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Al-Quds University

Knowledge and Practices of Nurses toward Prevention of Ventilator Associated Pneumonia at Pediatric Intensive Care Units - Gaza Strip

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M. Sc. Thesis

Jerusalem- Palestine

1440 / 2018

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A Thesis Submitted in Partial Fulfillment of Requirements for the Degree of Master in Pediatric Nursing- Faculty of Health Professions– Al-Quds University

1440 / 2018

Al-Quds University

Deanship of Graduate Studies

Pediatric Nursing Program \ Nursing Department

Thesis Approval

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Master thesis submitted and accepted. Date: 22/12/2018
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Dedication

All the kind feelings to my father and my mother who are praying and encouraged me all the time ….

My sincere gratitude to my wife and my children who supported me all the way through this study …

Special thanks to my brothers and sisters for their support which provided me with energy to complete my study ….

I would like to express my appreciations to all the nurses who are working in Pediatric Intensive Care Units in European Gaza Hospital, Al Rantesy hospital, Al Dora hospital, and Al Nasser hospital.

Ahmed Abuadwan

Declaration

I certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed:

Ahmed Salem Abuadwan

…../……/…...

Acknowledgement

First of all, praise to Allah, the lord of the world, and peace and blessings of Allah be upon our prophet Muhammad, all thanks for Allah who granted me the capability to accomplish this thesis.

I would like to express my deepest thanks to the academic staff at Al Quds University for the knowledge and skills they provided through my study.

I had the great fortune to complete this study under the supervision, guidance and valuable instructions of Dr. Hamza Abdeljawad.

I would like to convey my warm thanks to all the obstetricians and midwives at Al Shifa Maternity Hospital for their cooperation during data collection.

To my friends, and all those who contributed to the completion of this study, thank you very much.

Ahmed Abuadwan

December, 2018

Abstract

Ventilator associated pneumonia is the most fatal of hospital acquired infections, with high mortality rates. The purpose of the study was to determine the nursing knowledge and practices for prevention of ventilator associated pneumonia (VAP) in pediatric intensive care units in governmental hospitals in Gaza Strip. The sample of the study consisted of 55 nurses who are working in Pediatric Intensive Care Units in four governmental hospitals (European Gaza hospital, Al Rantesy hospital, Al Dora hospital, and Al Nasser hospital). For data collection, the researcher used self-administered questionnaire that measures knowledge and practices of nurses to prevent VAP. Reliability of the questionnaire was tested and Cronbache alpha coefficient was 0.684. For data analysis, SPSS (version 22) was used, and statistical analysis included frequencies, percentage, cross-tabulation, and chi square tests. The results of the study showed that the mean age of study participants was 30.80±5.22 years, 81.8% were male nurses, 60% live in a city, 89.1% have bachelor degree, 40% have 6 – 10 years of experience and 21.8% have 11 years and more experience in PICU, 27.3% were from EGH, 25.5% from Al Rantesy hospital, 20% from Al Dora hospital, and 27.3% from Al Nasser hospital, and 25.5% received training or education about PICU. The results also indicated that the overall average knowledge about measures to prevent VAP in PICU was above moderate (75.17%), and 63.6% of nurses have moderate level of knowledge, 30.9% have high knowledge, and 5.5% had low knowledge. Observation of practice reflected that 50.9% of nurses showed high level of practice, 43.6% showed moderate level of practice, and 5.5% showed low level of practice, and the overall average of practices was 77.11%, which revealed above moderate level of practices to prevent VAP. The results also showed that there were statistically no significant differences in levels of knowledge related to age, qualification, years of experience, hospital, while significant differences existed in relation to gender, place of residency, and training. Furthermore, there were statistically no significant differences in levels of practice related to age, gender, place of residency, years of experience, while significant differences existed in relation to qualification, and hospital. The study concluded that nurses who are working in PICU should be selected carefully, should receive adequate training, and should be monitored and evaluated periodically to maintain high quality of care and prevent the development of VAP.

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List of Abbreviations

ATS	American Thoracic Society
CDC	Centers for Disease Control and Prevention
EBG	Evidence-based Guidelines
EBS	Evidence-based Preventive Strategies
EGH	European Gaza Hospital
EO-VAP	Early Onset Ventilator-associated Pneumonia
ETT	Endotracheal Tube
GS	Gaza Strip
HAI	Hospital-associated Infection
HCPs	Healthcare Providers
ICU	Intensive Care Unit
LO-VAP	Late Onset Ventilator-associated Pneumonia
MV	Mechanical Ventilation
MOH	Ministry of Health
NGOs	Non-Governmental Organizations
NI	Nosocomial Infection
PICU	Pediatric Intensive Care Unit
PCBS	Palestinian Central Bureau of Statistics
SPSS	Statistical Package for Social Sciences
VAP	Ventilator-associated Pneumonia
UNRWA	United Nations Relief and Works Agency for the Palestinian Refugees in the Near East
WB	West Bank

Chapter One

1.1 Introduction

Ventilator associated pneumonia (VAP), is defined as hospital-acquired lung infection in patients who have been on mechanical ventilation (MV) for at least 48 hours (American Thoracic Society-ATS, 2005). MV is a core component of supportive therapy for critical care patients who cannot breath adequately on their own. Yet while a ventilator is often a lifesaving measure, it can frequently cause complications, including the nosocomial infection (NI). VAP is considered as the most common hospital-associated infection (HAI) among patients at intensive care units (ICUs). Data from developing countries reveal an incidence of VAP ranges from 15.87% - 30.67% (Ranjit and Bhattarai, 2011). Nearly 31% of pediatric patients developed VAP with an incidence 21.3 per 1000 ventilator days, according to a study done in pediatric Intensive Care Units (PICUs) at Cairo University Hospital (Galal et al. 2016), compared with 21.6% of ventilated patients in Palestinian's hospitals (Ruzieh et al. 2013).

Ventilator associated pneumonia is the most fatal of the HAI, with higher mortality rates than either central line infections or sepsis. Ventilated patients who develop VAP have mortality rate of 45% compared to 28% for ventilated patients who do not develop VAP. Intubation and MV increase the susceptibility of pneumonia since it facilitates the colonization of bacteria in the mouth and with the absence of cough reflex due to placement of the tube in the oropharynx to the trachea and then to the lower respiratory tract (Curtin, 2011).

Nurses are the first line of defense in preventing bacterial colonization of the oropharynx by practicing measures have its effect directly or indirectly on the risk factors associated with VAP occurrence in ICUs, and, so early autonomous nursing interventions could

contribute in prevention of such cases and ultimately reduce fatality of patients. Therefore, the study takes place as an initial step in Gaza Strip (GS) to assess knowledge and practices of nurses toward prevention of VAP at PICUs in the governmental hospitals of GS.

1.2 Problem statement

Ventilator associated pneumonia remains as critical issue in developing countries with limited medical and hygienic resource. The quality of patient care depends basically on the knowledge, skills and clinical practices of nurses at the workplace.

On the other hand, from the researcher's experience, the nurses at ICUs have a different knowledge, practices and compliances to the scientific standard protocol for prevention of HAI such as VAP. Thus, this entails for investigating the level of knowledge and practice of nurses regarding the prevention of VAP in order to decrease the incidence of such cases and untimely reducing morbidity and mortality rate among PICU patients on the governmental hospitals in GS.

1.3 Justification of the study

For many health institutions, VAP remain the common infection at ICUs with an incidence rate 21.6% in Palestine. It is responsible for high morbidity and mortality in ICUs and prolongs the duration of hospitalization for an average of 7 – 9 days per patient, which leading to increase in the health care costs on Palestinian Ministry of Health (MOH) (Ruzieh et al, 2013). Actually, nurses at PICUs are the first line of defense in preventing of HAI by practicing autonomous nursing interventions contribute positively in prevention of VAP and ultimately reduce fatality of patients.

Furthermore, up to the researcher's knowledge, in GS there is no previous published study spotting the light on the nursing knowledge and practice for prevention of VAP at PICUs. Therefore, this study takes place as the first one of its kind in GS to assess knowledge and

practices of nurses regarding the prevention methods of VAP at PICUs in the governmental hospitals in GS.

1.4 Goal of the study

The goal of the study was to determine the nurses' knowledge and practices for prevention of VAP in PICUs in governmental hospitals in GS.

1.5 Objectives of the study

- To identify the overall mean score and level of knowledge about prevention of ventilator associated pneumonia among pediatric intensive care nurses.
- To determine the overall mean score and degree of practice towards prevention of ventilator associated pneumonia among pediatric intensive care nurses.
- To assess the relationship between sociodemographic characteristics of subjects and prevention of ventilator associated pneumonia.
- To suggest recommendations and health prevention measures contributing to prevention of ventilator associated pneumonia.

1.6 Research questions

- What are the overall mean score and the level of knowledge about prevention of ventilator associated pneumonia among pediatric intensive care nurses?
- What are the overall mean score and degree of practices about prevention of ventilator associated pneumonia among pediatric intensive care nurses?
- What is the relationship between sociodemographic characteristic of nurses and their levels of knowledge and practices about the prevention of VAP?
- What are the recommended measures for prevention of ventilator associated pneumonia?

1.7 Context of the study

1.7.1 Sociodemographic context

Palestine lies within an area of 27,000 Km^2 (annex 1), expanding from Ras Al-Nakoura in the north to Rafah in the south. Due to Israeli occupation, Palestinian territory is divided into three areas separated geographically; the West Bank (WB) 5.655 Km^2, GS 365 Km^2 and east Jerusalem. The total population of Palestinians in WB and GS was 4,952 million (3,008 in WB and 1,943 in GS) with male to female ration 103.4:100. The population density (capita/km^2) is 778 in Palestine (506 in WB and 4,986 in GS) (Palestinian Central Bureau of Statistics - PCBS, 2017).

1.7.2 Economic context

The Palestinian economy is under high pressure to create decent and productive jobs, reduce poverty and provide economic security on an equal basis for all social groups in a rapidly growing and urbanizing population. Economic status in the Palestinian territories is very low. Gross Domestic Product is estimated about 9.3%, and the workforce participation 43.6, unemployment is very high and reached a rate of 26.9% for males (15.5% in WB and 34.4% in GS) and for females unemployment rate is 44.7% (29.8% in WB and 65.2% in GS) (PCBS, 2017). Due to blockade of the strip, a significant increase in poverty rates occurred in GS from 38.8% in 2011 to 53% by the end of 2017 (United Nations Office for the Coordination of Humanitarian Affairs - OCHA, 2018).

1.7.3 Health care system

The Palestinian health system compose of different sectors. The major groups of health providers are the MOH, Non-governmental organizations (NGOs), United Nations Relief and Works Agency for Palestinian Refugees in the Near East (UNRWA), Military Health Services, and the private sector. The total number of hospitals in Palestine is 81 hospitals, 51 of them in WB including east Jerusalem. The number of hospitals in MOH is 27

hospitals, of these hospital, there are 14 hospitals in WB and 13 hospitals in GS. The number of beds allocated to admit children is 19.3% of the total number of beds in MOH hospitals (260 beds in WB and 381 beds in GS), and there are four PICUs in GS allocated in European Gaza Hospital (EGH, Al Rantesy Pediatric Hospital, Al Dora pediatric Hospital, and Al Nasser Pediatric Hospital (MOH, 2017).

1.7.4 The status of children in Palestine

In the Palestinian community, young age occupies a considerable large proportion of the population as the percentage of children aged 0 - 14 years is 38.9% (36.6% in WB and 42.6% in GS), and those aged between 15 – 29 years accounted for 29.7% (29.9% in WB and 29.5% in GS) (PCBS, 2017). The number of children under the age of 18 is 2,115,370 children in Palestine according to the results of Population, Housing and Establishments Census 2017, of which 1,083,720 males and 1,031,650 females. The percentage of children in Palestine is 45.3% of the population (43.4% in WB and 48.0% in GS). In addition, 10.8% of women were married in childhood under the age of 18 years (8.5% in WB and 13.8% in GS) (PCBS, 2018).

Concerning children's health-related statistics, 0.9% of the children have at least one form of disability (0.7% in WB and 1.2% in GS). The main causes of disability among children included congenital or genetic causes ranked first by 45.5% (43.5% males and 48.3% females), followed by causes related to pregnancy and childbirth 23.3% (22.8% males and 24.1% females), then 21.1% for pathological causes (22.2% males and 19.6% females) (PCBS, 2018). Concerning education, enrollment of children in basic education (6 – 15 years) in GS reached 94.3% for male children and 95.9% for female children. There are 443,425 children enrolled in basic education in GS (223,928 males and 219,497 females), and classroom density was 36.9 (37.1 in government schools and 39.0 in UNRWA

schools), and rate of student per teacher was 24.8 (21.9 in government schools and 30.4 in UNRWA schools) (PCBS, 2017).

