

# Evidence-based guidelines for the prevention of ventilator-associated pneumonia: knowledge, adherence and perceived barriers among nurses

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## Abstract

**Background/Aims** Ventilator-associated pneumonia is a common but avoidable healthcare-associated infection in intensive care units, leading to preventable deaths. The study aimed to assess the knowledge of, adherence to and barriers against evidence-based guidelines for preventing ventilator-associated pneumonia among nurses at an intensive care unit in Palestine.

**Methods** A cross-sectional study was conducted, using a convenience sampling method to recruit 250 intensive care nurses working in the southern region of Palestine. Data were collected using a self-administered questionnaire comprising four sections: sociodemographic characteristics; knowledge of ventilator-associated pneumonia prevention (scored as a %); adherence to evidence-based guidelines (scored as a %); and barriers to adherence (rated on a 5-point Likert scale). Independent *t*-tests, ANOVA and Pearson's correlation were used to assess relationships between variables. Significance was set at  $P < 0.05$ .

**Results** Most participant had a moderate or low level of knowledge, while 61.2% reported good adherence to evidence-based guidelines for prevention of ventilator-associated pneumonia. Significant positive relationships were found between adherence scores and experience working in intensive care ( $P = 0.033$ ) and knowledge scores and completion of specific infection-prevention training ( $P = 0.034$ ). Barriers with the highest mean scores were lack of knowledge, lack of educational programmes and lack of time.

**Conclusions** Intensive care nurses may be lacking knowledge regarding evidence-based guidelines for the prevention of ventilator-associated pneumonia, leading to difficulties implementing these guidelines in practice. Adherence may improve with experience working in intensive care, but interventions are needed to improve nurses' knowledge of infection prevention and ensure that this is translated to practice.

**Implications for practice** Mentorship programmes should be implemented to enhance adherence to evidence-based guidelines in intensive care units. Incorporating guidelines for ventilator-associated pneumonia prevention into the nursing curriculum should also be considered, to ensure that all nurses are equipped for safe and effective practice.

**Key words:** Adherence; Barriers; Evidence-based guidelines; Infection prevention; Intensive care; Knowledge; Ventilator-associated pneumonia

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## Introduction

Healthcare-associated infections (also known as nosocomial infections) are illnesses that develop during medical treatment in healthcare settings, including long-term care facilities and hospitals (Sikora and Zahra, 2023). In the intensive care unit, these infections typically arise within 48 hours of admission, and contribute to higher mortality and morbidity rates, as well as prolonged hospital stays (Edwarson and Crains, 2019; Taye et al, 2023). Common healthcare-associated infections include urinary catheter-related infections, surgical site infections, central line-associated bloodstream infections and ventilator-associated pneumonia (Divatia et al, 2019; Jawad et al, 2021).

Patients with mechanical ventilation for over 48 hours are at risk of contracting ventilator-associated pneumonia, caused by the microaspiration of subglottic secretions from an underinflated endotracheal tube cuff (Cason et al, 2007; Blot et al, 2014; Madhuva et al, 2020). Intubation disrupts the body's natural cough or gag reflex, leading to secretion buildup and potential microaspiration (Sedwick et al, 2012). While proper inflation of the endotracheal tube cuff is crucial, it does not entirely prevent microaspiration (Mietto et al, 2013). Ventilator-associated pneumonia is the most common healthcare-associated infection acquired in hospital settings (Vincent et al, 2020). It can lead to reduced tidal volume, decreased oxygen saturation, fever, leukocytosis, increased respiratory rate and tracheobronchial secretions. There are two subtypes of ventilator-associated pneumonia: early onset, occurring within 96 hours of mechanical ventilation; and late onset, occurring  $\geq 96$  hours after ventilation.

Epidemiological data have shown substantial variations in the incidence of ventilator-associated pneumonia. In a study of 8983 cases of pneumonia, 97.3% were linked to intubation (Magiorakos et al, 2017), but rates ranged widely between countries, from 2.1 cases per 1000 intubation days in Luxembourg to 13.7 in Hungary, with a median of 9.5. Rates are also higher among patients being treated for trauma and cancer compared to other conditions, indicating that the intensive care unit case mix affects the prevalence of ventilator-associated pneumonia (Stoclin et al, 2020; Mergulhão et al, 2024). Mortality attributed to this condition has been estimated at around 13%, with variations depending on illness severity (Melsen et al, 2013). Late-onset ventilator-associated pneumonia often involves multidrug-resistant pathogens, leading to a higher risk of morbidity and mortality (Goel et al, 2016; Mergulhão et al, 2024).

