Research Article

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# Practice of Ventilation-Associated Pneumonia Prevention and Associated Factors among Health Care Professionals Working in Intensive Care Units at Public Hospitals in Addis Ababa, Ethiopia.

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## ABSTRACT

**Background :** Ventilation-associated pneumonia is the foremost as often as possible life-threatening nosocomial disease in intensive care units. It increases dismalness and mortality rates in mechanically, ventilated patients.
**Objective :** To evaluate the practice of ventilation-associated pneumonia and associated factors among healthcare professionals working in intensive care units at public hospitals in Addis Ababa, Ethiopia, 2022.
**Methods :** A hospital-based cross-sectional study design was utilized among 154 healthcare professionals working intensive care unit from December 1 to 31, 2022. A simple random sampling method was utilized. Data was entered through Epi-data version 3.1 and analyzed utilizing SPSS version 25. Multicollinearity was checked considering the variance inflation and the goodness of the test was done utilizing the Hosmer-Lemeshow test. Binary logistic regression was done, and factors with a p-value < 0.25 within the bivariable analysis were taken into the multivariable analysis. Statistical significance was announced at a p-value < 0.05 with an adjusted odds ratio and 95% confidence interval.
**Result :** The level of practice of ventilation-associated pneumonia prevention was 54.5% with 95%CI [46.8-62.3]. Gender [AOR: 0.33, 95%CI: 0.13-0.85], knowledge [AOR: 11.74, 95%CI: 3.87-36.66], profession [AOR: 7.07, 95%CI: 1.56-32.00], training [AOR: 6.69, 95%CI: 1.91-23.39], and marital status [AOR: 0.04, 95%CI: 0.01-0.14] were altogether related to the practice of ventilation-associated pneumonia prevention.
**Conclusion :** About five in 10 health care professionals working in in care units at public hospitals in Addis Ababa practice ventilation-associated pneumonia prevention. Gender, knowledge, proficient training, and marital status were critical components within the practice of ventilation-associated pneumonia prevention. Hence, appropriate administration of gender orientation personality, improving the knowledge of health care professionals, actualizing proficient measures, giving preparation training for health care professionals, and appropriate administration of marital-related conditions might improve the practice of ventilation-associated pneumonia prevention.

**Keywords :** intensive care unit, practice, intensive care unit health care professionals, ventilation-associated pneumonia, public hospitals

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## INTRODUCTION

Ventilation-associated pneumonia (VAP) is hospital-acquired pneumonia that occurs in patients who have been treated with mechanical ventilation for 48-72 hours or longer and who had no clinical sign of lower respiratory contamination time recently they were intubated and treated with mechanical ventilation started (Center for Disease Controls, 2012; Maria et al., 2013; Timsit et al., 2017; Aurang et al., 2018; Alecrim et al., 2019; AMAS & Ankitashar, 2019). Ventilation-associated pneumonia is the foremost regularly life-threatening nosocomial disease in serious care units (Center for Disease Controls, 2012; Bassi et al., 2014; Hassan et al., 2017; Diling et al., 2019). It increments dismalness and mortality rates in mechanically, ventilated patients (Maria et al., 2013; Bassi et al., 2014; Hassan et al., 2017; Priyanka, 2018; AMAS & Ankitashar, 2019). It is the foremost common nosocomial contamination, with the predominance rate extending from 10% to 70% in basic care units (Maria et al., 2013; Resende & Callegari, 2013; Priyanka, 2018).

Works of writing demonstrate that appropriate utilization of VAP rules successfully decreases the VAP rates within the serious care unit (ICU) (Kapucu et al., 2013; Nahla, 2013; Alvarez et al., 2014; Bagheri-Nesami, 2014; ZM Hassan et al., 2016; Leila et al., 2016; Alecrim et al., 2019). Recognizing the hazard variables for the event of VAP progresses in actualizing basic and viable preventive measures including non-invasive ventilation, safeguarding amid crisis intubation, minimizing the event of re-ventilation, and minimization of sedation (Alvarez et al., 2014; Bagheri-Nesami, 2014; ZM Hassan et al., 2016; Frota et al, 2019). The past consideration did not address all ICU healthcare health care professionals except nurses (Girma et al., 2018), in any case, this ponder included other specialists working in the ICU in addition to nurses. Essentially, the previous considered evaluated as it were components (handwashing and oral care) (Girma et al., 2018), but, this study included the three components of patient care practice (handwashing, suctioning, and oral care). Subsequently, this thought pointed to assessing ICU healthcare professionals' practice and associated factors at public hospitals in Addis Ababa (AA), Ethiopia.

