ORIGINAL ARTICLE

Nurses' Knowledge and Compliance With Standard Operating Procedures For Preventing Ventilator-Associated Pneumonia Among Patients At Princess Marina Hospital Intensive Care Unit, In Gaborone, Botswana

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ABSTRACT

Background: Ventilator-associated pneumonia is a significant global healthcare concern, contributing to high mortality rates of 24% to 76%, high morbidity rates and prolonged lengths of hospital stay, particularly in low to middle-income countries. Intensive care unit nurses, who have constant contact with patients, must know how to prevent ventilator-associated pneumonia and comply with several standard prevention strategies.

Aim: This study evaluated nurses' knowledge and compliance with standard operating procedures for preventing ventilator-associated pneumonia among patients in the Princess Marina Hospital intensive care unit in Gaborone, Botswana.

Methodology: A descriptive cross-sectional study involved (n=19) from a population of 21 Princess Marina Intensive Care Unit nurses. Data was collected using a self-administered, structured questionnaire and an observational checklist and analysed using the Statistical Package for Social Sciences, version 29. Descriptive statistics were used, and the Fisher exact test determined relationships between variables, with significance set at $P < 0.05$.

Results: The results showed 63.2% good knowledge, 31.6% self-reported good compliance, and 0% observed good compliance. There were no significant associations between years of intensive care unit experience, receipt of training on preventing ventilator-associated pneumonia, nurses' knowledge of VAP prevention and self-reported compliance.

Conclusion: The identified knowledge gap among nurses and low compliance require enhanced in-

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service lectures and structured educational programs on ventilator-associated pneumonia prevention to enhance nurses' knowledge. Regular updates to standard operating procedures and frequent file audits accompanied by feedback should be emphasised to improve nurses' compliance and guide nurses properly in current best practices.

INTRODUCTION

Ventilator-associated pneumonia is a common complication of mechanical ventilation, especially in developing countries.[1] It is an infection of the pulmonary parenchyma occurring after 48 hours of mechanical ventilation or within 48 hours following disconnection.[2] Globally, the Centres for Disease Control and Prevention (CDC) indicate that pneumonia is the most prevalent infection in acute hospitals, with 32% due to ventilators.[3] This issue is heightened in low to middle-income countries, where VAP significantly affects 7% to 41% of patients and is associated with prolonged hospital stays and increased healthcare resource utilisation.[4] Within low-resource settings, including those in Africa, the burden of healthcare-associated infections like VAP presents a considerable challenge.[5] At Princess Marina Hospital's ICU in Botswana, despite the apparent absence of specific VAP surveillance, hospital statistical reports reveal high mortality rates ranging from 40.2% to 54% and prolonged average lengths of stay between 20.7 and 38.9 days. Given its known association with such adverse outcomes, these indicators strongly suggest a potential VAP problem,

To address this, organisations like the European Respiratory Society and the Society for Healthcare Epidemiology of America have developed several evidence-based guidelines to prevent VAP and its complications.[6] As primary caregivers, ICU nurses should comply with evidence-based standards to prevent VAP. In Botswana, the Ministry of Health provides a manual of quality health standards to guide the development of standard operating procedures. However, effective prevention relies on healthcare workers' knowledge and consistent compliance with these guidelines, factors often cited as challenges in developing countries, contributing to higher VAP incidence.[7]

In the context of Princess Marina Hospital ICU, there seems to be limited published information on nurses' knowledge and compliance with SOPs for preventing VAP. This lack of data on nurses' knowledge of VAP prevention and compliance with context-specific standardised guidelines raises concerns that the PMH ICU may continue to experience undesired patient outcomes. Therefore, this study aims to evaluate Princess Marina Hospital ICU nurses' knowledge and compliance with standard operating procedures for preventing VAP among patients. The results help identify targeted educational interventions to enhance nurses' knowledge and compliance with standards of practice and ultimately improve the quality of care.

