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Nursing Practice for Prevention of Ventilator Associated Pneumonia in ICUs at Public Hospitals in Sana'a, City-Yemen

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Abstract

***Background**: Ventilator-Associated Pneumonia is a known serious health hazard among patients on mechanical ventilation with mortality rate ranges from 6- 60% and as high as 74%. **Aim**: To identify nursing practice for prevention of ventilator associated pneumonia in ICUs at public hospitals in Sana'a, City-Yemen. **Methods**: A descriptive, cross-sectional study was carried out among ICU nurses at public hospitals in Sana'a City-Yemen. The sample size was determined by using EpiCalc program, 2000. A stratified random sampling was carried out to select the sample from 4 major public hospitals. Data were collected using an observational checklist, 50 nurses were tested for practice. Data coded and entered into SPSS version 21.0 for descriptive and inferential statistics. Approval, and consent form were obtained. **Results**: The ICU nurses, (60%) were female, (50%) were married with age mean ± SD, 28.4±4.5 years. About (54%) had working experience from 1-3 years. Two third (66%) the nurses had a diploma degree, (52%) had no courses training in ICU and (82%) had no training program on the prevention of VAP. 52% of nurses had a poor level of practices, (42%) had a moderate level and (6%) had a good level of practice. Level of Nurses' practice was statistically associated with ICU training course (P-value= 0.03) and years of work experience (p-value 0.050) but no association between level of practice and marital status, educational level, training program on prevention of VAP and diploma in respiratory therapy (P-value>0.05). **Conclusion**: ICU nurses' practice was found to be poor (52%). Increasing practices of nurses staff through the courses training, workshop, and curriculums.*

Keywords: VAP; ICU; Nursing; Practice; Sana'a.

Introduction

Ventilator-associated pneumonia (VAP) 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]. Mechanical ventilation (MV) is an essential, lifesaving therapy for patients with critical illness and respiratory failure; these patients are at high risk for complications such as VAP[3,4]. The risks of VAP in a critical/intensive care unit patient are 6- 20 times higher since the intubation brings bacterial oropharyngeal colonization[5]. VAP is a major complication of mechanical ventilation and is a recognized marker of quality of care in an intensive care

unit, VAP is a common infection in ICUs[6,7]. VAP is the second most common nosocomial infection and the leading cause of death from nosocomial infections in critically ill patients[8,9].

To ensure the highest standards of nursing care, the nursing practice must be based on a strong body of scientific knowledge. This can be achieved through adherence to the evidence-based guidelines for the prevention of ventilator-associated pneumonia[10]. Critical care nurse has an important and crucial role in preventing VAP [1,10]. This study underscores the importance of identifying the current practice on the prevention of VAP among the ICU nurses and finds if there are factors that contribute to reducing the level of knowledge and practices toward prevention of VAP.

Aim of the study

To identify nursing practice for prevention of ventilator associated pneumonia in ICUs at public hospitals in Sana'a, City-Yemen.

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.

A descriptive, cross-sectional study was carried out to identify practice 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 use EpiCalc program, 2000 taking into consideration the following; The sample size to practice was calculated as a follows: the population of the study were all nurses working in ICU at four public hospitals (Al-Thowrah hospital, Al-Sabeen, Al-Kuwait, and Al- Jomhury hospital) was 205 nurses, Precision (4%), and 95% confidence level. The final sample size was 50 Yemeni nurses. A stratified random sampling was applied to select the sample size from 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 select 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 midwives in public hospitals have the 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. Observation checklist was applied to assess the actual nurses' practice. During the three shifts, each nurse attended mechanically ventilated patients was observed by the

researcher for about 1-2 hours, the time is selected randomly whereby the researcher stays around ICU. Within these hours, the nurses were occupied with patients care practice. The observation checklist was included the twenty observe. The observation checklist included (Common prevention practice toward prevention of VAP was consisted of 5 questions, suction strategies toward prevention of VAP was consisted of 6 questions, position and ventilator equipment care toward prevention of VAP was consisted of 4 questions and other nursing care practice toward prevention of VAP was consisted of 5 questions).

The observation checklist was adopted from previously validated and reliable studies by Burja, et al., (2017)[11], Aferu (2016)[9], al-sayaghi (2014)[12] Neuville, et al., (2017)[7] Labeau, et al., (2007)[13].