Evidence-based guidelines are crucial for preventing ventilator-associated pneumonia in the intensive care unit, with nurses playing a key role (Darawad et al, 2018; Aysegul et al, 2020). Preventive measures include minimising the duration of mechanical ventilation, regular oral care, proper positioning and good hand hygiene (Blot et al, 2014). Nurses are essential in applying these practices, given their continuous bedside presence and technical expertise (Flaubert et al, 2021). However, studies have shown that nurses often lack the necessary knowledge and adherence to ventilator-associated pneumonia prevention strategies (Akin Korhan et al, 2014; Rafiei et al, 2020; Al-Sayaghi, 2021). For example, a study in Iran highlighted a significant lack of understanding among emergency department nurses regarding the prevention of ventilator-associated pneumonia (Rafiei et al, 2020), while research conducted in Turkey and Yemen reported limited knowledge and understanding of prevention among intensive care nurses (Akin Korhan et al, 2014; Al-Sayaghi, 2021). Nurses in Jordan have also been found to demonstrate insufficient compliance with preventive measures (Aloush, 2017).

Barriers to ventilator-associated pneumonia prevention practices include lack of time, heavy workload, insufficient education, staffing shortages and the absence of policies and protocols (Aloush and Al-Rawajfa, 2020; Al-Khazali et al, 2021). These challenges contributed to the high prevalence of the condition reported in a study conducted in Jordan, where poor oral care and low compliance were observed among nurses caring for mechanically ventilated patients (Batiha et al, 2015).

These international studies highlight the challenges and barriers associated with adherence to evidence-based practices for ventilator-associated pneumonia prevention, indicating a need to assess these factors in local intensive care units. Yet, there are limited data on prevention in the authors' country of Palestine. Therefore, this study aimed to evaluate knowledge of and adherence to ventilator-associated pneumonia prevention guidelines, alongside any associated barriers, among intensive care nurses in Palestine. Identifying challenges and areas for improvement can allow these factors to be addressed, reducing infection rates and improving patient outcomes.

## Methods

A cross-sectional, descriptive correlational design was used to perform this study. The study population consisted of intensive care nurses working in 12 governmental and non-governmental hospitals in the southern regions of Palestine.

### Participants

A convenience sampling technique was used to recruit participants, with all intensive care nurses who met the inclusion criteria being invited. To be included, nurses needed to work full time in an intensive care unit (including critical care and paediatric intensive care units), have a Diploma degree or higher and agree to participate in the study. Nurses who were on extended leave (such as maternity leave or career break), those working part time and those with less than 6 months of experience in intensive care units at the time of the study were excluded.

The required sample size was calculated using the Raosoft online tool, with the following parameters: a population of 339, a margin of error of 0.05, a 99% confidence interval and a 50% response rate. The required sample size was determined to be 225. To account for potential attrition, 270 nurses were invited to participate.

The researchers visited the 12 hospitals and met with the head nurses and nursing chiefs in the intensive care, critical care and paediatric intensive care units. The study objectives were explained and the researchers requested a list of eligible nurses and their duty schedules. The researchers then met with nurses during their breaks to clarify the study's purpose and obtain consent. Participants then filled in a paper-based questionnaire, which was handed back to the researchers on completion.

### Data collection

A self-administered, structured questionnaire was used to collect data. The questionnaire consisted of four parts and was written in English. Data collection took place in June 2024.

Part one collected sociodemographic data, including participants' age, gender, level of education, nursing experience, intensive care unit experience, work sector and whether they had received any special training on infection control.