METHODOLOGY

A descriptive cross-sectional study investigated knowledge and compliance with SOPs for preventing VAP among (n=19) Princess Marina Hospital ICU nurses in Gaborone, Botswana, a key public referral centre and teaching hospital. The census method was used because of the small population of 21 nurses. Permanently employed nurses who willingly provided informed consent were included in the study, whereas those on leave were excluded. The study achieved a 90.5 %(n=19) response rate.

The study employed a structured, self-administered questionnaire to collect data on nurses' knowledge and compliance with SOPs for preventing ventilator-associated pneumonia. The knowledge section adopted eleven closed-ended questions from pre-validated international questionnaires from Labeau *et al*[8] and Jansson *et al.*[9], previously used in Finland (2015), Western India (2023), and Tanzania (2020) to assess nurses' knowledge of the prevention of VAP. These questions had difficulty and discriminative indexes of 0.1 to 0.9 and 0.10 to 0.65, respectively[9].

The self-reported compliance section included fifteen closed questions developed using Princess Marina Hospital ICU's existing SOPs for VAP prevention and recent relevant literature, with some questions adopted from a validated compliance questionnaire of Cronbach's alpha coefficient (α= 0.698), and the reliability of the tool using the Wilcoxon test (P=0.194).[10] In addition to ensuring the reliability of the tools, a pilot study was conducted on five eligible respondents at Nyangagwe Referral Hospital. The supervisors and critical care experts evaluated the modifications.

An observational checklist was used to observe nurses' compliance as they provided care to patients. The ventilator bundle checklist comprised six different observational events. This included the main five steps of the bundle, with the addition of the attachment of the checklist to patients' files to ensure proper documentation. The study adopted five elements of the checklist from the Princess Marina Hospital ICU ventilator bundle checklist, which forms part of the SOPs. The structured checklist had "yes" indicative of compliance and "No" for non-compliance. Nurses who consented to participate in the study and filled out the questionnaire were each observed individually using a standardised checklist. There was no concealment during the observation process.

The researcher sought ethical clearance from the University of Zambia Biomedical and Research Ethics Committee (UNZABREC): **REF.No.5283-2024**, and the Health Research Development Committee (HRDC) in Botswana. Permission to conduct the study was obtained from the Ministry of Health in Botswana, the Princess Marina Hospital Research Board of the participating hospital, and the Hospital administration.

The researcher explained the purpose of the study and scheduled a convenient time for data collection during various working hours. Following the participants' expression of understanding of the terms and their willingness to sign a consent form if they agreed, the researcher distributed the questionnaires and waited for them. The researcher also distributed the questionnaires to each nurse individually and made herself available to responders to answer any questions. Additionally, on each day of data collection, the researcher assessed nurses' compliance by observing nurses and reviewing the files of admitted patients to ensure correspondence on some elements stated on the observational checklist. Additionally, the researcher checked the availability of SOPs for preventing VAP and their up-to-date status.

The observational checklist used was predefined and clearly outlined the specific events observed, and a standardised checklist form was used to record observed data. To maintain observer blinding, the respondents were assigned unique numerical codes immediately after questionnaire completion. During patient care observation, the observer only saw these numerical codes and had no way of knowing the actual identity of the individuals. This method ensured the observations were not linked to the numerical order of questionnaire completion, preventing unintentional bias, maintaining the confidentiality and anonymity of nurses caring for those patients.

Statistical Package for Social Sciences (SPSS) version 29 was used for data analysis. Descriptive statistics and non-parametric tests were used. Fisher's exact test assessed relationships between variables at a significance level of P<0.05. The results were presented in tables. Knowledge was scored out of 10 (0- 69% = poor, 70- 100% = good). Self-reported was scored out of 15(0- 94% = poor, 95-100% good). Observed compliance, scored out of six based on the checklist, was converted to percentages with similar cut-off points.

RESULTS

The results below are of socio-demographic characteristics, knowledge of nurses on prevention of ventilator-associated pneumonia, self-reported compliance with standard operating procedures and observed compliance using a ventilator bundle checklist among the (n=19) ICU nurses.