The validity of the Arabic version of the observation checklist was reviewed by five experts in order to determine if all observes were clearly worded and would not be misinterpreted. Experts included two academic staff in critical and medical-surgical nursing and 3 ICU nurse specialist, the ICU respiratory therapist, and a registered nurse who has worked in the ICU for 6 years and more. The reliability of the observation checklist was tested by using Cronbach's Alpha So, the tool was found to be highly reliable for data collection coefficient was (0.73). The piloted of the observation checklist was performed before data collection. A pilot study was done on 10 nurses working in the ICU on items in observation checklist to determine the clarity, feasibility of the study and drawbacks of the observation checklist. Following the pilot study, minimal modifications to the layout and presentation of the instrument were made. The piloted 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 statistics were used, including frequency, the percentage for categorical variables, and the mean and standard deviation for continuous variables. To find the association between practice 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. The above weight was converted into percentage ranging from (0 – 100 %).

The levels of practices 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 have the right to refuse to participate without any effect on their working.

Results

Demographical characteristics

Table 1 showed that more than half of ICU nurses (60%) were female, and (50%) were married. The most (66%) were aged from 20 to 30 years old with mean±SD was (28.4±4.5) year. The mean±SD of work experiences was (4.7 ±4.0) year. Two third (66%) of nurses had diploma degree. While (48%) were attended training course in ICU, (18%) attended training program in VAP prevention and only (10%) of them were had diploma in respiratory therapy.

Table 1: Demographic characteristics of ICU nurses (N=50)

Demographic characteristics	F	%
Sex		
• Male	20	40
• Female	30	60
Marital status		
• Married	25	50
• Unmarried	25	50
Age (year)		
• 20 - 30 years	33	66
• 31- 40 years	16	32
• ≥ 41years	1	2
Working experience (year)		
• 1 - 3 years	27	54
• 4 - 6 years	11	22
• 7 - 9 years	5	10
• ≥ 10 years	7	14
Level of education		
• Diploma degree	33	66
• Bachelor degree	16	32
• Master degree	1	2
Course training in ICU		
• Yes	24	48
• No	26	52
Program in VAP prevention		
• Yes	9	18
• No	41	82
Diploma in respiratory therapy	9	18
• Yes	5	10
• No	45	90

Total practice toward prevention of VAP

The total practice of ICU nurses toward common nursing care toward prevention of VAP (oral, hand care and environmental care) toward prevention of VAP showed that (44.8%) of nurses were done correct practices and (55.2%) were not done correct practices. As regards to the practice toward suction and cuff pressure strategies showed that (29.6%) of nurses were done practice correctly and (70.4%) were not done correct practice. The practice of ICU nurses toward position, chest physiotherapy and ventilator equipment care (humidifier, circuit, filters & ETT tube) strategies toward prevention of VAP showed that (71.5%) of nurses were done practice correct and (28.5%) were not done correct practice. The practice toward other nursing care toward prevention of VAP (assessment, documentation, sedation and weaning protocol strategies) toward prevention of VAP showed that (51.2%) of the nurses were done correct practices and (48.8%) were not done correct practices toward prevention of VAP. More details in table 2.

Table 2: Total nurses' practice toward prevention of VAP (N = 50)

Total Practice	Yes	No
	%	%
Common nursing care toward prevention of VAP	44.8	55.2
Suction strategies toward prevention of VAP	29.6	70.4
Position and ventilator equipment care toward prevention of VAP	71.5	28.5
Other nursing care toward prevention of VAP.	51.2	48.8

Overall practice toward prevention of VAP

Figure 1 showed that less than half of ICU nurses were done correctly practices all items related to prevention of VAP (47.2%), whereas the (52.8%) of ICU nurses were not done correctly practices all items related to prevention of VAP.

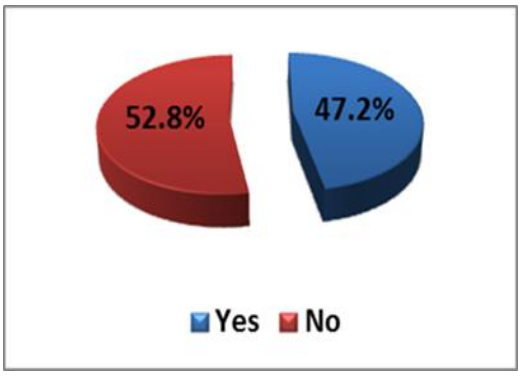

Figure 1: Overall practice toward prevention of VAP

Level of practices toward prevention of VAP.

