



ORIGINAL RESEARCH

Assessing Measures for Preventing Ventilator Associated Pneumonia among Nurses Working in Intensive Care Units: A Case of Two Selected Referral and Teaching Hospitals in Kigali

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Abstract

Background: Ventilator associated pneumonia (VAP) is the most common hospital acquired infection in intensive care units (ICUs). This infection has been found to be associated with increased duration on mechanical ventilation, longer hospital stay, higher treatment costs as well as increased rate of morbidity and mortality.

Objective: The aim of this study was to assess measures of preventing VAP among nurses working in ICUs.

Methodology: A cross-sectional study design was used. A proportionate stratified sampling method was used to select 72 participants at two selected referral hospitals in Kigali. Data were analyzed using SPSS version 20.0.

Results: Forty two (58.3%) participants were female, 38 (52.8%) were aged between 30 to 39 years. Most participants 80.6% had no critical care nursing qualification and 43.1%, had work experience from 1 year to 3 years. Only 46.7% were observed to be adhering to hand washing practices. Having critical care training course was significantly associated with adherence to endotracheal tube suctioning (OR 14.1: CI 3.3-58.5, $p = 0.002$).

Conclusion: Only 9.7% self-reported and 13.3% observed participants demonstrated acceptable levels of adherence to ventilated associated pneumonia prevention.

Keywords

Intensive care nurses, Mechanical ventilation, Ventilator associated pneumonia, Mechanical ventilation

List of Acronyms and Abbreviations

CDC: Center for Disease Control; ETS: Endotracheal Suctioning; ETT: Endotracheal Tube; GCS: Glasgow Coma Scale; HAI: Hospital Acquired Infection; ICU: Intensive Care Unit; NICU: Neonates Intensive Care Unit; OETT: Oral Endotracheal Tube; PICU: Pediatric Intensive Care Unit; RMRT: Rwanda Military Referral and Teaching Hospital; VAP: Ventilator associated pneumonia; WHO: World Health Organization

Introduction

Ventilator-associated pneumonia (VAP) is a type of hospital-acquired infection (HAI) characterized by inflammation of the pulmonary parenchyma caused by infectious agents in patients undergoing mechanical ventilation. Ventilator-associated pneumonia typically develops within 48 hours of intubation and mechanical ventilation [1]. The use of artificial airways and mechanical ventilation is often life-saving for critically ill patients admitted to intensive care units (ICUs). However, these interventions increase the risk of respiratory infections, particularly VAP, due to the invasive nature of the endotracheal tube, which facilitates the direct entry of microorganisms into the lower respiratory tract [2].

The most common bacterial pathogens associated with VAP in ICU patients include *Klebsiella spp.*,

Staphylococcus aureus, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*. Typical clinical signs and symptoms of VAP are fever exceeding 38 °C without an alternative cause, purulent tracheal secretions, positive tracheal aspirate cultures, and chest X-ray findings of new or persistent diffuse infiltrates not attributable to other conditions [3].

VAP is the second most common hospital-acquired infection in ICUs after urinary tract infections, accounting for approximately 20% of HAIs [4]. It is observed in 10-25% of ICU patients, particularly those in neurological ICUs, and is associated with high mortality rates ranging from 22% to 71% [5]. Prevalence rates in developing countries range from 9% to 27% [3], with higher rates of 25% to 36% reported in sub-Saharan Africa [3]. In Kenya, a study at Kenyatta National Hospital found an incidence of 12.2% among ICU patients and up to 28% among mechanically ventilated patients. Similarly, in Uganda, the VAP incidence among ICU patients was reported at 38% [6].

At Rwanda Military Referral and Teaching Hospital, ICU records from May 1 to June 1, 2016, revealed that out of 18 patients admitted, 14 were mechanically ventilated, and 2 cases (5%) showed signs of VAP, including one diagnosed with *Klebsiella spp.* and another with new chest X-ray infiltrates. Higher rates of hospital-acquired infections were noted at the University Teaching Hospital in Kigali, where surveillance reported a 50% rate of HAIs in the ICU and 23.1% in the NICU [7].

Ventilator-associated pneumonia has significant consequences, including prolonged mechanical ventilation, extended hospital stays (by 4-5 days), and increased healthcare costs [8]. Measures to prevent VAP, such as hand hygiene, oral care, patient positioning, and tracheal suctioning, are reportedly implemented in Rwandan hospitals. However, the extent of their use and barriers to implementation remain unclear.