1.8 Operational definition

Ventilator associated pneumonia (VAP)

It is a nosocomial pneumonia in a patient on mechanical ventilator support by endotracheal tube or tracheostomy for more than 48 hours with signs and symptoms of pneumonia.

Intensive care unit: A special area in a hospital, where critically ill patients or highly dependent patient, who need close and frequent observation, can be cared for by qualified and special trained staff working under the best possible condition.

Intensive care nurse: registered nurse who working at PICU

Nursing knowledge: a theoretical understanding of measures to prevent VAP, practice, and implementation of measures to prevent VAP, which classified low 60%, moderate 70-80%, high knowledge above80%.

***Prevention measures*:** Practice, and implementation of measures to prevent VAP, , which classified low 60%, moderate 70-80%, high practice above80%.

1.9 Boundaries of the study

Conceptual boundary: assess the knowledge and practice of nurses towards measures for prevention of VAP.

Setting boundary: the study has been done at PICUs in governmental hospitals in GS (EGH, Al Rantesy Pediatric Hospital, Al-Dora Hospital, and Al Nasser Pediatric Hospital).

Temporal boundary: the whole study is proposed to be applied in the period between November 2017 till October 2018.

Population boundary: eligible registered nurses who are working at PICUs in governmental hospitals in GS during the time of study implementation.

1.10 Lay out of the study

This study consists mainly of five chapters: Introduction, Conceptual Framework and Literature Review, Methodology, Results and Discussion, and Conclusion.

The first chapter presented introduction to the study, where a brief background regarding the subject of the study was provided. The researcher illustrated the research problem, justification for conducting the study, goal and objectives of the study, questions of the study, context of the study, and definition of terms.

The second chapter consisted of two parts: the first part was the conceptual framework where the researcher provided a diagram of the conceptual framework of the study. The second part was the literature review related to the study topic and variables. In-depth detailed theoretical inquiry including previous studies were presented.

The third chapter described methodology including study design, population, sample, setting of the study, period of the study, eligibility criteria, instruments for data collection, pilot study, data entry and statistical analysis, ethical considerations, and limitations of the study.

The fourth chapter presented the results and discussion. The researcher treated the results in the form of tables and figures to make it easy for the reader to understand. The results were discussed and compared with available published previous studies that related to the topic of this study and its objectives.

The fifth chapter presented conclusion, recommendations, and suggestions for further studies.

Chapter Two

Conceptual framework and literature review

2.1 Conceptual framework

The below conceptual framework (Figure 1) was used to guide and direct the research process. The diagram denotes that the prevention of VAP is related to different factors including sociodemographic characteristics, knowledge, and practice of nurses.

Sociodemographic factors include age of the nurse, gender, residency, qualification, years of experience, and training. The researcher assumed that these factors play an important role in enhancing nurses' knowledge and improving their practice to prevent the occurrence of VAP. It is obvious to say that adequate knowledge is important factor, but this knowledge should be reflected in nurses' practice during caring with MV patients in PICU.

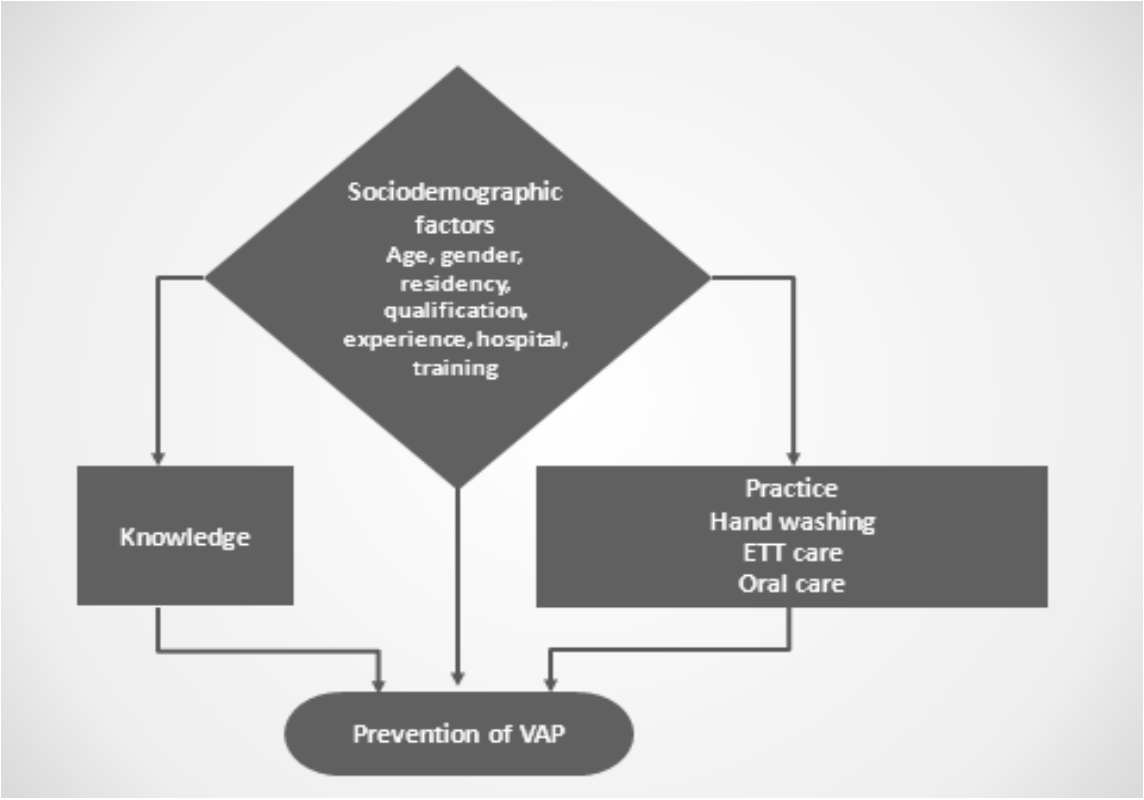

Figure (2.1): Diagram of conceptual framework (Self-developed)

Factors associated with knowledge and practices of nurses about prevention of VAP

Worldwide, VAP is a major clinical concern associated with high incidence rates, mortality rate and healthcare costs (Kapoor, 2017). There are documented guidelines and strategies to prevent VAP , that the ICU nurses are in a good position to put strategies into practice as they are at the patient's bedside 24-hours a day and therefore, important role to do so.

Different factors play a role in level of knowledge and extent of practice to prevent development of VAP in critical care settings including nurses' age, qualification, experience, and training. A cross-sectional survey with qualitative-quantitative design has been conducted in Iran. The purpose of the study was to evaluate knowledge, attitudes and adherence of healthcare providers (HCPs), and the sample of study consisted 53 HCPs who are working in PICUs. The results of the study showed that knowledge of HCPs was poor and significantly different between different qualifications. The adherence of HCPs was low with significant differences between different qualifications (Jahansefat et al., 2016). Other descriptive study carried in India showed that only 55.8% of participants had an adequate knowledge on prevention of VAP, and there was no significant association between knowledge score and educational qualification, years of experience in ICU (Sherpa et al., 2014).

In addition, a descriptive study was conducted in Egypt to assess knowledge of pediatric critical care nurses regarding evidence base guidelines (EBGs) for prevention of VAP. The results indicated that 44.9% of studied nurses their ages were ranged from 20 to less than 25 years, and 42.9% had less than 5 years of experience in the intensive care unit. The majority (98 %) of them had bachelor degree in nursing, and 79.6% of them didn't take any previous training about guidelines of prevention of VAP. The results also showed that there is strong correlation between years of experiences, previous training on guidelines of

prevention of VAP and knowledge of nurses on the EBGs for prevention of VAP, while, there was no correlation between age and nurses' level of knowledge regarding EBGs for preventing VAP (Ahmed and Abosamra, 2015).

A descriptive correlational study was carried out in Johannesburg, South Africa aimed to determine the knowledge of ICU nurses with respect to EBGs for prevention of VAP. The sample of the study consisted of 83 ICU nurses, and the results reflected lack of knowledge about EBGs for prevention of VAP. Also, the results showed that there were no significant differences in the knowledge between the nurses who received training and the nurses who did not receive training. Also, there was weak correlation between years of experience in ICU and knowledge (Gomes, 2010). Another cross-sectional observational study was carried out in Tanzania aimed to identify knowledge and practice of ICU nurses on prevention of VAP. The sample of the study consisted of 118 nurses working in ICU, PICU, and emergency medicine department. The results of the study showed that 90% of nurses did not have ICU training, and showed no association between knowledge and years of experience, ICU training, and qualification. Also, practices on prevention of VAP was statistically associated with qualification, but not associated with ICU training and years of experience (Said, 2012).

A descriptive, cross sectional study was carried out in Saudi Arabia showed that the mean score of the total knowledge was higher for female nurses than for male nurses, but the difference was not statistically significant. Bachelor and master degree nurses scored a higher mean of the total knowledge than diploma nurses and the difference was statistically significant. There were no significant differences in knowledge between single, married and divorced nurses, but there was a significant correlation between the total knowledge score and ICU experience, while age of the nurse was not significantly correlated with the total knowledge score (Yaseen and Salameh, 2015).

Furthermore, a study was carried out in Alexandria, Egypt, aimed to assess nurses' compliance of EBGs for preventing VAP in critical care units. The sample of the study consisted of 60 nurses, and the results showed that statistically significant difference between mean percent score of nurses' knowledge and application of measures to prevent VAP. It was found that nurses didn't have enough knowledge and didn't adhere to the guideline to prevent VAP, and no statistically significant difference between knowledge and application of VAP prevention guidelines (Alhirish et al., 2010). Another case-control study carried out in Lebanon aimed to determine the effect of nurses training on VAP prevention Bundle on VAP incidence rate at a critical care unit. The results of the study indicated that there were significant improvements in most items of nurses' general knowledge related to VAP after the training. Moreover, comparison of the knowledge related to the VAP prevention bundle of nurses before and after training, with respect to head elevation, nurse's knowledge had been improved from 79.2% to 100% afterward (Ismail and Zahran, 2015).

2.2 Literature review

2.2.1 Background

Nosocomial infection (NI) is a localized or systemic infection acquired in a hospital or any other healthcare facility by a patient admitted for a reason other than the pathology present during admission, that may manifest 48 hours after the patient admitted to the hospital (Kamunge, 2013). Despite major advances in pediatric healthcare services, nosocomial infection remains a major cause of morbidity and mortality in PICU. Among these infections, VAP is common and considered the second most frequently NI that occurs in PICU settings (Foglia et al. 2007). Therefore, VAP not only contributes to prolonged hospital length of stay and increased cost, but also to mortality and morbidity (Rosenthal, 2011). VAP is defined as a hospital acquired pneumonia that develops in patients who have been treated with MV for 48 hours or longer, who had no signs or symptoms of lower respiratory tract infection before they were intubated (Centers for Disease Control and Prevention - CDC, 2012).

2.2.2 Mechanism of pathogenesis of VAP

It has been reported that the origin and pathogenesis of VAP remains unclear. Most likely, it is the result of micro-aspirations rather than blood stream associated infiltrates of the lung, and entry of bacteria to the lung may be facilitated directly through the endotracheal tube (ETT) during disconnection from the ventilator circuit. In addition, most of the bacteria found in the endotracheal aspirates of patients suffering from VAP are also found in the naso-oropharynx and even in gastric secretions. However, once a patient is intubated, bacteria have direct access to the lower airway because the endotracheal tube bypasses normal filtration mechanisms and the barrier function of the epiglottis (Chang and Schibler, 2016).

The complex interplay between the ETT as a risk factor, virulence of the invading bacteria and host immunity largely determine the development of VAP. The presence of an ETT is the most important risk factor, resulting in a violation of natural defense mechanisms such as the cough reflex (Hunter 2012; Zolfaghari and Wyncoll 2011). In MV patients, infectious bacteria reach the lower respiratory tract by different ways including; micro aspiration which can occur during intubation; development of a biofilm laden with bacteria within the ETT; pooling and collection of secretions around the ETT cuff; and impairment of mucocilliary clearance of secretions with gravity dependence of mucus flow within the airways (Grgurich et al. 2013; Mietto et al. 2013; Zolfaghari and Wyncoll 2011). Pathogenic material can also collect in surrounding anatomic structures, such as the stomach, sinuses, nasopharynx and oropharynx, with replacement of normal flora by more virulent strains (Zolfaghari and Wyncoll 2011; Grgurich et al. 2013; Rocha et al. 2013).