Part two measured knowledge of ventilator-associated pneumonia using 10 multiple-choice questions, originally developed by Labeau et al (2008) and validated by Blot et al (2008). The English version of the questionnaire was further validated for reliability, achieving a Cronbach's alpha of 0.8, indicating good internal reliability (Darawad et al, 2018). Correct answers on the questionnaire receive a score of 1, while incorrect answers receive a 0. Total scores on this section (out of 10) were converted into percentages, with <50% indicating poor knowledge, 51–80% indicating moderate knowledge and 81–100% indicating good knowledge (Labeau et al, 2008).

Part three assessed adherence to evidence-based guidelines for ventilator-associated pneumonia prevention using 15-item scale developed by Lorente et al (2004). Participants indicated the frequency with which they adhered to guidelines described in each item, using a 5-point Likert scale (1=never; 5=always). Total scores were converted into percentages and classified using Bloom's (1956) cut-off point, where <60% indicated poor adherence, 60–79% indicated fair adherence and 80–100% indicated good adherence.

Part four investigated the barriers to adherence using the eight-item scale developed by Yaseen and Salameh (2015). Each item states a barrier to adherence, such as 'lack of knowledge of ventilator-associated pneumonia prevention' and 'staff shortages in the intensive care unit'. Participants were asked to rate the extent to which they agreed that each factor represented a barrier to adhering to evidence-based guidelines, using a 5-point Likert scale (1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree). Mean scores were calculated for each item, with higher scores indicating that the factor was perceived as a greater barrier to adherence.

### Validity and reliability

The questionnaire was reviewed by five experts in nursing education and medical fields, who provided feedback and approved necessary modifications. Reliability analysis demonstrated acceptable internal consistency, with Cronbach's alpha values of 0.82 for knowledge, 0.88 for adherence and 0.84 for barriers.

A pilot study was conducted with 20 nurses working in an intensive care unit in Palestine. From these data, Cronbach's alpha coefficients for knowledge, adherence and barriers were calculated at 0.76, 0.82 and 0.80 respectively. The nurses who participated in the pilot study were excluded from the actual study. The time required to complete the questionnaire in the pilot study was 15–20 minutes.

### Data analysis

The SPSS (version 26) was used to clean and analyse the data. Descriptive analysis was used to calculate and present frequencies, percentages, means and standard deviations. An independent *t*-test was used to compare mean scores between two groups and ANOVA was used to compare means across more than two groups. A Pearson's correlation test was also employed. Significance was set at 0.05 across all tests.

### Ethical considerations

Ethical approval for the study was granted by the Faculty of Postgraduate Studies and Scientific Research at Palestine Ahliya University (IRRB number: CAMS/CCNA/31/524), and permission was obtained from management at the included hospitals. Before enrolling in the study, all participants were informed about the study's objectives and provided written informed consent. They were assured of the confidentiality of their information, that participation was voluntary and that they could withdraw from the study at any time. For data analysis, participants were assigned a code number to maintain their privacy and ensure the confidentiality of their responses.

## Results

### Participants characteristics

Of the 270 questionnaires distributed to nurses, 250 were completed and returned, giving a 92.6% response rate. The mean age of participants was 32.5 years (standard deviation: 7.1 years). Other characteristics are shown in **Table 1**. Over half of the participants were men, with most holding a Bachelor's degree. Most had up to 10 years of experience in nursing, while 60.4% had 6 months–5 years of experience in the intensive care unit. Most (79.6%) had received specific training in infection prevention, although just over one-fifth had not.

### Knowledge and adherence levels

The number and percentage of participants' who had poor, moderate/fair and good levels of knowledge of ventilator-associated pneumonia prevention and adherence to evidence-based guidelines are shown in **Table 2**. Only 5.2% of participants had a good level of knowledge, while 50% had moderate knowledge. Meanwhile, 61.2% of participants reported good levels of adherence to preventive measures, with only 1 (0.4%) having poor adherence.

