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TABLE OF CONTENTS

Original Research *Al-Razi Univ J Med Sci 2020; 4(1)*

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Knowledge of ICU Nurses Toward Prevention of Ventilator Associated Pneumonia at Public Hospitals in Sana'a, City-Yemen

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Abstract

***Background**: Ventilator-associated pneumonia is defined as a type of pneumonia in a patient receiving mechanical ventilation that was not present at the time of admission to hospital or that occurs 48 hours after intubation and mechanical ventilation. **Aim**: To determine the knowledge of ICUs nurses on prevention of ventilator-associated pneumonia at public hospitals in Sana'a city. **Methods**: A descriptive cross-sectional study was conducted among ICU nurses at public hospitals in Sana'a City-Yemen. The sample size was determined using EpiCalc, 2000. A stratified random sampling was applied to select the sample from 4 major public hospitals. Data were collected using questionnaire, 87 nurses were tested for knowledge. Data were coded and entered into SPSS version 21 for descriptive and inferential statistics. Information letters, consent form were obtained. **Results**: 54% of the nurses were females, (50.6%) were married with mean age ± SD, 28.4±4.2 year. About 55.2% of the nurses had working experience from 1-3 years. About two thirds (65.5 %) of the nurses had a diploma degree, (51.7%) had courses training in ICU and (81.6%) had no training program on the prevention of VAP. (57.5%) of ICU nurses had moderate knowledge regarding prevention of VAP, (36.8%) had poor knowledge and (5.7%) had good knowledge. Insignificant relationship between knowledge toward prevention VAP and ICU training, gender and years of working experience (P-value>0.05). A significant relationship between knowledge toward prevention VAP and level of education was found (P-value=0.001). **Conclusion**: ICU nurses' knowledge of VAP prevention was inadequate. Increasing knowledge of intensive care unit nursing staff through the courses training include VAP prevention, workshops and curriculum are recommended.*

Keywords: VAP; Knowledge; ICUs; Nurses; Sana'a

Introduction

Ventilator-associated pneumonia (VAP) is defined as a type of pneumonia in a patient receiving mechanical ventilation that was not present at the time of admission to hospital or that occurs 48 hours after intubation and mechanical ventilation[1,2]. It is characterized by a new or progressive pulmonary infiltrates, fever, leukocytosis and purulent trachea-bronchial secretions[1,2]. VAP is a known as serious health hazard in patients on mechanical ventilation with mortality rate ranges from 6- 60% and as high as 74%[3]. VAP is known to be one of the most serious infections acquired in

ICUs, with an incidence of 6-60%, and a high morbidity-mortality rate and an increase in healthcare costs. VAP is a problem in ICU and dramatically increases morbidity and mortality rates on mechanically ventilated patients. It is among the most common infectious complication in patients admitted to ICU[3].

VAP increases the severity of illness as it increase oxygen demands, sputum production, and produces alveolar collapse leading to impaired gas exchange. The patient might experience discomfort, agitation, delirium, immobility, and/or risk for impaired skin integrity, hemodynamic instability, as well as an increased stress response and malnutrition[1]. This study hihlights the importance of identifying the current knowledge on the prevention of VAP among the ICU nurses and find out if there are factors that contribute to reducing the level of knowledge toward prevention of VAP.

Aim of the study

To determine the knowledge of ICUs nurses toward prevention of VAP at public hospitals in Sana'a city.

Subjects and Methods

This study was conducted in four public hospitals in Sana'a City, Yemen that include (Al-Thowrah, Al-Sabeen, Al-Kuwait, and Al- Jomhury hospital). All hospitals provide primary, secondary and tertiary healthcare and referee hospitals to all Yemeni people. There are 2083 nurses in these hospitals, which represent 63.3% of the total healthcare workers. Based on Yemeni annual statistical health report (2001)[4]. There are three nurses' categories working in these hospitals; registered nurse, practical nurse, and patient care assistants nurse.

A descriptive, cross-sectional study carried out to determine the knowledge of ICU nurses toward prevention of VAP at public hospitals in Sana'a city - Yemen. This study conducted from October 2017 to October 2018. All nurses with various educational backgrounds and working in ICU at public hospitals in Sana'a City, Yemen during the data collection period and who had a duration of working 1 year and more were invited to participate in the study.