## METHODS AND MATERIALS

### Study area and period

The study was conducted at public hospitals in AA, which is the capital city of Ethiopia, a seat of the African Union, and the Economic Commission for Africa. AA city has a population of 3,384,569. The city comprises 6 zones and 28 woredas. It comprises up to 79 health facilities including hospitals. From these, 5 hospitals are possessed by the AA Health Bureau, and 4 hospitals are claimed by the Federal Ministry of Health. In this study, three randomly chosen public hospital ICUs specifically; Yekatit 12 Hospital, Addis Ababa Burn, Emergency and Trauma (AaBET) Hospital, and Saint Paul's Hospital were included. Each study hospital had an ICU that gave comprehensive basic and critical support ventilation for patients. The study was conducted from December 1-30/2022.

**Study design :** An institutional-based cross-sectional study was conducted.

**Source population :** All health care professionals working at public hospitals' ICUs in AA.

**Study population :** All chosen healthcare professionals working at public hospitals' ICUs in AA during the study period.

### Eligibility criteria

All healthcare professionals working within the ICUs of the chosen hospitals during the study period were included. In any case, healthcare professionals working for less than one month within the ICU, and healthcare professionals on yearly and maternal take off during the period were prohibited.

### Sample size determination

The sample size was calculated employing a single population extent equation, employing a predominance of the practice of VAP prevention of 89.9% from the past study (Girma et al., 2018), expecting an edge of blunder of 5%, and a certainty level of 95%.

$$\frac{\left(\frac{z@}{z}\right)^2 p(1-p)}{d^2} = \frac{(1.96)^2 0.899x0.101}{(0.05)^2} = 139.5 = 140$$

By considering a 10% non-response rate, the last sample estimate was 154.

### Sampling procedure

Out of the eight public hospitals giving ICU in AA, three hospitals, specifically; AaBET, Yekatit 12, and Saint Paul`s Hospital were included in the consideration by employing a simple random sampling technique. Concerning the healthcare professionals working in each hospital's ICU, there were 58 in AaBET, 44 in Yekatit 12, and 81 in Saint Paul`s. At that point, the corresponding allotment was used to decide the required number of healthcare professionals working in each hospital's ICU. Based on this, 49 from AaBET, 37 from Yekatit 12, and 68 from Saint Paul`s. At last, a simple random sampling technique was utilized to select the study units from each hospital by taking the registration number of health professionals working within the ICU as an examining outline. (Figure 1).