2.2.3 Diagnosis of VAP

Diagnosis of VAP is a challenging issue to HCPs in ICU settings. Up to date, there is no universally accepted gold standard diagnostic criterion for VAP, and several clinical methods have been recommended but none have the needed sensitivity or specificity to accurately identify this disease (Center for Disease Control and Prevention, and National Healthcare Safety Network – CDC/NHSN, 2013). According to CDC (2017), the standard diagnostic criteria include the following:

For any pediatric patient:

At least one of the following:	**At least two of the following:**
Fever > 38°C or hypothermia of <36.5°C. Leukopenia ≤4000 WBC/mm^3 or leukocytosis ≥ 15,000 WBC/mm^3**.**	New onset of purulent sputum or change in character of sputum or increased respiratory secretions or increased suctioning requirements. New onset or worsening cough or dyspnea or tachypnea. Rales or bronchial breath sounds. Worsening gas exchange (e. g., O_2 desaturations, increased oxygen requirements, or increased ventilator demand).

Source: (CDC, 2017)

For a child > 1 year old to ≤12 years old:

At least three of the following
Fever of >38°C or hypothermia of <36.5°C**.** Leukopenia ≤ 4000 WBC/mm^3 or leukocytosis ≥ 15,000 WBC/mm^3**.** New onset of purulent sputum or change in character of sputum or increased respiratory secretions or increased suctioning requirements**.** New onset or worsening cough or dyspnea, apnea, or tachypnea. Rales or bronchial breath sounds. Worsening gas exchange (e. g., O_2 desaturations [e.g., pulse oximetry < 94%], increased oxygen requirements, or increased ventilator demand)

Source: (CDC, 2017)

For infants ≤ 1 year old:

At least three of the following:
Temperature instability**.** Leukopenia ≤ 4000 WBC/mm^3 or leukocytosis ≥ 15,000 WBC/mm^3 and left shift (≥10% band forms)**.** New onset of purulent sputum or change in character of sputum or increased respiratory secretions or increased suctioning requirements**.** Apnea, tachypnea, and nasal flaring with retraction of chest wall of nasal flaring with grunting**.** Wheezing, rales, or rhonchi. Cough. Bradycardia (<100 beats/min) or tachycardia (>170 beats/min).

Source: (CDC, 2017)

The time of onset of pneumonia is an important epidemiologic variable and risk factor for the outcome among ventilated patients. Early-onset VAP (EO-VAP) defined as occurring within the first 4 days of mechanical ventilation, and usually carries a better prognosis and is likely to be caused by pathogens which are sensitive to antibiotics. Late-onset VAP (LO-VAP) occurs after 5 days or more and is more likely to be caused by multidrug-resistant nosocomial pathogens, and is associated with increased patient mortality and morbidity (Jakribettu et al. 2016). It was reported that among patients admitted to ICU, EO-VAP was found in 19.3% of patients and LO-VAP was found in 8.4% of VAP cases (Amanati et al. 2017). Furthermore, Khan et al. (2016) found that out of 394 VAP episodes, 63 (16%) were EO-VAP episodes and 331 (84.0%) were LO-VAP episodes.

A prospective cohort study carried out in Bangladesh found that 52% of the VAP cases were EO-VAP, while 48% were LO-VAP. Acinetobacter was the commonest organism isolated from LO-VAP, while Pseudomonas was the commonest isolates obtained from EO-VAP ($p = 0.046$). Klibsiela, MRSA and E. coli were almost identically distributed

between groups. The overall mortality rate was 44%, and the mortality was significantly higher in the LO-VAP (Mallick et al. 2015).

2.2.4 Epidemiology of VAP in children

Ventilator associated pneumonia is the second most common NI diagnosed in MV patients. VAP occurs MV patients with the highest risk being early in the course of hospitalization (Rana et al. 2017). Literature and previous studies reflected variations in incidence and prevalence of VAP in different settings, and can affect up to 12% of ventilated children (Chang and Schibler, 2016), while Balasubramanian and Tullu (2014) stated that VAP occurs in 3 – 10% of MV pediatric patients. Earlier reports indicated that VAP can occur within 48 hours of MV and has an incidence of 15 – 60% (Rello et al. 2001; Chastre and Fagon, 2002).

According to CDC report, the estimated rate of VAP is 1.4 to 5.8 events per 1000 intubated patients, with a downward trend since 2000, data from the CDC National Nosocomial Infections Surveillance System has indicated a mean rate of VAP in pediatric ICU was 2.9 per 1000 ventilator days (CDC, 2012).

In the WB of Palestine, the incidence of VAP reported in a cohort study was 21.6%, (Ruzieh et al. 2013), compared to other prospective cohort study conducted in India according to CDC criteria reported as 38.4% (Vijay et al. 2018). In addition, a study carried out in India aimed to assess incidence and risk factors associated with VAP in PICU conclude that of all MV patients, 33.7% developed VAP (Malhotra et al. 2018). Moreover, a study carried out in India showed that 48 patients developed VAP out of 51 isolates were recovered, and the incidence of EO-VAP was 19% while LO- VAP was 81% (Rana et al. 2017).

In other regions, a retrospective cross-sectional study carried out in Philippines aimed to assess incidence of VAP among PICU patients. The study sample consisted of 132 pediatric patients and the results showed that 15.2% of patients developed VAP, and VAP rate was 0.98 per 1000 ventilator days (Lozada, 2013). Earlier studies reflected that VAP is one of the top causes of HAI in the PICU, accounting for 18% to 26% of all HAIs in PICU (Foglia et al. 2007). Moreover, a retrospective descriptive study conducted in Cleveland, USA aimed to identify the risk factors associated with VAP in pediatric patients, that found 20% of NIs are VAP, with an incidence of 4 to 44 per 1000 intubated children (Morinec et al. 2012).

2.2.5 Risk factors for the development of VAP

Ventilator associated pneumonia is a serious complication that affects a considerable percentage of patients admitted to PICU, and several factors contribute to the development of VAP.

The primary risk factor is the ETT itself – it can provide a direct passageway for airborne pathogens into the lungs, or act as a reservoir for pathogens by providing a place for biofilm to form or secretions to pool. VAP results from the invasion of the lower respiratory tract and the lung parenchyma by microorganisms; intubation compromises the integrity of the oropharynx and trachea and allows oral and gastric secretions to enter the lower airway compromising its integrity, moreover, pathogens can reach the lung from exogenous sources such as hands of healthcare workers, ventilator circuits, and the biofilm of ETT and increasing risk of VAP (Malhotra et al. 2018). Furthermore, intubated patients are at risk for VAP because of their poor cough and gag reflexes and their immobility. Also, the risk for VAP is greater for intubated children than for intubated adults because of the used devices include un-cuffed ETT, nasally placed ETT, open-circuit suctioning, use of physiological saline during suctioning, and developing teeth (Johnstone et al. 2010).

Risk factors for VAP in children include use of opiates for sedation, sustained neuromuscular blockade, use of enteral nutrition, previous antibiotic therapy, the technique used for endotracheal suctioning, reintubation, ventilator circuit changes, gastro-esophageal reflux, subglottal or tracheal stenosis, young infants, and trauma or surgical problems (Morinec et al. 2012; Abdel-Gawad et al. 2010; Hsieh et al. 2010; Bigham et al. 2009). In addition, a study carried out by Liu, et al. (2013) to identify risk factors of VAP in PICU, found that risk factors of VAP included genetic syndrome, steroids, reintubation or self-extubation, bloodstream infection, prior antibiotic therapy and bronchoscopy.

A retrospective, cross sectional study carried out in Philippines found that risk factors for the development of VAP included reintubation, prolonged ventilator days, prolonged stay in PICU, enteral feeding, positive blood culture, inhaled bronchodilators, and systemic steroids (Lozada, 2013). Other a prospective cohort study was conducted in India found that risk factors for VAP included use of proton pump inhibitor, enteral feeding and re-intubation (Vijay et al. 2018). Another study reported that risk factors for VAP in children include use of opiates for sedation, sustained neuromuscular blockade, use of enteral nutrition, previous antibiotic therapy, the technique used for endotracheal suctioning, reintubation, ventilator circuit changes, gastro-esophageal reflux, subglottal or tracheal stenosis, and trauma or surgical problems. Primarily, unlike adults, children have developmental and physiological differences for a wide range of ages. Age is also a factor in immunity, so younger or preterm infants are more likely than older children or adults to experience infection and to have more frequent episodes of infection (Srinivasan et al. 2009).

2.2.6 Nurses' knowledge and practices about VAP

Nurses' knowledge regarding VAP is an important determinant in reduction of VAP among MV patients, and adequate nursing knowledge would facilitate optimal delivery of nursing care (Subramanian et al. 2013). Thus, nurses need to have an awareness of the problem as well as evidence-based preventive strategies (EBS) to adhere to these strategies and integrate them into their nursing care (Akin et al. 2014). Therefore, skilled and knowledgeable nurses are very important and needed to make appropriate decisions in patient care and minimize risks to their patients. However, some surveys reported that there is a substantial lack of knowledge among ICU nurses about EBS for prevention of VAP (Ali, 2013). To overcome the problem of lack of knowledge, Chithra and Raju (2017) implemented a structured teaching program on knowledge regarding VAP for nurses, and the findings revealed that there was a marked increase in the overall knowledge score of post-test than pre-test score. In addition, Elseoud et al. (2016) reported that implementation of educational program was effective and reduced the incidence rate of VAP in ICU. The same as, Jahansefat et al. (2016) emphasized the need for evaluating, enhancing and expanding the knowledge of health care workers about the guidelines for prevention of VAP.

In Palestine, a descriptive, cross-sectional study carried out to investigate ICU nurses' knowledge, practice, attitude and barriers to nursing care of intubated patients. The results showed that despite the high qualifications of nurses who are working in ICU, the knowledge level for about half of them (48.8%) was poor, and the practices level of 41.7% of them was acceptable (Aqel et al. 2016).

A descriptive, cross sectional study was carried out in Saudi Arabia aimed to estimate critical care nurses' knowledge about preventive guidelines of VAP. The results showed 83 % of nurses believed that their hospitals had VAP policies and guidelines. In addition,

86.5% of respondents recognized the importance of recumbent position for prevention of VAP, 85.6% knew the importance of closed system suctioning for prevention of VAP and 78% reported preferring the use of kinetic beds to reduce the risk of VAP. The results also indicated that the mean of the total knowledge score was 7.13 ±1.36 (Yaseen and Salameh, 2015).

Furthermore, a descriptive study carried out in Egypt aimed to assess knowledge of PICU nurses regarding evidence-based guidelines (EBG) for prevention of VAP in both PICU and NICU. The results reflected inadequate knowledge of PICU nurses regarding EBGs for prevention of VAP. The study raised the need for written, updated protocols for best evidence-based practice with continuous nursing education (Ahmed and Abosamra, 2015). Moreover, a pre-interventional and post-interventional trial study carried out in Lebanon aimed to assess the incidence of VAP in PICU. The results indicated that there was significant decrease in the incidence rate of VAP after implementation of VAP bundle, and that resulted in reduction of the length of stay in the hospital stay, morbidity, and mortality (Obied et al. 2014).

Another descriptive study carried out in Iran aimed to evaluate the knowledge of nurses in the ICU in University hospitals of Sari, Iran. The study sample consisted of 52 ICU nurses, and the results showed that 34.6% of nurses answered correctly about oral route for ETT intubation, 78.8% answered correctly about the type of humidifier, and 80% chose the closed suction system as the correct answer. Using kinetic beds, ETT with extra lumens for the drainage of subglottic secretions, and semi-recumbent positioning were the correct options chosen by 90.4%, 65.4%, and 82.2% of the participants. Respondents had the least knowledge about the frequency of ventilator circuit changes (17.3%), the frequency of humidifier changes (3.8%), and the frequency of changes in the suction system (13.5%).

The results also indicated that the average level of knowledge about preventing VAP was 51.92% which is low (Bagheri-Nesami and Amiri, 2014).

2.2.7 Preventive measures for VAP

Among the ICU staff, nurses have the most critical role in implementing most of the VAP preventive measures, thus their knowledge and practices are of great importance. Most of the measures included in VAP Prevention Bundle guidelines are largely related to the daily nursing care activities. The key concepts of the VAP Prevention Bundle are five concepts. These concepts include; head of bed elevation 30 degrees or more, use of thrombo-embolic prophylaxis, use of peptic ulcer disease prophylaxis, daily interruption of sedative drug infusions with a constant assessment of readiness to extubate, and providing oral care (Tolentino et al. 2007).