This study aims to evaluate the application of VAP preventive measures among ICU nurses at the University Teaching Hospital of Kigali and Rwanda Military Referral and Teaching Hospital, and to identify associated barriers. The findings will inform ICU nurses on implementing evidence-based preventive strategies and guide hospital policymakers in developing improved prevention and control protocols. These efforts aim to reduce ICU length of stay and morbidity and mortality associated with VAP. Additionally, the study will provide a foundation for further nursing research on effective VAP prevention measures.

Methods and Materials

This study was conducted in two selected public referral hospitals in Kigali, Rwanda: The University Teaching Hospital of Kigali (UTHK) and Rwandan Military Referral and Teaching Hospital RMRT. The University Teaching Hospital of Kigali (UTHK) is situated

in Kigali City, Nyarugenge District. It serves patients from across the country, including referrals from over 40 district hospitals. The hospital has a total of 445 beds with an average occupancy rate of 72%. It includes both pediatric and adult Intensive Care Units (ICUs).

RMRT are located in Kigali City, Kicukiro District. It provides care to both civilian and military patients from all regions of the country. The hospital has a capacity of 400 beds, with 88% of admissions being civilian patients and 12% military patients, according to RMRT statistics from 2015.

Research design

Cross-sectional study design was used to conduct this study.

Population

The study populations for this study were nurses working in ICUs of two selected referral and teaching hospitals in Kigali.

Inclusion and exclusion criteria: The inclusion criterion includes all nurses working in ICUs of the study hospital. Nurses who were on leave during data collection and work experience less than 6 month are excluded from the study.

Sampling and sample size determination

Stratified sampling technique was used to select study participants from nurses working in ICUs of Rwanda Military Referral and Teaching Hospital and University Teaching Hospital of Kigali. The sample chosen from each stratum is proportional to the size of total population.

Sampling strategy: All nurses from ICUs in RMRT and UTHK who met the inclusion criteria were included in the sampling frame for this study. A stratum in this study was each referral hospital and the researcher used a proportionate because the numbers of nurses in these strata were not equal. University Teaching Hospital of Kigali had 55.2% (48 nurses) and RMRT had 44.8% (39 nurses) of the total target population (87 nurses).

Sample size calculation: Since the total number of the populations were small and manageable, all (72 nurses) fulfilling the inclusion criteria were taken.

Operational definition

Ventilator: Is a machine which provides artificial means to assist patients who may not breathe on their own because of illness, trauma, congenital defects, or drugs (WHO, 2011, p. 1).

Ventilator associated pneumonia: In this study, VAP is nosocomial pneumonia in a patient mechanically ventilated supported by endotracheal tube or tracheostomy tube with no signs or symptoms of respiratory infection prior to mechanical ventilator support.

Intensive care unit: It is a special unit in a hospital, where critically ill patients or highly dependent patients who require close monitoring can be cared for by well qualified and specially trained staff working under the best possible conditions.

Critical care nurse: These are nurses working in the intensive care units, neonatal intensive care units and high dependency units.

Data collection instruments

Questionnaire and observation checklists were used as tools for data collection. The questionnaire comprised of closed ended questions which consisted of seven sections including: demographic characteristics of the respondents, factors promoting measures for preventing ventilator associated pneumonia, measures of hand washing or sanitization, oral hygiene, patients positioning, endotracheal tube suctioning, and adherence of all the measures for preventing the ventilator associated pneumonia.

Validity and reliability of instruments

The questionnaire used was developed and tested by Hirko and Michael [9]. The researcher granted permission from the author to utilise the tool and some of the questions were adopted and others modified based on related literature. *Validation of the researchers modified questionnaire and observation checklist* was done by critical care nurse experts to see if the tool was accurate and well adapted to clinical practice reality. The instrument was *pre-tested*. Also reliability was tested with Cronbachs alpha coefficient and it was = 0.711.

Data collection procedure

After obtaining ethical clearance and permission from the University of Rwanda, CMHS research committee and the teaching hospitals research committee, the researcher approached the Nurse Managers and explained the purpose of the study to them. The principal investigator and six data collection enumerators conducted the observation on implementation measures for preventing VAP in critical care settings among nurses attending the mechanically ventilated patients. At the UTHK three data collection enumerators were selected and trained and each one observed five ICU nurses in the five days consecutively under the supervision of the principal investigator.