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**Figure 1**

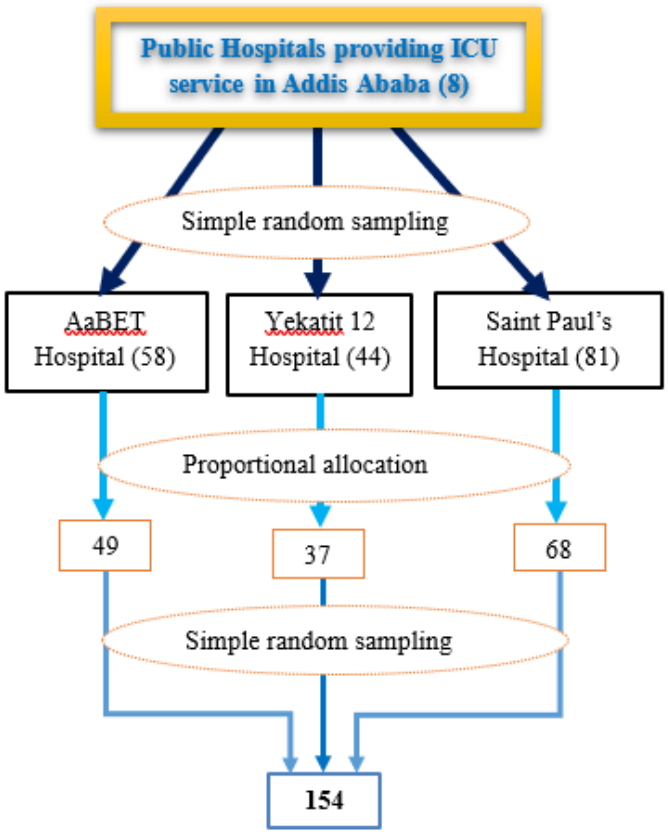



Figure 1: Schematic representation of sampling procedure for practice of VAP prevention and associated factors among health care professionals working in ICU at public hospitals in AA, Ethiopia, 2022.

**Study variables**

**Dependent variable :** Practice of VAP prevention

**Independent variables**

**Sociodemographic factors :** gender, age, religion, marital status, educational status, profession, training, and work experience.

**Knowledge variables :** knowledge-related factors

**Operational definition**

Practice of VAP prevention: The response to activities performed by ICU health care professionals concerning the prevention of VAP was evoked through 24 structured questions. The questions are assembled beneath the foremost common practicing VAP prevention methods (hand washing, suctioning, and oral care). The reaction was designated to each 0 (zero) for not practicing and 1 for practicing. At that point, the score was computed and categorized as good practice (in case the practice level of health professionals was ≥ the mean value) or poor practice (if the practice level of health care professionals was less than the mean value) (Girma et al., 2018).

**Knowledge :** The response of ICU health care professionals about the practice of VAP prevention was evoked through 20 organized survey questions having a single adjusted reply from given four choices. Amid the knowledge section, the reaction was apportioned to each 1 for right and 0 (zero) for wrong answers. At that point, the score was computed and categorized as good knowledge (if the score was ≥ the mean) or poor knowledge (if the score was < the mean (Girma et al., 2018).

**Intensive care unit (ICU) :** A hospital unit that's concentrated with extraordinary equipment and extraordinarily trained healthcare professionals who give care to fundamentally sick patients requiring immediate and nonstop consideration.

**Data collection tool and procedure**

The tool consists of three parts. The first portion was utilized to evaluate the sociodemographic data, the second portion was utilized to assess the knowledge of ICU health care professionals, and the third portion was an organized practice checklist utilized to survey the practice of the health care professionals within the ICU of each hospital. Data were collected using organized, pre-tested, and self-administered survey questions. The questions were adjusted from related sorts of writing and modified in like manner to the setup (Maria et al., 2013; Alvarez et al., 2014; Girma et al., 2018). Six bachelor's degree sciences pharmacists and one experienced master's in sciences epidemiologist were recruited for data collection and supervision respectively. The data collection process was carried out by self-administering the questionnaire for the selected healthcare professionals within the ward.

**Data quality assurance**

The questionnaire was prepared in English in collaboration with senior health care specialists and a two-day training was given for data collectors and supervisors. A pre-test was done on 5% of the entire calculated test estimate (8 health care professionals working in ICU) at Saint Peter Hospital ICU a week before the actual data collection. Based on the pre-test result, the correction and modification were done. To check the reliability, the Cronbach's alpha test was done and the result was 0.812. Ongoing follow-up and supervision were performed by the researchers throughout the data collection period and all filled questions were looked into for completeness before data entry.

**Data analysis**

Data was entered utilizing Epi-data version 3.1 and traded to SPSS version 25 for analysis. Descriptive analysis was done and the outcomes were presented utilizing tables, figures, and percentages. Multicollinearity was checked by considering the variance inflation factor and tolerance. The goodness of the test was done using the Hosmer-Lemeshow test. Binary logistic regression was done, and factors with a p-value < 0.25

within the bivariable examination were taken into the multivariable examination. Factually, significance was declared at a p-value < 0.05 with an adjusted odds ratio and 95% confidence interval.