There are various guidelines regarding preventive measures for VAP in different parts of the world such as guidelines represented by CDC, Institute of Healthcare Improvement, European care bundle and clinical practice guide including semi-recumbent position, discontinuation of the sedative drugs once a day to check the possibility of extubation, using new ETT, the drainage of subglottic secretions, using orogastric tube and comprehensive dental and oral hygiene (Cason et al. 2007), the administration of prophylactic agents for gastric ulcer and deep vein thrombosis, hand hygiene, staff education, using the protocol for weaning the patients from MV (Rello et al. 2010), oral intubation, kinetic beds, closed suction system, changing the humidifiers weekly or for each patient, changing the suction system for every new patient and using gloves (Muscedere et al. 2008). All these measures aim to modify the care provided for the patients with MV, leading to reduced incidence of VAP.

A study carried out in Egypt aimed to improve health outcome of patients on MV through decreasing VAP in surgical ICU at Zagazig University Hospitals after implementation of health education program covering the guidelines recommended by Association for Professionals in Infection Control and Epidemiology (APIC). The results indicated that before intervention, 31.7% of ventilated patients developed VAP while in the post-intervention phase only 16.7% of patients were diagnosed as VAP cases with a statistically significant difference. The VAP incidence rate dropped by 25.7% from 29.5 VAP cases/1000 vent. days in pre-intervention phase to 21.5 in post-phase. The effect of educational intervention on total knowledge among physicians and nurses about VAP prevention measures improved significantly. This study revealed that a relatively simple education program for implementation of guidelines recommended by APIC reduced the incidence rate of VAP in ICU (Abo Elseoud et al. 2016).

A study carried out in Tanzania found that on observation, 100% of nurses did not wash their hands before entering ICU, 83.3% wash their hands before contact with patients, 66.7% wash their hands after contact with patients, 66.7% wash their hands after contact with a source of microorganisms, 83.3% of nurses use sterile gloves during ETT suction, 90% of nurses use clean gloves when doing oral care, 80% clean patient's mouth using toothbrush or gauze moistened with mouth wash, and 73% clean equipment after usage (Said, 2012). A descriptive, cross sectional study was carried out in Saudi Arabia found that the main barriers that restrict prevention of VAP were lack of VAP courses (74.2%) shortage of qualified nurses (74.2%), lack of knowledge during studying in the college (50.5%), failure to change gloves between patients (55.9%) and improper hand washing (57%). Other barriers included lack of time (48.4%) and not wearing personal protective equipment (36.6%) (Yaseen and Salameh, 2015). Another study was carried out in Egypt, examined barriers that prevent implementation of measures to prevent VAP found that the

most common barriers that hinder them from performing measures to prevent cross contamination were unavailability of the necessary material and workload (Alhirish et al., 2010).

Chapter Three

Methodology

3.1 Study design

This study utilized a descriptive, cross-sectional design. This design are appropriate for describing the status of phenomena or for describing relationships among phenomena and involves the collection of data once the phenomena under study are captured during a single period of data collection (Polit and Beck, 2012)

3.2 Study population

The study population consisted of all the nurses who are working in PICUs in governmental hospitals of GS. Their total number is 60 nurses who are working full time.

3.3 Sampling method and sample size

Due to the relatively small number of study population, the researcher included all the nurses in the sample (census sample). The researcher distributed 60 questionnaires to the eligible nurses and 55 agreed to participate in the study and filled the questionnaires, with response rate 91.6%. Distribution of study sample is presented in table (3.1).

Table (3.1): Distribution of study sample by hospital

Hospital name	Number of nurses	Number of participants
European Gaza Hospital	15	15
Al Rantesy pediatric hospital	16	14
Al Dora pediatric hospital	13	11
Al Nasser pediatric hospital	16	15
Total	**60**	**55**

3.4 Setting of the study

The study has been carried out in the four governmental hospitals that have PICU; European Gaza Hospital in Khanyounis, Al Rantesy pediatric hospital, Al Dora pediatric hospital, and Al Nasser pediatric hospital in Gaza city.

3.5 Period of the study

This study has been conducted from November 2017 to October 2018. Data collection has been carried out from April to June 2018.

3.6 Eligibility criteria

3.6.1 Inclusion criteria

- Nurses who are working in PICU for at least three months.

- Working full-time schedule.

3.6.2 Exclusion criteria

- Volunteer or student nurses.

3.7 Instruments of the study

The study utilized two instruments:

1. **Self-administered questionnaire:** that measures knowledge and practices of nurses to prevent VAP (Annex 3). The questionnaire consisted of the following parts:

Part 1: Sociodemographic characteristics of participants including: age, gender, place of residency, qualification, years of experience, and postgraduate training.

Part 2: knowledge of nurses to prevent VAP, consisted of 26 items (adapted from Said, 2012). Scoring for responses on items: (2) for true answer, and (1) for false answer.

2. Observational checklist: includes VAP bundle compliance checklist; that adapted from CDC, (2003). The checklist consisted of 27 items (annex 4) distributed on three main domains:

- Hand washing domain: consisted of 5 items.
- Suctioning and care of ETT/tracheotomy domain: consisted of 12 items.
- Oral care domain: consisted of 10 items.

3.8 Pilot study

A pilot study has been conducted on 10 nurses before starting the actual data collection in order to test reliability of the questionnaire, and to identify the clarity or ambiguity of questionnaire statements. Because of the limited number of available subjects in the study and no changes were done n the questionnaire's items, the 10 questionnaires that have been used in the pilot study were included in the actual study sample.

3.9 Validity and reliability of the questionnaire

3.9.1 Face and content validity

The questionnaire has been evaluated by panel of experts (Annex 5) in the field of paediatric ICU and research methodology in order to evaluate adequacy of the questionnaire items to measure knowledge and practices of nurses to prevent VAP, which will ultimately give the questionnaire confidence in its results.

3.9.2 Reliability of the instrument

The researcher used Cronbache alpha method to examine the reliability of the questionnaire as presented in table (3.2).

Table (3.2): Reliability of study instruments (Cronbache alpha coefficient)

Questionnaires and domains	Alpha coefficient
Knowledge	0.631
Practice (Hand washing)	0.711
Practice (Suction & ETT care)	0.610
Practice (Oral care)	0.689
Practice (Overall)	0.684

3.10 Data collection

Data has been collected by the researcher. Each questionnaire has a consent form (annex 2) in the first page that asks the participants to participate in the study voluntary. Time allocated for each questionnaire was 15-20 minutes.

3.11 Data entry and analysis

The process of data entry and analysis included the following process:

- Overview of questionnaires.
- Designing data entry model using SPSS program (version 22).
- Coding and data entry into the computer by assistance of a statistician.
- Data cleaning to ensure accurate entry of data. This process was achieved by
- checking out a random of questionnaires and performing descriptive statistics
- for all the variables.

Data analysis included

- Frequencies and percentages distribute for the study variables.

- Cross-tabulation and Chi square have been performed to find significance of differences related to sociodemographic variables,.
- To examine reliability of the questionnaire, Cronbache alpha coefficient has been used.

3.12 Ethical and administrative considerations

Before starting the study, the researcher obtained approval from Al-Quds University, approval from Helsinki Committee (annex 6), and approval from MOH (annex 7) to conduct the study. Participants were asked for their agreement (annex 1)to be included in the study with assurance of confidentiality of obtained data.

3.13 Limitation of the study

Difficulty in including all eligible nurses included in the study due to working rotation shifts especially night shift.

Hawthorne effect could be happened during observation of practice of participants.

Limited literature about the topic, since it is the first study done in GS.

Chapter Four

Results and discussion

This chapter presents the findings and discussion of statistical analysis of data. Description of demographic characteristics of participants was illustrated as well as the results of different variables were identified as inferential results. The results were discussed in relation to available literature review and previous studies.

4.1 Descriptive results

4.1.1 Sociodemographic characteristics of study sample

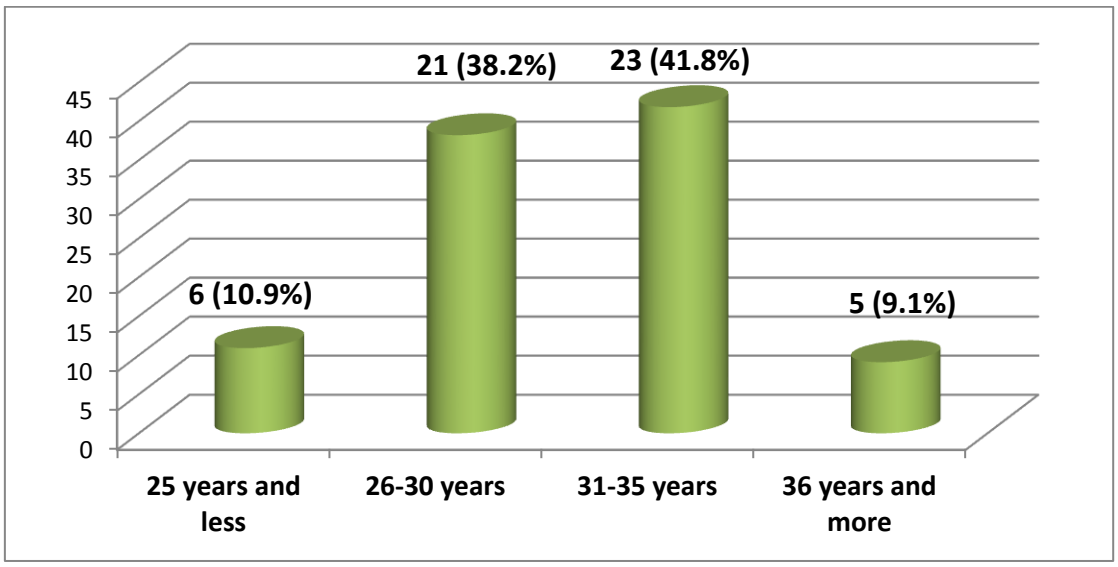

Figure (2): Distribution of study participants by age

As presented in figure (2), the sample of the study consisted of 55 eligible nurses who are working in PICU in GS hospitals; that their age ranged between 22 – 53 years, with mean age 30.80, SD 5.22 years. The majority of subjects were in middle age group of 31 – 35 years, whereas 21 (38.2%) and 23 (41.8%) of them lie respectively in the age groups 26 – 30, and 31 – 35 years of age.

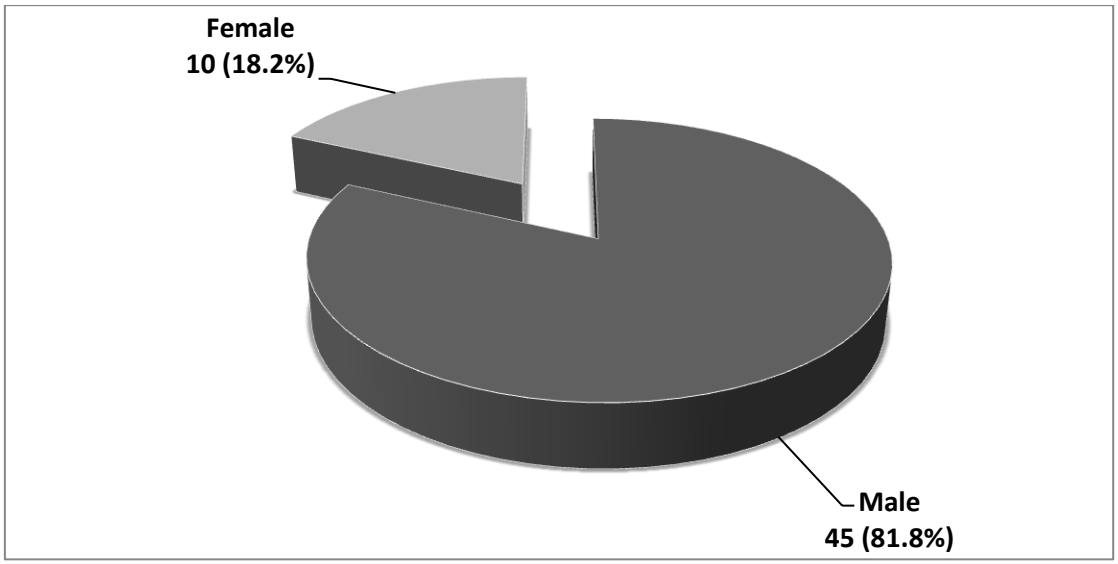

Figure (3): Distribution of study participants by gender

The results of figure (3) showed that the majority of study participants 45 (81.8%) were male nurses, compared to only 10 (18.2%) were female nurses.

