrome”(Madhuvu et al., 2020).

VAP: a subgroup of nosocomial pneumonia, is “a complication contagious pneumonia among patients in intensive care units who were treated with mechanical ventilation for 48 hours or more, with no prior signs or symptoms of lower respiratory tract infection prior to intubation and treated with mechanical ventilation. Thus, resulting in a significant increase in hospital costs and length of stay (LOS) for patients”(Özen & Armutçu, 2018; Wami et al., 2018).

Evidence base-guideline: a set of globally agreed measures used to lessen the incidence of VAP in patients who are receive on ventilators. To decrease the likelihood of mechanical ventilation complication, the Institute for Health Care Improvement suggested using a ventilation bundle for intubated patients(Aslam et al., 2016).

Knowledge: Oxford dictionary defined Knowledge as the information, understanding, and skill earned through education and experience, in this instance knowledge pertaining to evidence base guideline for VAP prevention (2010:827).

MV: It is a machine that works on the principle of work of the lungs by introducing air loaded with oxygen and excreting it loaded with carbon dioxide, where it is used when the work of the lungs fails, for several reasons, including: to open the airway, enter a concentrated amount of oxygen, and excrete the accumulated carbon dioxide. This comes in the case of respiratory diseases or neurological diseases that led to respiratory dysfunction(Walter, 2021).

Adherence: "the fact of behaving according to a particular rule, etc., or of following a particular set of beliefs, or a fixed way of doing something"(Oxford dictionary).

## 1.8 Operational Definition

VAP: the occurrence of respiratory infection on patient who received on mechanical ventilator after more than 24 hours from intubation, and it diagnostic by chest x-ray show lung infiltration is associated by at least two signs of flowing(Aloush, 2018):

1. increase of body temperature  $>38^{\circ}\text{C}$
2. increase WBCs  $>12\ 000/\text{mL}^3$
3. decrease WBCs  $<4000/\text{mL}^3$
4. purulent pulmonary secretion
5. increase in minimal fraction of inspired oxygen to  $>10\%$ .

MV: is a device that performs the function of breathing when a person is unable to do so on their own, and this come by giving positive pressure of air containing oxygen through endotracheal tube to lung, many parameters on ventilator screen to control breath quality delivered to patient (Dries & Marini, 2019).

Evidence base guideline: the practice roles approved by CDC and other infection control central , it should be taken during working with patient who received on MV to decrease incidence of VAP during treatment period (Aysegul et al., 2020).

Knowledge: the extent of nurses' scientific knowledge and theories of the evidence base guideline for VAP prevention recommended by the CDC and the Global Infection Control Centers (Bankanie et al., 2021) , that is include ten multiple choice question to evaluated it(Blot et al., 2007).

Adherence: extent of work by intensive care nurses based on the recommended evidence base guideline for preventing VAP in patients connected on MV (Jahansfat et al., 2016), that is include ten items based on three point (1=Done completely , 2=Not done completely and accurately, 3= not done)(Blot et al., 2007).

## **Chapter Two: Literature Review**

### **2.1 Introduction**

This chapter presents a summary of the available research on the adherence and knowledge of intensive care nurses to EBGs to decrease the incidence rate of VAP. and the researcher chose to expand the scope of the literary study to include other additional nations to enable the researcher to collect the latest data on this topic, moreover, literary research revealed that adherence and knowledge about intensive care nurses in the EBGs is an important and developmental issue in the mentioned countries.

During the review, the review presents the results of previous studies on the extent to which nurses know and adhere to the EBGs to prevent occur VAP, and the goal of the review is the current view of the extent to which nurses are adherence by the EBGs in ICUs with regard to decrease the incidence rate of VAP.

The evaluation of the literature examined the roles of nurses in ICUs to decrease the incidence rate of VAP, and the effect of negative and positive attitudes towards the occurrence of VAP and its relationship to the percentage of adherence to using the EBGs to prevent its occurrence was examined. As well as studying the extent of nurses' awareness of the EBGs recommended by the CDC and infection control centers.

### **2.2 Literature Review**

The topic was studying the extent to which critical care nurses adhere to the guidelines to reduce events associated with the use of ventilators, the most important of which is the VAP, among nurses in Palestine governmental hospitals.

In order to conduct a literature study, the research identified the incidence rate of VAP as well as key terminology and variables related to understanding and adherence to EBGs for prevention of VAP. A literature review was conducted using electronic databases like PubMed and Google Scholar to find pertinent publications and journals.

### **2.2.1 Research Topic Definition**

The term "ventilator associated incident" refers to a category of cases in which there is a severe drop in oxygenation (CDCP, 2018). It can be caused by Infectious illnesses like VAP and sepsis are among them, as are non-communicable diseases such as: "barotrauma, pulmonary edema, pulmonary embolism, and acute respiratory distress syndrome" (CDCP, 2018).

Ventilator associated pneumonia is a term describe pneumonia that occurs when the ventilator is used for more than 48 hours and without initial symptoms and signs that indicate pneumonia in the patient prior to initiation of ventilation, which increases the patient's stay in the hospital and thus increases hospital costs (Wami et al., 2018).

In the critical care units the incidence of VAP is between 25 to 42%, and considered the second largest infection, also, the incidence of VAP increases in patients who use endotracheal tube with an increase in the duration of their stay on the mechanical ventilator, among ventilated patients, the incidence of VAP in other study is 22.8%, this is common among patients with nosocomial pneumonia as 86% of them require ventilatory assistant (Ferreira et al., 2016; Papazian et al., 2020).

A bundle of care is a set of evidence-based clinical practices, structured guideline aimed at improving patient health care outcomes by enabling and supporting changes in patient care and encouraging adherence to standards(Papazian et al., 2020).

### **2.3 Pathophysiology of VAP**

There are few proposed mechanisms for the development of pneumonia associated with MVs, the most common of which is believed to be a development of the colonization of the upper airway, leading to the colonization of the trachea, then bronchitis, and pneumonia. This is depending on both the natural host defenses (mechanical, humoral, and cellular immunological components), and the quantity, variety, and pathogenicity of the bacteria. Mechanical defenses, such as ciliary movement and mucus secretion, can be changed in a patient under intubation. The artificial airway is prohibited from gag reflex and crescent functions and provides a pillar for the growth of the delicate biological membrane that acts as a cabinet for pathogens. This bio membrane can be removed and delivered to the lower respiratory system through mechanical suction or high-pressure air flow, which leads to pneumonia in a sensitive host. Hyperactive bacteria can be secondary for proton pump inhibitors and type 2 antihistamines to prevent stress ulcers, which deviates the acidity of the stomach and enhances the colonization of the upper digestive system. In a weak patient who suffers from a potentially depressed mental condition (perhaps secondary for anesthesia), and increases the risk of aspiration(Kallet, 2015; Santos et al., 2019).

in general, pneumonia is developed from microorganisms penetrating alveoli and causes inflammatory process leading to infiltration lung during inflammatory mediators is produced, during that part of cycle can be developed pleural effusion and respiratory distress syndrome (ARDS), and that can be lead to death (Santos et al., 2019).

## **2.4 Literature Related to VAP, Nurse's Knowledge and Adherence to Ebg's for Prevention VAP**

A cross section study conducted to evaluate EBGs knowledge among intensive care nurses, data was collected during the Flemish Society for Critical Care Nurses' annual congress, 638 questionnaires were collected, with a response rate of 74.6%. The results showed that 19% of respondents recognized the oral route as the recommended method for intubation, the closed suction system was identified as recommended by 17% of the participants, 20% knew that it should be changed for each new patient, 60% and 49% respectively, the subglottic drainage was recognized and kinetic beds. However, only 13% of participants knew that it was advisable to change the humidifier on a weekly basis. 49% of respondents said that ventilator circuits should change for a new patient, it is well known that the semi-recumbent position prevents VAP (90%). The average level of knowledge was higher among the most experienced nurses (more than one year of experience) and those with a special degree in emergency and intensive care (Blot et al., 2007).

A mixed method study was conducted to evaluate nurses and infection control preventionists knowledge, practices, and adherence of VAP bundles of care in the ICU. Data was collected from 60 participants (56 ICU nurses and 4 infection control preventionists), the study found that mean knowledge score related to specific VAP bundles was 5 (range 3-8), adherence to EBGs for prevention VAP result range from 38.5 to 100%, with excellent compliance to head of bed elevation, and poorest compliance for readiness extubate. Also, the study showed VAP median guideline adherence was 84.6% and lack in knowledge regarding guideline bundle of VAP prevention. The study recommended the necessity of having training courses for nurses

in intensive care departments to reduce of VAP, which would enhance their abilities in dealing with patients connected to ventilators(Abad et al., 2021).

A descriptive study was published in three hospitals in Northern California to measure nurses' awareness of adherence to VAP guideline bundle interventions for mouth hygiene, elevated head bed, spontaneous breathing trial, sedation vacation, proton pump inhibitor, and prevention of deep vein thrombosis, and a 57 points questionnaire was adopted to collect data on the step to which VAP guideline interventions were performed by intensive nurses, data were composed from ICU with sample size 28, all but one nurse reported the implementation of VAP package interventions in agreement with hospital policy, and the self-reported nurses' perception of compliance with VAP guideline interventions was measured to have been fulfilled for 68% of the sample population, understanding VAP nurses and perceiving the scope of the VAP bundle between 63-85%, nearly 70 % and 80 % of the participants reported that 'yes' to raise the bed of the bed and daily anesthesia vacations, respectively, and the interventions that had the lowest number of participants` yes' were mouth care in chlorhexidine and the prevention of peptic ulcers, and it was. Mouth care, the only intervention in which 100 % of the population sample was reported about 'OK' or 'strongly OK' that implementation will help prevent VAP, the participants in the anesthesia leave most of the time answered 80-99 % of the questionnaire elements, through all six interventions reported 95 % Of the average participants that they are 'corresponding' or 'strongly agreed' that the hospital's intervention policy / guidelines/guidelines were clear and specific. Three different participants reported their "lack of agreement" regarding the care of mouth in chlorhexidine, daily anesthesia leaves, and prevention of peptic ulcers(Luna, 2015).

Another study conducted in Jourdan to evaluate Jordanian nurses' adherence to EBGs for prevention VAP, 260 questionnaire were distributed and 224 were retained with response rate 86% , 16 questionnaire from 224 were incomplete, total 208 participants main age was  $27.7 \pm 4.5$  years , female distributed 58.2% from participants, experience was  $4.8 \pm 3.8$  years of work and  $3.3 \pm 3.4$  years in ICUs working, participants' score of VAP care knowledge was 43% and their mean score of EBGs adherence was 81.3% , the item with the highest rate of adherence was the one for infection control measures, which received higher scores when scores were compared between items "Adequate hand hygiene between patients" 94.2% followed by "Semi recumbent positioning of the patient (30-45 degrees)" 92.3% and "Used catheter and gloves are disposed of in a manner that prevents contamination from secretions" 91.8%. On the other hand, the suctioning process-related items received the lowest scores. The item with the lowest adherence rate was "Two nurses perform suctioning" 57.7% preceded by "Continuous subglottic suctioning" 61.5% and "Sodium chloride instillation" 63%, the correlation between total level of knowledge and adherence to EBGs for prevent VAP is concerning because it suggests that nurses who are more familiar with VAP care bundles are more likely to follow VAP guidelines. This supports Sedwick et al. 2's earlier finding that nurses can significantly improve patients' outcomes by utilizing VAP evidence-based practice, which is advised to be carried out during the implementation of clinical practice guidelines with ongoing education after implementation (Darawad et al., 2018).

A cross sectional study conducted in Tanzania at 2021 amid to evaluate ICU nurses' knowledge, adherence and barriers to EBGs for VAP prevention, among 116 ICU nurses in main hospitals in Tanzania. The result showed that the average degree of

knowledge It was 3.86 (SD = 1.56), based on ten questions, or 38.6% of the total. The performance of nurses with a degree or higher in nursing teaching was suggestively better than that of nurses with a diploma or less ( $p = 0.004$ ). Based on 25 questions, the average self-reported adherence score for EBGs to prevent occur VAP was 15.20 (SD = 0.93), or 60.8%. Taking into account the severity and impact of VAP and the higher risk of hospital-acquired injuries (HAI) in nations with limited resources, such as Tanzania, the main barriers to the implementation of e-assistance plans for the prevention of VAP were a lack of skills (96.6%), a lack of adequate staff (95.5%), and a lack of knowledge (79.3%), a low level of knowledge and adherence means the need for continuous educational interventions and evaluation of the implementation of EBGs for VAP prevention by considering the context Local(Bankanie et al., 2021).

Another study published in Mumbai in 2018 amid to assess the awareness of EBGs for the prevention of VAP among intensive nurses. Data was gathered using a standardized, self-administered questionnaire with two components, participants were chosen using non-probability convenient sampling, and an over-all of 150 nurses who were actively providing health care for patients on mechanical ventilation were chosen as participants. The first section of the questionnaire contained demographic characteristics, and the second part contained evidence-based VAP prevention guidelines, 72% of the participants were females when the data were examined using descriptive statistical analysis and inferential analysis in SPSS version 17, age of participants ranged from 25 to 29 years old on average, with a majority of 36% having more than 5 years of experience and 26% having 1-3 years. Of the nurses, 51.3% had nursing diplomas, while 43.3% had degrees. Despite the fact that 44.3% of nurses participated in ICU training sessions held in hospitals, 56.7% of them did not, the knowledge of nurses was

found to have a mean of 24.75+21.35, demonstrating that the common of nurses had poor knowledge of VAP preventive guidelines. Knowledge and nursing practices are crucial to reducing the incidence of VAP, to keep the nurses up to date with EBGs, a research advised that every hospital implement a regular continuous education program(Fernandes et al., 2018).

On the other hand, a cross section study was done in Australia aimed to evaluate critical care nurse's knowledge and adherence to EBGs for the prevention of VAE, 294 online questionnaires were collected with response rate 27.3%. The majority experience in ICU work above 10 years with 39% from participants, post graduate qualification was done from 213 participants, the average knowledge rating was a 6/10. (IQR: 5-7). Giving oral care to patients on mechanical ventilation had the highest adherence level (n = 259, 90.9%) and placing the patient in a semi-fowlers position (n = 241, 84.6%). There was no association between individuals' total score and the number of years they had worked as intensive care nurses ( $p = 0.674$ ), however, there was a strong positive link between their overall knowledge score and having completed a postgraduate degree. The median self-reported adherence was 8/10 (IQR: 6-8), however, Participants' knowledge and adherence to recommendations based on evidence did not correlate  $P = 0.144$  (Madhuvu et al., 2020).