Data analysis

Data was analyzed using descriptive statistics such as the frequency distributions and percentages. Inferential statistics, namely the bivariate analysis (Pearson chi-square and Fishers exact test) were used to find associations between various variables and adherence to all measures for preventing ventilator associated pneumonia (VAP). Simple logistic regression analysis was also used to predict measure of an endotracheal tube suctioning. The results obtained from those

different statistical analyses were presented in tables. The researcher used statistical package for the social sciences software (SPSS), version 25 for the data analysis. P-Value less than 0.05 were used to consider as statistically significant.

Ethical considerations

After getting research clearance from the CMHS research ethics committee, the researcher submitted the letter to the Director Generals of the two selected referral hospitals and permission for data collection was granted (Ref:/CMHS/IRB/004/2017). Then researcher met with the ICU nursing staff, and described the aim of the study and the procedures to be used. All participants were allowed to ask questions if not clear. The participants were allowed to refuse to answer any particular question as well as to discontinue participation in the study at any time without any penalty. Participation in the study was voluntary and all responses were anonymous and treated with confidentiality. The code was used on the questionnaires instead of names and after completing them, participants put the questionnaires in the same envelope. The researcher kept the questionnaires in a locked cupboard and no other person had access to those data.

Results

Demographic characteristics of the participant

The response rate of the participants (N = 72) was 100%. According to the results, the majority (52.8%) were in the age category between 30-39 years. By looking on the gender (41.7%) participants were male and (58.3%) were female. Many of the participants (52.8%) had advanced diploma in General Nursing. Most participants (80.6%) had no Critical Care Nursing course. Work experience was also considered and the majorities (43.1%) were between 1 to 3 years ([Table 1](#)).

Availability and implementation of policy/guideline

Of the total participants, the majority [64 (88.9%)] answered that they had hand washing policy/guideline but only 41 (56.9%) read it. Regarding oral hygiene policy/guideline, few of the participants 19 (26.4%) answered that they had it whereas a high number of 53 (73.6) answered that they did not have it and 12 (16.7%) read it always. Concerning positioning of the patients policy/guideline, a large proportion of 46 (63.9%) had and 30 (41.7%) reported that they read it always. About an endotracheal tube suctioning policy/ guideline, half of the participants 36 (50.0%) had it and only 17 (23.6%) read the guideline ([Table 2](#)).

Measures of hand washing and its barriers

From all ICU Nurses participated in this study, 66 (91.7%) wash or sanitize hands before entering in intensive care units. Those who washed or sanitized

Table 1: Demographic characteristics of the participant respondents on assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali.

Variables	Participants Response (N = 72)	
	Frequency	Percentage
Age		
20-29	24	33.3
30-39	38	52.8
40 and above	10	13.9
Total	72	100.0
Gender		
Female	42	58.3
Male	30	41.7
Total	72	100.0
Education level		
Advanced diploma	38	52.8
Bachelor's degree	34	47.2
Total	72	100.0
Critical care nursing training course		
Yes	14	19.4
No	58	80.6
Total	72	100.0
Critical care nursing qualification		
No critical care nursing course	58	80.6
Certificate in critical care nursing	10	13.9
Diploma in critical care nursing	4	5.6
Total	72	100.0
Working experience in ICUs		
6 Months -1 Year	6	8.3
> 1-3 Years	31	43.1
> 3-5 Years	22	30.6
> 5 years	13	18.1
Total	72	100.0

Table 2: Availability and implementation of policy/guideline on assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali.

Variables	Participants Response (N = 72)				
	Availability of policy/guideline		Reading of policy/guideline		
	Yes n (%)	No n (%)	Always n (%)	Sometimes n (%)	Not read at all n (%)
Hand washing	64 (88.9)	8 (11.1)	41 (56.9)	23 (31.9)	8 (11.1)
Oral hygiene	19 (26.4)	53 (73.6)	12 (16.7)	7 (9.7)	53 (73.6)
Positioning of the patients	46 (63.9)	26 (36.1)	30 (41.7)	16 (22.2)	26 (36.1)
Endotracheal tube suctioning	36 (50.0)	36 (50.0)	17 (23.6)	19 (26.4)	36 (50.0)

n: number of frequencies, %: percentage

their hands before touching a patient were 68 (94.4%) of those who did not. only 2 (2.8%) did not and they replied as because of lack of alcohol, the other 2 (2.8%) replied as they forget to do so and 1 (1.4%) had reasoned-out as lack of time. A large proportion, 69 (95.8%) wash or sanitize the hands after touching a patient, only 3

(14.2%) did not. Those who wash or sanitize their hands after touching different patients were 68 (94.4%), and 2 (2.8 %) did not do it because of forgetfulness and 2 (2.8%) because of lack of alcohol rub. A high number 70 (97.2%) of participants wash or sanitize hands after contact with a source of microorganisms.