The sample size was determined through the use of EpiCalc program, 2000. The sample size was calculated as follows: the population of the study were all nurses working in ICUs at four public hospitals was 205 nurse, precision (3%), and 95% confidence level. The final sample size was 87 Yemeni nurses. A stratified random sampling was applied to select the sample size from the 4 major public hospitals. After official approvals obtained from the previously selected settings, the researcher obtained lists of nurses' currently working in the study settings via random sampling methods The list was reviewed and nurses meeting the inclusion criteria were included in the study to selected from the total population (N)= 205 nurses were subdivided according to hospitals (Al-Thowrah hospital n= 98, Al-Jomhury hospital n= 42, Al-Kuwait hospital n= 35 and Al-Sabeen hospital n= 30). Calculation the sample size from each stratum in the hospital was prepared by the following formula: $\frac{n}{N} * K = sample\ size\ to\ each\ hospital.$

Where: n = (sample size), N= (study population) and k= (population of each hospital). Then a selection of nurses to be sampled from each stratum was done by probability proportional sampling in order to ensure that all nurses in public hospitals have the ICUs same probability of selection irrespective of the size of their cluster.

Data were collected through the three months from 1st March to 30th May 2018 where good rapport was

maintained in the whole period of data collection. A structured questionnaire was administered to assess the knowledge of ICU nurses. A close-ended questionnaire with an information letter and consent form attached and handed to ICU nurses by the researcher. A code number was applied. Nurses were told to sign the consent form. The questionnaire consisted of twenty-eight questions. The questionnaire divided into the following parts: a). Demographic characteristics of nurses (sex, marital status, age, level of education, duration of working, courses training in ICU, attending training programs on prevention of VAP, diploma in respiratory therapy), b). knowledge of ICU nurses toward VAP, which included eighteen questions. This part comprised of **(**Knowledge about general information on VAP, knowledge about ETT tube strategies toward the prevention of VAP, Knowledge about position strategies toward the prevention of VAP, Knowledge about suction strategies toward prevention of VAP, knowledge about common prevention strategies toward the prevention of VAP and knowledge about other strategies toward prevention of VAP).

The questionnaire was adopted from previously validated and reliable studies by Burja, et al., (2017)[5], Aferu (2016)[6], al-sayaghi (2014)[7] Neuville, et al., (2017)[8] Labeau, et al., (2007)[9]. and from prevention of VAP guidelines[10,11].

The validity of the Arabic version of the questionnaire reviewed by five experts in order to determine if all questions were clearly worded and would not be misinterpreted. Experts included two academic staff in critical and medical-surgical nursing and three ICU nurse specialists, the ICU respiratory therapist, and a registered nurse who has worked in the ICU for 6 years and more. The reliability of the questionnaire was tested using Cronbach's Alpha So, the tool was found to be highly reliable for data collection coefficient was (0.73). The piloted of the questionnaire was performed before data collection. A pilot study was done on ten nurses working in the ICU on items in a questionnaire to assess the clarity, feasibility of the study and drawbacks of the questionnaire. Following the pilot study, minimal modifications to the layout and presentation of the instrument were made. The pretest nurses were excluded from the final study sample.

A statistical package for the social science (SPSS 21.0) was used for statistical analysis of data. Descriptive measures, including frequency, the percentage for categorical variables, and the mean and standard deviation for numerical variables. To find the relationship between knowledge and demographic data was used chi-square test for categorical data, and P-value ≤ 0.05 was considered significant. Each correct responses to the items in the questionnaire or checklist was given (1 score), and (0 score) was given to either wrong or don't know responses. The above weight was converted into percentage ranging from (0 – 100 %).

The levels of knowledge were classified as follows: good level was assigned to nurses who got 76%-100%, moderate 50%-75% and poor 0%-49%. Approval was obtained prior to carrying out this study from the college of medical sciences of Al-Razi University. A cover letters was sent to principles of hospitals to obtain approval to conduct this study. The purpose of the study was explained to participants. The consent was taken from all nurses in the study. All nurses also have the right to refuse to participate or to withdraw from the

study without any effect on their working.

Results

Demographic characteristics

Table 1 shows that, more than half of ICUs nurses (54%) were female, and (50.6%) were married. Most of the nurses (70.1%) were aged from 20 to 30 years old with Mean±SD was (28.4±4.2) year. The Mean±SD of work experiences was (4.7±3.9) year. About two third (65.5%) of nurses had diploma degree in nursing. While (51.7%) attended training course in ICU, (18.4%) attended training program in VAP prevention and only (10.3%) of them had diploma in respiratory therapy.