Additionally, a study was carried out utilizing Knowles' adult learning theory to assess nurses' comprehension of VAE/VAP. A questionnaire measuring VAP knowledge was sent to 58 ICU nurses as part of the trial to see if an educational intervention would improve the nurses' grasp of the evidence-based intervention. The results of this study could be used to direct the implementation of a learning intervention based on EBGs to raise the standard and security of ventilated patients. In comparison to nurses'

knowledge prior to education ( $M = 9.55$ ,  $SD = .976$ ), the results demonstrated that nurses' knowledge increased after education ( $M = 11.43$ ,  $SD = .775$ ). Because it would shorten hospital stays, preventing VAEs and VAP among patients would benefit social change(Sanders-thompson, 2019).

A study was published in 2020, was aimed to assess the understanding and application of EBGs for the prevent occurrence of VAP among ICU nurses, it distributed the departments of medical ICU, surgical ICU, and thoracic ICU of one university and two learning and research hospitals in Izmir, Turkey, 102 ICU nurses was complete the questionnaire which contain three section: Identification Form for intensive nurses, evidence based practices for preventing VAP, and nursing practices questionnaire, face to face meetings were used to gather the data, and the most widely accepted practices for preventing VAP were choosing the orotracheal intubation technique (87.3%) and using heat-moisture exchangers to regulate humidity (84.3%) , the most widely followed suggestions were hand hygiene (98.0%), insufficient awareness of the usage of kinetic beds (51.0%) and endotracheal tubes with an extra lumen for aspiration of subglottic secretions (52.9%) was discovered by the study's ICU nurses. The least common recommendations were getting vaccinated for seasonal influenza (57.8%), using heat-moisture exchangers (100.0%), and maintaining the head height of the patients at 30-45 degrees (98.0%) when there is no contraindication, using extra-lumen endotracheal tubes to aspirate subglottic secretions and receiving seasonal influenza vaccinations to avoid VAP(Aysegul et al., 2020).

In a different study in 2020, aimed to evaluated ICU nurses' knowledge and use of the ventilator care guideline for avoiding ventilator-associated pneumonia over the course of 11 months, from November 2018 to September 2019. This cross-section study was

carried out in four tertiary care hospitals in Lahore. A sample of 136 nurses who met the inclusion and exclusion criteria was chosen, the participants' knowledge was rated as Excellent = 81-100%, Good = 61-80%, Average = 41-60%, and Poor = 40% based on the scoring system. The ventilator bundle practice was rated as having satisfactory 80% skills (used by Raulin D. Feria), the study's findings showed that nurses only know about 37.5% of the ventilator bundle on average, Based on the results of this study, it was determined that the ICU nurses of the sample tertiary care hospitals in Lahore had inadequate knowledge of the ventilator bundle since their mean practice score was 60.8%, which is also unsatisfactory by the criteria, although Corrective measures at an appropriate level are strongly advised since their use of the bundle does not meet the required standards(Aziz et al., 2020).

The quasi-experimental study's objective was to ascertain how employing the care package might affect VAP rates. There were three steps in this study's protocol. In the first, it was determined if the ICU nurses followed the VAP care bundle by making observations. ICU nurses received training on the subject in the second session. The median length of the patient's stay in the intensive care unit was 21.5 days, and there were 57.0% (n = 73) men and 43.0% (n = 55) women among the 128 patients in the third phase, the impact of VAP care bundle adherence on the VAP rates after education was provided. The mean patient age was 58.27 20.67 years in this phase (the minimum patient age was 18 years, and the maximum patient age was 93 years). The VAP rates following the education period were found to be significantly lower than the VAP rates prior to education, and the nurses' adherence to the VAP care bundle increased from 10.8% (n = 152) to 89.8% (n = 1,324) after education, a statistically significant increase (P =.0001 and P.05.) Reduced VAP rates were achieved by implementing a VAP care

bundle with education developed in accordance with evidence-based recommendations. In this study, it was discovered that the VAP rates were 15.91/103 ventilator days prior to education and 8.50/103 ventilator days after education. Therefore, it is suggested to use the VAP care bundle when caring for patients who are mechanically ventilated (Okğün Alcan et al., 2016).

The study was conducted by the King Abdullah University Hospital and the Islamic Hospital, both of which are located in the middle of Jordan. It assessed nurses' knowledge of and adherence to EBGs for preventing VAP. 193 registered nurses who worked either day or night shifts in the ICU departments of the hospitals participated in the study. The study included nurses working in ICUs with at least one year of experience, who were willing to participate, and who had a bachelor's degree; trainees and nurses with a diploma in nursing were excluded. Of these, 132 nurses worked in the first hospital's ICU units and 61 nurses in the second hospital's ICU. Based on current EBGs of VAP prophylaxis, the three-part questionnaire that the researchers utilized to gather the data for this study had three parts. The eight questions in the first section of the study covered the demographic data about the study participants. The questionnaire's second phase had 30 questions with two possible answers; the true option was represented by the number 1, while the false option was represented by the number 0. Eight negative assertions (items 4, 7, 9, 11, 17, 19, and 23) were documented in order to calculate the percentage of accurate responses. In order to determine the barriers to the adoption of VAP preventive techniques, the final section of the survey contained eight questions with "Always/ Sometimes/Never" response options. The study's findings revealed that nurses' overall mean awareness of VAP was low. According to Jordanian critical care nurses, the main barriers to providing effective

infection control were a lack of equipment (64.9%), forgetting to perform sterile techniques (54.1%), and a lack of time (53.1%). In comparison to other groups, nurses with a master's degree and a lot of experience had noticeably superior knowledge of VAP prevention. Therefore, it is essential to have sufficient understanding on VAP prevention to enhance patient care results. The results of this study showed that innovative methods were required to improve critical care nurses' knowledge and remove their barriers to VAP prevention(Alkhazali et al., 2021).

According to a 2016 study designed to examine the degree to which paramedical staff adhere to the CDC's bundle for the prevention of VAP, nearly 64% of nurses in adult critical care areas in various tertiary care hospitals in Karachi were unaware of the prevalence of the condition in their setting. In contrast, 79% of nurses complied with exhausting gloves, while 47.5% reported hand washing. Only 24% perform oral sectioning every two hours, 22.5% perform oral swabs every two hours, and 34.5% perform mouth brushing. The majority of them, 64%, prefer mouthwash to clean their teeth, however most of them weren't properly utilizing, cleaning, or storing Yankauer's equipment(Aslam et al., 2016).

To determine intensive care nurses' knowledge of preventing VAP, 121 registered nurses were given a self-administered questionnaire, cross-sectional designs, and a quantitative descriptive survey was conducted general ICU Kuala Lumpur Hospital, The questionnaires had adopted with permission and formatted into three sections, first section contains six questions about the demographic data, second section contains four multiple choice items testing the risk factors of VAP and third section had twenty multiple choice items, testing the preventive measures on VAP, Criteria for good knowledge among the nurses should be 80% and above (20-24 scores) and less than

80% (0-19 scores) would constitute poor knowledge, internal consistency reliability had done by using Cronbach Alpha and the result showed 0.739, the mean age of participants is 30 years (SD=6.01), all of the 121 participants in this study are 100% diploma holders, 64 (52.9%) out of the total number of participants have a certificate in Intensive care nursing but 57(47.1%) did not have it, the data shows that 48 (39.7%) of them have worked for more than 7 years and 43(35.5%) have been working for less than 4 years, 30 (24.8%) of them have been working over 4-7 years, the mean amount of years of working experience in nursing is 4 years (SD=3.62), in addition the mean amount of years that the nurses have worked in the critical care was 4 years (SD=3.11), second section data from questionnaire showed that 115 (95%) of participants had correct answer that the common source of bacteria that causes VAP among intubated patients, 104(86%) were respond correctly about a risk factor for VAP that mechanical ventilation can be the risk factor, 94 (77.7%) of the participants knew that the development of a VAP in critically ill patients has been demonstrated to result in increased mortality rate, increased period of hospital stay and increased cost of treatment, 36(29.8%) of the respondents are unable to identify that Pseudomonas, patient's age more than 65 years, presence of respiratory failure and mechanical ventilator support as being potential risks for VAP, researcher has classified the knowledge score into 2 levels, the score 80% and above considers the participants to have good knowledge and the score less than 80% considers them to have poor knowledge. (57.9%) of the respondents have reportedly poor knowledge and 51(42.1%) of them has good knowledge. According to the result, it shows that more respondents have poor knowledge than good knowledge (Manap & Jailani, 2019).

However, a study was developed in Australia for investigated the prevention of VAP in four Australian ICUs in a cross-sectional study that included three phases. The main aspects of care that were assessed were: (1) endotracheal suction practice and adherence to standard precautions: (2) frequency of endotracheal suctioning and mouth care. Forty-six nurses were surveyed for the surveys, which included intensive care nurses' assessments of their current practice, observation of the delivery of breathing care, and chart audit. The majority of the nurses said that endotracheal suctioning and oral care should be done "as required" or every two hours. However, during practice observations, no patient established oral care every two hours, nor was this documented. Additionally, inconsistent hand hygiene and standard precautions were observed while providing respiratory care, despite the fact that nurses had good knowledge of managing artificial airways. Gaps were discovered in the provision of oral care, the prevention of oropharyngeal secretion micro-aspiration, and the prevention of respiratory infection-related infections. According to a chart audit, nurses varied in their suctioning frequency, which was in line with the results of the clinical assessment that was recorded(Ciampoli et al., 2020).

A study in 2018 was conducted to evaluate the knowledge and adherence of ICU nurses in Sana'a City, Yemen, in relation to the VAP prevention. 87 Yemeni nurses from different public hospitals made up the study's sample, and the sample size was calculated using EpiCalc 2000. The researcher gave the ICU nurses information letters, consent forms, and questionnaires. For descriptive and inferential statistics, data were veiled and arrived into SPSS version 21. Utilizing a stratified simple random sampling method from four significant public hospitals, the sample size was established. Using an observational checklist to test 50 nurses' practice and 87 nurses' knowledge, the study's

findings revealed that 52% of single men and 54% of male ICU nurses. The average age of nurses (71.3%), with a standard deviation of 28.40 3.9 years, was between 20 and 30 years old. With a mean age standard deviation of 4.70 4.2 years and a working experience range of 1-3 years for more than half (55.2%) of the participants. The knowledge scores and their levels were as follows: Two thirds (65.5%) possessed a diploma. 51.7% of respondents received ICU training classes, whereas 81.6% had no VAP preventive instruction at all. The percentages of (5.7%) between 76% and 100%, (36.8%) between 50% and 75%, and (57.5%) between 0% and 49% are all positive, Poor knowledge, overall level of practice, (52%) of nurses had a bad level, (42%) had a moderate level; and (6% had a good level, significant correlations between knowledge of VAP prevention and level of education and sex (P value=0.001), years of employment (P value=0.37), and years of employment (P value=0.41). (P-value = 0.38), insufficient knowledge, overall level of practice, and (42%) of nurses did not correlate with ICU training. The majority of nurses (74%) performed tracheal suction and oral care while donning gloves and a gown before and after each patient care, and (28%) did so before performing hand disinfection. These practices were statistically associated with ICU training (P-value= 0.03) and years of work experience (P-value= 0.64) but not with educational level (P-value= 0.40). Additionally, (32%) used an antiseptic solution to perform oral care, and (100%) of the ICU, when doing tracheal suction, (42%) employed the sterile approach, (32%) sanitized the suctioning apparatus, and (54%) immediately disposed of the suction catheter following a single, ICU procedure. The nasogastric tube was checked by 54% of nurses, and 36% of nurses followed the protocol for weaning patients from mechanical ventilation, indicating that nurses' knowledge of VAP prevention is lacking. In addition, (88%) of nurses used the kinetic

bed for ventilated patients and (62%) performed respiratory chest physiotherapy. Knowledge did not correlate with ICU training, sex, or years of work experience, but it did significantly correlate with educational attainment. According to statistics, ICU nurses' practices of preventing VAP were related to their ICU training and years of work experience, but not to their educational background (Fattah & Mohammed, n.d.).

A study was created in 2016 to assess health care workers' (HCWs) knowledge, attitudes, and adherence to bundle for VAP prevention and explore the barriers to their implementation in clinical practice. In this quali-quantitative survey, two pediatric cardiac surgery ICUs (PCICUs) contributed 45 HCWs. Participants' knowledge, attitudes, and adherence were assessed using a validated multiple-choice questionnaire, and the study also examined the barriers to the implementation of bundles, among nurse assistants, nurses, and doctors, awareness of HCWs was poor and significantly varied (1.250.95, 4.531.73, and 5.542.01, respectively,  $P=0.001$ ), similarly, attitude of HCWs is negative and significantly different among nurse assistants, nurses, and doctors (respectively, 32.962.42, 34.002.44, and 36.814.35,  $P=0.003$ ), and the adherence of HCWs is poor and different among nurse assistants, nurses, inadequate EBG implementation is linked to many other barriers in addition to these well-known ones, which should be acknowledged and taken into account when designing infection control programs. The healthcare system faces difficult challenges, particularly in pediatric intensive care units, due to the unsatisfactory status of HCWs knowledge, attitude, and adherence (Jahansefat et al., 2016).

A cross-sectional study in a 26-bed adult mixed medical-surgical ICU in Finland combines a quantitative knowledge survey and self-reported adherence with qualitative data collection to assess the knowledge, adherence, and barriers of critical care nurses to

institution-specific ventilator bundles. A pre-validated multiple-choice ventilator bundle questionnaire was administered to all registered nurses who provided direct care (n = 155); the answer rate was 55.5% for 86 people and 47.2% for 15 people. Although respondents who had received in-service training on ventilator bundles had higher knowledge, there was little correlation between knowledge and adherence levels (0.48 [P .001]), Patient positioning, routine oral care using chlorhexidine, and strict hand hygiene were the guidelines that were followed the most frequently. In contrast, respiratory equipment and the management of sedation and analgesia were the guidelines that were followed the least frequently. Most of the barriers to implementing EBGs indicated a need for changes that are outside the control of individual nurses, and self-reported adherence did not correlate with knowledge or experience. Less experienced nurses reported significantly higher adherence than nurses with more ICU experience (29.0 vs 25.0 [P =.034]), patients (e.g., patient discomfort [4.8%] and fear of bad consequences [4.6%], and the environment (e.g., role ambiguities [36.4%])(Jansson et al., 2018).