Figure 2 reveals that there (52%) of ICU nurses were had a poor level of practice whereas (42%) of the ICU nurses had a moderate level of practice and only (6%) of the ICU nurses had a good level of practice.

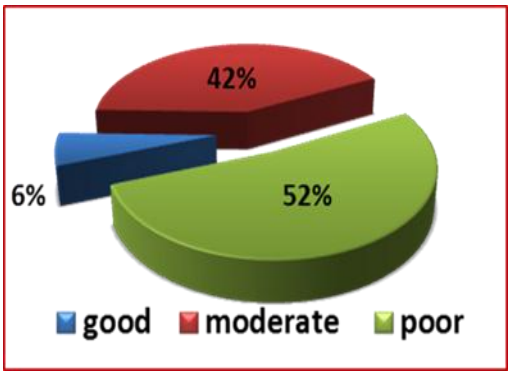

Figure 2: Level of practice toward prevention of VAP

Association between demographic data and level of practice.

Table 3 showed that a significant association between level of practice toward prevention VAP and courses training in ICU (P-value= 0.03). No statistically significant association between level of practice and training programs in prevention of VAP and diploma in respiratory therapy (P-value=0.42 and P-value=0.373) respectively.

Also there was no significant association between level of practice and marital status (P-value=0.23). No significant association between level of practice and age group (P-value=0.327).

No significant association between level of practice and educational level (P-value=0.40), whereas the statistically significant association between level of practice and experiences was observed (P-value= 0.050).

Table 3: Association between demographic data of nurses and level of practices toward Prevention of VAP

Demographic data	Level of Practice			P-value*
	Good	Moderate	Poor	
Sex				
• Male	1	8	11	0.93
• Female	2	13	15	
Marital status				
• Unmarried	1	8	16	0.23
• Married	2	13	10	
Age (year)				
• 20 - 30 years	3	11	18	0.327
• 31- 40 years	0	9	7	
• ≥ 41years	0	1	0	
Working experience (year)				
• 1 - 3	3	7	17	0.050
• 4 - 6	0	8	3	
• 7 - 9	0	1	4	
• ≥ 10	0	5	2	
Level of education				
• Diploma degree	3	13	17	0.40
• Bachelor degree	0	8	8	
• Master degree	0	0	1	
Training course in ICU				
• Yes	2	14	8	0.03
• No	1	7	18	
Program in VAP prevention				
• Yes	1	5	3	0.42
• No	2	16	23	
Diploma in respiratory therapy				
• Yes	1	2	2	0.373
• No	2	19	24	

X^2-test

Discussion

- ***Demographical data of ICU nurses***

About (60%) of ICU nurses were females and (50%) were unmarried. The mean ± SD of age was 28.4±4.5 year. In addition, 66% of nurses were aged ranged from 20 - 30 year. 66% had a diploma in nursing and the (48%) had courses training in ICU and the most of them (82%) not received any training program on the prevention of VAP and (54%) were working in ICU for 1-3 years. This findings were agreed with a study was conducted in Sana'a, Yemen by Al-Sayaghi, (2014)[12], who found that nearly two third (65.4%) of ICU nurses had diploma degree in nursing. As regards to age our study was agreed with the study done by Shaaban (2013)[12], who reported that the mean±SD age was 27.3 ± 5.6 year. Our result inconsistent with the results that reported by Passang et al., (2014)[15] who found (89.1%) of 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)[16]. Who found that (53.3%) 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)[17], who was found (42.5%) of ICU nurses had (2 to 5) years' of experience. Regarding to sex, marital status and level of education our results was disagreement with other results reported by Passang et al., (2014)[15] who found (71%) were females, furthermore, 63% unmarried and 51.4% had a diploma degree.