Table 1: Respondents' socio-demographic characteristics (n=19)

Variables	Frequency(n=)	Percentages (%)
Gender		
Male	7	36.8
Female	12	63.2
Total	**19**	**100**
AGE		
20-29	6	31.6
30-39	7	36.8
40+	6	31.6
Total	**19**	**100**
Level of Education		
Higher Diploma	14	73.7
Bachelor's Degree	5	26.3
Total	**19**	**100**
ICU training on VAP prevention in the last 2 years		
Yes		
No	10	52.6
Total	9	47.4
	19	**100**
Years of experience in the ICU		
=5years	12	63.2
>5 years	7	36.8
Total	**19**	**100**
Designation		
Registered Nurse	4	21.1
Nursing Officer I	5	26.3
Principal Registered Nurse	10	52.6
Total	**19**	**100**

The above table shows that female participants, 63.2 %(n=12), dominated the study. Age distribution was relatively equal (31.6% (n=6) per group), and most (73.7%) held a higher diploma. Just over half (52.6%, n=10%) had recent VAP prevention training (within 2 years), and most (63.2%) had ≥5 years of ICU experience.

Respondents' Knowledge of the Prevention of VAP

Table 2: The responses for knowledge on the prevention of VAP as provided by participants (n=19)

Questions	N (%)
VAP would occur in patients who are on mechanical ventilation for;	
6 hours	1(5.3)
12 hours	0(0)
24 hours	2(10.5)
48 hours	16(84.2)
Total	**19(100)**
Which of the following is the recommended route when intubating a patient?	
Oral intubation	15(78.7)
Nasal intubation	0(0)
Both routes of intubation	3(15.8)
I do not know	1(5.3)
Total	**19(100)**
How frequently are ventilator circuits changed according to evidence -based guidelines for preventing VAP?	0(0)
Every 48 hours	3(15.8)
Every 72 hours	3(15.8)
Every week	13(68.4)
For every new patient	**19(100)**
Total	
A nurse caring for a ventilated patient is required to wash their hands.	
Before oral and ETT suctioning	2(10.5)
After oral and ETT suctioning	0(0)
Before and after oral / ETT suctioning	17(89.5)
I don't know	0(0)
Total	**19(100)**
Which type of airway humidifier is recommended?	
Heated humidifier	2(10.5)
Heat and moisture exchanges	5(26.3)
Both types of humidifier	7(36.8)
I don't know	5(26.3**)**
Total	**19(100)**
Endotracheal tubes with extra lumen for drainage of subglottic secretions are recommended because they;	16(84.2)
Reduce the risk of VAP	0(0)
Increase the risk for VAP	1(5.3)
Does not influence the risk for VAP	2(10.5)
I do not know	**19(100)**
Total	
Which of the following is the recommended suction system?	
Open suction systems	0(0)
Closed suction systems	14(73.7)
Both systems	4(21.1)
I do not know	1(5.3)
Total	**19(100)**
Kinetic vs. standard beds;	
Kinetic beds increase the risk of VAP	0(0)
Kinetic beds reduce the risk of VAP	12(63.2)
The use of kinetic beds does not influence the risk for VAP	2(10.5)
I do not know	5(26.3)
Total	**19(100)**
Patient positioning recommended includes;	
Supine	0(0)
Semi-recumbent (30 - 45)	17(89.5)
The patient's position does not influence the risk for VAP	1(5.3)
I do not know	1(5.3)
Total	**19(100)**
It is recommended to perform oral care by using a chlorhexidine 0.12% .	
Once in a shift	6(31.6)
Every 4 to 6 hours and whenever necessary	5(26.3)
Twice daily	5(26.3)
I do not know	3(15.8)
Total	**19(100)**

Compliance of Nurses

The goal was to achieve 100% compliance, with 95% and above considered good compliance, while scores below 95 % were classified as poor.