Between January 1 and March 31, 2019, researchers conducted a study in ICU of a teaching and learning hospital in a major turkish city to assess the effectiveness of VAE prevention bundle practices in ICUs, following a literature review, the general directorate of public health, a division of the ministry of health of the republic of turkey, and the CDC criteria, data collection tools were developed. In the study, bundle general compliance in the ICU attained a compliance percentage of 85% using percentage and the wilcoxon test. The study period included a total of 354 ventilator-days, 38 patients, and all patients connected to the ventilator for at least two days in the relevant ICU between the study dates (Cocoros and Klompas, 2016; Jansson et al., 2017; Guess et al.,

2017; Kerlin et al.), In the study, it was found that infection rates decreased prior to, during, and following the intervention. In addition, it was noteworthy that the study's patient population increased while ventilator days decreased, because VAE prevention bundle methods produced in accordance with evidence-based recommendations were found to lower infection rates, their usage in ICUs is advised (Acun, 2021).

At a study, adult critical care nurses' knowledge, practice, and related factors for the prevention of VAP were assessed in a few hospitals in addis abeba, ethiopia. 129 adult intensive care nurses participated in a cross-sectional and observational study with a self-administered questionnaire and observational checklist; 78 (60.5%) of the participants were female, and 73 (56.6%) had a diploma. Between respondents with ICU training ( $p$  value = 0.04) and those with various educational backgrounds ( $p$  value = 0.021), a substantial knowledge gap was found. The study found that nurses with different levels of experience and those who had received ICU training had significantly different practices ( $p$  value = 0.038 and 0.041, respectively). This demonstrates that the vast majority of nurses working in adult intensive care units were undertrained and inexperienced(Wami et al., 2018).

In 2019, a study was amid to evaluate the awareness and adherence of ICU nurses to the ventilator care bundle in preventing VAP. The study's cross-sectional design used tools such as demographic information, a structured questionnaire, and an observation checklist to gather information from 60 participants working in the ICU. The majority of staff nurses, or 71.7% of them, were between the ages of 21 and 25, 25% of them were between the ages of 26 and 30, and the remaining 3.3% of them were older than 35. The majority of them, or 75% of them, were female and 25% were male. The majority had a B.Sc. in nursing, or 95% of them had that degree, or 1.7% had a GNM

degree, or 3.3% had a post-baccalaureate degree, findings regarding the knowledge of staff nurses regarding the ventilator care bundle revealed that 56.7% of them had excellent knowledge and 43.3% had good knowledge of the package, and findings regarding the compliance of staff nurses regarding the ventilator care bundle revealed a significant correlation between knowledge and compliance of staff nurses regarding the ventilator care bundle, the study's findings demonstrate a highly significant correlation between the group's knowledge and compliance scores, as well as a substantial correlation between knowledge scores and shifts and compliance scores with areas of work and shifts (p value 0.001) (Dumbre, 2019).

An analysis paper published in 2021 that used electronic searching was performed in the databases: Google Scholar, Research Gate, and PubMed to evaluate the effect of the nursing role, applying guidelines, and adherence of health professionals to VAP bundle prevention strategies in an effort to decrease rates of VAP in mechanically ventilated adult patients demonstrated the application of VAP bundle prevention as a daily component of nursing care among ICU nurses(Shudaifat et al., 2021).

## **2.5 Summary**

The literature review indicates the importance of following the rule of guidelines in working with patients connected to ventilators, because it reduces the risk of pneumonia, and indicated that practical experiences in critical care increase nurses' awareness of VAP and increase the effectiveness of applying EBGs. It also showed the importance of continuing education in hospitals to increase knowledge of EBGs for prevent occur VAP, and focused on the positives in reducing the incidence rate of VAP and the consequent decrease in the cost of treatment and safety for patients in hospitals.

## **2.6 Conclusion**

According to the literature review, there is a lack of understanding and adherence to the EBGs used to minimize VAP, which raises the incidence rate of the condition and its risk of severe complications. The study also confirmed the critical role of nursing in this stage and found that continued education and actual experience increase understanding of and adherence to the recommendations for reducing the onset of VAP.

## **Chapter Three: Research Methodology**

### **3.1 Introduction**

An outline of the research methods used in this study is provided in this chapter. It includes the following: research sample, the context of the study, length of the research, data source, criterion for inclusion and exclusion Process of sampling, sample size, and sample, Pilot study, Validity, Reliability, Data collection, Variables (Study measures), Ethical consideration, Analysis plan and Limitation of the study.

### **3.2 Research Design**

A quantitative, descriptive, cross-sectional study was conducted in the ICU nurses at the Palestine governmental hospital to evaluate their understanding of and adherence to EBGs for the prevention of VAP. The researcher was able to synthesize the data collected thanks to the study's design. In order to learn more about ICU nurses' knowledge of and adherence to EBGs for VAP prevention, describe it, and identify EBGs adherence in work by ICU nurses for VAP prevention, the researcher employed the research design. From here the recommendations for future practice.

### **3.3 Population**

The study was distributed to all nurses met the inclusion criteria and works in ICUs Palestinian hospitals. The total ICUs nurses is 251, Data was collected during the months April to June, 2022.

### 3.4 Sample Size

The sample size depended on response rate of nurses working in the ICUs department. Based on Statdisk online sample calculator (<https://www.statdisk.com>) the minimal sample size was 135, according these values:

Confidence level = 95%

P = the decimal representation of the proportion of choices made (0.25 used for sample size needed)

E = margin of error (e.g., 0.05 =  $\pm 5$ )

Population = 251.

### 3.5 Setting of the Study

The study was conducted in general in Palestine (West Bank), where it covered all the intensive care departments of the Palestinian Ministry of Health (PMH) in the south, north and center, where the study was conducted in all government hospitals in the West Bank that include an intensive care department, and they are as follows:

- Martyr Abu Al-Hasan Qassem Hospital / Yatta, has 7 ICU nurses.
- Queen Alia Hospital / Hebron, has 34 ICU nurses.
- Dura Governmental Hospital / Dura, has 12 ICU nurses.
- Beit Jala Governmental Hospital / Bethlehem, has 14 ICU nurses.
- Jericho Governmental Hospital / Jericho, has 12 ICU nurses.
- Palestine Medical Complex (PMC) / Ramallah, has 57 ICU nurses divided in 3 ICUs.
- Rafidia Surgical Hospital / Nablus, has 24 ICU nurses.
- Al-Watani Medical Hospital / Nablus, has 22 ICU nurses.
- Martyr Yasser Arafat Hospital / Salfeet, has 12 ICU nurses.

- Martyr Darwish Nazzal Hospital / Qalqilya, has 10 ICU nurses.
- Martyr Thabet Thabet hospital / Tulkarm, has 18 ICU nurses.
- Turkish Hospital / Tubas, has 15 ICU nurses.
- Martyr Khalil Suleiman Hospital / Jenin, has 14 ICU nurses.

### **3.6 Duration of the Study**

On January 31, 2021, this study received ethical approval. Protocol approval period: 31<sup>th</sup> Jan 2021 to 31<sup>th</sup> Jan 2022. Data was collected in the month of (April to June 2022) as indicated in the proposal and facilitate the task of the researcher.

Data was analyzed in (June 2022). The final thesis was submitted for examination in (August 2022).

### **3.7 Instrumentation**

Data was collected from ICU nurses who work in ICUs nurses using a self-administered questionnaire designed to assess nurse's knowledge and adherence to prevent occurrence of VAP.

The tool used in the research was adopted and edited after permission from (Blot et al., 2007) and (Madhuvu et al., 2020), after obtaining approval for its use, it has been modified and developed to be consistent with the objectives of the research, the origin instrument was designed to assess nurses knowledge and adherence to EBGs for VAP prevention, the compilation of the survey was done through literature review, consultation with supervisor and experts in the field of anesthesiology and specialist in intensive care.

The survey was divided into three sections:

Section one: Demographic and nursing experience which include:

- age
- years of experience
- working in ICU
- working with intubated patients
- qualification type
- current nurse role
- hospital name

Section two: Knowledge of EBGs for Prevention of VAP

The survey consisted of twelve multiple choice questions, contain one correct answer to evaluate nurse's knowledge of EBGs for prevention VAP, two new question was added to this section of survey after adopt and it is: Use of proton pump inhibitor medications, and endotracheal tube cuff pressure measurement.

The level of knowledge was categorized to four components based on their percentage scores based on (Aziz et al., 2020) study : (Excellent = 81-100%, Good = 61-80%, Average = 41-60%, Poor = < 40%).

Section three: Nurses' Adherence to EBGs for Prevention VAP, which contain:

Twelve points related to nurses working, choose the most appropriate answer relevant to practice, also consisted of closed-ended questions based on three answer related practice (Done completely (1), Not done completely and accurately (2), Not done (3)), two new question was added to this section after adopt and it is: Perform sedation vacation daily for sedated mechanically ventilated patients, and assess intubated patients daily if can change from invasive to non-invasive ventilation

The level of adherence was categorized three components based on their percentage scores based on (Al-Sayaghi, 2021) study: total scores < 50% were considered unsafe adherence, scores between the 50-75% were considered acceptable adherence, scores >75% were considered high adherence.

### **3.8 Inclusion Criteria**

The inclusion criteria set for sample selection as follows:

- 1- All Registered nurses who are working in an adult ICUs in Palestinian governmental hospitals.
- 2- All head nurses of intensive care departments in government hospitals.
- 3- ICUs nurses who have experience in ICU more than six months.
- 4- ICUs nurses who worked with intubated patient.

### **3.9 Exclusion Criteria**

The exclusion criteria set for sample selection as follows:

- 1- Student nurses.
- 2- Nurses volunteers.
- 3- Part time nurses.
- 4- Nurses working outside the ICUs.
- 5- ICUs nurses who have experience less than six months.
- 6- Maternity leave
- 7- researchers

### **3.10 Sample and Sampling**

The study included all nurses in intensive care in addition to ICUs heads nurses of departments, as the research sample are all nurses working in ICUs in government hospitals for a period of not less than six months, and those who meet to inclusion criteria, the number of participants in the research depends on the percentage of response rate to participation in the research, all ICUs nurses in governmental hospital is 252 nurses with response rate 84.9% (n=213).

### **3.11 Pilot Study**

Pilot study was conducted on 10 surgical ICU at An-Najah University Hospital, Nablus, and it excluded from study, in order to test the questionnaire in terms of spelling accuracy, ease of filling, and comprehensiveness, and to clarify if there is linguistic ambiguity and its modification, the questionnaire was reviewed by Intensive care specialist and anesthesiologist to verify the strength and accuracy of the questionnaire points and the necessary recommendations were taken from them.

The questionnaire was filled out between 5-10 minutes, and that was good because it is suitable for intensive care nurses who are at work, as the questionnaire will be filled out without hindrances within a short time.

### **3.12 Validity**

After constructing the questionnaire, it was reviewed by five experts, an Anesthesiologist, an Intensive Care Specialist, an two Academic Learning, and Clinical Application Specialist, and their comments were taken into consideration and modified before data collection, and the survey was recommended from the experts.

### **3.13 Reliability**

The questionnaire is a set of comprehensive questions for the guiding evidence base to prevent the occurrence of VAP, and they are facts that must be worked out, as Pilot Study was taken to make spelling adjustments or take notes on incomprehensible questions, and the appropriate time period for filling out the questionnaire was 8-12 minutes, as the questions asked were clear and smooth. Also, before undergoing the Pilot, the questionnaire was presented to experts, while the Pilot study was conducted on 10 nurses from the Surgical ICU at An-Najah University Hospital, Cronbach's Alpha was determined for knowledge section and adherence section, Cronbach's Alpha for knowledge was 0.92 and for adherence was 0.87, in addition, the Questionnaire Assessment (discrimination level) was developed and showed no question removed and result was present in result chapter.

### **3.14 Data Collection**

The questionnaire was distributed and collected from ICU nurses who are working in all governmental hospitals (West bank, Palestine, April to June, 2022), the questionnaire was self-completed by nurses during shifts in researcher presence or when time permits after take approval and permission from MOH and hospitals administration, the integrated questionnaire consisted of three sections:

- i. General characteristics or demographic data; age, qualification, years of ICU experience, and whether the respondent had a special role in ICU.
- ii. Twelve multiple-choice questions testing the nurse's knowledge of EBGs to reduce VAP.

- iii. Twelve questions on a three-point Likert scale that assess nurses' adherence with the VAP guidelines.

### 3.15 Variables (Study Measures)

Dependent variable	Independent variable
Knowledge to the EBGs for prevention VAP	Age
Adherence to the EBGs for prevention VAP	Years of experience in ICUs
	Current Role nurses in ICUs
	Qualification type

### 3.16 Ethical Consideration

Ethical reviewing and approval for this study was taken by the Health Research Ethics Committee of the AAUP, from the Palestinian MOH and of the hospitals administrators where the study conducted, in addition, the confidentiality of the participants was taken such us no name or personal information were presented in this study.

### 3.17 Data Analysis

*SPSS* (Statistical Package for Social Sciences) *v26* software (IBM Corporation, 2019) was used for data analysis. Descriptive statistics, i.e., frequencies, means, medians and interquartile ranges (*IQR*) were used to summarize the survey data, and inferential statistics were used to explore possible relationships and differences between the study variables (Pallant, 2020). Non-parametric tests were used to analyze the association between the general characteristics of nurses and their knowledge score because the data were not normally distributed (Blot et al., 2007; Madhuvu et al., 2020). The link

between the characteristics of nurses (age, years of experience, qualification, and current role in ICU) and their knowledge of and adherence to EBGs was examined using the Kruskal-Wallis test. The strength of the association between the total scores and the characteristics of nurses was forecast using linear regression, statistical significance was defined as a p-value 0.05.(Polit and Beck, 2020).

## Chapter Four: Results

### 4.1 Introduction

The main study goal was to assess critical care nurses' adherence to evidence base guidelines to prevent occur VAP for patients who received on MV during treatment plan about any underlying causes, in addition, this study further was assess intensive care nurse's knowledge regarding ventilated associated pneumonia and how can prevention it, in Palestine governmental hospitals.

### 4.2 Questionnaire Assessment (Discrimination Level)

Tests revising based on their scores is crucial to developing the instruction. So, we computed the difficulty level, discrimination level, and quality of the 4 response options or alternatives on twelve multiple-choice questions that were used to measure nurses' knowledge of evidence-based guidelines for preventing VAP (Haladyna, 1999; Kelley, 1939; Labeau et al., 2007).

- The difficulty level of an item or a question equals the percentage of respondents who answer the question correctly. Possible values range from 0 to 100%.
  - Items with values less than 10% are considered very difficult (i.e., items answered correctly by less than 10% of the respondents).
  - Items with values more than 90% are considered very easy (i.e., items answered correctly by more than 90% of the respondents).
- The item discrimination (*ID*) level indicates of whether an item or a question can distinguish between high and low performers, with 27% of respondents in each

group. The respondents were divided into high performers and low performers. The

*ID* index was computed as follows:

$$ID = \frac{N_H - N_L}{N_H + N_L} \times 100\%, \text{ where}$$

$N_H$  = Number of correct answers in the high performer group,

$N_L$  = Number of correct answers in the low performer group.