- ***Common nursing care toward prevention of VAP:***

The current study report no nurse observed to wash hands before entering ICU. This could be due to lack of nurses' education and training on infection control measures. Alp and Voss (2006)[18] emphasized that hand washing before and after patient care, using of gloves when dealing with body fluids, and sterilizing equipment are basic elements in prevention of VAP. This indicates the need for infection control training programs for ICU nurses working the studied ICU. It is noted that in all the studied ICUs, nurses performed oral care without any antiseptic solution, and did not use closed tracheal suctioning. While it is recommended for healthcare workers including nurses to wash hands before entering the intensive care unit[19]. The observer associate absence of a tap and reagent for hand rub in the inlet door as a factor, which hinders hand washing before entering ICU**.** Researchers perceives that dryness, irritation, and fissures caused by soap or alcohol-based products may contribute to poor compliance to hand washing. It, therefore, suggested that the use of waterless alcohol gels may improve the hand hygiene of healthcare workers because these gels are less damaging to the skin and they efficiently and effectively remove transient flora from the hands[19]**.** Hands should be wash in contact with patients, the materials around them and the secretions from the patient, and before and after invasive procedures, whether or not gloves used or changed. Our study showed that only (28%) of nurses were performed regular hands disinfect before oral care and before tracheal suction, before and after every patient care. In ICU infections are among the most common complications affecting ICU patients due to poor adherence to an aseptic procedure like endotracheal suctioning (ETS)[20]**.** Application of aseptic technique in suctioning practice and hand washing before and after such procedures strongly emphasized in the literature[21]. Nurses observed not wash their hands before ETS as expected because of the time it takes out of a busy work schedule particularly, in high-demand situations, such as emergency, under busy working conditions and at times of overcrowding or understaffing.

With the application of multimodal intervention practice on the nosocomial infection to the health workers, hand hygiene compliance reported to increase from 40% to 53% before patient contact and from 39% to 59% after patient contact[22]**.** In another study, it was reported that hand washing rates were only 23% before patient contact and 48% after patient contact[23]**.** Similar findings of a study done to HCW found that among HCWs, hand hygiene applications before patient contact were significantly worse than hand hygiene applications after patient contact[24].

Notably, however, a large number (74%) of participants in our study were observed to wear sterile gloves and gown before oral care and tracheal suction. This may suggest a perception

among nurses that wearing gloves and using a 'non-touch' aseptic technique when inserting the suction catheter negates the need for frequent hand washing yet the literature clearly suggests that gloves do not replace the need for hand washing[25]**.** These findings support earlier studies that report moderate and even low levels of adherence to recommended ETS procedure [26, 21,19.]

This finding is similar to study conducted in Addis Ababa, Ethiopia by Perez-Granda, et al., (2013)[27]. toward prevention of Ventilator-Associated Pneumonia: can knowledge and clinical practice be simply assessed in a large institution, they reported that (35.2%) of ICU nurses were performed regularly disinfect hands and wear gloves before tracheal suctioning but disagreed with a study conducted in Isfahan, Iran. Was done by Adib-Hajbaghery et al, (2013)[28]. About the intensive care nurses practice for oral care of mechanically ventilated patients**,** who is reported there were (53.8%) of ICU nurses were used oral care with Chlorhexidine to patients.

Hand washing hygiene is a cheap and primary infection control procedure, therefore, the researcher is suggesting the measure for improvement by continuous education during hand over of the shifts, seminar and posters, ensuring the availability of adequate hand washing utilities like soap, water taps, drying tissues and reducing workload by improving nurse to patient ratio.

Whereas only (32%) of nurses performed regular oral care with an antiseptic solution (chlorhexidine). In oral care protocol for intubated patients in ICU and CICU at MNH, using a toothbrush with toothpaste, brushing with a swab, using mouthwash or oral rinse solution, suctioning the oral secretions after oral care and assessing the oral cavity were not clearly stated. The AACN guidelines recommend brushing the teeth twice a day, swabbing the mouth every 2 to 4 hours, and suctioning the oral cavity frequently as per need in order to minimize colonization of endotracheal microbes[29].

Although the American Dental Association has no standards for the orally intubated patient, tooth brushing with toothpaste is recommended twice a day and swabbing the mouth every 2 to 4 hours[29]. In addition, this practice is now included in the AACN's oral care protocol[30]**.** However, in the current study observer find using a toothbrush can be inadequate due to time-consuming and difficultness in the manipulation of the endotracheal tube which limits access to the oral cavity and causes fear of potential dislodgement of the tube.

- ***Suction and cuff pressure strategies toward prevention of VAP:***

The results of the study showed that all of the nurses were not performed regular using the closed endotracheal suction system, and only (32%) of nurses were performed regular sterilization or disinfection to suctioning equipment. Whereas (42%) of the nurse was used sterile technique when performing tracheal suction and about (54%) disposed of suction catheter immediately after one single use. 20% of ICU nurses were performed regular subglottic suctioning before deflating cuff or repositioning the tub, and (30%) were regular control and maintenance of cuff pressure.