Table 3: Intensive care nurses' self-reported compliance with SOPs for VAP prevention

COMPLIANCE ELEMENTS	n=19(%)
I adequately wash my hands before and after contact with each patient.	
Yes	18(94.7)
No	1(5.3)
Total	**19(100)**
I use chlorhexidine oral rinse as recommended.	
Yes	10(52.6)
No	9(47.4)
Total	**19(100.0)**
I dispose of the used catheters and gloves in a manner that prevents contamination from secretions.	
Yes	19(100)
No	0(0)
Total	**19(100)**
I perform subglottic secretion and mouth suctioning before repositioning the patients.	
Yes	14(73.7)
No	5(26.3)
Total	**19(100)**
I use protective gowns during suctioning.	
Yes	18(94.7)
No	1(5.3)
Total	**19(100)**
I hyper oxygenate patients pre-suctioning.	
Yes	18(94.7)
No	1(5.3)
Total	**19(100)**
I assess the depth of Sedation as often as recommended.	
Yes	19(100)
No	0(0)
Total	**19(100)**
I perform daily examinations of the patient's readiness for weaning from mechanical ventilation.	
Yes	18(94.7)
No	1(5.3)
Total	**19 (100)**
I perform a spontaneous breathing test as recommended.	
Yes	16(84.2)
No	3(15.8)
Total	**19(100)**
[illegible]	
Yes	19(100)
No	0(0)
Total	**19(100)**
I use mechanical devices (socks and compression pump) and give pharmacological prophylaxis to prevent DVT.	
Yes	18(94.7)
No	1(5.3)
Total	**19(100)**
I give pharmacological peptic ulcer prophylaxis as recommended.	
Yes	18(94.7)
No	1(5.3)
Total	**19(100)**
I use a disposable ventilator circuit for each patient.	
Yes	18(94.7)
No	1(5.3)
Total	**19(100)**
I replace the humidification system in case of evident contamination.	
Yes	14(73.7)
No	5(26.3)
Total	**19(100)**
I ensure appropriate endotracheal tube cuff pressure (20 -25 cm of H_2O) controlled by a manometer.	
Yes	16(84.2)
No	3(15.8)
Total	**19(100)**

Table 3 shows that nearly all respondents, 94.7 % and reported adequate handwashing before and after contact with each patient. However, only 52.6 % used chlorhexidine oral rinse as recommended. All confirmed proper disposal of the used catheters and gloves in a manner that prevents contamination from secretions. Most 73.7 % performed subglottic secretion and mouth suction before repositioning patients, and almost all 94.7% used protective gowns during suctioning and hyperoxygenated patients pre-suctioning.

Regarding other practices, all (100%) reported frequent sedation depth assessment and proper head of bed elevation (30-45°). Most (94.7%) performed daily examinations of the patient's readiness for weaning from mechanical ventilation and used DVT/peptic ulcer prophylaxis and disposable ventilator circuits. A high percentage, 84.5 %, performed spontaneous breathing tests as recommended, 73.4% replaced the humidification system in case of evident contamination, and 84.2% ensured appropriate endotracheal tube cuff pressure.

Table 4: Observed compliance with SOPs ventilator care checklist

Observed elements	n=19(%)
Are the elements recorded and the ventilator bundle checklist attached to the patient's file	
Yes	7(36.8)
No	12(63.2)
Total	**19(100)**
Daily sedation vacation and daily assessment of readiness to extubate are discussed or done by nurses	
Yes	17(89.5)
No	2(10.5)
Total	**19(100)**
Oral care and hygiene using chlorhexidine done by nurses	
Yes	0(0)
No	19(100)
Total	**19(100)**
Is the head of the bed elevated to at least 30-45°	
Yes	10(52.6)
No	9(47.4)
Total	**19(100)**
Is prophylaxis for peptic ulcer disease given as ordered ?	
Yes	16(84.2)
No	3(15.8)
Total	**19(100)**
Is prophylaxis for deep venous thrombosis given as ordered ?	
Yes	11(57.9)
No	8(42.1)
Total	**19(100)**

The table above shows that out of six observed elements, attaching and recording on ventilator bundle checklist had low compliance (36.8%). Daily sedation vacation and assessment of readiness to extubate showed higher compliance (89.5 %). There was 100 % non-compliance with oral care and hygiene using chlorhexidine. Head of the bed elevation to 30-45 ° had 52.6% compliance, peptic ulcer prophylaxis 84.2 %, and DVT prophylaxis 57.9 %.