- Possible values range from -100% to 100% (values less than 15% are bad, values from 15% to 25% are satisfying/mediocre, values from 25% to 35% are good, and values of 35% or higher are very good).
- The quality of a response alternative equals the percentage of participants who choose the alternative.
  - Possible values range from 0 to 100%. Alternatives with a value of 0 are not attractive, and those with a value of 100% might be very attractive.

Table 1 summarizes item analysis findings. The values for item difficulty and discrimination

were very good to satisfying. From item difficulty analysis it seems that both question 9 (patient positioning; value 77.9%) and question 10 "(use of 0.12% chlorhexidine gluconate antiseptic oral rinse; value 77.0%)" were the easiest questions. Question 11 "(use of proton pump inhibitor medications; value 21.1%)" was the more difficult one. The analysis of item discrimination showed that question 8 "(kinetic vs. standard beds; value 66.7%)" was the best in distinguishing between respondents with high and low performance, while question 1 "(oral vs. nasal route for endotracheal intubation; value 22.7%)" was the worst one. Nevertheless, all these values are acceptable, suggesting no items should be excluded.

In the evaluation of the answer options' quality, none had values of 0.0, suggesting that these options are suitable and no reformulation should be considered. Overall, the standard response alternative "I do not know" had the lowest score. The exception was for both questions 7 "(Endotracheal tubes with an extra lumen for subglottic secretion drainage)" and question 8 "(kinetic vs. standard beds)". The inclusion of this choice might restrain respondents from gambling.

<b>Question</b>		<b>Item difficulty (%)</b>	<b>Quality of the option (%)</b>	<b>Item discrimination (%)</b>
<b>1. "Oral vs. nasal route for endotracheal intubation"</b>		71.4		22.7
A*	"Oral intubation is recommended"		71.4	
B	"Nasal intubation is recommended"		4.7	
C	"Both routes of intubation can be recommended"		20.2	
D	"I do not know"		3.8	
<b>2. "Frequency of ventilator circuit changes"</b>		31.0		38.9
A	"It is recommended to change circuits every 48 hours (or when clinically indicated)"		33.3	
B	"It is recommended to change circuits every week (or when clinically indicated)"		33.3	
C*	"It is recommended to change circuits for every new patient (or when clinically indicated)"		31.0	
D	"I do not know"		2.3	
<b>3. "Type of airway humidifier"</b>		46.5		65.4
A	"Heated humidifiers are recommended"		21.6	
B*	"Heat and moisture exchangers are recommended"		46.5	
C	"Both types of humidifiers can be recommended"		30.0	
D	"I do not know"		1.9	
<b>4. "Frequency of heated humidifier changes (HME)"</b>		49.3		44.8
A*	"It is recommended to change humidifiers every 48 hours"		49.3	

	(or when clinically indicated)"			
B	"It is recommended to change humidifiers every 72 hours (or when clinically indicated)"		30.5	
C	"It is recommended to change humidifiers every week (or when clinically indicated)"		12.2	
D	I do not know		8.0	
<b>5. "Open vs. closed suction systems"</b>		50.2		44.8
A	"Open suction systems are recommended"		15.0	
B*	"Closed suction systems are recommended"		50.2	
C	"Both systems can be recommended"		31.9	
D	"I do not know"		2.8	
<b>6. "Frequency of change in suction systems"</b>		31.9		40.4
A	"Daily changes are recommended (or when clinically indicated)"		44.6	
B	"Weekly changes are recommended (or when clinically indicated)"		21.1	
C*	"It is recommended to change systems for every new patient (or when clinically indicated)"		31.9	
D	"I do not know"		2.3	
<b>7. "Endotracheal tubes with extra lumen for drainage of subglottic secretions"</b>		60.1		52.9
A*	"These endotracheal tubes reduce the risk of VAP"		60.1	
B	"These endotracheal tubes increase the risk of VAP"		23.5	
C	"These endotracheal tubes do not influence the risk of VAP"		7.0	
D	"I do not know"		9.4	
<b>8. "Kinetic vs. standard beds"</b>		57.3		66.7
A	"Kinetic beds increase the risk of VAP"		14.6	
B*	"Kinetic beds reduce the risk of VAP"		57.3	
C	"The use of kinetic beds does not influence the risk of VAP"		11.7	
D	"I do not know"		16.4	
<b>9. "Patient positioning"</b>		77.9		32.5
A	"Supine positioning is recommended"		10.8	

B*	"Semi-recumbent positioning is recommended"		77.9	
C	"The position of the patient does not influence the risk of VAP"		8.9	
D	"I do not know"		2.3	
<b>10. "Use of 0.12% chlorhexidine gluconate antiseptic oral rinse (mouth wash)"</b>		77.0		38.3
A*	"0.12% chlorhexidine gluconate antiseptic oral rinse reduce the risk of VAP"		77.0	
B	"0.12% chlorhexidine gluconate antiseptic oral rinse increases the risk of VAP"		8.9	
C	"0.12% chlorhexidine gluconate antiseptic oral rinse does not influence the risk of VAP"		7.5	
D	"I do not know"		6.6	
<b>11. Use of proton pump inhibitor medications</b>		21.1		23.1
A	"These proton pump inhibitor medications reduce the risk of VAP"		41.8	
B*	"These proton pump inhibitor medications increase the risk of VAP"		21.1	
C	"Intubated patients should be receiving on proton pump inhibitor medication"		28.6	
D	"I do not know"		8.5	
<b>12. "Endotracheal tube cuff pressure measurement"</b>		34.7		23.4
A	"(15-18) MMHG"		27.2	
B*	"(18-24) MMHG"		34.7	
C	"(25-30) MMGH"		31.5	
D	"I do not know"		6.6	
Asterisk items are correct answers				
Abbreviation VAP: ventilator-associated pneumonia				

### 4.3 Demographic of Respondents

The study was carried out in the intensive care units of all Palestinian government hospitals, and the number reached 13 hospitals, where there is the one intensive care department in the all hospital except for the PMC contains 3 intensive care department,

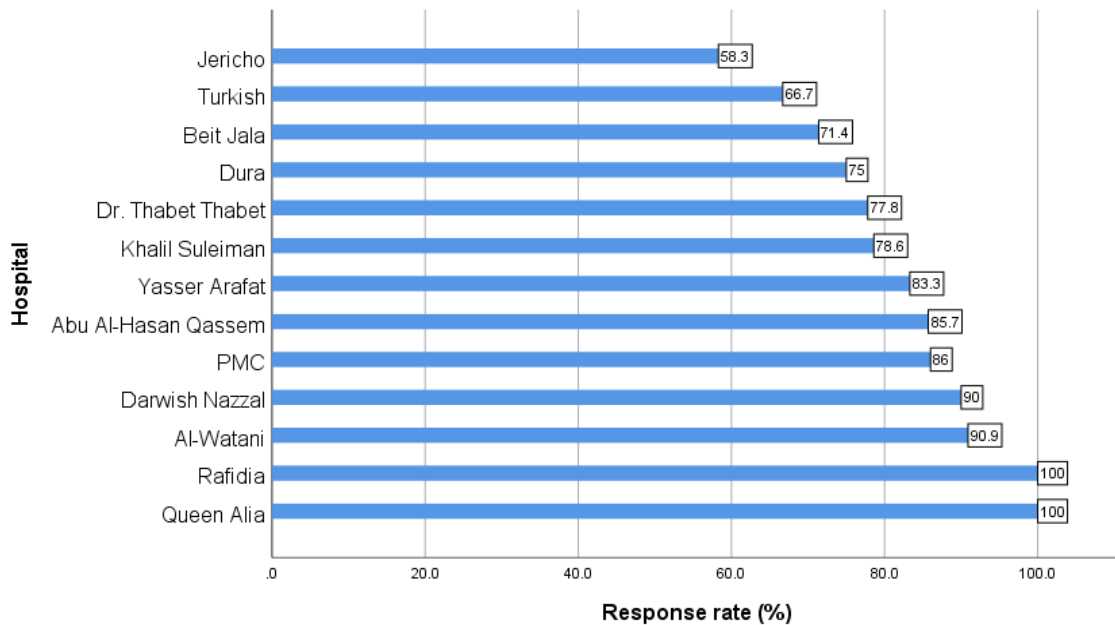
which are (the old ICU, the modern ICU, and The Kuwaiti ICU), where they were collected with each other in statistical analysis, there were a number of nurses who were excluded from the research and were the following: -

- Jericho Governmental Hospital / Jericho, due to their experience (less than six months), 3 nurses were excluded.
- Martyr Abu Al-Hasan Qassem Hospital / Yatta, the one nurse was excluded due to he is a researcher.
- PMC, due to their experience (less than six months), 3 nurses were excluded.
- Martyr Darwish Nazzal Hospital / Qalqilya, one female nurse was excluded due to maternity leave.
- Turkish Hospital / Tubas, due to their experience (less than six months), 3 nurses were excluded.

Of the 251 intensive care respondents, 213 completed the questionnaire with response rate 84.9%. Table 2 summarizes nurses' response rate according to hospital (see also Fig.1). The highest response rate (100%) was obtained in Queen Alia and Rafidia hospitals, while the lowest (58.3%) in Jericho hospital. Noting that, the Palestine Medical Complex (PMC)/ Ramallah has the largest ICU team ( $n = 57$ ) and consists of three divisions. The general characteristics of the sample are presented in Table 3. A total of 99 respondents (46.5%) are younger than 28 years. Most of respondents had less than 5 years of ICU experience ( $n = 135, 63.4%$ ), and most of them held a bachelor's degree ( $n = 163, 76.5%$ ). The majority of respondents had not a special role in ICU ( $n = 191, 89.7%$ ).

**Table 2: Nurses' Response Rate According To Hospital.**

Hospital		ICU Team	Response n (%)
1	Jericho Governmental Hospital/ Jerico	12	7 (58.3)
2	Turkish Hospital/ Tubas	15	10 (66.7)
3	Beit Jala Governmental Hospital/ Bethlehem	14	10 (71.4)
4	Dura Governmental Hospital/ Dura	12	9 (75.0)
5	Martyr Dr. Thabet Thabet Governmental Hospital/ Tulkarm	18	14 (77.8)
6	Martyr Khalil Suleiman Hospital/ Jenin	14	11 (78.6)
7	Martyr Yasser Arafat Hospital/ Salfeet	12	10 (83.3)
8	Martyr Abu Al-Hasan Qassem Hopspital/ Yatta	7	6 (85.7)
9	Palestine Medical Complex (PMC)/ Ramallah	57	49 (86.0)
10	Martyr Darwish Nazzal Hospital/ Qalqilya	10	9 (90.0)
11	Al-Watani Medical Hospital/ Nablus	22	20 (90.9)
12	Rafidia Surgical Hospital/ Nablus	24	24 (100.0)
13	Queen Alia Hospital/ Hebron	34	34 (100.0)
<b>Total cohort</b>		<b>251</b>	<b>213 (84.9)</b>

**Fig. 1.** Nurses' response rate according to hospital ( $n = 213$ ).

<b>Characteristic</b>	<b>No. of respondents (%)</b>
Age	
< 28	99 (46.5)
28 - 35	84 (39.4)
> 35	30 (14.1)
Years of intensive care unit experience	
< 5	135 (63.4)
5 - 10	53 (24.9)
> 10	25 (11.7)
Qualification	
Diploma	26 (12.2)
Bachelor's	163 (76.5)
Master's	24 (11.3)
Current role in ICU	
ICU Nurse	191 (89.7)
Associate Nurse Manager	9 (4.2)
Nurse Unit Manager	13 (6.1)

#### **4.4 Respondents Knowledge**

Table 4 shows the percentages of participants that answered each question correctly (see also Fig. 2). The question with the best accuracy rate (77.9%) concerned patient placement, the one with the worst accuracy rate (21.1%) concerned the use of proton pump inhibitors as equipment.

- 71.4% of the respondents knew that the oral route as the recommended way for intubation.
- It was known by 31% of respondents that ventilator circuits should be changed for each new patient.

- Heat and moisture exchangers were identified as the recommended type of humidifier by 46.5% of respondents, and 49.3% recognized that it is recommended to change them every 48 hours.
- Closed suctioning systems were checked as recommended by 50.2% of respondents, and 31.9% knew that these must be changed for each new patient only.
- 60.1% and 57.3%, respectively, recognized subglottic drainage and kinetic beds to reduce the incidence of VAP.
- Semi-recumbent positioning and is well acknowledged to prevent VAP (77.9%).
- It was known by 77.0% of respondents that using 0.12% chlorhexidine gluconate antiseptic oral rinse reduces the incidence of VAP and only 21.1% knew that proton pump inhibitor medications increase the incidence of VAP.
- Finally, (18-24) MMHG were checked as the recommended of Endotracheal tube cuff pressure measurement by 34.7%.