Variable		n (%)
Gender	Male	144 (57.6)
	Female	106 (42.4)
Level of education	Diploma	11 (4.4)
	Bachelor's degree	220 (88.0)
	Master's degree or higher	19 (7.6)
Experience in nursing	1–5 years	108 (43.2)
	6–10 years	107 (42.8)
	>10 years	35 (14.0)
Experience in intensive care	6 months–5 years	151 (60.4)
	6–10 years	80 (32.0)
	>10 years	19 (7.6)
Received specific infection prevention training?	Yes	199 (79.6)
	No	51 (20.4)

**Table 2. Description of the nurses' knowledge of evidence-based guidelines for ventilator-associated pneumonia prevention (n=250)**

Variable		n	(%)
Knowledge	Poor	112	44.8
	Moderate	125	50.0
	Good	13	5.2
Adherence	Poor	1	0.4
	Fair	96	38.4
	Good	153	61.2

### Participant characteristics, knowledge and adherence

#### Age

An independent *t*-test found no significant differences between knowledge and adherence scores based on participants' age. For this analysis, participants were divided into two groups based on the mean age of 32.5 years (Table 3).

#### Gender

An independent *t*-test found no significant differences between male and female participants in terms of their knowledge of ventilator-associated pneumonia and adherence to evidence-based guidelines for prevention (Table 4).

#### Level of education

One-way ANOVA found no significant differences between knowledge and adherence scores based on participants' level of education (Table 5). However, there was a visible trend whereby mean knowledge scores were higher as the education level increased. The lack of significance may be explained by the relatively high variability in scores within each group, which may have reduced the statistical power to detect differences. Similarly, there was a trend in adherence scores, with participants educated to a higher level scoring higher on average, but these differences were not significant, suggesting that other factors may be more influential in determining adherence.

#### Experience in nursing

One-way ANOVA found no significant differences between knowledge and adherence scores based on participants' experience in nursing (Table 6).

#### Experience in intensive care

One-way ANOVA found a significant difference between participants' mean adherence scores based on their years of experience working in intensive care ( $P=0.033$ ), with those who had over 10 years of experience scoring higher on average than those who had 6–10 years of experience. Interestingly, those who had worked in intensive care for 6 months–5 years also had a higher mean score than those with 6–10 years of experience. There were no significant differences in knowledge scores based on experience in intensive care (Table 7).

#### Completion of specific infection prevention training

An independent *t* test showed a significant difference in mean knowledge scores based on whether participants had received specific infection prevention training, with those who had received this training scoring higher ( $P=0.034$ ). However, there was no significant difference in adherence scores between the two groups (Table 8).

#### Relationship between knowledge and adherence

The Pearson correlation test found a positive correlation between participants' knowledge and adherence score ( $r=0.124$ ). However, this relationship was not significant ( $P=0.051$ ).

**Table 3. Participants' knowledge and adherence scores by age group**

Variable	Mean % score (standard deviation)		t-test	P
	≤32.5 years	>32 years		
Knowledge	55.9 (19.7)	56.4 (17.6)	-0.200	0.842
Adherence	82.4 (8.3)	81.7 (8.2)	0.673	0.502

**Table 4. Participants' knowledge and adherence scores by gender**

Variable	Mean % score (standard deviation)		t-test	P
	Male (n=144)	Female (n=106)		
Knowledge	56.5 (16.8)	55.7 (20.9)	0.323	0.747
Adherence	81.9 (8.6)	82.2 (7.7)	0.273	0.785

**Table 5. Participants' knowledge and adherence scores by level of education**

Variable	Mean % score (standard deviation)			F test	P
	Diploma	Bachelor's degree	Master's degree		
Knowledge	49.1 (27.4)	56.2 (18.0)	58.9 (20.0)	1.004	0.368
Adherence	79.4 (9.3)	81.9 (8.0)	85.2 (9.6)	2.006	0.137

**Table 6. Participants' knowledge and adherence scores by years of experience in nursing**

Variable	Mean % score (SD)			F test	P
	1–5 years	6–10 years	>10 years		
Knowledge	54.9 (20.5)	56.7 (17.7)	58.0 (15.3)	0.462	0.631
Adherence	83.0 (8.0)	80.7 (8.0) <sup>1</sup>	83.1 (9.3)	2.549	0.081

**Table 7. Participants' knowledge and adherence scores by years of experience in intensive care**

Variable	Mean % score (standard deviation)			F test	P
	6 months–5 years	6–10 years	>10 years		
Knowledge	55.3 (20.1)	57.1 (16.2)	58.4 (16.4)	0.406	0.667
Adherence	82.5 (7.9)	80.4 (8.4)	85.3 (8.8)	3.447	0.033