Table (4.1): Sociodemographic characteristics of study sample

Variable	Number (n-55)	Percentage (%)
Residency		
Village	2	3.6
Camp	20	36.4
City	33	60.0
Total	55	100.0
Qualification		
Diploma	2	3.6
Bachelor	49	89.1
Master degree	4	7.3
Total	55	100.0
Experience		
Less than one year	6	10.9
1 – 5 years	15	27.2
6 – 10 years	22	40.0
11 years and more	12	21.8
Total	55	100.0
Hospital		
EGH	15	27.3
Al Rantesy hospital	14	25.5
Al Dora hospital	11	20.0
Al Nasser hospital	15	27.2
Total	55	100.0
Postgraduate training / education about pediatric Intensive Care		
Yes	14	25.5
No	41	74.5
Total	55	100.0

Table (4.1) showed that two thirds of study participants 33 (60%) live in a city, compared to 33 (36.4%), 2 (3.6%) live in camp and village respectively. The results also showed that

the majority of subjects 49 (89.1%) have bachelor degree compared respectively to 2 (3.6%) and 4 (7.3%) have diploma and master degree. The same as, the study results showed that 22 (40%) have 6 – 10 years of experience in PICU and 12 (21.8%) have 11 years and more experience in PICU.

On other hand, the results showed that 15 (27.3%) of nurses were work on EGH, compared to 14 (25.5%), 11 (20%), and 15 (27.3%) nurses were belong respectively to Al Rantesy hospital, Al Dora hospital, and Al Nasser hospital. The results also showed that one fourth 14 (25.5%) of them received postgraduate training or education about PICU.

4.2 Inferential results

Question 1: What is the level of knowledge about prevention of ventilator associated pneumonia among PICUs nurses?

To answer this question, the researcher calculate frequencies, and percentage in order to show the level of knowledge among participants as illustrated in table (4.2).

Table (4.2): Knowledge of nurses about prevention of VAP in PICUs nurses (n= 55)

No.	Item	True answer		False answer		Rank
		n	%	n	%	
1	Oral ET intubation rout is recommended than nasal intubation	44	80.0	11	20.0	11
2	It is recommended to connect ventilator circuit for more than one patient in case of non-infected disease.	48	87.3	7	12.7	6
3	It is recommended to change ventilator circuit when clinically indicated.	54	98.2	1	1.8	1
4	The best airway humidifier for preventing ventilator associated pneumonia is heated humidifiers	32	58.2	23	41.8	24
5	It is recommended to change humidifiers every 48 hrs.	33	60.0	22	40.0	22
6	It is recommended to change humidifiers when clinically indicated.	47	85.5	8	14.5	8
7	Using closed suction system is recommended as preventive measure of ventilator associated pneumonia	47	85.5	8	14.5	9
8	It is recommended to change suction system every week	32	58.2	23	41.8	25
9	It is recommended to change suction system when clinically indicated.	49	89.1	6	10.9	5
10	Use endotracheal tubes with extra lumen for drainage of subglottic secretions increase the risk of ventilator associated pneumonia	33	60.0	22	40.0	23
11	The position of the patient plays a role in the risk of ventilator associated pneumonia	41	74.5	14	25.5	13
12	Head of the bed elevation should be ranging from 10-20 degrees,	36	65.5	19	34.5	19
13	The nurse is required to use clean suction catheter for endotracheal suctioning.	38	69.1	17	30.9	16
14	The nurse is required to use sterile suction catheter twice for the same patient	44	80.0	11	20.0	12
15	Dusting of respiratory and bedside equipment with antiseptic should be done weekly	38	69.1	17	30.9	17
16	A nurse who caring for ventilated patient is required to wash hands before oral and endotracheal tube suctioning	52	94.5	3	5.5	2
17	Hand washing and glove usage are the best two preventive strategies for ventilator associated pneumonia	50	90.9	5	9.1	3
18	It is recommended to perform oral hygiene by using a swab moistened with mouth wash and water once in a shift	39	70.9	16	29.1	15
19	Prolonged use of stress ulcer prophylaxis to a ventilated patient decrease the risk of ventilator associated pneumonia	29	52.7	26	47.3	26
20	Maintenance of a high nurse to patient ratio in pediatric critical care setting is associated with increased risk ventilator associated pneumonia	35	63.6	20	36.4	20
21	In-service education improved my knowledge toward prevention of ventilator associated pneumonia	45	81.8	10	18.2	10
22	It is recommended to perform chest percussion before endotracheal suctioning to reduce the risk of ventilator associated pneumonia	50	90.9	5	9.1	4
23	Early weaning from endotracheal tube increases the risk of ventilator associated pneumonia	40	72.7	15	27.3	14
24	Over-fed ventilated patient is associated with decreased the risk of ventilator associated pneumonia	48	87.3	7	12.7	7
25	Maintenance of low endotracheal cuff pressure could increase the risk for ventilator associated pneumonia	37	67.3	18	32.7	18
26	Unplanned extubation is associated with increased risk of ventilator associated pneumonia	34	61.8	21	32.8	21
Overall		**75.1**		**24.8**		

As presented in table (4.2), the overall average of knowledge among participants about measures to prevent VAP in PICUs was 75.17%, which revealed above moderate level of knowledge. The highest scores indicated that 54 (98.2%) of nurses knew that it is recommended to change ventilator circuit when clinically indicated, followed by 52 (94.5%) knew that the nurse who cares for ventilated patient is required to wash hands before oral and ETT suctioning, while low scores indicated that 32 (58.2%) knew that it is recommended to change suction system every week, followed by 29 (52.7%) knew that prolonged use of stress ulcer prophylaxis to a ventilated patient decrease the risk of ventilator associated pneumonia.

Table (4.3): Level of knowledge about prevention of VAP among PICUs nurses

Level of knowledge	**Range of scores**	**n**	**%**
Low	Less than 60 %	3	5.5
Moderate	60 – 80 %	35	63.6
High	More than 80 %	17	30.9

Table (4.3) showed that more than two-thirds 35 (63.6%) of PICUs nurses have moderate level of knowledge about prevention of VAP, 17 (30.9%) have high level of knowledge, while 3 (5.5%) have low level of knowledge.

Question 2: What is the degree and measures of practices about prevention of ventilator associated pneumonia among PICUs nurses?

Table (4.4): Practices of PICUs nurses about prevention of VAP

No.	Domains of practices	Not done	Done	Rank
		%	%	
1	Hand washing	32.72	67.28	3
2	Suctioning and care of ETT/tracheotomy	17.59	82.41	1
3	Oral care	18.36	81.64	2
Overall score		**33.8**	**77.1**	

As presented in table (4.4), the overall average of practices among participants about measures to prevent VAP in PICUs was 77.11%, which revealed above moderate level of practice. The suctioning and care of ETT/tracheotomy measures captured highest score (82.41%) of practices, followed by oral care (81.64%), and hand washing (67.28%).

Table (4.5): Level of practices about prevention of VAP among PICU nurses

Level of practice	Range of scores	n	%
Low	Less than 60 %	3	5.5
Moderate	60 – 80 %	24	43.6
High	More than 80 %	28	50.9

As shown in table (4.5), 28 (50.9%) of PICUs nurses practice preventive measures to avoid VAP to high extent level, compared to 24 (43.6%) of nurses practice preventive measures to avoid VAP to moderate extent level, and only 3 (5.5%) of nurses practice preventive measures to avoid VAP to low extent level.

Table (4.6): Observed practices of Hand washing (n= 55)

No.	Hand washing items	Not done		Done		Rank
		n	%	n	%	
1	Hand washing before entering PICU	44	80.0	11	20.0	5
2	Before patient contact.	21	38.2	34	61.8	4
3	After patient contact.	2	3.6	53	96.4	1
4	After contact with a source of microorganisms.	6	10.9	49	89.1	2
5	Use of alcohol rub	17	30.9	38	69.1	3
Overall		**32.7**		**67.2**		

As presented in table (4.6), the overall average of practices among participants about hand washing measures to prevent VAP in PICUs was 67.28%. The highest observed practices indicated that 53 (96.4%) of nurses washed their hands after patient contact, followed by 49 (89.1%) of nurses washed their hands after contact with a source of microorganisms, while the least observed practice indicated that 11 (20.0%) of nurses washed their hands before entering PICUs.

Table (4.7): Observed practices of Suctioning and care of ETT/tracheotomy (n= 55)

No.	Suctioning and care of ETT/tracheotomy items	Not done		Done		Rank
		n	%	n	%	
1	Hand washing before suctioning.	45	81.8	10	18.2	12
2	Wear gloves before doing any procedure.	3	5.5	52	94.5	3
3	Prepare sterile equipment required during suctioning.	3	5.5	52	94.5	4
4	Insuring environmental cleanness.	6	10.9	49	89.1	6
5	Insert the catheter into the ETT gently by using aseptic technique.	9	16.4	46	83.6	9
6	Discard suction tube immediately after one single use.	2	3.6	53	96.4	2
7	Measure the amount and characteristics of secretion.	10	18.2	45	81.8	10
8	Change circuits for every new patient or when clinically indicated.	3	5.5	52	94.5	5
9	Maintenance of adequate ETT cuff pressure.	20	36.4	35	63.6	11
10	Change humidifiers every week or when clinically indicated	7	12.7	48	87.3	7
11	Hand washing after suctioning.	8	14.5	47	85.5	8
12	Documentation.	0	0	55	100.0	1
Overall		**17.5**		**82.4**		

As presented in table (4.7), the overall average of practices among participants about suctioning and care of ETT/tracheotomy measures to prevent VAP in PICUs was 82.41%. The highest observed practices indicated that all the nurses document in the patient's chart each time they perform suctioning and ETT care, followed by 53 (96.4%) of nurses discard suction tube immediately after one single use, 52 (94.5%) of nurses wear gloves when

performing suctioning and ETT care, 52 (94.5%) of PICU nurses prepare sterile equipment required during suctioning, while the least observed practice indicated that 10 (18.2%) of nurses wash their hand before suctioning.

Table (4.8): Observed practices about prevention of VAP (Oral care) n= 55

No.	Oral care items	Not done		Done		Rank
		n	%	n	%	
1	Hand washing before oral care	34	61.8	21	38.2	10
2	Wear clean gloves	1	1.8	54	98.2	3
3	Position a patient in a semi recumbent.	5	9.1	50	90.9	6
4	Clean mouth using toothbrush or gauze moistened with mouth wash and water	15	27.3	40	72.7	8
5	Rinse mouth with a clean swab	12	21.8	43	78.2	7
6	Suction secretions as they accumulate, if necessary	0	0	55	100.0	1
7	Apply water soluble jelly to patient's lips	32	58.2	23	41.8	9
8	Clean equipment and return it to its proper place	1	1.8	54	98.2	4
9	Hand washing after oral care	0	0	55	100.0	2
10	Documentation	1	1.8	54	98.2	5
Overall		**18.3**		**81.6**		

As presented in table (4.8), the overall average of practices among participants about oral care measures to prevent VAP in PICUs was 81.64%. The highest observed practices indicated that all the nurses suction secretions as they accumulate, if necessary, followed by 54 (98.2%) of PICUs nurses document in patient's chart each time they perform oral care, and 54 (98.2%) of nurses wore clean gloves when they perform oral care, while the least observed practice indicated that 21 (38.2%) of nurses washed their hands before doing oral care to their patients.

Question 3: What is the relationship between demographic characteristic of nurses and their levels of knowledge and practices about the prevention of VAP?

Table (4.9): Differences in knowledge and practice related to age

Variable	Age (years)				χ^2	P value
	≤ 25 n (%)	26 – 30 n (%)	31 – 35 n (%)	≥ 41 n (%)		
Level of knowledge						
Low	1 (16.7%)	1 (4.8%)	1 (4.3%)	0	5.577	0.472
Moderate	3 (50.0%)	11	18 (78.3%)	3 (60.0%)		
High	2 (33.3%)	9 (42.8%)	4 (17.4%)	2 (40.0%)		
Total	6 (100%)	21	23 (100%)	5		
Level of practice						
Low	0	1 (4.8%)	2 (8.7%)	0	8.949	0.176
Moderate	2 (33.3%)	14	7 (30.4%)	1(20.0%)		
High	4 (66.7%)	6 (28.5%)	14 (60.9%)	4 (80.0%)		
Total	6 (100%)	21	23 (100%)	5		

Table (4.9) showed that the highest number of nurses have moderate level of knowledge as 3 (50%), 11 (52.4%), 18 (78.3%), and 3 (60%) of nurses aged ≤ 25, 26 – 30, 31 – 35 and ≥ 41 years respectively have moderate level of knowledge while 2 (33.3%), 9 (42.8%), 4 (17.4%) and 2 (40%) of nurses aged ≤ 25, 26 – 30, 31 – 35 and ≥ 41 years respectively have high level of knowledge without statistically significant differences between the groups (P= 0.472).