## RESULT

### Sociodemographic characteristics of healthcare professionals

An add up to 154 healthcare professionals working within the ICU took part in the consider made an overall response rate of 100%. Of them, 87(56.5%) were males and more than half, 92(59.7%) were within the age group of 20-29 years old. More than half, 96(62.3%) were followers of the Orthodox religion and 95(61.7%) were married. The educational level of 104(67.5%) was degree and more than half, 122(79.2%) were nurses in the profession. More than half 114(74.0%) of them have gotten ICU training in the practice of VAP prevention and the work experience of 59(38.3%) had six months to 2 years. (Table 1).

**Table 1 :** Socio-demographic characteristics of health care professionals working in ICU at public hospitals of AA, Ethiopia, 2022.

| Variables (n=154) | Category | Frequency | Percent |
|---|---|---|---|
| Gender | Male | 87 | 56.5 |
| | Female | 67 | 43.5 |
| Age | 20-29 years old | 92 | 59.7 |
| | 30-39 years old | 60 | 39.0 |
| | ≥ 40 years old | 2 | 1.3 |
| Religion | Orthodox | 96 | 62.3 |
| | Protestant | 42 | 27.3 |
| | Muslim | 16 | 10.4 |
| Marital status | Single | 59 | 38.3 |
| | Married | 95 | 61.7 |
| Educational level | Diploma | 22 | 14.3 |
| | Degree | 104 | 67.5 |
| | Masters | 28 | 18.2 |
| Profession | Nurse | 122 | 79.2 |
| | Doctors | 32 | 20.8 |
| Training | Yes | 114 | 74.0 |
| | No | 40 | 26.0 |
| Work experience | < 6 month | 47 | 30.5 |
| | 6 month – 2 year | 59 | 38.3 |
| | > 2 year | 48 | 31.2 |

### Knowledge of health care professionals about VAP prevention

Of one hundred fifty-four intensive care unit healthcare professionals, 89(57.8%) had good knowledge. On the other hand, 65(42.2%) had poor information concerning the prevention of VAP. (Figure 2).

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**Figure 2**

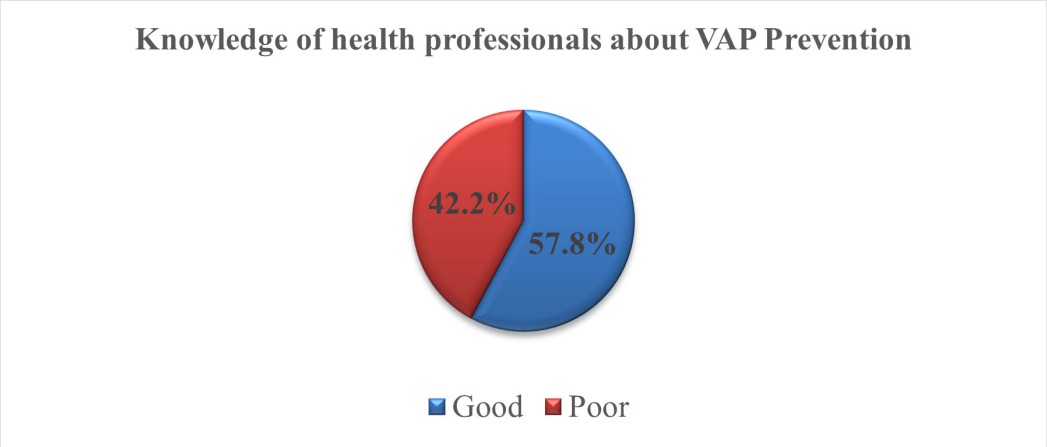



Figure 2: Knowledge of health care professionals about VAP prevention at public hospitals of AA, Ethiopia, 2022.

**Practice of VAP prevention among healthcare professionals**

Of one hundred fifty-four intensive care unit healthcare professionals, 84(54.5%) had a good practice, but, 70(45.5%) had a poor practice of ventilation-associated pneumonia prevention. (Figure 3).