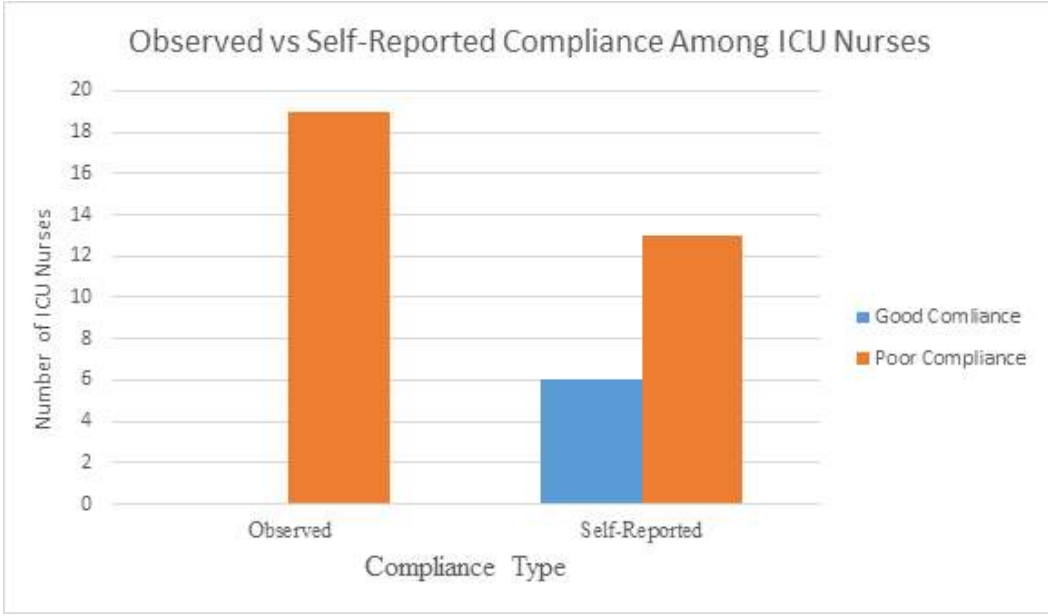

Figure 1: Observed and Self-reported compliance among intensive care unit nurses (n=19)

The figure above shows a summary of compliance levels among ICU nurses. It revealed that observing nurses using a checklist only resulted in poor compliance, ranging between 17 % and 83 %, as no respondents achieved the 95% threshold for good compliance. Consequently, overall self-reported compliance scores ranged from 67% to 100%. Only six ICU nurses (31.6%) showed good compliance (100%), while most (68.4%, n=13) demonstrated poor compliance.

Associations Between Demographic Characteristics, Nurses' Knowledge And Compliance With Sops For VAP Prevention

The data analysed using Fisher's exact test ($P<0.05$ significance) showed no significant associations between gender, level of education, years of experience, ICU training on VAP prevention, knowledge and self-reported compliance. Due to the small sample size, age and designation were analysed descriptively. ICU nurses aged 30-39 years showed the highest rate of poor compliance (85.7%) compared to 66.7% in the age group of 20-29 and 50% in those 40 years and above. Regarding designation, the Principal Registered nurses had the highest percentage of poor compliance (80%), followed by Registered Nurses (75%) and Nursing Officer I (40%).

DISCUSSION

The study evaluated Princess Marina Hospital ICU nurses' knowledge and compliance with SOPs for VAP prevention, and it identified some associations between the socio-demographic characteristics. These characteristics include age, gender, years of ICU experience, having received training on VAP prevention in the last two years, designation and qualification. They are important in determining nurses' knowledge and compliance with standards for VAP prevention. Understanding them, helps identify targeted interventions to enhance ICU nurses' understanding and compliance with SOPs for VAP prevention.