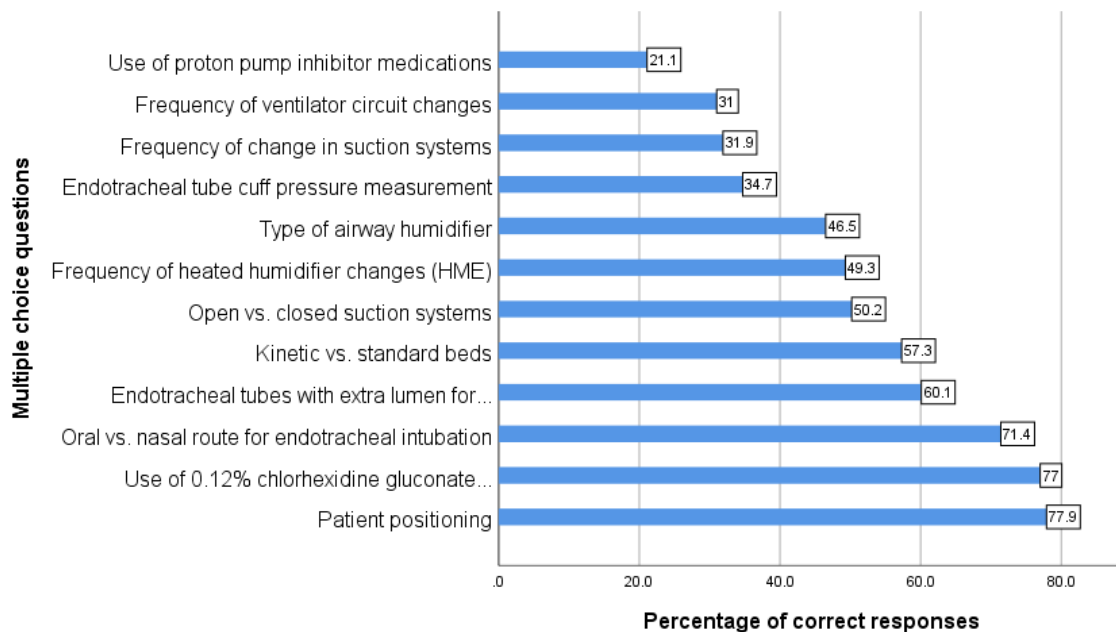
**Table 4: Nurses' answers on twelve multiple-choice questions regarding of knowledge to EBGs for prevention of VAP.**

Question		Percentage of answers (%)
<b>13. "Oral vs. nasal route for endotracheal intubation"</b>		
A*	"Oral intubation is recommended"	71.4
B	"Nasal intubation is recommended"	4.7
C	"Both routes of intubation can be recommended"	20.2
D	"I do not know"	3.8
<b>14. "Frequency of ventilator circuit changes"</b>		
A	"It is recommended to change circuits every 48 hours (or when clinically indicated)"	33.3
B	"It is recommended to change circuits every week (or	33.3

	when clinically indicated)"	
C*	"It is recommended to change circuits for every new patient (or when clinically indicated)"	31.0
D	"I do not know"	2.3
<b>15. "Type of airway humidifier"</b>		
A	"Heated humidifiers are recommended"	21.6
B*	"Heat and moisture exchangers are recommended"	46.5
C	"Both types of humidifiers can be recommended"	30.0
D	"I do not know"	1.9
<b>16. "Frequency of heated humidifier changes (HME)"</b>		
A*	"It is recommended to change humidifiers every 48 hours (or when clinically indicated)"	49.3
B	"It is recommended to change humidifiers every 72 hours (or when clinically indicated)"	30.5
C	"It is recommended to change humidifiers every week (or when clinically indicated)"	12.2
D	"I do not know"	8.0
<b>17. "Open vs. closed suction systems"</b>		
A	"Open suction systems are recommended"	15.0
B*	"Closed suction systems are recommended"	50.2
C	"Both systems can be recommended"	31.9
D	"I do not know"	2.8
<b>18. "Frequency of change in suction systems"</b>		
A	"Daily changes are recommended (or when clinically indicated)"	44.6
B	"Weekly changes are recommended (or when clinically indicated)"	21.1
C*	"It is recommended to change systems for every new patient (or when clinically indicated)"	31.9
D	I do not know	2.3
<b>19. "Endotracheal tubes with extra lumen for drainage of subglottic secretions"</b>		
A*	"These endotracheal tubes reduce the risk of VAP"	60.1
B	"These endotracheal tubes increase the risk of VAP"	23.5

C	"These endotracheal tubes do not influence the risk of VAP"	7.0
D	"I do not know"	9.4
<b>20. "Kinetic vs. standard beds"</b>		
A	"Kinetic beds increase the risk of VAP"	14.6
B*	"Kinetic beds reduce the risk of VAP"	57.3
C	"The use of kinetic beds does not influence the risk of VAP"	11.7
D	"I do not know"	16.4
<b>21. "Patient positioning"</b>		
A	"Supine positioning is recommended"	10.8
B*	"Semi-recumbent positioning is recommended"	77.9
C	"The position of the patient does not influence the risk of VAP"	8.9
D	"I do not know"	2.3
<b>22. "Use of 0.12% chlorhexidine gluconate antiseptic oral rinse (mouth wash)"</b>		
A*	"0.12% chlorhexidine gluconate antiseptic oral rinse reduce the risk of VAP"	77.0
B	"0.12% chlorhexidine gluconate antiseptic oral rinse increases the risk of VAP"	8.9
C	"0.12% chlorhexidine gluconate antiseptic oral rinse does not influence the risk of VAP"	7.5
D	"I do not know"	6.6
<b>23. "Use of proton pump inhibitor medications"</b>		
A	"These proton pump inhibitor medications reduce the risk of VAP"	41.8
B*	"These proton pump inhibitor medications increase the risk of VAP"	21.1
C	"Intubated patients should be receiving on proton pump inhibitor medication"	28.6
D	"I do not know"	8.5
<b>24. "Endotracheal tube cuff pressure measurement"</b>		
A	"(15-18) MMHG"	27.2

B*	"(18-24) MMHG"	34.7
C	"(25-30) MMGH"	31.5
D	"I do not know"	6.6
Asterisk items are correct answers		
Abbreviation VAP: ventilator-associated pneumonia		

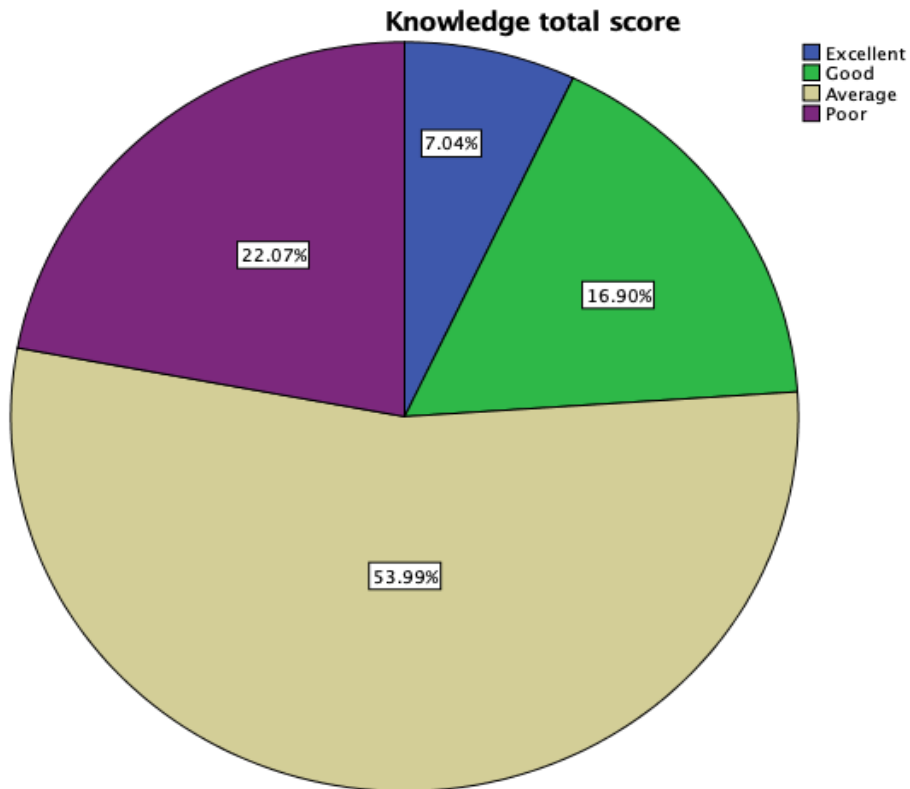


**Fig. 2.** "Percentage of correct responses to the knowledge questions" ( $n = 213$ ).

According level of knowledge categories "(Excellent = 81-100%, Good = 61-80%, Average = 41-60%, Poor = < 40%)", and respondents' knowledge, statically analysis was showed 15 respondents excellent knowledge level, 36 respondents have good, 115 respondents have average and 47 respondents have poor knowledge, see below (Table 5, Figure 3).

**Table 5: Knowledge Total Score According Respondents.**

Knowledge total score	Excellent	Good	Average	Poor
n (%)	15 (7.0)	36 (16.9)	115 (54.0)	47 (22.1)

**Fig. 3.** knowledge total score according respondents.

The total knowledge scores according to participants characteristics are demonstrated in Table 6. The average score was 6.1 (50.8%) on twelve questions. Kruskal-Wallis test results revealed no substantial differences in knowledge level were found between age categories, nor did the years of ICU experience and the role in ICU affect the results ( $p$ -values are 0.551, 0.230, and 0.989, respectively). However, there was a significant difference ( $p$ -value = 0.049) in the knowledge level of respondents based on qualification. Linear regression analysis identified qualification (per category increase) to be independently associated with better knowledge level (see Table 7). The coefficient of determination ( $R^2$ ) value of 0.02 suggests that the variation in the mean knowledge scores is 2% explained by qualification. This shows a significant association between the qualifications of nurses and their mean scores on the questionnaire's twelve multiple-choice items. The analysis revealed that qualification (per category increase) was independently associated with an increase in total knowledge score of 0.60 points (95% CI: 0.03 – 1.18) on twelve questions. However, there was no statistically significant difference between the respondents' characteristics (age, years of experience, and role in ICU) and their knowledge of VAP prevention ( $p$ -value > 0.05). These variables were stepwise removed from the regression model.

**Table 6: Nurses' mean knowledge scores (%), median, and *IQR* on twelve multiple-choice questions according to respondents' characteristics (subgroups). The *p*-value (Kruskal-Wallis test) indicates how score differ according to the subgroups.**

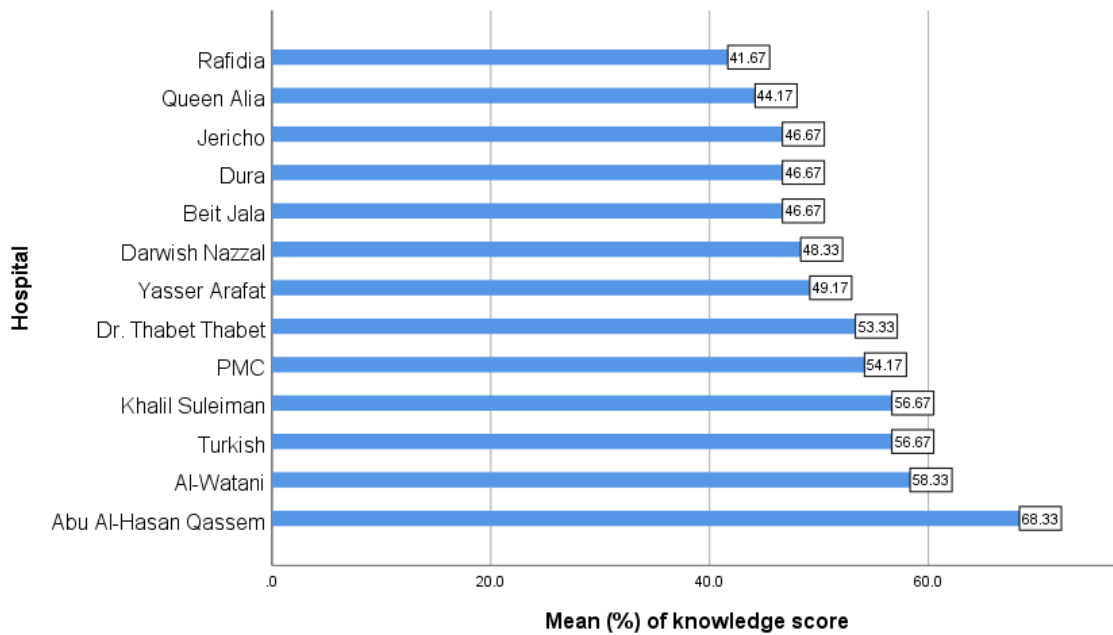
Characteristic	Mean (%)	Median ( <i>IQR</i> )	Significance ( <i>p</i> -value)
Age			0.551
< 28	6.1 (50.8)	6.0 (2.0)	
28 – 35	6.0 (50.0)	6.0 (3.0)	
> 35	6.2 (51.7)	6.0 (2.3)	
Years of ICU experience			0.230
< 5	6.2 (51.7)	6.0 (3.0)	
5 – 10	5.6 (46.7)	6.0 (3.0)	
> 10	6.3 (52.5)	6.0 (2.5)	
Qualification			0.049
Diploma	5.5 (45.8)	6.0 (2.0)	
Bachelor's	6.1 (50.8)	6.0 (3.0)	
Master's	6.7 (55.8)	6.5 (2.0)	
Current role in ICU			0.989
ICU Nurse	6.1 (50.8)	6.0 (2.0)	
Associate Nurse Manager	5.8 (48.3)	6.0 (4.5)	
Nurse Unit Manager	6.2 (51.7)	6.5 (4.5)	
<b>Total cohort</b>	<b>6.1 (50.8)</b>	<b>6.0 (2.0)</b>	–

**Table 7: "Linear regression with the mean knowledge regarding the prevention of VAP"**

Characteristic (independent variable)	B ± standard error	95% confidence interval	Significance ( <i>p</i> -value)	<i>R</i> <sup>2</sup>
Qualification (per category increase)	0.60 points ±0.29	0.03 – 1.18	0.041	0.02
Age (per category increase)	–0.01	–0.41 – 0.39	0.957	< 0.001
Years of ICU of experience (per category increase)	points ±0.20	–0.52 – 0.29	0.583	0.001
	–0.11	–0.54 – 0.58	0.947	< 0.001
Current role in ICU (per category increase)	points ±0.21			
	0.02 points ±0.28			

A comparison between the overall knowledge level according to the hospital is presented in Table 8 (see also Fig. 4). Abu Al-Hasan Qassem Hospital/ Yatta got the best knowledge level (mean = 8.2, 68.3%). However, the worst knowledge level (mean = 5.0, 41.7%) was obtained in Rafidia Surgical Hospital/ Nablus. Overall, our findings highlight the need for complete education based on current recommendations and show that nurses' knowledge of VAP standards is average.