**Figure 3**

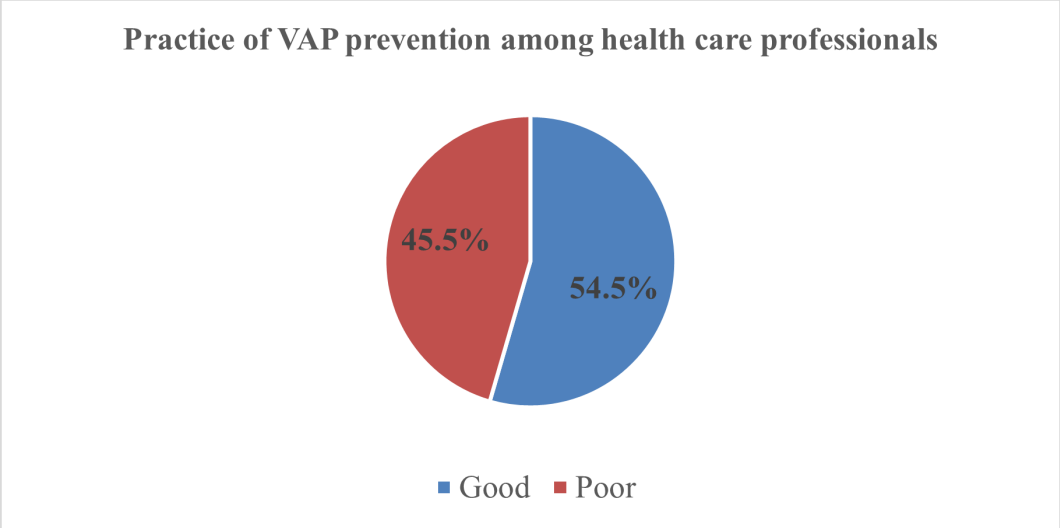



Figure 3: Practice of VAP prevention of health care professionals working in ICU at public hospitals of AA, Ethiopia, 2022.

**The specific practice of VAP prevention among healthcare professionals**

Concerning the hand washing practice of VAP prevention, 37(24.0%) had poor hand washing, however, the rest 117(76%) had good hand washing. For suctioning practice of VAP prevention, 53(34.4%) had poor and 101(65.6%) had good suctioning practice. For oral care practice of VAP prevention, 67(43.5%) and 87(56.5%) had poor and good practices of VAP prevention respectively. (Figure 4).

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**Figure 4**

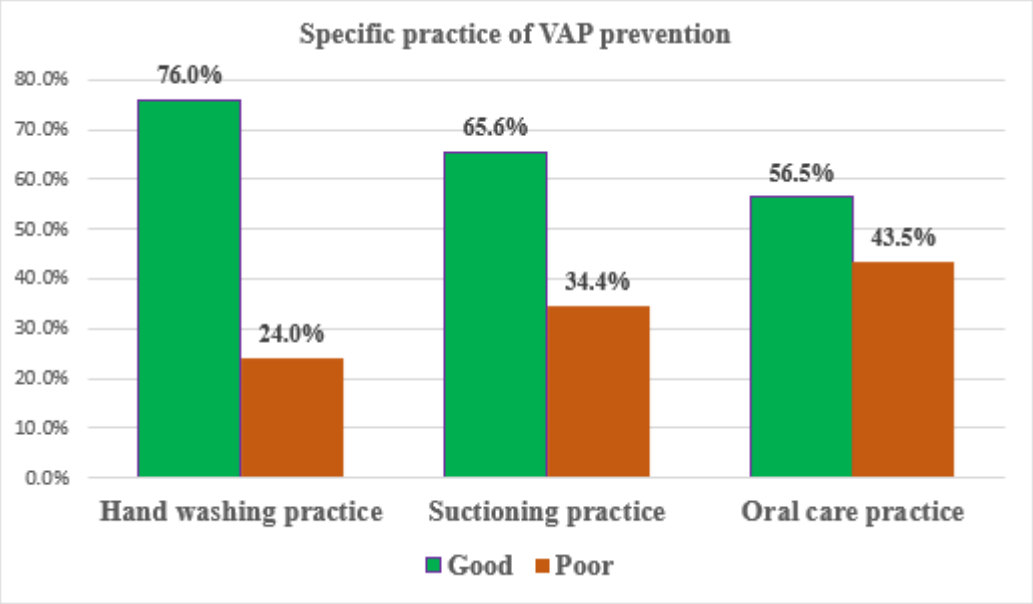



Figure 4 : Specific practice of VAP prevention among healthcare professionals working in ICU at public hospitals of AA, Ethiopia, 2022.