This finding is agreed with the study conducted by Ally Tatu (2012)[31] in Tanzania. to identify knowledge and practice of intensive care nurses toward prevention of ventilator-associated pneumonia**,** he was found that (50%) of ICU nurses discard suction tube immediately after one

single use while this finding disagrees with study conducted in Addis Ababa about the assessment of knowledge and practice of nurses working in the ICU towards prevention of ventilator-associated pneumonia by Aferu (2016)[9] who was reported that (76.7%) of ICU nurses were preparing sterile equipment required during suctioning.

- ***Patient position and ventilator equipment care toward prevention of VAP:***

Most of the nurses (78%) kept the patient in a semi-sitting position at (30˚ to45˚), (88%) used the kinetic bed for a ventilated patient. Whereas about (62%) of nurses were done regular respiratory chest physiotherapy and (58%) were avoidance of elective change of ventilator circuit, filters, humidifier, and endotracheal tubes only with a new patient or when clinically indicated.

This finding is agreed with a study conducted in Mansoura, Egypt was conducted by Nahed Kandeel and Nayera Tantawy (2012)[32] toward Current Nursing Practice for Prevention of Ventilator-Associated Pneumonia in ICUs. They found that there were (62%) of ICU nurses' frequent changes of ventilator circuits every new patient.

The present study was disagreed with a study conducted in Egypt about the critical care nurses' knowledge and compliance with VSP bundle at Cairo university hospital[14]**.** Who was found that there were only (33.3%) of ICU nurses were maintained continuously patient's position in (30o-45o) if not contraindicated.

- ***Other nursing care toward prevention of VAP:***

This finding showed that more than half of ICU nurses (54%) were checked the nasogastric tube for residual volume through the esophagus and (36%) used of protocol for weaning from mechanical ventilation. (32%) of nurses were apply sedation interruption whereas (66%) were applied an assessment of readiness to weaning and extubation, and about (68%) were did documented all the procedures. This finding is agreed with study conducted in Addis Ababa, Ethiopia about knowledge, practice and associated factors of adult intensive care nurses' on prevention of ventilator-associated pneumonia in public hospitals was conducted by Wami et al., (2018)[5]. They reported that (58%) of ICU nurses were performed documentation to procedures during oral care. The finding of the present study was disagreed with study conducted in Amman, Jordan about evidence-based guidelines for prevention of ventilator-associated pneumonia: Evaluation of intensive care unit nurses' adherence by Muhammad et al., (2017)[33]**.** Who was found (90.4%) of nurses were used guideline or sedation protocol (sedation vacation and assess readiness to extubation patient from mechanical ventilation.

- ***Association between level of practice and training:***

The current study showed a significant association between level of practice toward prevention VAP and courses training in ICU but no statistically significant association between level of practice and training program and diploma in respiratory therapy. Hence, in order to decrease the incidence of VAP, protocols for VAP prevention and monitoring tools must be developed[34]. Additionally, ICU nurses need to receive training on VAP preventive measures and to be orientated about the current evidence based guidelines.

Babcock et al., (2004)[35] found that an educational program for ICU nurses

and respiratory therapy staff on correct practices for VAP prevention, risk factors and preventive strategies was associated with reduced rate of VAP in ICU setting.

In the same sense, Gallagher's (2012)[36]. Study findings suggest that education of nurses can improve mechanically ventilated patient outcome, and improve the quality of care. On the other hand, it is very interesting that in the absence of VAP prevention protocol, and infection control training program at the hospitals, ICU nurses implemented some of the preventive measures, and followed some of the recommendations for VAP prevention. May be nurses leaned what they know from their clinical experience. This issue worth to be investigated.

Conclusion

The current study provided a picture of the current nursing practice for prevention of VAP in ICUs. We conclude that more than half (52%) of ICU nurses had a poor level of practice toward prevention of VAP.

Recommendation

Introduction of ongoing in-service education into hospitals and ICUs to improve practiec on prevention of VAP which is a common nosocomial infection in the intensive care units. Further qualitative studies are required to assess the basis of nursing practice for prevention of VAP in ICUs.

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