Table 1: Demographic characteristics of ICUs nurses (N=87)

Demographic characteristics	F	%
Gender		
• Male	40	46
• Female	47	54
Marital status		
• Married	44	50.6
• Unmarried	43	49.4
Age (year)		
• 20 - 30 years	61	70.1
• 31- 40 years	25	28.7
• ≥ 41years	1	1.1
Working experience (year)		
• 1 - 3 years	48	55.2
• 4 - 6 years	19	21.8
• 7 - 9 years	8	9.2
• ≥ 10 years	12	13.8
Level of education		
• Diploma in nursing	57	65.5
• Bachelor in nursing	29	33.3
• Master in nursing	1	1.1
Training course in ICU		
• Yes	45	51.7
• No	42	48.3
Training program in prevention VAP		
• Yes	16	18.4
• No	71	81.6
Diploma in respiratory therapy		
• Yes	9	10.3
• No	78	89.7

Overall Knowledge toward prevention of VAP

The overall knowledge of ICU nurses on general information toward the prevention of VAP showed that (59.2%) of the nurses were answered correctly. As regards to the ETT tube strategies (44.3%) were answered correctly**.** About bed position and chest physiotherapy strategies (65.9%) answered correctly**.** As regards to suction strategies (64%) answered correctly. About common strategies, 43.7% answered correctly. On the other hand, the total knowledge about other strategies toward prevention of

VAP showed that (26.4%) of the nurses answered correctly. More details in table 2.

Table 2: Overall nurses' knowledge about prevention of VAP (N = 87)

Total knowledge	Correct answer	Incorrect/don't know
	%	%
General information	59.2	40.8
ETT tube strategies	44.3	55.7
Position strategies	65.9	34.1
Suction strategies	64	36
Common strategies	43.7	56.3
Other strategies	26.4	73.6

Overall knowledge toward prevention of VAP

Figure 1 shows that nearly the half (49.7%) of ICU nurses had correct answer regarding knowledge toward prevention of VAP. While (50.3%) of them had incorrect or don't know answer.

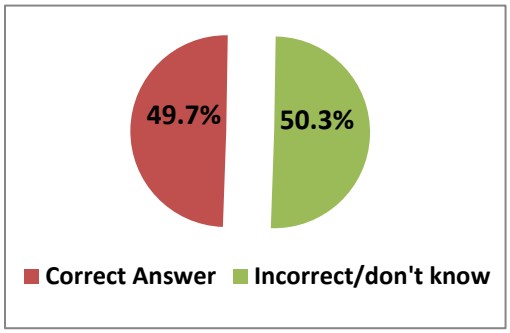

Figure 1: Overall knowledge toward prevention of VAP.

Level of knowledge toward prevention of VAP

Figure 2 shows that more than half (57.5%) of ICU nurses had moderate knowledge regarding prevention of VAP, (36.8%) of them had poor knowledge while only (5.7%) of them had good knowledge.

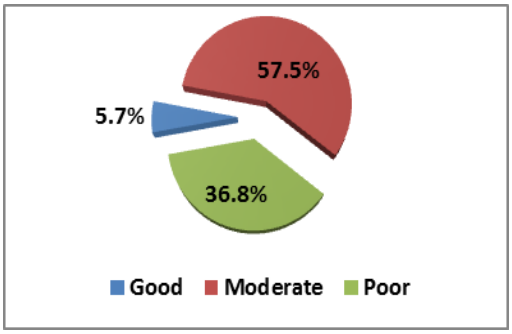

Figure 2: Level of knowledge toward prevention of VAP.

Relationship between demographic data and level of knowledge toward prevention of VAP.

Table 3 reveals that there was no statistical significant relationship between level of knowledge and gender(*P*-value>0.05), also statistically significant relationship between level of knowledge and working experience (*P*-value>0.05).

Whereas there was a statistically significant relationship between level of knowledge and education and training program in VAP prevention (P-value<0.05) but there was no statistically significant relationship between level of knowledge and training course in ICU and diploma in respiratory therapy (*P*-value>0.05).