**The practice of VAP prevention regarding the knowledge of health professionals**

Out of the 154 professionals, 64(76.2%) had good knowledge and 20(23.8%) had poor practice. On the other hand, 25(35.7%) had good knowledge and 45(64.3%) had poor practice. (Figure 5).

**Figure 5**

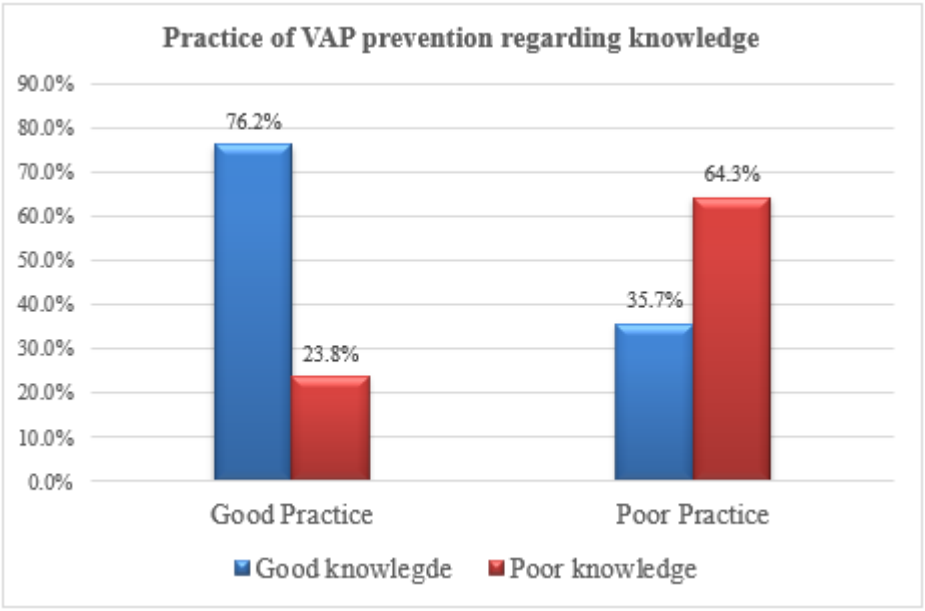



Figure 5 : Practice of VAP prevention concerning knowledge of health care professionals working in ICU at public hospitals of AA, Ethiopia, 2022.

**The practice of VAP prevention regarding the gender of health professionals**

Out of the 154 professionals, 61(72.6%) of males and 23(27.4%) of females had good practice. On the other hand, 26(37.1%) of males and 44(62.9%) of females had poor practice. (Figure 6).