Socio-demographics

Most of the respondents' level of education (73.7%) was a higher diploma, while a minority (26.3%) held a bachelor's degree. This contrasts with Saudi Arabian findings by Al-Sayaghi[1], where most nurses

had a bachelor's degree (79.5 %), potentially due to the prevalence of diploma programs in Botswana with limited bachelor's degrees offered currently. However, this may change with new degree programs being introduced in other universities in the country. Additional findings revealed no significant association between level of education and self-reported compliance with SOPs for VAP prevention, p=0.26. This contrasts with Soni and Raj[11], who identified a statistically significant association between self-reported compliance towards the prevention of VAP and level of education, with *P*=0.001. The difference could be because of varying educational systems and staff development programs. Even though there was no association, descriptively majority, 78.6 %, with higher diplomas had poor compliance. This implies a need to acquire more knowledge and skills through higher qualifications to increase the likelihood of compliance. Hence, encouraging continuous professional development may significantly contribute to nurses' knowledge and compliance with SOPs for VAP prevention.

Lightly over half of the participants (52.6 %) reported receiving VAP prevention training, similar to findings by Al-Sayaghi[1], where 69.4 % received training, but higher than in studies by Getahun *et al* 31.86 % and Ghimire and Neupane[9], 3.9 % received training. However, descriptive patterns revealed that 70% of respondents who received ICU training on VAP prevention had poor compliance. No significant association was found between ICU training on VAP prevention and compliance, indicated by *P*=1.00. These findings align with Bankernie *et al*[12] but differ from Al-Sayaghi[1] where VAP prevention training positively impacted compliance. This may reflect limited formal training opportunities in public facilities due to a shortage of nurses; as such, reviewing training programs and implementation of structured education is crucial[13]. Additionally, the lower training rate in this study might be because training older than two years was categorised as not trained due to evolving VAP prevention practices. Additionally, the COVID-19 pandemic disrupted formal in-person training, leading to reliance on peer-to-peer or informal sessions that some healthcare providers may not consider formal training. Alternatively, a study on finding the impact of ICU training on nurses' compliance with SOP for VAP prevention can be conducted. This highlights the need for structured VAP prevention training programs to enhance nurses' knowledge.

Regarding years of ICU experience, most respondents (63.2 %) had $\leq$ 5 years of ICU experience, consistent with the findings of Aziz *et al*[14] (55%) and Al-Sayaghi[1] (64.2%). The similarity may be due to the frequent staff rotations in ICUs to relieve others from the highly reported ICU burnout due to workload. While frequent rotations distribute workloads, skilled and experienced staff should be retained in the ICU to ensure quality care and patient safety. ICU rotations are done every two years, with specialised nurses often remaining longer due to their expertise and to orient new staff. The study found no significant association between ICU years of experience and self-reported compliance (p=0.62). These findings align with Kalovwe[15], who also found no significant association. While less experienced nurses (75%) had slightly poorer compliance descriptively, this could be because those with more experience may have acquired skills to comply because of repeated exposure to routine practice. This calls for robust monitoring and auditing systems to track compliance and identify areas of improvement, especially for nurses with $\leq$5 years of experience.

Most respondents (52.6 %) were Principal Registered Nurses, likely due to the high proportion of higher diploma holders (73.7%). No comparable studies on nursing designations were found, as these are specific to Botswana's healthcare system and influenced by experience and education. Bachelor's degree holders normally progress from Assistant Nursing Officers to Nursing Officers levels. Higher diploma holders start as Registered Nurses and advance to Principal Registered Nurses with further promotion depending on additional qualifications

and vacancies. This study suggests that the majority are in senior positions. Although seniors are believed to have accumulated wisdom and experience, a balance between junior and senior positions is required, as the study revealed that most have experience in general nursing, not ICU experience.

Nurses' knowledge of the prevention of ventilator-associated pneumonia

One of the specific objectives of this study was to assess nurses' knowledge of preventing ventilator-associated pneumonia. As they spend most of their time with patients, nurses should thoroughly understand the ventilation modes, troubleshoot ventilators and assess and care for the patients requiring mechanical ventilation[16]. Overall, the knowledge scores out of 10 questions ranged from 2 to 10 (20 to 100 %), aligning with those by Bankanie *et al*[12] where the scores ranged from 1 to 9 (10-90%).In this study, 63.2% (n=12) had good knowledge while 36.8 % (n=7) demonstrated poor knowledge of preventing ventilator-associated pneumonia. However, the overall result of good knowledge falls below the 70% mark, indicating generally poor knowledge of VAP prevention among Princess Marina Hospital ICU nurses. These findings contrast with those of Getahun *et al*[7] where 48.04 % had good knowledge and 51.96 % had poor knowledge. Despite the differences, both studies concluded that the overall knowledge of VAP prevention was poor.