Table 3: Relationship between demographic data of nurses and level of knowledge toward prevention VAP (N=87)

Demographic data	Level of knowledge			P-value*
	Good	Moderate	Poor	
Gender				
• Male	1	25	14	0.417
• Female	4	25	18	
Marital status				
• Married	2	25	17	0.057
• Unmarried	3	25	15	
Age (year)				
• 20 - 30 years	2	36	23	0.515
• 31- 40 years	3	13	9	
• ≥ 41years	0	1	0	
Working experience (year)				
• 1 - 3	1	28	19	0.37
• 4 - 6	1	6	1	
• 7 - 9	2	6	4	
• ≥ 10	1	10	8	
Level of education				
• Diploma in nursing	2	30	25	0.001
• Bachelor in nursing	2	20	7	
• Master in nursing	1	0	0	
Training course in ICU				
• Yes	4	24	17	0.386
• No	1	26	15	
Training program in prevention VAP				
• Yes	3	10	3	0.02
• No	2	40	29	
Diploma in respiratory therapy				
• Yes	0	5	4	0.689
• No	5	45	28	

x^2-test

Discussion

Demographic data of ICU nurses:

Eighty-seven of ICUs nurses were recruited. About 54% of ICUs nurses were females, and (50.6%) were married. The mean ± SD of age was 28.4± 4.3 years. In addition, 70.1% of the nurses their age ranged from 20 - 30 years. About (65.5%) had a diploma in nursing and about half of ICUs nurses (51.7%) had courses training in ICU and most of them (81.6%) did not received any training program on the prevention of VAP and (55.2%) working in ICU for 1-3 years. This findings was agreed with a study conducted in Sana'a, Yemen by Al-Sayaghi, (2014)[7], who found that nearly two third (65.4%) of ICU nurses had diploma degree. As regards to age of participants this results was agreed with study done by Shaaban (2013)[12], who reported that the mean±SD age was 27.3± 5.6 years also this result disagreed with results that reported by Passang et al., (2014)[13], who found (89.1%) of the nurses belonged to the age group of 20-29 years.

Regarding to year of experience our results are in agreement with the study conducted by Sebastian (2011)[14]. Who found that (53.33%) of ICU nurses had 1 to 5 year experience. Whereas our finding disagrees with the study conducted in Saudi Arabia by Meherali et al., (2010)[15], who found that (42.5%) of ICU nurses had (2 to 5) years' experience. Regarding to sex, marital status and level of education our results was disagrees with other results reported by Passang et al., (2014)[13] who found (71%) were females, furthermore, 63% unmarried and 51.4% had a diploma degree.

Knowledge on prevention of VAP:

The prevention of VAP is primarily the responsibility of the nurse whose knowledge and practice influence the health outcome of ICU patients. Critical care nurses play an important role in the prevention of VAP and has an important and crucial role in preventing VAP[1]. To eensure the highest standards of nursing care, the nursing practice must base on a strong body of scientific knowledge. This can be achieved through adherence to the evidence-based guidelines for the prevention of VAP, ultimately improving patients' outcomes. Improved outcomes will shorten the patient's ICU length of stay, hospitalization as well as benefit the patient financially with decreased hospital costs[16].

The present study showed that, 57.5% of the nurses had poor knowledge, (36.8%) had moderate knowledge and (5.7%) of the nurses had good knowledge scores toward the prevention of VAP. Level of knowledge was observed to be inadequate. The results of this study were similar to another study conducted by Passang et al., (2014)[13], who found that, 44.2% had inadequate knowledge on the prevention of VAP. Thus it is inferred that a high proportion of the critical care nurses have inadequate knowledge on prevention of VAP which can be improved by many strategies. These findings were not supported by a study conducted by Mohamad et al. (2010)[17] and by Omrane et al., (2007)[18]. The study findings showed adequate knowledge on the prevention of VAP.

The results related to the occurrence of the VAP showed that about two-thirds (65.5%) of the nurses knew the VAP was occurs after 48 hours after intubation and mechanical ventilation. This finding approxemitelly similar to study conducted in Saudi Arabia by Yaseen and Salameh (2015)[19]. They found that the majority (70.2%) of ICU nurses knew that VAP occurs more than or equals to 48 hours after endotracheal intubation. This study showed that more than the half of the nurses (58.6%) knew that oral intubation and the endotracheal tubes with the extra lumen that is used for drainage of subglottic secretions and it reduces the risk for VAP about (63.2%) whereas about (42.5%) of them knew the accidental extubation and re-intubation of endotracheal tube are increasing the risk for VAP. Also, the correct recommendation to the maintenance of adequate pressure inside of the tracheal balloon should be keeped between 20 and 30 cmH2O was known only by about (12.6%). On the other hand, the total knowledge of ICU nurses toward intubation & cuff pressure strategies toward prevention of VAP was poor (44.3%). The result was agree with the study conducted by Paula and Gomes (2010)[20], they recommended that the route of patient intubation is oral intubation about (69.88%), and the endotracheal tubes with extra lumen for drainage of subglottic secretions of the 83% of

nurses (60.2%) answered that these endotracheal tubes reduce the risk for VAP but disagreed with another study that conducted by Aferu (2016) [6]. Who reported that the unplanned extubation could increase risk of aspiration lead to increased risk of VAP about (70.9%) and the ETT with well-maintained pressure cuff to decrease the risk for VAP about (61.5%). This study showed that (57.5%) of the nurses knew the head of bed should be elevated if there is no contraindication by about (30 - 45˚) angle, also the use of kinetic bed reduces the risk for VAP by about (54%). Whereas the majority (86.2%) of the nurses reported that the chest physiotherapy reduces the risk for VAP.