In addition, 4 (66.7%), 6 (28.5%), 14 (60.9%), and 4 (80%) of nurses aged ≤ 25, 26 – 30, 31 – 35 and ≥ 41 years respectively showed high level of practices, while 2 (33.3%), 14 (66.7%), 7 (30.4%), and 1 (20%) of nurses aged ≤ 25, 26 – 30, 31 – 35 and ≥ 41 years respectively showed moderate level of practice, without statistically significant differences between the groups. This result reflected that there were statistically no significant

differences in levels of knowledge and practices about prevention of VAP related to the age of the PICU nurses.

Table (4.10): Differences in knowledge and practice related to gender (n= 55)

Variable	Gender		χ^2	P value
	Male n (%)	Female n (%)		
Level of knowledge				
Low	2 (4.4%)	1 (10.0%)	5.982	0.050 *
Moderate	32 (71.2%)	3 (30.0%)		
High	11 (24.4%)	6 (60.0%)		
Total	45 (100%)	10 (100%)		
Level of practice				
Low	1 (2.2%)	2 (20.0%)	5.063	0.080
Moderate	20 (44.4%)	4 (40.0%)		
High	24 (53.4%)	4 (40.0%)		
Total	45 (100%)	10 (100%)		

*significant at 0.05

Table (4.10) showed that 32 (71.2%) and 11 (24.4%) of male nurses have moderate and high level of knowledge respectively, while 3 (30%) and 6 (60%) of female nurses have moderate and high knowledge respectively (p= 0.050), which indicated that higher percentage of male nurses have moderate level of knowledge and higher percentage of female nurses have high level of knowledge about prevention of VAP in PICU.

In addition, 20 (44.4%) and 24 (53.4%) of male nurses showed moderate and high level of practice respectively, while 4 (40%) and 4 (40%) of female nurses showed moderate and high level of practice respectively (P= 0.080). This result indicated clearly, although of insignificant statistical differences, that male nurses have a higher level of practice to prevent VAP compared to female nurses.

Table (4.11): Differences in knowledge and practice related to residency (n= 55)

Variable	Place of residency			χ^2	P value
	Village n (%)	Camp n (%)	City n (%)		
Level of knowledge					
Low	2 (100.0%)	0	1 (3.0%)	38.535	0.000 *
Moderate	0	11 (55.0%)	24 (72.8%)		
High	0	9 (45.0%)	8 (24.0%)		
Total	2 (100%)	20 (100%)	33 (100%)		
Level of practice					
Low	0	1 (5.0%)	2 (6.1%)	0.702	0.951
Moderate	1 (50.0%)	10 (50.0%)	13 (39.4%)		
High	1 (50.0%)	9 (45.0%)	18 (54.5%)		
Total	2 (100%)	20 (100%)	33 (100%)		

*significant at 0.05

As shown in table (4.11), 11 (55%) and 9 (45%) of nurses who live in camps have moderate and high knowledge respectively, while 24 (72.8%) and 8 (24%) of nurses who live in cities have moderate and high knowledge respectively (P= 0.000) which indicated that nurses who live in cities have statistically significant higher level of knowledge about prevention of VAP compared to nurses who live in camps or villages.

Moreover, 10 (50%) and 9 (45%) of nurses who live in camps showed moderate and high level of practice respectively, while 13 (39.4%) and 18 (54.5%) of nurses who live in cities showed moderate and high level of practice respectively (P= 0.951) which indicated that there were no significant differences in practice to prevent VAP related to place of residency.

Table (4.12): Differences in knowledge and practice related to qualification (n= 55)

Variable	Qualification			χ^2	P value
	Diploma n (%)	**Bachelor n (%)**	**Master n (%)**		
Level of knowledge					
Low	0	3 (6.1%)	0	1.992	0.737
Moderate	2 (100.0%)	31 (63.3%)	2 (50.0%)		
High	0	15 (30.6%)	2 (50.0%)		
Total	2 (100%)	49 (100%)	4 (100%)		
Level of practice					
Low	1 (50.0%)	2 (4.1%)	0	12.497	0.014 *
Moderate	1 (50.0%)	23 (46.9%)	0		
High	0	24 (49.0%)	4 (100.0%)		
Total	2 (100%)	49 (100%)	4 (100%)		

*significant at 0.05

As shown in table (4.12), 31 (63.3%) and 15 (30.6%) of nurses who have bachelor degree have moderate and high knowledge respectively, while 2 (50%) and 2 (50%) of nurses who have master degree have moderate and high knowledge respectively (P= 0.737) which indicated that there were no significant differences in knowledge to prevent VAP related qualification.

The results also showed that 23 (46.9%) and 24 (49%) of nurses who have bachelor degree showed moderate and high level of practice respectively, while 4 (100%) of nurses who have master degree showed high level of practice (P= 0.014) which indicated that nurses who have master degree showed statistically significant higher level of practice about prevention of VAP compared to nurses who have bachelor degree.

Table (4.13): Differences in knowledge and practice related to years of experience

(n= 55)

Variable	Experience (years)				χ^2	P value
	< one n (%)	**1 – 5 n (%)**	**6 – 10 n (%)**	**> 10 n (%)**		
Level of knowledge						
Low	1 (16.7%)	0	1 (4.5%)	1 (8.3%)	4.359	0.628
Moderate	2 (33.3%)	10 (66.7%)	15 (68.2%)	8 (66.7%)		
High	3 (50.0%)	5 (33.3%)	6 (27.3%)	3 (25.0%)		
Total	6 (100%)	15 (100%)	22 (100%)	12 (100%)		
Level of practice						
Low	0	1 (6.7%)	1 (4.5%)	1 (8.3%)	6.847	0.335
Moderate	3 (50.0%)	10 (66.7%)	6 (27.3%)	5 (41.7%)		
High	3 (50.0%)	4 (26.7%)	15 (68.2%)	6 (50.0%)		
Total	6 (100%)	15 (100%)	22 (100%)	12 (100%)		

Table (4.13) showed that 2 (33.3%) and 3 (50%) of nurses who have an experience of less than one year have moderate and high level of knowledge, 10 (66.7%) and 5 (33.3%) of nurses who have 1 - 5 years of experience have moderate and high level of knowledge, 15 (68.2%) and 6 (27.3%) of nurses who have 6 – 10 years of experience have moderate and high level of knowledge, 8 (66.7%) and 3 (25%) of nurses who have more than 10 years of experience have moderate and high level of knowledge (P= 0.628) which indicated that there were statistically no significant differences in level of knowledge to prevent VAP related to years of experience of PICU nurses.

The results also showed that 3 (50%) and 3 (50%) of nurses who have an experience of less than one year showed moderate and high level of practice, 10 (66.7%) and 4 (26.7%) of nurses who have 1 - 5 years of experience showed moderate and high level of practice, 6 (27.3%) and 15 (27.368.2%) of nurses who have 6 – 10 years of experience showed moderate and high level of practice, 5 (41.7%) and 6 (50%) of nurses who have more than

10 years of experience showed moderate and high level of practice (P= 0.335) which indicated that there were statistically no significant differences in level of practices to prevent VAP related to years of experience of PICU nurses.

Table (4.14): Differences in knowledge and practice related to hospital name

Variable	Hospital				χ^2	P value
	EGH n (%)	Al Rantesy n (%)	Al Dora n (%)	Al Nasser n (%)		
Level of knowledge						
Low	1 (6.7%)	1 (7.1%)	0	1 (6.7%)	7.159	0.306
Moderat	11 (73.3%)	11 (78.6%)	7 (63.6%)	6 (40.0%)		
High	3 (20.0%)	2 (14.3%)	4 (36.4%)	8 (53.3%)		
Total	15 (100%)	14 (100%)	11 (100%)	15 (100%)		
Level of practice						
Low	1 (6.7%)	0	0	2 (13.3%)	15.955	0.014 *
Moderat	3 (20.0%)	4 (28.6%)	6 (54.5%)	11 (73.3%)		
High	11 (73.3%)	10 (71.4%)	5 (45.5%)	2 (13.3%)		
Total	15 (100%)	14 (100%)	11 (100%)	15 (100%)		

*significant at 0.05

Table (4.14) showed that 11 (73.3%) and 3 (20%) of nurses from EGH have moderate and high level of knowledge, 11 (78.6%) and 2 (14.3%) of nurses from Al Rantesy hospital have moderate and high level of knowledge, 7 (63.6%) and 4 (36.4%) of nurses from Al Dora hospital have moderate and high level of knowledge, 6 (40%) and 8 (53.3%) of nurses from Al Nasser hospital have moderate and high level of knowledge (p= 0.306) which indicated that there were statistically no significant differences in level of knowledge to prevent VAP related to hospital.

In addition, the results showed that 3 (20%) and 11 (73.3%) of nurses from EGH showed moderate and high level of practice, 4 (28.6%) and 10 (71.4%) of nurses from Al Rantesy hospital showed moderate and high level of practice, 6 (54.5%) and 5 (45.5%) of nurses from Al Dora hospital showed moderate and high level of practice, 11 (73.3%) and 2

(13.3%) of nurses from Al Nasser hospital showed moderate and high level of practice (p= 0.014), which indicated that nurses from EGH and Al Rantesy showed statistically significant higher level of practices to prevent VAP compared to nurses from Al Dora and Al Nasser hospital.

Table (4.15): Differences in knowledge and practice related to postgraduate training (n= 55)

Variable	Postgraduate training		χ^2	P value
	No n (%)	Yes n (%)		
Level of knowledge				
Low	0	3 (7.3%)	6.976	0.031 *
Moderate	13 (92.9%)	22 (53.7%)		
High	1 (7.1%)	16 (39.0%)		
Total	14 (100%)	41 (100%)		
Level of practice				
Low	1 (7.1%)	2 (4.9%)	1.735	0.420
Moderate	4 (28.6%)	20 (48.8%)		
High	9 (64.3%)	19 (46.3%)		
Total	14 (100%)	41 (100%)		

*significant at 0.05

Table (4.15) showed that 13 (92.9%) and 1 (7.1%) of nurses who did not receive postgraduate training have moderate and high knowledge respectively, while 22 (53.7%) and 16 (39%) of nurses who have received postgraduate training have moderate and high knowledge respectively (p= 0.031), which indicated that nurses who received postgraduate training have statistically significant higher knowledge to prevent VAP compared to nurses who did not receive postgraduate training.

In addition, 4 (28.6%) and 9 (64.3%) of nurses who did not receive postgraduate training showed moderate and high level of practice respectively, while 20 (48.8%) and 19 (46.3%) of nurses who have received postgraduate training showed moderate and high level of

practice respectively (p= 0.420), which indicated that there were statistically no significant differences in level of practice related to receiving postgraduate training, although of that the high level of practice shown in nurses who have postgraduate training.

4.3 Discussion

Ventilator associated pneumonia is a serious hospital acquired pneumonia that develops in patients who have been treated with mechanical ventilation for 48 hours or longer. The purpose of this study was to determine nurses' knowledge and practices for prevention of VAP in PICUs in governmental hospitals of south GS. The sample of the study consisted of 55 nurses with mean age 30.80, SD 5.22 years. The majority of study participants were male nurses, the majority of them were from the middle age, two-thirds live in a city, the majority of participants have bachelor degree, less than half of them have an experience of 6 – 10 years, one-fifth have an experience of 11 years and more, and one-fourth of participants did not receive postgraduate training.

The results obtained by Yaseen and Salameh (2015) showed that the study sample consisted of 93 nurses, 69.9% of them were females, and 48.4% had bachelor degree while 37.6% had diploma degree, 53.4% had 1- 5 years of experience in ICU and 46.6% had more than 6 years of clinical experience. Also, Ahmed and Abosamra, (2015) results indicated that 44.9% of nurses age ranged from 20 to less than 25 years, 42.9% had less than 5 years of experience in ICU, and 98 % of them had bachelor degree in nursing.

These results revealed that male nurses are more than female nurses which is in accordance with the general situation in GS as the number of employed male nurses in MOH is higher than the number of female nurses. In addition, the results indicated that the majority of nurses working in PICU have bachelor degree, which reflects the situation in critical care

settings as highly educated nurses are assigned to work in these areas which need qualified and skilled nurses.

4.3.1 Knowledge of PICUs nurses about prevention of VAP

Nurses' knowledge about VAP is an important determinant in reduction of VAP among MV patients, and adequate nursing knowledge would facilitate optimal delivery of nursing care (Subramanian et al. 2013).

The results of the study indicated that the majority of nurses knew that it is recommended to change ventilator circuit when clinically indicated, the majority of nurses were knowledgeable about the importance of washing hands before oral and ETT care. In contrary, low level of knowledge was apparent in some aspects, as half of nurses knew that prolonged use of stress ulcer prophylaxis decreases the risk of VAP.