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Figure 6

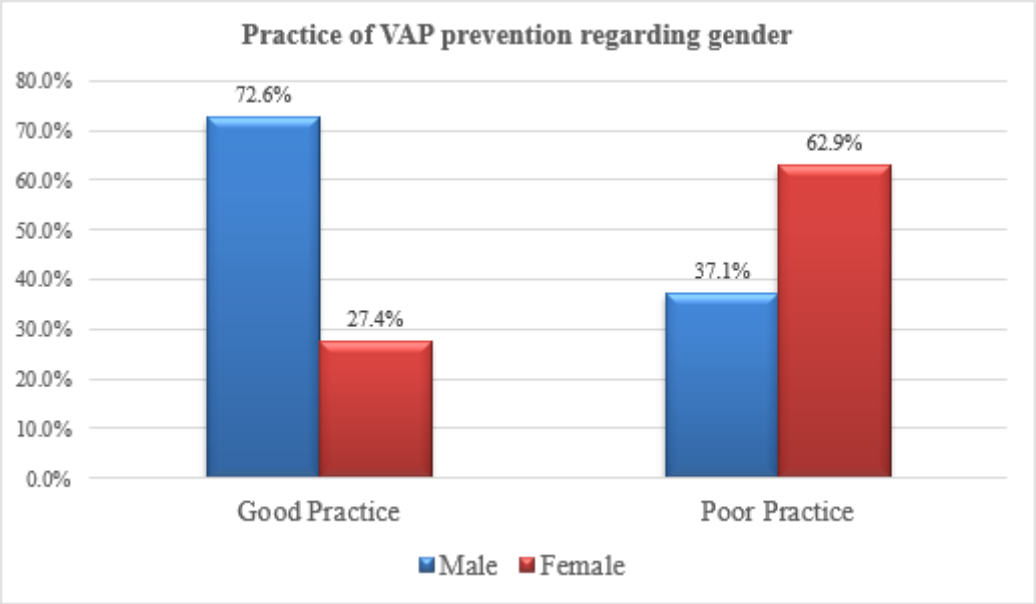



Figure 6 : Practice of VAP prevention concerning the gender of health care professionals working in ICU at public hospitals of AA, Ethiopia, 2022.

**Factors associated with the practice of VAP prevention**

In bivariable logistic regression examination, gender, knowledge, profession, training, and marital status were essentially related to the practice of VVAP prevention. Essentially in multivariable logistic regression examination, gender [AOR: 0.33, 95%CI: 0.13-0.85], knowledge [AOR: 11.74, 95%CI: 3.87-36.66], profession [AOR: 7.07, 95%CI: 1.56-32.00], training [AOR: 6.69, 95%CI: 1.91-23.39], and marital status [AOR: 0.04, 95%CI: 0.01-0.14] were essentially related with practice of VAP prevention among health care professionals working in ICU of AA. (Table 2).

**Table 2 :** Factors associated with the practice of VAP prevention among healthcare professionals working in ICU at public hospitals of Addis AA, 2022.

| Variables (n=154) | Category | Practice of VAP Prevention | | COR(95%CI) | AOR(95%CI) | P-value |
|---|---|---|---|---|---|---|
| | | Poor | Good | | | |
| Gender | Male | 26(16.9%) | 61(39.6%) | 1 | 1 | |
| | Female | 44(28.6%) | 26(14.9%) | 0.22(0.11-0.44) | 0.33(0.13-0.85) | 0.021* |
| Knowledge | Poor | 45(29.2%) | 20(13.0%) | 1 | 1 | |
| | Good | 25(16.2%) | 64(41.6%) | 5.76(2.86-11.61) | 11.74(3.87-35.66) | 0.000* |
| Profession | Nurse | 65(42.2%) | 57(37.1%) | 6.16(2.22-17.05) | 7.07(1.56-32.00) | 0.011* |
| | Doctors | 5(3.2%) | 27(17.5%) | 1 | 1 | |
| Intensive care unit training | Yes | 60(39.0%) | 54(35.0%) | 3.33(1.49-7.45) | 6.69(1.91-23.39) | 0.003* |
| | No | 10(6.5%) | 30(19.5%) | 1 | 1 | |
| Marital status | Single | 8(5.2%) | 51(33.1%) | 1 | 1 | |
| | Married | 62(40.3%) | 33(21.4%) | 0.08(0.04-0.19) | 0.04(0.01-0.14) | 0.000* |

Truncations: AOR: Adjusted Odds Ratio; COR: Crude Odds Ratio; VAP: Ventilation Associated Pneumonia.

Hint: "*": Significance at p-value less than 0.05.