<b>Table 8: Nurses' mean (%) of the total knowledge scores on twelve questions according to hospital.</b>		
<b>Hospital</b>		<b>Knowledge level mean (%)</b>
1	Rafidia Surgical Hospital/ Nablus	5.0 (41.7)
2	Queen Alia Hospital/ Hebron	5.3 (44.2)
3	Jericho Governmental Hospital/ Jerico	5.6 (46.7)
4	Dura Governmental Hospital/ Dura	5.6 (46.7)
5	Beit Jala Governmental Hospital/ Bethlehem	5.6 (46.7)
6	Martyr Darwish Nazzal Hospital/ Qalqilya	5.8 (48.3)
7	Martyr Yasser Arafat Hospital/ Salfeet	5.9 (49.2)
8	Martyr Dr. Thabet Thabet Governmental Hospital/ Tulkarm	6.4 (53.3)
9	Palestine Medical Complex (PMC)/ Ramallah	6.5 (54.2)
10	Martyr Khalil Suleiman Hospital/ Jenin	6.8 (56.7)
11	Turkish Hospital/ Tubas	6.8 (56.7)
12	Al-Watani Medical Hospital/ Nablus	7.0 (58.3)
13	Martyr Abu Al-Hasan Qassem Hospital/ Yatta	8.2 (68.3)
<b>Total cohort</b>		<b>6.1 (50.8)</b>



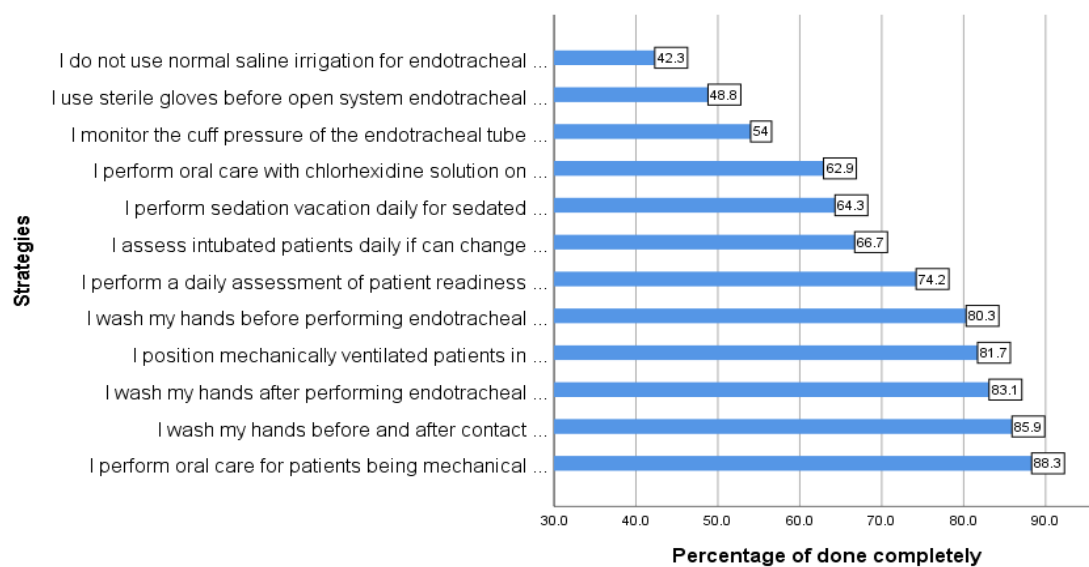
**Fig. 4.** Mean (%) of total knowledge scores on twelve questions according to hospital.

#### 4.5 Respondents Adherence

Table 9 demonstrates our findings on nurses' adherence to evidence-based guidelines (see also Fig. 5). The most adhered to procedures were performing oral care on mechanically ventilated patients ( $n = 188, 88.3\%$ ) and washing hands before and after contact with the patient ( $n = 183, 85.9\%$ ). The least adhered to practices were related to endotracheal suctioning; not using of normal saline irrigation ( $n = 90, 42.3\%$ ) and the use of sterile gloves for open endotracheal suctioning ( $n = 104, 48.8\%$ ).

**Table 9: Nurses' Adherence To Evidence-Based Guidelines (n = 213).**

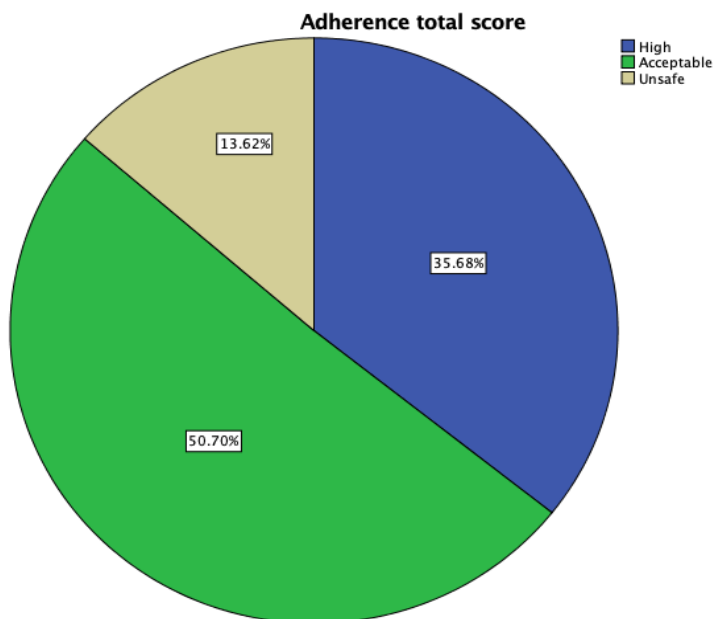
Strategies		Done completely n (%)	Not done completely n (%)	Not done n (%)
1	"I perform oral care for patients being mechanical ventilated"	188 (88.3)	23 (10.8)	2 (0.9)
2	"I perform oral care with chlorhexidine solution on mechanically ventilated patients daily"	134 (62.9)	53 (24.9)	26 (12.2)
3	"I perform a daily assessment of patient readiness for extubation"	158 (74.2)	47 (22.1)	8 (3.8)
4	"I wash my hands before and after contact with the patient"	183 (85.9)	26 (12.2)	4 (1.9)
5	"I wash my hands before performing endotracheal suctioning"	171 (80.3)	32 (15.0)	10 (4.7)
6	"I use sterile gloves before open system endotracheal suctioning"	104 (48.8)	88 (41.3)	21 (9.9)
7	"I wash my hands after performing endotracheal suctioning"	177 (83.1)	32 (15.0)	4 (1.9)
8	"I don't use normal saline irrigation for endotracheal suctioning"	90 (42.3)	67 (31.5)	56 (26.3)
9	"I monitor the cuff pressure of the endotracheal tube for my patient at least once every 8h"	115 (54.0)	71 (33.3)	27 (12.7)
10	"I position mechanically ventilated patients in semi-fowlers position"	174 (81.7)	35 (16.4)	4 (1.9)
11	"I perform sedation vacation daily for sedated mechanically ventilated patients"	137 (64.3)	62 (29.1)	14 (6.6)
12	"I assess intubated patients daily if can change from invasive to non-invasive ventilation"	142 (66.7)	55 (25.8)	16 (7.5)

**Fig. 5.** Nurses' adherence to evidence-based guidelines.

According level of adherence categories (total scores < 50% were considered unsafe adherence, scores between the 50-75% were considered acceptable adherence, scores >75% were considered high adherence) and respondents' adherence, statically analysis was showed 76 respondents' high adherence, 108 respondents have acceptable, and 29 respondents have unsafe adherence, see below (Table 10, Fig.6).

**Table 10: Adherence total score according respondents.**

Adherence total score	High	Acceptable	Unsafe
n (%)	76 (35.7)	108 (50.7)	29 (13.6)



**Fig. 6.** Adherence total score according respondents.

The adherence level according to respondents' characteristics is demonstrated in Table 11. The mean score was 8.3 (69.2%) on twelve questions. Kruskal-Wallis test results revealed no substantial differences in adherence level were found based on respondent's characteristics (age, years of ICU experience, qualification, and the current role in ICU), i.e.,  $p$ -values  $> 0.05$ . Similar findings were obtained by regression analysis. Moreover, linear regression was performed to predict the extent of the association between knowledge of and self-reported adherence to EBGs (Table 12). The coefficient of determination ( $R^2$ ) value of 0.03 suggests that the variation in the mean adherence scores is 3% explained by the knowledge level. The analysis revealed that knowledge level (per unit increase) was independently associated with an increase in total adherence score of 0.20 points (95% CI: 0.05 – 0.35).

**Table 11: Nurses' Mean Adherence Scores Of Done Completely (%), Median, And IQR On Twelve Questions According To Respondents' Characteristics (Subgroups). The  $p$ -Value (Kruskal-Wallis Test) Indicates How Score Differ According To The Subgroups.**

Characteristic	Mean (%)	Median (IQR)	Significance ( $p$ -value)
Age			0.547
< 28	8.5 (70.8)	9.0 (3.0)	
28 – 35	7.6 (63.3)	8.0 (3.0)	
> 35	7.5 (62.5)	9.0 (3.3)	
Years of intensive care unit experience	8.3 (69.2)	9.0 (3.0)	0.170
< 5	8.0 (66.7)	8.0 (3.0)	
5 – 10	9.0 (75.0)	9.0 (4.0)	
> 10			
Qualification			0.225
Diploma	8.5 (70.8)	9.0 (4.0)	
Bachelor's	8.2 (63.8)	8.0 (3.0)	
Master's	9.0 (75.0)	10.0 (4.0)	

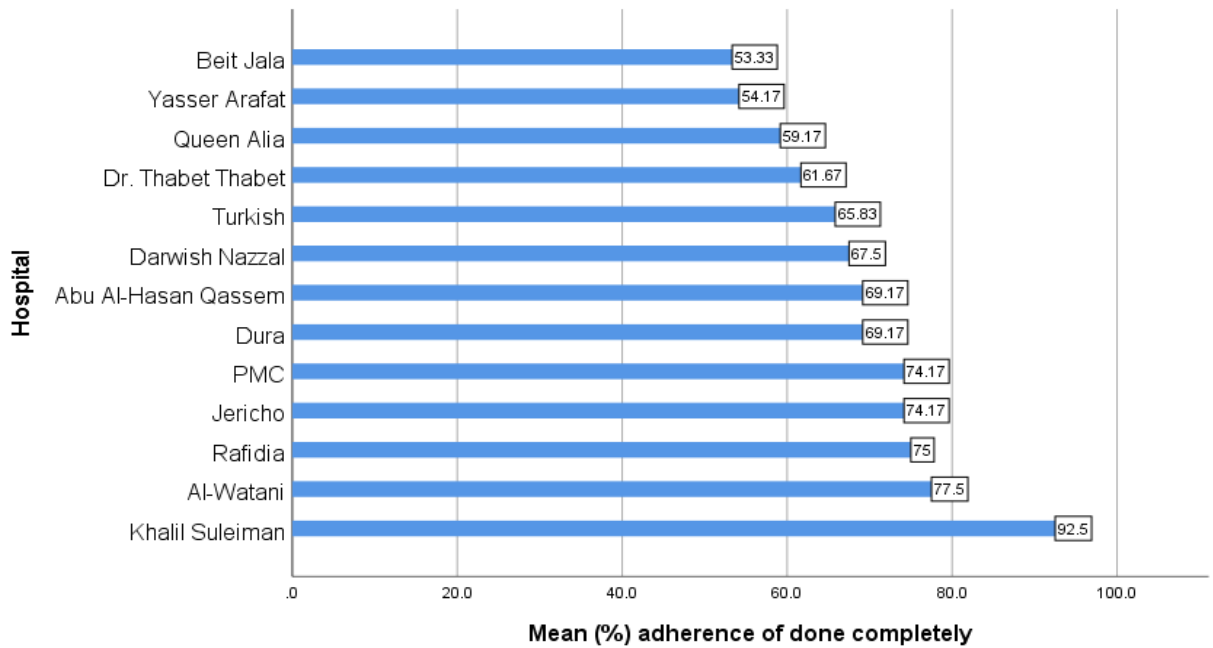
Current role in ICU			0.175
ICU Nurse	8.2 (68.3)	8.0 (3.0)	
Associate Nurse Manager	9.1 (75.8)	9.0 (3.5)	
Nurse Unit Manager	9.4 (78.3)	10.0 (4.5)	
<b>Total cohort</b>	<b>8.3 (69.2)</b>	<b>9.0 (3.0)</b>	—

**Table 12: Linear Regression With The Mean Adherence To Evidence-Based Guidelines.**

Predictor or independent variable	B $\pm$ standard error	95% confidence interval	Significance (p-value)	R <sup>2</sup>
Knowledge score	0.20 Points $\pm$ 0.08	0.05 - 0.35	0.01	0.03
Qualification (per category increase)	0.27 Points $\pm$ 0.33	-0.38 - 0.93	0.41	0.003
Age (per category increase)	-0.10 Points $\pm$ 0.23	-0.55 - 0.35	0.66	0.001
Years of ICU of experience (per category increase)	0.14 Points $\pm$ 0.23	-0.31 - 0.60	0.61	0.002
Current role in ICU (per category increase)	-0.17 Points $\pm$ 0.09	-0.34 - 0.01	0.08	0.012

A comparison between the overall adherence level according to the hospital is presented in Table 13 (see also Fig. 7). Khalil Suleiman Hospital/ Jenin was the most adhered to procedures (mean = 11.1, 92.5%). However, Beit Jala Governmental Hospital/ Bethlehem was the least adhered to procedures (mean = 6.4, 53.3%). Overall, our findings demonstrate that nurses' adherence to evidence-based guidelines was good (mean = 8.3, 69.2%).

<b>Table 13: Nurses' Mean Adherence Scores (%) Of Done Completely On Twelve Questions According To Hospital.</b>		<b>Adherence/ done mean (%)</b>
<b>Hospital</b>		
1	Beit Jala Governmental Hospital/ Bethlehem	6.4 (53.3)
2	Martyr Yasser Arafat Hospital/ Salfeet	6.5 (54.2)
3	Queen Alia Hospital/ Hebron	7.1 (59.2)
4	Martyr Dr. Thabet Thabet Governmental Hospital/ Tulkarm	7.4 (61.7)
5	Turkish Hospital/ Tubas	7.9 (65.8)
6	Martyr Darwish Nazzal Hospital/ Qalqilya	8.1 (67.5)
7	Martyr Abu Al-Hasan Qassem Hopspital/ Yatta	8.3 (69.2)
8	Dura Governmental Hospital/ Dura	8.3 (69.2)
9	Palestine Medical Complex (PMC)/ Ramallah	8.9 (74.2)
10	Jericho Governmental Hospital/ Jerico	8.9 (74.2)
11	Rafidia Surgical Hospital/ Nablus	9.0 (75.0)
12	Al-Watani Medical Hospital/ Nablus	9.3 (77.5)
13	Martyr Khalil Suleiman Hospital/ Jenin	11.1 (92.5)
<b>Total cohort</b>		<b>8.3 (69.2)</b>



**Fig. 7.** Mean (%) for total adherence scores (done completely) on twelve questions according to hospital.

## **Chapter Five: Discussion**

### **5.1 Introduction**

The study results are presented in this chapter in terms of the study's goals and purposes, as well as its variables, constraints, suggestions for the future, and its conclusion.

### **5.2 Discussion**

A cross section descriptive, research design with a quantitative approach was applied to assess the intensive care nurse's knowledge and adherence to EBGs for prevention VAP among all governmental ICUs at Westbank in Palestine. The population for the study was all ICUs nurse's in all Palestinian governmental hospital and it in 13 governmental hospitals, the sample size was determined as response rate of participants (n=213). Each individual objective is used to guide the discussion in this chapter, which also incorporates the research findings discussed in Chapter 4 of the study.

The following study goals serve as the foundation for the discussion:

- 1- Assess the knowledge of ICUs nurses regarding of EBGs for prevention VAP.
- 2- Assess ICUs nurse's adherence to EBGs for prevention VAP.
- 3- Determine the association between critical care nurses' sociodemographic characteristics and knowledge to EBGs for prevention VAP.
- 4- Determine the relationship between critical care nurses' sociodemographic characteristics and adherence to EBGs for prevention VAP.