Measures of the oral hygiene

Of the 72 participants 33 (45.8%) perform oral care two times per shift to the patients who are mechanically ventilated, 13 (18.1%) did not perform. Concerning to one who is responsible for making sure that the patients receive appropriate oral hygiene, a large proportion [58 (80.6%)] of participants reported that oral hygiene of the patients who are mechanically ventilated is nurses responsibility while 8 (11.1%) reported that oral hygiene is a shared responsibility between doctors and nurses.

Measures of the patient positioning

Of the 72 participants, 46 (63.9%) participants always position the patients at the angle of 30° to 45° while 12 (16.7%) did not. A large proportion 60 (83.3%) reported that they were responsible for making sure that patients are positioned at an angle of 30° to 45° and 11 (15.3%) reported that it is a shared responsibility between doctors and nurses.

Measures of endotracheal tube suctioning

Of the 72 participants, only 28 (38.9%) of the participants answered that they perform sterile technique suctioning while the majority 38 (52.8%) did not. A large proportion 64 (88.9%) of participants answered that performing sterile technique suctioning is a nurses responsibility while 6 (8.3%) answered that it is shared responsibility between doctors and nurses.

Participants self-reported adherence to all measures for VAP prevention

Adherence was considered after the participant answered all questions related to measures for preventing ventilator associated pneumonia including hand washing or sanitization, oral hygiene, patient positioning and endotracheal suctioning and knowing that it is his/her responsibilities. The participant was considered as adhering to hand washing or sanitization if he/she answered yes to all questions related to hand washing or sanitization on the questionnaire.

These participant were also considered as adhering to providing oral hygiene if he/she recognized that oral hygiene is his/her responsibility and performed it at least twice or once per shift. For patient positioning, the participant was accounted as adhering if he/she always positioned the patient at angle of 30° to 45° and recognized that it is the nurse's responsibility. The participant was considered as adhering to an endotracheal tube suctioning if he/she answered yes, that he/she always performed a sterile endotracheal tube suctioning and also recognized that it is the nurse's responsibility. Therefore, the overall adherence of the participants to prevention of VAP was considered if adherence was fulfilled on each measure.

Of the 72 participants, 63 (87.5%) were adhering to hand washing and sanitization while only 24 (33.3%) ICU nurses were adhering to oral hygiene then the overall

in all measures only 7 (9.7%) of the participants were adhering.

Bivariate analysis adherence to oral hygiene

The association between socio demographic characteristics and adherence to measure of oral hygiene of the patient mechanically ventilated was assessed. The Fishers exact test and Pearson chi-square were calculated and there were no statistical significant relationship found ([Table 3](#)).

Adherence to measure of an endotracheal tube suctioning calculated using fishers exact test indicated that there were statistical significant associations between critical care nursing course and adherence to an endotracheal tube suctioning; p-value < 0.001. Concerning age group, gender, education level and years of experience, Pearson chi-square and the Fishers exact test showed that there were no statistical significant relationships found.

Adherence to all measures of hand washing , oral hygiene , patient positioning and endotracheal tube suctioning was calculated and Fishers exact test indicated that there was statistical significant association between critical care nursing course and adherence to all measures, p-value = 0.002. Concerning age group, gender, education level and years of experience, Fishers exact test reveals that there was no statistical significance found.

Logistic regression analysis of self-reported responses

During logistic regression analysis, the researcher sought to analyze factors that determine the adherence to measures of ventilator associated pneumonia prevention. While doing the bivariate analysis, the researcher assessed the association of individual characteristics (age, gender, education level, experience and critical care nursing course) with overall adherence to measures for preventing VAP or adherence to endotracheal tube, hand washing, patient positioning and oral hygiene. For participants responses, nurses working in ICU who were trained with critical care nursing course were 15.5 times more likely to adhere to all measures for VAP prevention. On the other hand, nurse with the same training were 14.1 times more likely to adhere to endotracheal suctioning ([Table 4](#)).