### Perceived barriers to adherence to evidence-based guidelines

The results of the questionnaire section on barriers to adherence to evidence-based guidelines for ventilator-associated pneumonia prevention are shown in **Table 9**. The barriers with the highest scores, indicating the greatest perceived impact, were lack of knowledge about prevention ( $4.7 \pm 0.7$ ), lack of educational programmes ( $4.5 \pm 0.7$ ) and lack of time to deliver proper infection control measures ( $4.5 \pm 0.7$ ). The barriers with the lowest mean scores were lack of written protocols for ventilator-associated pneumonia ( $2.3 \pm 1.4$ ) and staff shortages in the intensive care unit ( $2.2 \pm 1.5$ ).

**Table 9. Results of the questionnaire on perceived barriers to adherence to evidence-based guidelines on VAP prevention**

Statements about barriers	Lowest score	Highest score	Mean	Standard deviation
Lack of knowledge of VAP prevention	2.0	5.0	4.7	0.7
Lack of educational programmes on VAP (such as in-service education or courses)	2.0	5.0	4.5	0.7
Staff shortages in the intensive care unit	1.0	5.0	2.2	1.5
Lack of equipment, such as gloves and face masks	2.0	5.0	4.0	1.0
Lack of written VAP protocols in the hospital	1.0	4.0	2.3	1.4
Forgetting to practice the sterile technique	2.0	5.0	4.1	1.0
Lack of time to deliver proper infection control	2.0	5.0	4.5	0.7
Hospital system insufficiencies	2.0	5.0	4.2	1.0

VAP=ventilator-associated pneumonia

## Discussion

In this study, only 5.2% of the intensive care nurses who participated had a good level of knowledge of ventilator-associated pneumonia and the evidence-based guidelines for its prevention, with 50% having a moderate knowledge. This finding reflects a complex, multifaceted issue, and may indicate broader systemic challenges within the Palestinian healthcare system, such as limited resources, insufficient opportunities for continuing education and varying levels of formal training across institutions. These factors could hinder the consistent application of best practice and impede the development and implementation of comprehensive training programmes (Batan et al, 2018; Salameh and Aboamash, 2022; Aqtam et al, 2023).

Cultural factors may also play a role in shaping the level of knowledge and adherence to evidence-based guidelines. For example, there may be a lack of emphasis on ongoing professional development, driven by entrenched traditional practices or systemic priorities that do not always facilitate the integration of the latest scientific evidence into daily clinical care. Additionally, intensive care nurses in Palestine face substantial barriers, such as heavy workloads, inadequate institutional support and limited access to professional development resources. These challenges can impede their ability to engage with, fully comprehend and effectively apply new evidence-based guidelines in clinical practice (Batan et al, 2018; Daraghmeah et al, 2024). Therefore, addressing these systemic, cultural and structural issues is crucial to enhancing the adoption of evidence-based guidelines and improving patient outcomes in Palestinian healthcare settings (Ahmad Al-Nawaja'a et al, 2024).

The findings of this study align with previous research conducted in Iraq (Hussein, 2020), Tanzania (Bankanie et al, 2021) and Ethiopia (Akalu et al, 2022), where knowledge of ventilator-associated pneumonia prevention was found to be insufficient, with mean scores of 67%, 61.4% and 51.9% respectively. Similarly, a study conducted in northern Iran reported that knowledge levels regarding ventilator-associated pneumonia prevention were insufficient (Farmanbar et al, 2019). However, research conducted in other geographical settings found higher levels of knowledge in intensive care units, suggesting that this may vary depending on environmental and contextual factors. For example, participants in a study in Saudi Arabia scored an average of 71.6% on knowledge of ventilator-associated pneumonia prevention, while Jiang et al's (2024) study in China found that 81.7% of participants had 'fair' levels of knowledge. That said, the literature reflects a lack of good knowledge of ventilator-associated pneumonia and its prevention in intensive care units. Although the reasons for this were not assessed in the present study, it may be a result of nurses graduating from universities and beginning working in intensive care settings without sufficient training on infection control or the care of patients on mechanical ventilators. Additionally, the authors have observed a lack of targeted training in these

areas of clinical care, which aligns with the participants' identification of lack of training ventilator-associated pneumonia prevention as a barrier to evidence-based practice.