### **5.2.1 Discussion The Knowledge Of Icus Nurses Regarding To Ebgs For Prevention VAP.**

According to the current study, the oral route was identified as the recommended method of intubation by 71.4% of the respondents, and 31% of respondents knew that ventilator circuits should be changed for each new patient. Heat and moisture exchangers were identified as the recommended method of intubation, and the most correctly answered question in the current study was related to patient positioning (77.9%), while the least correctly answered question was related to equipment (21.1%), closed suctioning systems were checked as advised by 50.2% of respondents, and 31.9% knew that these must be changed for each new patient only. Subglottic drainage and kinetic beds were also recognized by 60.1% and 57.3%, respectively, as reducing the incidence of VAP, as well as semi-recumbent positioning, which is well known to prevent VAP (77.9%). It was known by 77.0% of respondents that using 0.12% chlorhexidine gluconate antiseptic oral rinse reduces the incidence of VAP and only 21.1% knew that proton pump inhibitor medications increase the incidence of VAP, and (18-24) MMHG were checked as the recommended of Endotracheal tube cuff pressure measurement by 34.7%, in addition ,the total knowledge scores on twelve questions according to all hospitals was (50.8%). Overall, our findings demonstrate that nurses' knowledge of VAP guidelines is average.

This is consistent with a study published in Australia aimed to evaluate ICU nurse's knowledge of VAP and compliance with evidence-based recommendations for the prevention of VAE, the median score for knowledge of evidence-based recommendations was 6 (IQR: 5-7) (out of 10), in ten survey questions to gauge knowledge, patient positioning questions received the most correct answers (90.9%) and

the least correct answers (23%) related to equipment; use of kinetic beds versus standard, and showed lack participants knowledge in totally percentage 54.2%(Madhuvu et al., 2020).

Regarding to average ICU nurse's knowledge in current study, Other study was conducted in Sana'a City, Yemen, in 2018, to evaluate the knowledge and practices of ICU nurses, the sample included 87 nurses from various public hospitals. Knowledge scores and levels were as follows: In terms of knowledge, (5.7%) scored 76% to 100%, good, (36.8%) scored between 50% and 75%, and (57.5%) scored 0% to 49% poorly. In terms of practice, (52%) of nurses had a poor level, (42%) had a moderate level, and (6%) had a good level(Fattah & Mohammed, n.d.). The current study showed nurse's knowledge regarding EBGs for prevention VAP more than this study.

Moreover, this is inconsistent with a study carried out by(Aziz et al., 2020) to evaluate ICU nurses' knowledge and use of the ventilator care bundle to prevent VAP , 136 nurses who met the inclusion and exclusion criteria were chosen for this cross-sectional, descriptive study, which was carried based on the scoring system used, the knowledge level was categorized as Excellent = 81-100%, Good = 61-80%, Average = 41-60%, Poor = 40%, and the practice of the ventilator bundle was assessed as; satisfactory 80% skills (used by Raulin D. Feria). The study's results showed that nurses have poor knowledge of the ventilator bundle with a mean score of 37.5%, based on the results, tertiary care hospitals nurse's in Lahore do not have sufficient knowledge of the ventilator bundle.

In other study was consistent with current study, was distributed ICU nurses in Kuala Lumpur Hospital, sample size is 121 registered nurses, the study showed poor nurses knowledge for EBGs to prevent occurrence of VAP with percentage main score 59.5%(Manap & Jailani, 2019).

The lack of knowledge regarding the EBGs for preventing the occurrence of VAP among intensive care nurses may be due to the lack of keeping pace with the changing scientific updates, and the lack of educational courses in hospitals to develop a mechanism to reduce the incidence of VAP, and the qualification level has a major role in giving a good amount of knowledge to reduce VAP.

### **5.2.2 Discussion The Icus Nurse's Adherence To Ebgs For Prevention VAP.**

in the current study showed that administering oral care on mechanically ventilated patients (n = 188,88.3%) and washing hands before and after contact with the patient (n = 183,85.9%) were the procedures that ICU nurses adhered to the most, the endotracheal suctioning procedures that were least adhered to included not using sterile gloves for open endotracheal suctioning (n = 104,48.8%) and not using normal saline irrigation (n = 90,42.3%). In addition, a comparison of overall adherence according to all respondents found that the level of adherence to EBGs was acceptable with a score (mean = 8.3, 69.2%).

This is consistent with a study was published in 2020, was showed the most adhered-to procedures were giving oral care to mechanically ventilated patients 90.9%, and positioning the patient in a semi-fowlers position 84.6%. On the other hand, the procedures that were least adhered-to were using sterile gloves for open endotracheal

suctioning 18.9% and using normal saline irrigation for endotracheal suctioning (Madhuvu et al., 2020).

Another study was published in 2018 aimed to assess critical care nurses' knowledge, adherence and barriers related to institution specific ventilator bundle, descriptive study in a 26-bed adult mixed medical-surgical ICU in Finland using quantitative survey of knowledge and self-reported adherence with qualitative gathering of barrier data, a pre-validated multiple-choice Ventilator Bundle questionnaire was distributed to all registered nurses, sample size 155, with response rate was 55.5%, and 47.2% of respondents had more than ten years of ICU experience, the levels of knowledge and self-reported adherence were 71.1% and 65.8% of the total score, which is consistent with the current study (Jansson et al., 2018).

A study carried out by (Aziz et al., 2020) to evaluate ICU nurses' knowledge and use of the ventilator care bundle to prevent VAP, 136 nurses who met the inclusion and exclusion criteria were chosen for this cross-sectional, descriptive study, the practice of the ventilator bundle was assessed as satisfactory 80% skills (used by Raulin D. Ferial), the mean practice score demonstrated by ICU nurses was 60.8%, which is also not satisfactory according to the criteria. In comparison between current study and this study, the current study showed more level of adherence to EBGs for prevent occur VAP.

Current study was showed the mean score level of adherence to EBGs more than a descriptive, cross-sectional study was conducted to assess the compliance of Jordanian nurses for EBGs to prevent VAP and the barriers, a convenience sample of 294 nurses from nine hospitals in Jordan completed a self-reported questionnaire, a result was showed according to the study compliance categories, 45.6% of the participants

reported 'insufficient compliance, 24.8% weak compliance and 29.6% sufficient compliance(Aloush & Al-Rawajfa, 2020).

The adherence to EBGs for prevent the occurrence of VAP in this research is acceptable in light of the presence of little knowledge of the EBGs for nurses in ICUs, and this indicates that there are practical practices taken from clinical learning that is not based on knowledge, so work on this is routine and not based on knowledge.

### **5.2.3 Discussion The Association Between Critical Care Nurses' Sociodemographic Characteristics And Knowledge Regarding Of VAP.**

In the current study was no substantial differences in knowledge level were found between age categories, nor did the years of ICU experience and the role in ICU affect the results ( $p$ -values are 0.551, 0.230, and 0.989, respectively). However, there was a significant difference ( $p$ -value = 0.049) in the knowledge level of respondents based on qualification.

In a study was conducted in 2018 in Addis Abeba, Ethiopia, to evaluate adult intensive care nurses' knowledge, practice, and associated factors on prevention of VAP, for 129 respondents, 78 (60.5%) were females and 73 (56.6%) had diplomas, was showed a significant difference in knowledge between respondents with ICU training and between participants with different educational levels ( $P$  value = 0.04), and there was a significant difference in practice between ICU nurses, which is consistent with current study(Wami et al., 2018).

However, (Madhuvu et al., 2020) study was conducted to evaluate nursing knowledge and adherence to EBGs to decrease risks for VAP was showed there was no correlation ( $p$  = 0.674) between the participants' years of experience in intensive care

nursing and their overall score, but there was a significant positive association between completion of a postgraduate degree and their overall knowledge score. Other study in Tanzania at 2021, included 116 ICU nurses, and when evaluating the ICU nurses' knowledge, compliance, and impediments toward EBGs for the prevention of VAP, the results revealed that the mean knowledge score was 3.86 (SD = 1.56), based on ten questions (equal to 38.6%), on average. Significantly more frequently ( $p = 0.004$ ) did nurses with a degree or a higher level of nursing education do better than those with a diploma or a lower level of nursing education. The mean self-reported compliance score for EBGs for the prevention of VAP was 15.20 (SD = 0.93), or 60.8%, based on 25 questions. The main obstacles to the application of EBGs for VAP prevention were a lack of skills (96.6%), a lack of competent staff (95.5%), and a lack of information (79.3%), given the severity and impact of VAP and the higher risks of HAI in resource-limited countries like Tanzania. The lower level of knowledge and compliance implies the need for ongoing educational interventions and evaluation of the implementation of the EBGs for VAP prevention (Bankanie et al., 2021). And its studies are consistent with current study.

In other study was distributed ICU nurses in Kuala Lumpur Hospital, sample size is 121 registered nurses, the study was showed a significant relationship between age, years' experience in nursing and participation in infection control, certificate in Intensive Care Nursing and experience in Critical care unit. ( $p$ - value < 0.05), and its consistent with current study regarding qualification level affect knowledge level (Manap & Jailani, 2019).

A descriptive, cross-sectional study was consistent with current study, conducted to assess the compliance of Jordanian nurses for EBGs to prevent VAP and the barriers , A convenience sample of 294 nurses from nine hospitals in Jordan completed a self-reported questionnaire, a result was showed the nurses with more experience and previous education on ventilator , associated pneumonia reported higher compliance scores than their counterparts with less experience and no previous education(Aloush & Al-Rawajfa, 2020).

It is natural that the extent of knowledge of nurses with regard to the EBGs for preventing the occurrence of VAP will increase with the increase of qualification level, but in this current research there is an effect of increasing the extent of knowledge through the qualification level, but it is very little.

#### **5.2.4 Discussion The Relationship Between Critical Care Nurses' Sociodemographic Characteristics And Adherence To Ebg For Prevention VAP.**

No substantial differences in adherence level were founded in current study based on respondent's characteristics (age, years of ICU experience, qualification, and the current role in ICU), i.e.,  $p$ - values  $> 0.05$ . Moreover, linear regression was performed to predict the extent of the association between knowledge of and self-reported adherence to EBGs, the coefficient of determination ( $R^2$ ) value of 0.03 suggests that the variation in the mean adherence scores is 3% explained by the knowledge level, the analysis revealed that knowledge level (per unit increase) was independently associated with an increase in total adherence score of 0.20 points (95% CI: 0.05 – 0.35).

In addition, in study was conducted by (Madhuvu et al., 2020) showed same result and consistent with current study, no correlation was found between following evidence-based recommendations and participants' knowledge ( $p = 0.144$ ) or years of experience ( $p = 0.650$ ). Participants with and without specialist titles did not differ in terms of adherence ( $p = 0.479$ ), nor did those with or without postgraduate degrees ( $p = 0.236$ ).

Moreover, study amid to assess ICU nurse's adherence to VAP guidelines in middle region of Jordan hospitals, sample size 208 participants with response rate 86%, study which was found adherence level 81.3% and participants score of VAP care knowledge was poor 43%, participants score of VAP care knowledge had a significant positive correlation with their score of VAP guidelines adherence( $P=0.012$ ), and it was consistent with current study(Darawad et al., 2018).

As well (Jansson et al., 2018) study Showed low correlation between knowledge and adherence scores was low ( $\rho 0.48 [P < .001]$ ).

Other study was amid to evaluate the implementation of the EBGs for preventing VAP rates among ICU nurses, the quasi experimental study use the protocol consisted of 3 phases, in the initial phase, observations were made to determine the VAP care bundle adherence of ICU nurses, in the second phase, education was provided to ICU nurses on the subject of the VAP care bundle, for the third phase, the effect of VAP care bundle adherence on the VAP rates after education, the result showed The nurses' VAP care bundle adherence improved after education from 10.8% to 89.8% and showed statistically significant improvement ( $P = 0.0001$ ) and it's not consistent with current study regarding knowledge effect to the adherence level to EBGs for prevent VAP(Okgün Alcan et al., 2016).

In fact, the extent of knowledge of something enhances commitment to it, as in the current research it appears that the extent of adherence to the EBGs for prevent the occurrence of VAP is affected by the extent of knowledge in them, but this effect is very little and almost negligible, and this explains that the extent of adherence to the EBGs is due to the Routine work and practical habits in ICU.

## **Chapter Six: Conclusion, Recommendations, Limitations and Budget of the study**

### **6.1 Conclusion**

Based on the findings, we can conclude that ICU nurse knowledge regarding EBGs for Prevention VAP was low with average score was 6.1 (50.8%). However, there was a significant difference (p-value = 0.049) in the knowledge level of respondents based on qualification. The study further revealed that ICUs nurse's adherence to EBGs for prevention VAP was acceptable with mean score was 8.3 (69.2%), and there's no statistically significant different in adherence level were found based on respondent's characteristics (age, years of ICU experience, qualification, and the current role in ICU), i.e., p- values > 0.05.

These results can be used to reconsider the practical practices used in the ICUs and focus on them to increase the awareness of nurses to EBGs and reduce the incidence of VAP.

### **6.2 Recommendations of this Study**

- Dissemination of recommendations for the current study among the ICUs nursing to raise the extent of knowledge and adherence to the EBGs to reduce the risk of VAP.
- Holding workshops and educational courses in hospitals to raise awareness and knowledge of ICUs nurses with EBGs to prevent the occurrence of VAP.
- Continuing education follow-up on an ongoing basis for updates on the guidelines to prevent VAP and follow-up work on them.

- Increasing the directives of the Ministry of Health to monitor the continuing education regarding the guidelines for preventing the occurrence of VAP and the extent of their implementation.
- Monitoring the educational process in colleges and universities to promote the graduation of students with competence and knowledge for EBGs to prevent VAP.

### **6.2.1 Recommendations for Future Research**

- The role of policymakers, healthcare providers, and quality, patient safety, and infection control departments in prevention VAP in Palestinian hospitals.
- Exploring the factors that affect the ICUs nurses and that reduce the extent of knowledge and adherence to the EBGs to prevent the occurrence of VAP.
- The impact of a shortage of staff on adherence of EBGs for prevention VAP.
- The impact of training programs on ICUs nurse's knowledge, attitudes and practices regarding VAP.

### **6.3 Limitation of the Study**

The limitation of this study was the limited information, insufficient and inappropriate data registry related to insufficient time and workload toward participants, Limited resources like literature, and guidelines/protocols, the lack of funds spent on scientific research, and Transportation.

This study is going to be more specific if could conduct in other privet hospitals to reflex more ICUs nurse's knowledge and adherence to EBGs for prevention VAP, and evaluate nurses' barriers related this research title.