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## DISCUSSION

In this study, the level of practice of ventilation-associated pneumonia prevention was 54.5% with 95%CI [46.8-62.3]. It was steady with a study conducted in AA, Ethiopia that showed particularly that 49.6% wash their hands before patient contact (Girma et al., 2018). However, this study`s result was higher than a comparable study in which 44.2% (Girma et al., 2018) washed their hands after patient contact 36.4% used alcohol hand rub, and in Tanzania, 33.3% washed their hands after patient contact (DAT et al., 2012). Moreover, this study was lower than a study conducted in AA, in which 86.6% washed their hands after contact with a source of microorganisms (Aurang et al., 2018). This may be due to the contrast in coding the result variable, in which the result variable in this study was computed, not at all like the past studies, in which components of practice were independently talked about.

In this study, gender was altogether related to the practice of VAP prevention among healthcare professionals working in intensive care units. Female healthcare professionals were 67% less likely to practice VAP prevention compared to male healthcare professionals. This can be due to time deficiencies from being active with personal, familial, and social workloads.

This study appeared that knowledge was altogether related to the practice of VAP prevention among healthcare professionals working in intensive care units. Healthcare professionals with good knowledge were 11.74 times more likely to practice VAP prevention compared to healthcare professionals with poor knowledge. This is often a result of having the knowledge of how to utilize it, recognizing negative and positive results of the practice, and understanding the well-being advancement status of patients.

In this study, the profession was essentially related to the hone of VAP prevention among healthcare professionals working in intensive care units. Nurses were 7.07 times more likely to practice VAP prevention compared to medical doctor specialists. This might be due to having visit contact with patients as nurses spend more time with patients than medical doctor specialists.

ICU training was altogether related to the practice of VAP prevention among healthcare professionals working in intensive care units. Healthcare professionals who got ICU training were 6.69 times more likely to practice VAP prevention compared to healthcare professionals who did not get ICU training. It was comparable to another study that showed prepared healthcare professionals were 1.39 times more likely to practice VAP prevention (19).

In this study, marital status was essentially related to the practice of VAP prevention among healthcare professionals working in intensive care units. Healthcare professionals whose marital status was married were 96% less likely to practice VAP practice compared to healthcare professionals whose marital status was single. This can be due to time deficiency from being active with familial, kinfolk's relatives, and social issues.

### Limitations of the study

The study may be inclined to review predisposition (recall bias) and personal desirability as the data collection handle was self-administered.

## CONCLUSION

About five in 10 health care professionals working in care units at public hospitals in Addis Ababa practice ventilation-associated pneumonia prevention. Gender, knowledge, proficient training, and marital status were critical components within the practice of ventilation-associated pneumonia prevention. Hence, appropriate administration of gender orientation personality, improving the knowledge of health care professionals, actualizing proficient measures, giving preparation training for health care professionals, and appropriate administration of marital-related conditions might improve the practice of ventilation-associated pneumonia prevention.

### Abbreviations used

**AA :** Addis Ababa; **AaBET :** Addis Ababa Burn, Crisis, and Injury; **AOR :** Adjusted Odds Ratio; **COR :** Crude Odds Ratio; **ICU :** Intensive Care Unit; **SPSS :** Statistical Software Package for Social Sciences; **VAP :** Ventilation Associated Pneumonia.

### Ethical consideration

Ethical clearance was obtained from the Institutional Review Board of Saint Paul Millennium Medical College (IRB/125/13). A letter of permission was obtained from the Medical Directors of each hospital and a permission letter was provided to the respective Director of ICU.

### Informed consent

Written informed consent was obtained from each participant ICU health care professionals, the information obtained from them would not have been disclosed. Coding was used to eliminate names and other personal identifications of respondents. The respondents` right to refuse, or stop at any time, confidentiality, and the purpose of the information was only for a research was clearly stated. Thoroughly, the research fulfills the required principles of the declaration of the Helsinki General Assembly, Seoul, Korea, and October 2008.

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**Authors` contribution**

All authors have made substantial contributions to the work. Participated in the conception, design, and acquisition, conducted the data analysis and interpretation; took part in drafting, revising, and critically reviewing the article. All authors gave final approval of the version to be published and all authors have agreed on the journal to which the article has been submitted; and agreed to be personally accountable for all aspects of the work.

**Availability of data**

The used for this study are available on secured and reasonable request.

**Declaration of interests**

All authors declare that they have no conflict of interest.

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