This study found significant differences in participants' adherence to evidence-based guidelines based on experience working in intensive care, with those who had more experience having higher levels of adherence. This aligns with a study conducted in Saudi Arabia, which found a relationship between nurses' experience and their knowledge of evidence-based guidelines for preventing ventilator-associated pneumonia (Bokhary et al, 2022). Similarly, research by Yaseen and Salameh (2015) in Saudi Arabia, Hussein (2020) in Iraq, Al-Khazali et al (2021) in Jordan and Akalu et al (2022) in Ethiopia indicated that nurses with more work experience in the intensive care unit had better knowledge of clinical guidelines compared to less experienced nurses. However, Madhuvu et al's (2020) study in Australia found no significant correlation between participants' years of experience working in intensive care and their knowledge scores, instead reporting a link between postgraduate education and knowledge. This contrasts with the present study, where there were no significant differences in participants' knowledge scores based on level of education. This highlights the complex interplay between education, experience and ongoing professional development in shaping nurses' knowledge and adherence to evidence-based guidelines for ventilator-associated pneumonia prevention.

In this study, 61.2% of participants reported good adherence to evidence-based guidelines, with only one (0.4%) reporting poor adherence. That said, this result must be interpreted with caution, as participants were self-evaluating their adherence, which may have introduced bias. The relatively low proportion of participants with good knowledge of these guidelines, plus the barriers to adherence that they identified in the questionnaire, also suggest that these adherence scores may not fully reflect real-life practice. However, this finding was consistent with studies conducted in Finland and Tanzania, where adherence levels were 65.8% and 60.8%, respectively (Jansson et al, 2018; Bankanie et al, 2021). These insights should provide a foundation for future strategies to improve care quality in intensive care units and to emphasise the importance of continuous professional development in nursing practice (Aloush and Al-Rawajfa, 2020).

This study found no significant differences in levels of knowledge and adherence related to gender, age, level of education and overall experience in nursing. This aligns with previous research showing that level of education and experience did not significantly influence adherence to guidelines (Aloush and Al-Rawajfa, 2020; Bankanie et al, 2021). However, other researchers found that less experienced nurses reported higher levels of adherence than more experienced nurses (Jansson et al, 2018; Jiang et al, 2024). This phenomenon may be caused by less experienced nurses feeling less certain and potentially more motivated in the early stages of their careers, potentially leading to closer observation and adherence to guidelines in practice.

There was no significant relationship between participants' knowledge and adherence scores in this study. This finding aligns with Bankanie et al's (2021) study, which also found no significant relationship between knowledge and adherence to ventilator-associated pneumonia prevention guidelines. Furthermore, the present study found that, although there was a significant relationship between completion of infection prevention training and knowledge scores, there was no significant relationship between training and adherence scores. This suggests that clinical practice and decision making may not always be directly influenced by theoretical knowledge or scientific evidence. Instead, factors such as institutional culture, personal beliefs, workload, resource availability and habitual practices may influence nurses' adherence to guidelines (Fashafsheh et al, 2015; Ahmad Al-Nawaja' a et al, 2024). Furthermore, the healthcare system in Palestine may be challenged by political and economic instability, impacting the availability of supplies and the implementation of best practices. This underscores the need for targeted interventions, continuous professional development and organisational support to strengthen evidence-based practice. Future research is warranted to explore this disconnect and bridge the gap between knowledge acquisition and its practical application in clinical settings.

The primary barriers to adherence to prevention guidelines identified in this study were lack of knowledge, lack of educational programs and lack of time. Bankanie et al (2021) found similar obstacles to the implementation of evidence-based guidelines for

ventilator-associated pneumonia prevention, including insufficient skills (96.6%) and lack of information (79.3%). Further supporting this, Mehta and Soni (2016) highlighted barriers such as a lack of specific guidelines (70.6%), inadequate guidance (72.8%), insufficient training (72.8%), influence from senior/peer practices (64%) and a lack of time (77.2%). However, staff shortages were a considerable barrier identified by Bankanie et al (2021) (95.5%), while 100% of participants in Mehta and Soni's (2016) study reported that inadequate resources was a major obstacle. This varies from the present study, where staff shortages in the intensive care unit scored the lowest as a barrier to guideline adherence. Instead, participants placed more emphasis on lack of time for individual procedures.