The difference in results could be attributed to the differences in VAP prevention training, emphasis and resources between the two settings. Additionally, as noted by Bankanie *et al*[12] , the significant differences between the lowest and highest knowledge score could imply difficulty in sharing updated evidence-based guidelines, which could be the case in Princess Marina Hospital ICU as well. This poor knowledge of VAP prevention poses a significant risk to critically ill patients and suggests structural weaknesses that could lead to poor compliance and adverse outcomes. No significant association was found between nurses' knowledge and self-reported compliance (P =1.00). This contrasts with studies by Bankanie *et al*[12] and Dumbre[16], as a significant association was found with a *P*-value of 0.01. These findings suggest an urgent need to review SOPs thoroughly and training programs to help improve ICU nurses' knowledge and address concerns related to VAP prevention.

Nurses' compliance

Compliance with SOPs was determined as self-reported and observed. While Botswana's 2013 Ministry of Health compliance standard is 80%, studies by Banjar *et al*[17] and Osman *et al*[18] suggest that maintaining a compliance rate of $\geq$ 95% significantly reduces VAP incidence rates. Therefore, this study used a$\geq$95 threshold across observed elements and self-reported compliance assessment. Overall, the self-reported compliance was poor (68.4 % below the 95 % threshold), with only 31.6% demonstrating good compliance. This aligns with Soni and Raj[11], where the high compliance rate was 48.5% and the low compliance rate was 51.1 %. This study's poor compliance rate with SOPs for VAP prevention might be due to outdated SOPs, a shortage of nurses and limited resources. The lack of VAP guidelines, guidance and training has also been reported as a barrier to compliance and prevention[11].

A ventilator bundle checklist from Princess Marina ICU incorporated some environmental factors to assess observed compliance among nurses caring for patients in the Princess Marina ICU. According to the 2013 Ministry of Health Quality Health Standards Manual, healthcare professionals are compliant if they meet an 80 percent compliance rate. However, recent studies by Banjar *et al*[17] and Osman *et al*[18] indicated that maintaining a compliance rate of 95 percent or higher significantly reduces ventilator-associated pneumonia incidence rates. Therefore, similar to self-reported compliance, the threshold for observed compliance was set at $\geq$95 percent across six observed elements.

The Botswana 2013 Ministry of Health guidelines mandate SOP manual revision every five years and SOPs updates every two years. However, observation revealed that Princess Marina ICU's VAP prevention SOPs were last updated in 2014. This may be due to resource limitations like printer access. However, outdated SOPs can negatively impact nurses' compliance and patient outcomes, especially given rapid advancements in VAP prevention. These findings imply that ensuring timely updates of SOPs requires shared responsibility among all nurses, not just quality personnel.

Overall observed compliance in this study was poor, with all respondents falling below the 95% good compliance threshold, with scores ranging from 25-75%. This aligns with the observed compliance rate in the study by *Tabaeian et al*[10] where the observed compliance rate was 56.32 %. This poor compliance may contribute to the current concerns of increased mortality and prolonged ICU stays. Furthermore, the negative outcomes associated with poor compliance, such as the reported high mortality and morbidity in Princess Marina ICU, could lead to a fear of the quality of care provided. The significant difference between self-reported (31.6%) and observed compliance (0 %) is concerning, strongly suggesting a gap between what nurses report doing and their actual practices in VAP prevention.

The findings of this study align with the Donabedian model, which provided a framework for the investigations. It is a model that has been used to provide a framework for evaluating the quality of healthcare services based on three main components: structure, process, outcome, and the causal relationship among them[19]. The model is widely applied to performance assessment at the healthcare system level[20]. However, the study focused on the structure and process rather than measuring the outcome.