Similar results obtained by Yaseen and Salameh (2015) which showed that 86.5% of respondents recognized the importance of recumbent position for prevention of VAP, 85.6% knew the importance of closed system suctioning for prevention of VAP and 78% reported preferring the use of kinetic beds to reduce the risk of VAP. In addition, the results of Bagheri-Nesami and Amiri (2014) showed that 34.6% of nurses answered correctly about oral route for ETT intubation, 78.8% answered correctly about the type of humidifier, and 80% chose the closed suction system as the correct answer. Using kinetic beds, ETT with extra lumens for the drainage of subglottic secretions, and semi-recumbent positioning were the correct options chosen by 90.4%, 65.4%, and 82.2% of the participants, while low scores were in knowledge about the frequency of ventilator circuit changes (17.3%), the frequency of humidifier changes (3.8%), and the frequency of changes in the suction system (13.5%).

These results reflected that nurses were knowledgeable about specific preventive measures for prevention of VAP, and that was attributed to the qualification and experience of these nurses, and the fact that nurses who are working in PICU are selected carefully and usually receive special instructions and training to enable them to take care of the patients in a safe, and quality manner.

The results also reflected that two-thirds of nurses have moderate level of knowledge and one-third of nurses have high level of knowledge. In general, the overall knowledge of PICU nurses about prevention of VAP was above moderate. Yaseen and Salameh (2015) found that the mean score of the total knowledge was 7.13 ±1.36, and Bagheri-Nesami and Amiri (2014) found that the average level of knowledge about preventing VAP was 51.92% which is low. In addition, the results obtained by Ali (2013) reflected lack of knowledge among ICU nurses about strategies for prevention of VAP which was inconsistent with our study results. Moreover, Aqel et al. (2016) reported that despite the high qualifications of nurses who are working in ICU, the knowledge level for 48.8% of them was poor, and Sherpa et al. (2014) found that 55.8% of participants had adequate knowledge on prevention of VAP. Furthermore, Jahansefat et al. (2016) showed that knowledge of HCPs was poor, and Gomes (2010) found lack of knowledge about prevention of VAP.

The results of the study indicated that the majority of nurses have above moderate and high knowledge about prevention of VAP in PICU, which is explained in the context that these nurses are selected carefully and receive special attention from nursing administration. In addition, those nurses receive periodical updates and refreshment courses to maintain adequate knowledge that enable them to bridge the gap between theory and practice. Moreover, nurses who are working in PICU receive annual training on advanced life

support and attend lectures about infection control to improve their comprehensive knowledge.

4.3.2 Practices of PICUs nurses about prevention of VAP

The results of the study showed that 80% of nurses do not wash their hands before entering PICU, 94.5% of nurses wear gloves before doing any procedure, 94.5% prepare sterile equipment required during suctioning, 94.5% change circuits for every new patient or when clinically indicated, 85.5% wash their hands after suctioning, 96.4% wash their hands after contact with patients, and 98.2% clean equipment after use and return it to its proper place. The results obtained by Said (2012) showed that 100% of nurses did not wash their hands before entering ICU, 83.3% wash their hands before contact with patients, 66.7% wash their hands after contact with patients, 66.7% wash their hands after contact with a source of microorganisms, 83.3% of nurses use sterile gloves during ETT suction, 90% of nurses use clean gloves when doing oral care, 80% perform oral care, and 73% clean equipment after usage.

These results reflected high performance of nurses in most of the aspects of nursing care to protect themselves and the patients. The weakest point was clear in washing hands before entering PICU, and that could be related to the structure of these units, and to overcome this problem each unit should have washing tools at the entrance gate to the unit such as tap water and soap or alcohol for hand rub, so everyone should wash hands before entering the unit.

Other studies showed that nurses perform many activities to prevent VAP such as drainage of subglottic secretions, using orogastric tube and dental and oral hygiene (Cason et al. 2007). Moreover, Bagheri-Nesami and Amiri (2014) showed that 90.4% of nurses prefer using kinetic beds, 65.4% use ETT with extra lumens for the drainage of subglottic secretions,

and 82.2% put the patient in semi-recumbent position. In addition, Rello et al. (2010) reported that the administration of prophylactic agents for gastric ulcer and deep vein thrombosis, hand hygiene, staff education, using the protocol for weaning the patients from MV were among the measures performed to prevent development of VAP. Other preventive measures reported by Muscedere et al. (2008) included oral intubation, using kinetic beds, using closed suction system, changing the humidifiers weekly or for each patient, changing the suction system for every new patient and using gloves.

The results also indicated that half of the nurses showed high level of practices, less than half of nurses showed moderate level of practices, and in general, the overall average of practices about measures to prevent VAP in PICUs was above moderate. When comparing these results with other studies, we found that the results obtained by Aqel et al. (2016) showed that the practices level of 41.7% of nurses was acceptable, and Yaseen and Salameh, (2015) reported that the main barriers that restrict prevention of VAP were lack of VAP courses (74.2%) shortage of qualified nurses (74.2%), lack of knowledge during studying in the college (50.5%), failure to change gloves between patients (55.9%) and improper hand washing (57%), lack of time (48.4%) and not wearing personal protective equipment (36.6%).

In my opinion, nurses performance is the key factor for acquiring VAP in PICU because they are in direct contact with the patient 24-hours a day, thus, nurses activities should adhere to protocols and guidelines of preventing VAP. It is of great value to monitor and observe nurses during performing the required care and tasks, and giving them feedback about their performance, and head nurses and senior nurses are responsible to carry out this role. It is also important that infection control team members observe the nurses during their work to make sure that the nurses are doing their tasks properly and within the infection control guidelines.

4.3.3 The relationship between demographic characteristic and levels of knowledge and practices to prevent of VAP

The results showed that there were statistically no significant differences in levels of knowledge related to age of the nurse, qualification, years of experience, hospital. The results also reflected that male nurses have moderate level of knowledge and female nurses have high level of knowledge about prevention of VAP. Moreover, nurses who live in cities have statistically significant higher level of knowledge about prevention of VAP, and nurses who received training have statistically significant higher knowledge to prevent VAP.

In addition, there were statistically no significant differences in levels of practices about prevention of VAP related to the age of the nurse, gender, place of residency, years of experience, and training, while nurses who have master degree, and nurses from EGH and Al Rantesy hospitals showed statistically significant higher level of practices about prevention of VAP in PICU.

Comparing these results with other studies reflected that a range of different factors influenced knowledge and practice for prevention of VAP in PICU. Ahmed and Abosamra (2015) found that there was strong correlation between years of experiences, previous training and knowledge of nurses about the EBGs for prevention of VAP, but there was no relationship between age and nurses' knowledge. In addition, Yaseen and Salameh (2015) found that the total knowledge was higher among female nurses compared to male nurses, bachelor and master degree nurses had higher knowledge than diploma nurses, and there was a significant correlation between the total knowledge and ICU experience, but there were no significant differences in knowledge related to marital status and age of the nurse. Moreover, Gomes (2010) found that there was weak correlation between years of experience in ICU and knowledge, but there were no significant differences in the

knowledge between the nurses who received training and the nurses who did not receive training. Also, Sherpa et al. (2014) reported that there was no significant association between knowledge score and educational qualification, and years of experience in ICU. Moreover, the results obtained by Said (2012) showed that there was no association between knowledge and years of experience, ICU training, and qualification. Also, practices on prevention of VAP were statistically associated with qualification, but not associated with ICU training and years of experience, and Jahansefat et al. (2016) found significant differences in knowledge related to qualification of the nurse.

The above results reflected variations in the factors that affect knowledge and practice and how these factors affect knowledge and practice to prevent VAP. These variations could be related to characteristics of nurses, environmental factors such as construction and structure of the workplace, cultural differences, educational background, and workload. It is important to equip nurses who are working in PICU with adequate knowledge and skills to enable them to offer care to the patients safely and in a quality manner, and to offer suitable work environment and adequate supplies such as sterile gloves, sterile suction tubes, antiseptic solutions to enable the nurses to maintain good health to the patients and avoid nosocomial infection.

Appropriate training of nurses to be qualified and skilled to care for critically ill patients is of great importance and that should be attained through special educational programs or through in-service training activities. Several studies indicated that training programs were effective in decreasing the incidence of VAP in critical care settings. Chithra and Raju (2017) implemented a structured teaching program on knowledge regarding VAP for nurses, and found a marked increase in the overall knowledge score after implementation of the program. Furthermore, Abo Elseoud et al. (2016) found that VAP incidence rate dropped by 25.7% after implementation of an education program, and Elseoud et al. (2016)

reported that implementation of educational program was effective and reduced the incidence rate of VAP in ICU. Also, Ismail and Zahran (2015) fond that there was improvement in nurses' general knowledge and practice related to VAP after the training.

In my opinion, nurses who are working in PICU should be trained adequately and monitored carefully because PICU is a special place and the children are more sensitive than adults and many undesired complications could occur with subsequent threat to child's health and wellbeing. Selection of these nurses should take in consideration their potentials and willing to learn and make efforts to develop their knowledge and skills. I think that the department of human resources development and department of in-service training should pay attention to the critical care units and offer appropriate learning and in-service training to qualify the nurses to work in PICU.

Chapter Five

Conclusion, Recommendations, and suggestions for further studies

5.1 Conclusion

Ventilator associated pneumonia is considered the most common hospital-associated infection among patients in PICU. Nurses who are working in PICU are the first line of defense in preventing hospitalized-acquired infection by practicing autonomous nursing interventions that contribute positively to prevention of VAP and ultimately reduce fatality of patients.

The purpose of the study was to assess the nursing knowledge and practices for prevention of VAP in PICU in governmental hospitals in Gaza Strip. The study utilized descriptive, cross sectional design, and the sample of the study consisted of 55 PICU nurses from four governmental hospitals in Gaza Strip. The results of the study showed that 63.6% of PICUs nurses have moderate level of knowledge and 30.9% have high level of knowledge, and generally, the results reflected above moderate level of knowledge about prevention of VAP. Also, the results showed that 43.6% of nurses practice preventive measures to avoid VAP to moderate extent, 50.9% of PICUs nurses practice preventive measures to avoid VAP to high extent, and generally, the results reflected above moderate level of practice of preventive measures to avoid VAP.

Several sociodemographic factors influence level of knowledge and practice. The results indicated that female nurses, and training contributed to higher level of knowledge, while age of the nurse, qualification, years of experience, and hospital did not affect level of knowledge.

In addition, nurses who have master degree, and nurses from EGH and Al Rantesy hospitals exhibited higher level of practices about prevention of VAP in PICU, while age

of the nurse, gender, place of residency, years of experience, and training did not contribute to differences in practice levels.

The study concluded that in order to maintain high level of knowledge and quality practices to prevent VAP, nurses who are working in PICU should be selected carefully, should receive adequate training, and should be monitored and evaluated periodically to maintain high quality of care and prevent the development of VAP.

5.2 Recommendations

In the light of study results, the researcher recommends the following:

For the nurses

- Emphasize the need to wash hands before entering PICU with soap and water or alcohol based glycerin for hand-rub to prevent transmission of pathogens from nurses hands to the patients.
- Offer protective materials such as apron to protect the nurses from contamination, and prevent cross-infection that results from movement of nurses between patients.
- Use disposable equipment and supplies especially ventilator tube circuits, and do not wash tubes and reuse for other patients.
- Develop and implement educational programs for PICU nurses and attendance to these programs should be obligatory.
- Ensure having written, clear protocols and guidelines that specify the process of procedures to make sure that everyone do the procedure in the same way.

For the organization

- Should offer water source and soap or alcohol for hand-rub at the entrance gate of each PICU.

- Minimize the number of visitors, and each visitor should put on a disposable clean gown before entering the PICU.
- Maintain suitable temperature and well-ventilated environment inside PICU.
- Offer adequate supplies and consumables to enable the nurses doing their care in a safe manner.

5.3 Suggestions for further research

- To conduct a study aiming to identify barriers that hinder the prevention of VAP in PICU.
- To conduct a study aiming to determine the incidence rate of VAP in PICU in Gaza Strip.
- To conduct a study aiming to evaluate the effectiveness of suggested educational program in reducing the incidence of VAP in PICU.

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Annexes

Annex (1): Map of Palestine

Annex (2): Consent form

بسم الله الرحمن الرحيم

الزميل الفاضل ... الزميلة الفاضلة:

السلام عليكم ورحمة الله وبركاته

بين أيديكم استبانة خاصة برسالة الماجستير التي أقوم بإجرائها وهي بعنوان:

"مستوى المعرفة والممارسة لمنع حدوث الالتهابات الصدرية الناتجة عن وصل المريض بجهاز التنفس الصناعي لدى الممرضين العاملين في أقسام العناية المركزة للأطفال في المستشفيات الحكومية في قطاع غزة"

Knowledge and Practices of Nurses toward Prevention of Ventilator Associated Pneumonia at Pediatric Intensive Care Units - Gaza Strip

يرجى الاستجابة على جميع فقرات الاستبانات بشكل صادق، مع العلم أنه لا توجد إجابات خاطئة ولكن إجابتك تعبر عن رأيك الشخصي، كما أن المعلومات التي سيتم جمعها سوف تستخدم لأغراض البحث العلمي فقط، ونلفت انتباهك بأن كتابة الاسم الشخصي اختياري وغير ملزم.