Overall, this study suggests that many intensive care nurses struggle to obtain sufficient knowledge of ventilator-associated pneumonia prevention and then to translate this knowledge to practice, with lack of education playing a considerable role. Providing online training sessions, workshops and simulation-based training, along with e-learning modules, could offer a flexible and accessible approach to supporting overworked nurses with infection-prevention training (Salameh, 2017; Ahmad Al-Nawaja'a et al, 2024). These initiatives could enable nurses to stay up-to-date on current protocols while accommodating their demanding schedules. Additionally, this training could enhance knowledge retention, promote adherence to evidence-based practice and contribute to improved patient outcomes (Fashafsheh et al, 2016; Salameh et al, 2023; Ahmad Al-Nawaja'a et al, 2024).

### Implications for practice

The findings of this study raise concerns about the impact of evidence-based guidelines in hospitals. To minimise preventable medical complications and promote patient safety in intensive care units, it is crucial to strengthen nurses' adherence to evidence-based guidelines through targeted interventions. This could include simulation-based training or e-learning modules; given time constraints on nurses, it is important that education initiatives provide flexible and interactive learning opportunities. The authors also recommend the establishment of mentorship and knowledge exchange programmes for intensive care nurses across the country of Palestine, to facilitate skill transfer.

Healthcare leaders can play a greater role in fostering a culture of adherence to evidence-based guidelines by integrating them into clear institutional policies, providing adequate resources and ensuring that continuous development programmes are available to intensive care nurses.

### Limitations

To the authors' knowledge, this is the first study of intensive care nurses' knowledge, adherence and associated barriers to ventilator-associated pneumonia prevention conducted in Palestine. While the study offers useful insights, it is essential to acknowledge certain limitations. First, a self-administered questionnaire was used to collect data, which may have introduced bias to responses, especially in participants' self-evaluation of their adherence to guidelines. Second, the cross-sectional design of the study limits the ability to establish causal relationships between variables. Third, the research was conducted in one region of Palestine, which may restrict the generalisability of the findings to other regions or healthcare settings.

### Key points

- Most participants had moderate or low levels of knowledge of ventilator-associated pneumonia prevention, but only one had poor adherence, highlighting a gap between what nurses know and what they do in practice.
- More experience in intensive care settings may improve adherence to evidence-based guidelines for infection prevention, while barriers include lack of educational programmes and time constraints.
- This study emphasises the need for ongoing training and stronger integration of infection prevention into the nursing curricular to improve patient outcomes.

## Conclusions

In this study, the majority of participants had moderate or low levels of knowledge regarding ventilator-associated pneumonia prevention, although adherence levels were generally fair or good. Age, gender, educational level and experience working in nursing did not seem to significantly affect participants' knowledge and adherence scores, although there was a significant positive relationship between experience working in the intensive care unit and adherence to evidence-based guidelines. Generally, there seemed to be a disconnect between knowledge and practice, with completion of infection prevention training influencing knowledge of ventilator-associated pneumonia prevention, but not adherence to guidelines. Several barriers to adherence were identified, the greatest being lack of knowledge and educational programmes, as well as insufficient time to practice good infection control.

To address these challenges, ongoing educational interventions and the development of effective guideline implementation strategies are needed. Given the prevalence and impact of ventilator-associated pneumonia on patients and healthcare services, the authors advocate for the integration of comprehensive content on the prevention of this condition into the nursing curriculum.

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### Author contribution statement

NA, AA and AB designed the study. Data collection was conducted by AA and MA. Data analysis was carried out by NA and AA. Writing of the original manuscript, review and editing of the manuscript were carried out by NA, AA, AB, BB and MA.

### Conflicts of interest

The authors declare that there are no conflicts of interest.

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### Data sharing statement

All data are available from the corresponding author on reasonable request.

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