Nursing Implications

Nurses have a crucial role in preventing VAP in ICUs, and the poor nurses' knowledge of preventing VAP and compliance findings at Princess Marina ICU are concerning. The implications of these findings highlight the need for ICU nurses to comply with recommended VAP prevention SOPs to mitigate negative outcomes. Nursing management should create a supportive ICU environment by increasing staffing and providing necessary resources. Ensuring access to reviewed and updated SOPs is critical, as current ones are outdated. Regular patient file audits and feedback can improve the accurate recording of VAP prevention measures. Orienting all ICU nurses to VAP prevention SOPs is essential, given the poor knowledge of over a quarter of staff.

The significant number of ICU nurses with poor VAP prevention knowledge, many without recent training, is likely to contribute to poor compliance and concerning high mortality, morbidity and prolonged stays at Princess Marina ICU. Developing a specific guideline and strategy for teaching VAP prevention that accounts for the problems in resource-limited settings while maintaining VAP prevention efficacy might be beneficial in decreasing knowledge gaps in resource-limited settings like Princess Marina ICU[6]. The limited research on ICU nurses' knowledge of VAP prevention and compliance in Botswana highlights a need for more studies by critical care nurse researchers. This can help identify sustainable strategies to improve compliance with VAP prevention guidelines in Botswana Hospitals. Enhanced knowledge and compliance have the potential to improve patient outcomes, reduce mortality and hospital stays and alleviate healthcare financial burdens experienced by the government.

STRENGTHS AND LIMITATIONS

The study achieved a high response rate, with 19 of 21 ICU nurses responding. This increases the potential representativeness of the study sample and reduces the risk of non-response bias. Additionally, provides a stronger foundation for conclusions drawn about the Princess Marina Hospital ICU nurses.

Two data collection methods were used, and this multiple employment of methods allows for triangulation of results. This enhances the validity and credibility of the study results and offers a more comprehensive understanding of compliance by capturing different aspects of the phenomenon.

The study was conducted in a single facility with a small sample size; the results may have limited generalisability to other settings. Additionally, the sample size restricted the use of other statistical analysis tests, like the Chi-square to assess associations between categorical variables and compliance.

The significant variation in compliance levels observed between the two data collection methods further compounds the limitation of generalisability to broader populations or contexts, as it introduces uncertainty about the actual level of compliance.

There is potential for bias in self-reported compliance because of social desirability and recall bias, which could lead to an inaccurate representation of actual compliance levels.

The use of checklist when observing compliance with elements has a potential for the Hawthorne effect, as observation was made without concealment .This could affect the accuracy of observed compliance, as it might not accurately reflect usual practice leading to overestimations of their compliance levels.

CONCLUSION

This study evaluated knowledge and compliance with SOPs for preventing VAP among Princess Marina Hospital ICU nurses. Overall knowledge was poor (63.2%), falling short of the 70% mark. This indicates a structural weakness that could negatively affect compliance with SOPs. Compliance was also poor, failing to meet the ≥95% target, suggesting issues with SOP implementation (process). While patient outcomes were not directly measured, poor knowledge and compliance raise concerns about VAP prevention effectiveness and potential negative impacts on patients. Addressing the knowledge gap and non-compliance through defined and detailed educational training programs is crucial for improving quality care and potentially reducing VAP complications, leading to better patient outcomes.

RECOMMENDATIONS

1. The study recommends that the institution implement ongoing training to enhance VAP surveillance, nurses' knowledge and compliance with the available and updated standards for ventilator-associated pneumonia prevention.
2. This study needs to be replicated on a larger sample to ensure the generalisability of findings to other settings and the ability to perform other statistical tests.
3. Quasi-experimental study design in this case is recommended to evaluate the effectiveness of VAP prevention training on knowledge and compliance.
4. There is a need to investigate the discrepancy in compliance level results, delving into potential reasons behind the difference between the self-reported and observed compliance and considering where the discrepancy arises.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this study.

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