On the other hand, the level of knowledge of nurses about bed position and chest physiotherapy strategies toward prevention of VAP, (65.9%) of the nurses answered correctly. This result in agreement with another study conducted by Ahmed and Abosamra (2015)[16]. They found about two third (67.3%) of ICU nurses maintained their patients in semi-recumbent position, and about (73.5%) of them toward kinetic versus standard beds to reduce the risk for VAP. This finding disagrees with other study conducted in Beirut, Lebanon by Ismail and Zahran (2015)[21], they reported that only (25%) of the nurses knew the best recommendation for a patient position on the bed should be elevated from (30- 45˚) degrees.

Our study showed that most of the ICU nurses (71.3%) knew that the regular subglottic suction should be done before deflating tube cuff and before repositioning the tube. Whereas the best type of endotracheal suction, is the use of closed suction systems by about (34.5%) and in finally the nurse is required to dispose of a suction catheter immediately after one single use about by (86.2%) of them. On the other hand, the overall nurses knowledge about suction strategies toward the prevention of VAP was (64%). This findings were agreed with the study conducted by Pauline (2015)[22]. Who found that two third (67.1%) of ICU nurses had knowledge on the subglottic suctioning reduces the risk of VAP but this finding disagrees with study conducted in Addis Ababa, Ethiopia by Wami (2014)[23]. The findings of this study showed that (49.6%) of the nurses knew that the nurse is required to dispose a suction catheter immediately after one single use.

The results of the present study showed that (35.6%) of the nurses knew the best solutions that used with comprehensive and regular oral care is cholerihyxidine solution, also (42.5%) knew the true recommendations to disinfect the hands and wear gloves it is before oral care and before ETT suctioning. Whereas the correct recommendation to changes of the humidifiers filters and ventilator circuit should be every new patient (or when clinically indicated) about (52.9%). This finding is agreed with the study conducted in Brazil by Guterres et al., (2013)[24]. They found that (38.8%) of ICU nurses knew the best solutions for oral care is cholerihyxidine solution. This finding disagrees with the study conducted in Sari, Iran by Bagheri-nesami and Amiri (2014)[25]. They reported that there was (17.3%) of the nurses knew that frequency of ventilator circuit changes is recommended to change circuits for every new patient.

The overall correct answers about knowledge of ICU nurses toward prevention of VAP was (49.7%). This finding is relative agree with the study conducted in Egypt by Ahmed and Abosamra (2015)[16], they found that

(34.7%) of ICU nurses had a satisfactory level of knowledge regarding evidence-based guidelines for preventing VAP.

Relationship between level of knowledge and demographic data: The current study found that nurses knowledge on prevention of VAP is statistically associated with the educational level (P-value=0.001). This is not similar to the results of the study conducted in Tanzania by Ally Tatu (2012)[26]. They indicated that there was no association between the educational level and knowledge on prevention of VAP. Findings of the current study showed that no significant association between level of knowledge on prevention of VAP and years of experience in ICU and ICU courses training (P-value>0.05). This is similar to the findings of the Global European Study done by Dodek, et al., (2004)[27]. In addition, a study done in South Africa by Labeau, et al. (2007)[9]. This indicated that there is no association between the level of knowledge, ICU training, years of experience and knowledge on prevention of VAP (P-value>0.05). This is findings similar with the findings reported by Ally. Tatu (2014)[26], who found that the nurses knowledge on prevention of VAP is not statistically associated with ICU training, level of education and years of experience (p-value>0.05).This is also similar to the findings of the global European study done by Dodek, et al., (2004)[27].

Conclusion

We conclude that (57.5%) of ICU nurses had moderate knowledge, (36.8%) had poor knowledge while only (5.7%) of them had good knowledge regarding prevention of VAP.

Recommendations

Updating of new information to develop knowledge and skills in order to provide the best care to patients.

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