Demographic characteristics and observed adherence to all measures for VAP prevention

According to the Fishers exact test hand washing, oral hygiene, positioning of the patient and endotracheal tube suctioning were associated with preventing Ventilator associated pneumonia at significance level of P-Value less than 0.05. Regarding age group, gender, educational level and years of experience, Fishers exact test reveals that there was no statistical significance observed ([Table 5](#)).

Table 3: Association between demographic characteristics and self-reported adherence to oral hygiene on assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali.

Variables	Participants Response (N = 72)				
	Adherence to measure of oral hygiene				P- value
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	
Age					
20-29 Years	11 (45.8)	13 (54.2)	24 (100)	Fisher's exact test	0.174
30-39 Years	9 (23.7)	29 (76.3)	38 (100)		
40 and above	4 (40)	6 (60)	10 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Gender					
Female	17 (40.5)	25 (59.5)	42 (100)	Pearson chi-square	0.204
Male	7 (23.3)	23 (76.7)	30 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Education level					
Advanced diploma (A1)	15 (39.5)	23 (60.5)	38 (100)	Pearson chi-square	0.318
Bachelor's degree (A0)	9 (26.5)	25 (73.5)	34 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Years of experience					
6 Months - 1 Year	1 (16.7)	5 (83.3)	6 (100)	Fisher's exact test	0.912
> 1-3 Years	11 (35.5)	20 (64.5)	31 (100)		
> 3-5 Years	8 (36.4)	14 (63.6)	22 (100)		
> 5 years	4 (30.8)	9 (69.2)	13 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Critical care nursing training course					
Yes	6 (42.9)	8 (57.1)	14 (100)	Fisher's exact test	0.529
No	18 (31.0)	40 (69.0)	58 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		

Table 4: Logistic regression of adherence on assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali.

Independent variable	Participants Responses (N = 72)			
	Dependent variables	Odds ratio (OR)	95% CI	P-value
Critical care nursing training course	Adherence to endotracheal tube suctioning	14.1	3.3-58.5	0.001*
Critical care nursing training course	Adherence to all measures of hand washing, oral hygiene positioning of the patient and endotracheal tube suctioning	15.5	2.6-92.6	0.003*

Discussion

Adherence to the implementation measures for preventing ventilator associated pneumonia

Under this objective of determining the adherence to the implementation measures for VAP prevention, the following four practices: hand washing, oral hygiene, positioning of the patient and endotracheal suctioning were discussed. For each practice, adherence was determined and then the overall adherence was determined. In this study 46.7% adhered to hand washing or sanitization, 33% adhered to oral hygiene,

80% adhered to patient positioning at an angle of 30-45 degree, and only 20% adhered to infection preventive measures of an endotracheal tube suctioning. The overall adherence to all measures for preventing ventilator associated pneumonia was found to be 13.3%. Although previous studies concluded that adherence to VAP prevention among nurses was generally unacceptable, the proportion of nurses with acceptable adherence levels were higher than this study.

A study done in Iran by a compliance with the standards for prevention of ventilator associated pneumonia by nurses in the intensive care units

Table 5: Demographic characteristics and observed adherence to practice on measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali.

Variables	Participants Observed (N = 30)				
	Adherence to measures of hand washing, oral hygiene positioning of the patient and endotracheal suctioning				
	Adherence n (%)	Non-adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	2 (20)	8 (80)	10 (100)	Fisher's exact test	0.752
30-39 Years	2 (11.8)	15 (88.2)	17 (100)		
40 and above	0 (0)	3 (100)	3 (100)		
Total	4 (13.30)	26 (86.7)	30 (100)		
Gender					
Female	2 (11.8)	15 (88.2)	17 (100)	Fisher's exact test	0.999
Male	2 (15.4)	11 (84.6)	13 (100)		
Total	4 (13.3)	26 (86.7)	30 (100)		
Education level					
Advanced diploma (A1)	2 (9.1)	20 (90.9)	22 (100)	Fisher's exact test	0.284
Bachelor's degree (A0)	2 (25)	6 (75)	8 (100)		
Total	4 (13.3)	26 (86.7)	30 (100)		
Critical care nursing training course					
Yes	4 (66.7)	2 (33.3)	6 (100)	Fisher's exact test	0.001*
No	0 (0)	24 (100)	24 (100)		
Total	4 (13.3)	26 (86.7)	30 (100)		
Years of experience					
6 Months - 1 Year	0 (0)	1 (100)	1 (100)	Fisher's exact test	0.999
> 1-3 Years	3 (15)	17 (85)	20 (100)		
> 3-5 Years	1 (12.5)	7 (87.5)	8 (100)		
> 5 years	0 (0)	1 (100)	1 (100)		
Total	4 (13.3)	26 (86.7)	30 (100)		

P-Value significant at $p < 0.05$

reported higher proportions of nurses adhering to VAP prevention practices [10]. The result showed that an adherence to hand hygiene based on the standard hand washing protocols was 32.5%, oral hygiene was 87.5%, use of sterile techniques to suction the airway through open technique was 41.6% and 30-45° elevation of the head of the bed was 96.6%.