Finally, Corona pandemic and the difficulty of meeting ICUs nurses in hospitals.

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## Appendix

Annex (1): Letter Of Introduction To Participants In Survey Research, Consent Form And Survey Research.



الجامعة العربية الأمريكية  
ARAB AMERICAN UNIVERSITY

*Arab American University*  
*Faculty of Graduate Studies*

**Ventilator-Associated Pneumonia Preventative Measures: Knowledge  
and Adherence Survey**

**By: Ismael Ahmad AL-Nawaja'a**

**Supervisor: DR. Basma Salameh**

**"2022"**



# الجامعة العربية الأمريكية

## ARAB AMERICAN UNIVERSITY

### *"Letter of Introduction to Participants in Survey Research"*

**Dear nurse**

My name is Ismael Ahmad Al-Nawaja'a, and I am a senior nursing student in master degree critical care program at Arab American University. I am conducting a research study, which is being supervised by Basma Salameh, PhD, Assist Professor of Nursing at Arab American university.

You are asked to take part in this research study about critical care nurses' adherence to evidence-based recommendations for preventing ventilator-associated events. VAP is the second most prevalent healthcare-associated infection, accounting for 25–42% of all infections that happen in ICUs. Patients who have been intubated are at risk of getting VAP, and the frequency rises with time spent on a ventilator. In this study, we will evaluate the degree to which ICU nurses in Palestine follow the evidence-based recommendations to lower VAP occurrences related with the use of ventilators.

I hope for your assistance in completing this study to the fullest, by joining the study, which is expected to be completed in August 2022.

**Researchers: Ismael Al-Nawaja'a / DR. Basma Salameh**

**Thank you**

" نموذج الموافقة على المشاركة في البحث "

هذا النموذج هو عمل قانوني من متطلبات البحث , حيث انه لا بد من أخذ موافقتك/ة لادخالك ضمن البحث , حيث انه اذا تم التوقيع عليه من قبلك سيتم ادخالك في البحث بشكل عام ومباشر , كما انه نتحفظ بكافة المعلومات الخاصة فيك/ي بسرية تامة ولن يتم نشرها , ولن يذكر اي اسم مشارك بالبحث , وعليه فانه من حقك/ي الخروج من البحث في اي وقت دون حق لنا بمعرفة الاسباب , وذلك عن طريق التواصل المباشر مع الباحثين .

الباحث : اسماعيل احمد النواجعة / د.بسمة سلامة .

رقم الهاتف :-

اسماعيل النواجعة : 0598858295

د.بسمة سلامة : 0569357783

الايمل : [Nawajaa.ismael@gmail.com](mailto:Nawajaa.ismael@gmail.com)

[Basma.salameh@aaup.edu](mailto:Basma.salameh@aaup.edu)

التاريخ : -----

توقيع المشارك في البحث : -----

Thank you for agreeing to participate in this survey. Please tick or write the answer which best matches your response.

### Section 1 Demographic and nursing experience: -

1. Please indicate your current age.

2. How many years of ICU experience do you have?

- Less than 6 months  
 More than 6 months

If less than 6 months, thank you for your interest in this study but you do not meet the inclusion criteria.

3. If more than 6 months, please enter exact years.

4. Are you working in an adult ICU?

- Yes  
 No

If No, thank you for your interest in this study but you do not meet the criteria

5. Do you look after ventilated patients?

- Yes  
 No

If No, thank you for your interest in this study but you do not meet the inclusion criteria.

6. What is your nursing qualification?

- diploma  
 Bachelor's  
 master's  
 PHD

7. What is your current role in ICU?
- ICU Nurse
  - Associate Nurse Manager
  - Nurse Unit Manager
8. In which government hospital do you work?

## **Section 2 Knowledge of Evidence-Based Guidelines for Prevention of VAP (Labeau et al., 2007)**

*Please select the most appropriate answer.*

9. "Oral vs. nasal route for endotracheal intubation".
- A. "Oral intubation is recommended"
  - B. "Nasal intubation is recommended"
  - C. "Both routes of intubation can be recommended"
  - D. "I do not know"
10. "Frequency of ventilator circuit changes".
- A. "It is recommended to change circuits every 48 hours (or when clinically indicated)"
  - B. "It is recommended to change circuits every week (or when clinically indicated)"
  - C. "It is recommended to change circuits for every new patient (or when clinically indicated)"
  - D. "I do not know"
11. "Type of airway humidifier".
- A. "Heated humidifiers are recommended"
  - B. "Heat and moisture exchangers are recommended"
  - C. "Both types of humidifiers can be recommended"
  - D. "I do not know"
12. "Frequency of heated humidifier changes (HME)".
- A. "It is recommended to change heated humidifiers every 48 hours (or when clinically indicated)"

- B. "It is recommended to change heated humidifiers every 72 hours (or when clinically indicated)"
  - C. "It is recommended to change heated humidifiers every week (or when clinically indicated)"
  - D. "I do not know"
13. "Open vs. closed suction systems".
- A. "Open suction systems are recommended"
  - B. "Closed suction systems are recommended"
  - C. "Both systems can be recommended"
  - D. "I do not know"
14. "Frequency of change in suction systems".
- A. "Daily changes are recommended (or when clinically indicated)"
  - B. "Weekly changes are recommended (or when clinically indicated)"
  - C. "It is recommended to change systems for every new patient (or when clinically indicated)"
  - D. "I do not know"
15. "Endotracheal tubes with an extra lumen for drainage of subglottic secretions".
- A. "These endotracheal tubes reduce the risk of VAP"
  - B. "These endotracheal tubes increase the risk of VAP"
  - C. "These endotracheal tubes do not influence the risk of VAP"
  - D. "I do not know"
16. "Kinetic vs. standard beds".
- A. "Kinetic beds increase the risk of VAP"
  - B. "Kinetic beds reduce the risk of VAP"
  - C. "The use of kinetic beds does not influence the risk of VAP"
  - D. "I do not know"
17. "Patient positioning".
- A. "Supine positioning is recommended"
  - B. "Semi-recumbent positioning is recommended"
  - C. "The position of the patient does not influence the risk of VAP"
  - D. "I do not know"
18. "Use of 0.12% chlorhexidine gluconate antiseptic oral rinse (mouth wash)".
- A. "0.12% chlorhexidine gluconate antiseptic oral rinse reduce the risk of VAP"

- B. "0.12% chlorhexidine gluconate antiseptic oral rinse increases the risk of VAP"
- C. "0.12% chlorhexidine gluconate antiseptic oral rinse does not influence the risk of VAP"
- D. "I do not know"

19. "Use of proton pump inhibitor medications".

- A. "these proton pump inhibitor medications reduce the risk of VAP"
- B. "these proton pump inhibitor medications increase the risk of VAP"
- C. "intubated patients should be receiving on proton pump inhibitor medication"
- D. "I do not know"

20. "Endotracheal tube cuff pressure measurement".

- A. "(15-18) MMHG"
- B. "(18-24) MMHG"
- C. "(25-30) MMGH"
- D. "I do not know"

### **Section 3 Nurses' Adherence to Evidence-Based Guidelines for Prevention of VAE**

21. For the following strategies, choose the most appropriate answer relevant to your practice in your primary place of employment.

<b>Strategies</b>	<b>Done completely</b>	<b>Not done completely and accurately</b>	<b>Not done</b>
"I perform oral care for patients being mechanical ventilated".			
"I perform oral care with chlorhexidine solution on mechanically ventilated patients daily".			
"I perform a daily assessment of patient readiness for extubation".			
"I wash my hands before and after contact with the patient".			
"I wash my hands before performing endotracheal suctioning".			

"I use sterile gloves before open system endotracheal suctioning".			
"I wash my hands after performing endotracheal suctioning".			
"I not use normal saline irrigation for endotracheal suctioning".			
"I monitor the cuff pressure of the endotracheal tube for my patient at least once every 8 hours".			
"I position mechanically ventilated patients in semi-fowlers position".			
"I perform sedation vacation daily for sedated mechanically ventilated patients".			
"I assess intubated patients daily if can change from invasive to non-invasive ventilation".			

*Adopted and edited with permission from Labeau et al, 2007*

**The End**  
**Thank You for Your Participation**

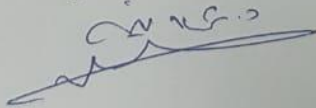
**Annex (2): Questionnaire Review And Recommendation.*****"Survey review letter and recommendation"*****Good Greeting:**

I am **Dr. Emad Tayym**, Intensive Care Specialist and Head of the Intensive Care Unit at Istishari Arab Hospital, I acknowledge that researcher **Ismael Ahmed Al-Nawaja'a** presented to me the questionnaire about his scientific research to obtain a master's degree in Intensive Care from the Arab American University, and the title of the research is: -

*"ICUs nurses' knowledge and adherence to EBGs for VAP prevention"*

After checking and reviewing the questionnaire, it was found that it is comprehensive to the EBGs, smooth in formula, and rich in its content, and therefore I recommend it use in scientific research and data collection.

Signature:



Date:

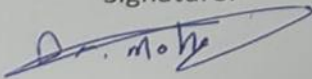
16.05.2022.

**"questionnaire review and recommendation"**

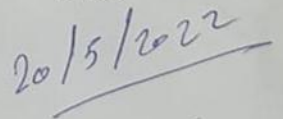
**Good Greeting: -**

I am **Dr. Muhammad Zeidan Al-Nawajaa**, anesthesiologist and head of the intensive care department at Abu Al-Hassan Qassem Hospital / Yatta, I acknowledge that the researcher **Ismael Al-Nawaja'a** presented me the questionnaire about his scientific research to obtain a master's degree in intensive care from the Arab American University, and the research is the extent of knowledge and adherence evidence base guideline to reduce the VAP among intensive care nurses for patients who connected to ventilators, and accordingly I acknowledge that the questionnaire is comprehensive and strong in its content, and I agree with it to collect data related to the research.

Signature:



Date:



## Annex (3): Researcher Mission Facilitation Form.

State of Palestine  
Ministry of Health  
General Directorate of Education in  
Health and Scientific Research



دولة فلسطين  
وزارة الصحة  
الإدارة العامة للتعليم الصحي  
والبحث العلمي

Ref.: .....  
Date:.....

الرقم: ٤٠٤/٤٠٤/٢٠٢٢  
التاريخ: ٢٠٢٢/٣/١٤

عطوفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،،  
الأخ مدير عام الإدارة العامة للمستشفيات المحترم،،،  
تعبه واعتذاره،،،

الموضوع: تسهيل مهمة بحث

يرجى التكرم بتسهيل مهمة الطالب: اسماعيل احمد خليل النواجعة، ماجستير عناية مكثفة- الجامعة العربية الامريكية، لعمل بحث بعنوان:  
" دراسة مدى المعرفة والعمل بارشادات قاعدة الادلة للحد من حدوث خطر العدوى والالتهاب الرئوي المرتبط بأجهزة التنفس الصناعي في أقسام العناية المكثفة من قبل الممرضين"  
حيث سيقوم الطالب بجمع معلومات من خلال تعبئة استبانة الدراسة من ممرضى اقسام العناية، ذلك في:

- جميع المستشفيات الحكومية ومجمع فلسطين الطبي

وذلك تحت اشراف د. بسمة سلامة، في الفترة ما بين 2022/3/15 - 2022/6/1.  
على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات.  
على ان يتم الالتزام بجميع تعليمات واجراءات الوقاية والسلامة الصادرة عن وزارة الصحة بخصوص جائحة كورونا، وتحت طائلة المسؤولية. وابرار شهادة التطعيم قبل دخول مرافق وزارة الصحة.  
على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاعتذار،،،



نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

## الملخص

### العنوان:

مدى المعرفة والعمل بإرشادات قاعدة الآلة للحد من حدوث خطر العدوى والالتهاب الرئوي المرتبط بأجهزة التنفس الصناعي في أقسام العناية المكثفة من قبل الممرضين.

### المقدمة:

الالتهاب الرئوي المرتبط بجهاز التنفس الصناعي (VAP) هو أحد المضاعفات الشائعة للمرضى الذين تم توصيلهم على جهاز التنفس الصناعي الميكانيكي (MV) في وحدات العناية المركزة (ICUs)، وقد لوحظ ما يقارب من 90% من الالتهاب الرئوي الذي تم الإصابة به في وحدة العناية المركزة على المرضى الذين تم توصيلهم بواسطة MV، وخطر الإصابة ب VAP أعلى من 6 إلى 21 مرة في المرضى الذين تم تنبيبهم لأكثر من 24 ساعة مقارنة بالآخرين، ويزداد الخطر مع زيادة مدة التهوية الميكانيكية.

لذلك، فإن الهدف من الدراسة الحالية هو تقييم معرفة ممرضات الرعاية الحرجة والتزامهم بالمبادئ التوجيهية لقاعدة الأدلة الإرشادية (EBGs) لمنع والتقليل من حدوث VAP.

### المنهجية:

تم تطبيق الدراسة في جميع وحدات العناية المركزة الحكومية الفلسطينية من أبريل إلى يونيو 2022. تم جمع البيانات الكمية باستخدام الاستبيان الذاتي الذي تم إكماله من قبل الممرضين المشاركين (ن = 213) وتم اختيارهم من 13 مستشفى (جميع وحدات العناية المركزة الحكومية) بمعدل استجابة 84.9%. تم استخدام الإحصاءات الوصفية والاستدلالية لتقييم معرفة ممرضين وحدة العناية المركزة والتزامهم ب EBGs للوقاية من VAP.

### النتيجة:

كشفت نتائج الدراسة أن متوسط درجات المعرفة لدى ممرضي وحدة العناية المركزة وفقا لجميع المستشفيات كان (50.8%). بشكل عام، تظهر النتائج التي توصلنا إليها أن معرفة الممرضين بإرشادات VAP متوسطة، وكان هناك فرق في مستوى معرفة المستجيبين بناء على المؤهلات العلمية ( $p = 0.049$ ). كما وجدت الدراسة أن التزام الممرضين بالمبادئ التوجيهية القائمة على الأدلة كان مقبولا (المتوسط = 8.3، 69.2%) ولم يتم العثور على اختلافات كبيرة في مستوى الالتزام بناء على خصائص المستجيبين. علاوة على ذلك، فإن معامل التحديد

(R<sup>2</sup>) بقيمة 0.03 يشير إلى أن التباين في متوسط درجات الالتزام هو 3% موضحا بمستوى المعرفة.

**استنتاج:**

لدى ممرضات وحدة العناية المركزة معرفة متوسطة ب EBGs للوقاية من VAP ومستوى مقبول من الالتزام بالمبادئ التوجيهية القائمة على الأدلة.