إقرار بالموافقة: .....

الباحث

أحمد أبو عدوان

Annex (3): Knowledge about preventing VAP questionnaire

Personal information:

Age:	☐ ☐ years
Gender:	☐ Male ☐ Female
Place of residency:	☐ Village ☐ Camp ☐ City
Qualification:	☐ Diploma ☐ Bachelor ☐ Master
Years of experience:	☐ less than one year ☐ 1 – 5 years ☐ 6 – 10 years ☐ 11 years and more
Hospital name:	☐ EGH ☐ Al Rantesy ☐ Al Dora ☐ Al Nasser
Received training:	☐ Yes ☐ No

Please put (X) mark in appropriate column for the following statements:

No.	Statement	Yes	No
1	Oral ET intubation rout is recommended than nasal intubation		
2	It is recommended to connect ventilator circuit for more than one patient in case of non-infected disease.		
3	It is recommended to change ventilator circuit when clinically indicated.		
4	The best airway humidifier for preventing ventilator associated pneumonia is heated humidifiers		
5	It is recommended to change humidifiers every 48 hrs.		
6	It is recommended to change humidifiers when clinically indicated.		
7	Using closed suction system is recommended as preventive measure of ventilator associated pneumonia		
8	It is recommended to change suction system every week		
9	It is recommended to change suction system when clinically indicated.		
10	Use endotracheal tubes with extra lumen for drainage of subglottic secretions increase the risk of ventilator associated pneumonia		
11	The position of the patient plays a role in the risk of ventilator		

	associated pneumonia		
12	Head of the bed elevation should be ranging from 10-20 degrees,		
13	The nurse is required to use clean suction catheter for endotracheal suctioning.		
14	The nurse is required to use sterile suction catheter twice for the same patient		
15	Dusting of respiratory and bedside equipment with antiseptic should be done weekly		
16	A nurse who caring for ventilated patient is required to wash hands before oral and endotracheal tube suctioning		
17	Hand washing and glove usage are the best two preventive strategies for ventilator associated pneumonia		
18	It is recommended to perform oral hygiene by using a swab moistened with mouth wash and water once in a shift		
19	Prolonged use of stress ulcer prophylaxis to a ventilated patient decrease the risk of ventilator associated pneumonia		
20	Maintenance of a high nurse to patient ratio in pediatric critical care setting is associated with increased risk ventilator associated pneumonia		
21	In-service education improved my knowledge toward prevention of ventilator associated pneumonia		
22	It is recommended to perform chest percussion before endotracheal suctioning to reduce the risk of ventilator associated pneumonia		
23	Early weaning from endotracheal tube increases the risk of ventilator associated pneumonia		
24	Over-fed ventilated patient is associated with decreased the risk of ventilator associated pneumonia		
25	Maintenance of low endotracheal cuff pressure could increase the risk for ventilator associated pneumonia		
26	Unplanned extubation is associated with increased risk of ventilator associated pneumonia		

Annex (4): Observation checklist of practices for prevention of VAP.

Domains and items	Done	Not
Hand washing		
Hand washing before entering PICU.		
Before patient contact.		
After patient contact.		
After contact with a source of microorganisms.		
Use of alcohol rub.		
Suctioning from the ETT/tracheotomy		
Hand washing before suctioning.		
Wear gloves.		
Prepare sterile equipment required during suctioning.		
Insuring environmental cleanness.		
Insert the catheter into the ETT gently by using aseptic technique.		
Discard suction tube immediately after one single use.		
Measure the amount and characteristics of secretion.		
Change circuits for every new patient or when clinically indicated.		
Maintenance of adequate ETT cuff pressure.		
Change humidifiers every week or when clinically indicated		
Hand washing after suctioning.		
Documentation.		
Oral care		
Hand washing before oral care.		
Wear clean gloves.		
Position a patient in a semi recumbent.		
Clean mouth using toothbrush or gauze moistened with mouth		
Rinse mouth with a clean swab.		
Suction secretions as they accumulate, if necessary.		
Apply water soluble jelly to patients lips.		
Clean equipment and return it to its proper place.		
Hand washing after oral care.		
Documentation.		

Annex (5): List of Experts

Name	**Place of work**
Dr. Khalil Shuaib	Palestine College of Nursing
Dr. Hamza Abdeljawad	Palestine College of Nursing
Dr. Mohammad Al Jerjawy	Palestine College of Nursing
Dr. Ahmad Al Shaer	Islamic University - Gaza

Annex (6): Approval from Helsinki Committee

المجلس الفلسطيني للبحث الصحي

Palestinian Health Research Council

تعزيز النظام الصحي الفلسطيني من خلال مأسسة استخدام المعلومات البحثية في صنع القرار

Developing the Palestinian health system through institutionalizing the use of information in decision making

Helsinki Committee

For Ethical Approval

Date: 05/02/2018 **Number:** PHRC/HC/325/18

Name: AHMED S. ABUEDWAN الاسم:

We would like to inform you that the committee had discussed the proposal of your study about: نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:

Knowledge and Practices of Nurses toward Prevention of Ventilator Associated Pneumonia at Pediatric Intensive Care Units- Gaza Strip

The committee has decided to approve the above mentioned research. Approval number PHRC/HC/325/18 in its meeting on 05/02/2018 و قد قررت الموافقة على البحث المذكور عاليه بالرقم والتاريخ المذكوران عاليه

Signature

Member **Member**

Chairman

5/2/2018

Genral Conditions:-

1. Valid for 2 years from the date of approval.
2. It is necessary to notify the committee of any change in the approved study protocol.
3. The committee appreciates receiving a copy of your final research when completed.

Specific Conditions:-

E-Mail:pal.phrc@gmail.com

Gaza - Palestine غزة - فلسطين

شارع النصر - مفترق العيون

Annex (7): Approval from Ministry of Health

State of Palestine
Ministry of health

دولة فلسطين
وزارة الصحة

التاريخ:06/05/2018
رقم المراسلة 214636

السيد : رامي عيد سليمان العبادله المحترم

مدير عام بالوزارة /الإدارة العامة لتنمية القوى البشرية - /وزارة الصحة

السلام عليكم ,,,

الموضوع/ تسهيل مهمة الباحث//أحمد أبوعدوان

التفاصيل //
بخصوص الموضوع أعلاه، يرجي تسهيل مهمة الباحث/ **أحمد سالم أبوعدوان**
الملتحق ببرنامج ماجستير التمريض – تخصص تمريض أطفال- جامعة القدس أبوديس في إجراء بحث بعنوان:-
"Knowledge and Practices of Nurses toward Prevention of Ventilator Associated Pneumonia at Pediatric Intensive Care Units- Gaza Strip"
حيث الباحث بحاجة لتعبئة استبانة من عدد من الممرضين العاملين في أقسام العناية المركزة للأطفال في مستشفى غزة الأوربي ومستشفى النصر للأطفال ومستشفى الرنتيسي ومستشفى الدرة وكذلك تعبئة نموذج ملاحظة من أقسام العناية في المستشفيات المذكورة، بما لا يتعارض مع مصلحة العمل وضمن أخلاقيات البحث العلمي، ودون تحمل الوزارة أي أعباء أو مسئولية.
وتفضلوا بقبول التحية والتقدير،،،
ملاحظة/ البحث حصل على موافقة لجنة اخلاقيات البحث الصحي
ملاحظة / تسهيل المهمة الخاص بالدراسة أعلاه صالح لمدة 6 شهر من تاريخه.

محمد ابراهيم محمد السرساوي
مدير دائرة/الإدارة العامة لتنمية القوى البشرية -

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عنوان الدراسة: مستوى المعرفة والممارسة لمنع حدوث الالتهابات الصدرية الناتجة عن وصل المريض بجهاز التنفس الصناعي لدى الممرضين العاملين في أقسام العناية المركزة للأطفال في المستشفيات الحكومية في قطاع غزة.

إعداد: أحمد أبو عدوان

إشراف: د. أكرم أبو صلاح

ملخص الدراسة

هدفت هذه الدراسة إلى معرفة مستوى المعرفة والممارسة لمنع حدوث الالتهابات الصدرية الناتجة عن وصل المريض بجهاز التنفس الصناعي لدى الممرضين العاملين في أقسام العناية المركزة للأطفال في المستشفيات الحكومية في قطاع غزة. تكونت عينة الدراسة من 55 ممرض وممرضة من العاملين في أقسام العناية المركزة للأطفال في أربعة مستشفيات هي: مستشفى غزة الأوروبي، مستشفى الرنتيسي للأطفال، مستشفى الدرة للأطفال، ومستشفى النصر للأطفال. لجمع البيانات تم استخدام استبانة لقياس مستوى المعرفة والممارسة من إعداد الباحث وقد تم إجراء دراسة استطلاعية بهدف التأكد من ثبات الاستبانة حيث بلغ معامل ألفا 0.684. لتحليل البيانات تم استخدام برنامج الرزم الإحصائية للعلوم الاجتماعية (SPSS version 22)، كما تم إجراء المعالجات الإحصائية التالية: التكرارات، النسب المئوية، واختبار مربع كاي.

أظهرت نتائج الدراسة أن متوسط أعمار المشاركين في الدراسة بلغ 30.80 سنة بانحراف معياري بلغ 5.22 سنة، 81.8% كانوا ممرضين ذكور، 60% منهم يسكنون في المدن، 89.1% حاصلين على درجة البكالوريوس، 40% منهم لديهم خبرة عملية في أقسام العناية المركزة للأطفال تتراوح بين 6 – 10 سنوات، 21.8% لديهم خبرة بلغت 11 سنة فأكثر، 27.3% منهم يعملون في مستشفى غزة الأوروبي، 25.5% يعملون في مستشفى الرنتيسي للأطفال، 20% يعملون في مستشفى الدرة للأطفال، 27.3% يعملون في مستشفى النصر للأطفال، كما أن 25.5% منهم تلقوا تدريب مختص بالعناية المركزة للأطفال.

كما بينت نتائج الدراسة أن مستوى المعرفة العام حول إجراءات منع حدوث الالتهابات الصدرية بلغ 75.17% وهي تعتبر درجة فوق متوسطة، كما بينت النتائج أن 63.6% من الممرضين كان لديهم مستوى متوسط من المعرفة، 30.9% من الممرضين كان لديهم مستوى عالي من المعرفة، في حين أن 5.5% من الممرضين كان لديهم مستوى متدني من المعرفة. بالنسبة للممارسة فقد بينت النتائج أن

50.9% من الممرضين أظهروا مستوى عالي من الممارسة، 43.6% من الممرضين أظهروا مستوى متوسط من الممارسة، في حين أن 5.5% من الممرضين أظهروا مستوى متدني من الممارسة، كما أن المستوى العام للممارسة بلغ 77.11% وهي تعكس أن مستوى الممارسة العام كان فوق المتوسط. وأظهرت نتائج الدراسة عدم وجود فروق ذات دلالة إحصائية في مستوى المعرفة تعزى لكل من عمر الممرض، المؤهل العلمي، سنوات الخبرة، والمستشفى الذي يعمل به الممرض، في حين كانت الفروق دالة إحصائياً بالنسبة لكل من الجنس، مكان السكن، والتدريب، حيث تبين أن مستوى المعرفة كان أعلى لدى الممرضات، ولدى سكان المدن، والذين تلقوا تدريب خاص بالعناية المركزة للأطفال. وبينت النتائج عدم وجود فروق ذات دلالة إحصائية في مستوى الممارسة تعزى لكل من عمر الممرض، الجنس، مكان السكن، وسنوات الخبرة، في حين لم تكن الفروق دالة إحصائياً بالنسبة لكل من المؤهل العلمي والمستشفى الذي يعمل به الممرض.

في الإجمال أظهرت الدراسة الحاجة لاختيار الممرضين الأكفاء للعمل في أقسام العناية المركزة للأطفال، كما أظهرت ضرورة التحاق الممرضين بدورات تدريبية خاصة بالعناية المركزة للأطفال، بالإضافة إلى ضرورة إجراء عملية مراقبة وتقييم دوري لأداء الممرضين للمحافظة على مستوى عالي من الأداء ومنع حدوث الالتهابات الصدرية الناتجة عن التنفس الصناعي.