Based on the recommended percentage adherence scale for VAP prevention of 0-25% adherence representing unacceptable, 26-50% representing average, 51-75% representing relatively acceptable, and 76-100% representing acceptable adherence [11]. This study had acceptable adherence only for measure of positioning the patient at an angle of 30-45 degrees, average adherence to hand washing or sanitization and oral hygiene, and unacceptable adherence to endotracheal tube suctioning with sterile technique. However, the overall adherence of this study to all measures (hand washing, oral hygiene, position of the patient and endotracheal suctioning) for preventing VAP was found 13.3% and which is unacceptable.

In this study, a large majority of 63 (87.5%) of the 72 respondents adhered to hand washing or sanitization. A study conducted in Brazil byrate for hand washing was 43.7% [12]. In the same study it was found that the most adherences to hand hygiene was among the physiotherapists (53.5%) and the fewer adherences was among the nursing staff (29.2%). The observations with the highest levels of compliance were “after touching the patient” (31.3%) and “after touching patient surroundings” (27.2%). Indications with the lowest adherence rates to hand hygiene were “before touching the patient” (18.4%) and “before aseptic procedure” (20.9%).

This study shows that, only 38.9% perform sterile technique of endotracheal tube suctioning while 52.8% did not perform. The same finding was found on a study conducted at University Hospital, Oulu, Finland on the “Evaluation of endotracheal suctioning practices of critical care nurses”. Practices of infection control: Prior hand disinfection to suctioning was 72.2%; wearing gloves was 100%, wearing apron was 32.5%; face mask

worn was 97.5; sterile procedure suctioning maintained was 67.6%, cuff pressure checked was 56.8%. Hand disinfection post suctioning was 52.5%. As this study indicate that, only 46.7% had inserted the catheter into the endotracheal tube gently using aseptic technique which is below compared to the study conducted at University Hospital, Oulu, Finland on the "Evaluation of endotracheal suctioning practices of critical care nurses" where the sterile procedure suctioning was maintained by 67.6% of participants [13]. In study done in Finland on critical care nurses knowledge of adherence to and barriers towards evidence-based guidelines for the prevention of ventilator associated pneumonia with the sample size of 101 participants revealed that an overall self-reported adherence of measures for preventing ventilator associated pneumonia was 84.0% [14].

Conclusions

This study focused on determining adherence to all measures for VAP prevention namely hand washing or sanitization, positioning of patients at an angle of 30-45 degrees, oral hygiene and endotracheal tube suctioning. Adherence was found to be extremely very low and unacceptable among ICU nurses in this study. Only 13.3% observed participants demonstrated acceptable levels of adherence to VAP prevention strategies. Nurses with critical care nursing qualification were 15.5 times more likely to adhere to endotracheal tube suctioning and to all measures for preventing ventilator associated pneumonia. Lack of guideline for endotracheal tube suctioning and oral hygiene were the identified barriers on implementing preventive measures of VAP among nurses working in intensive care units of the study hospitals.

Recommendations

This study recommended the following entities:

Referral and teaching hospitals

Provide the trainings related to the critical care nursing course, the ICU nurses could have the essential knowledge and skills to all measures for preventing ventilator associated pneumonia. Therefore, the researcher recommend to the hospitals to assure all ICU nurses are updated with the necessary training and following guideline.

Future researchers

The future researchers are recommended to conduct a study by including a large sample size involving all health care providers in critical care units.

Strength and Limitations

The strength of this study is using observation as a method of data collection and the limitation is having small sample size.

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Authors Contribution

RE and BRB had conducted the proposal development; write up, conception, design, data analysis and interpretation. GST had participated in proof reading, data quality check-up, validating the data analysis, manuscript preparation and publication process.

Conflict of Interest

The authors declare that there is no Conflict of interest for this study.

Source of Funding

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