



Original Article

An Exploration of Health Care Worker Adherence on Ventilator-Associated Pneumonia Bundle Interventions: A Quantitative Study at P.T. Birta City Hospital and Research Center Pvt. Ltd.

Rosan Prasain¹, Arisetty Radha Prasain^{2*}, Dikshya Nepal³
Dr. Romi Budhathoki⁴ and Dr. Anil Kumar Basnet⁵

¹B.Sc Nursing, Rajiv Gandhi University of Health Science, Bangalore, Karnataka, India

²M. Sc. Nursing, Rajiv Gandhi University of Health Science, Bangalore, Karnataka, India

³Bachelor of Public Health, Purbanchal University, Nepal

⁴Masters in Hospital Administration, Sikkim Manipal University, Sikkim, India

⁵MD Internal Medicine, BPKIHS, Nepal

Corresponding Author: *Arisetty Radha Prasain

DOI: <https://doi.org/10.5281/zenodo.10879508>

Abstract	Manuscript Information
<p>Background: The most prevalent hospital-acquired illness among patients in a critical care unit using mechanical ventilation is ventilator-associated pneumonia. The nurses in Intensive Care Units have been shown to be in the best position to apply their knowledge into practice since they provide nursing care to patients at their bedsides around-the-clock, which makes them crucial in preventing ventilator-associated pneumonia (VAP). This study aimed to assess the adherence of health care workers to ventilator associated pneumonia bundle intervention.</p> <p>Methods: A quantitative cross-sectional study was conducted using structured questionnaire among 50 health care workers working in the Intensive Care Units (ICU) of P.T. Birta City Hospital and Research Center Pvt. Ltd. Data was analyzed in terms of frequencies and percentage using statistical package for social sciences (SPSS version 23).</p> <p>Results: Eighty percent of health care workers in the study demonstrated acceptable understanding and perception of ventilator associated pneumonia and VAP bundle interventions in accordance with hospital policy/guideline, and the total mean compliance rate for VAP bundle implementation was 91%.</p> <p>Conclusion: There was acceptable level of adherence to the guidelines for preventing ventilator-associated pneumonia (VAP) in the intensive care units, however further observational studies are still required to assess the health care workers' adherence.</p>	<ul style="list-style-type: none"> ▪ ISSN No: 2583-7397 ▪ Received: 27-02-2024 ▪ Accepted: 24-03-2024 ▪ Published: 26-03-2024 ▪ IJCRM:3(2);2024:95-101 ▪ ©2024, All Rights Reserved ▪ Plagiarism Checked: Yes ▪ Peer Review Process: Yes <p>How to Cite this Manuscript</p> <p>Rosan Prasain, Arisetty Radha Prasain, Dikshya Nepal, Dr. Romi Budhathoki, Dr. Anil Kumar Basnet. An Exploration of Health Care Worker Adherence on Ventilator-Associated Pneumonia Bundle Interventions: A Quantitative Study at P.T. Birta City Hospital and Research Center Pvt. Ltd. International Journal of Contemporary Research in Multidisciplinary. 2024; 3(2): 95-101.</p>

Keyword: Adherence, Health Care Worker, ICU, Ventilator-Associated Pneumonia, VAP Bundles.

1. Introduction

The ventilator associated pneumonia (VAP) is one of the most common hospital-acquired risk associated with the patients on a Mechanical Ventilator (MV) which can be preventable by incorporating the VAP care bundle as a daily routine component of care in the ventilator patient's in ICU, and can be considered as a nursing-sensitive indicator that reflects patient outcomes^[1]. The problem of providing appropriate ventilation with minimal difficulties is crucial, as the lungs are typically one of the principal organs involved in multiple organ failure. With a crude mortality rate of about 30%, nosocomial pneumonia is one of the most common hospital-acquired infection-related causes of death.

One type of infection that patients on mechanical ventilation can develop is called ventilator-associated pneumonia (VAP)^[1]. In order to reduce the negative impact of VAP, the Institute of Healthcare Improvement (IHI) has suggested the use of "Ventilator Associated Pneumonia (VAP) Bundles of Care." This bundle includes several measures, such as preventing deep vein thrombosis (DVT), maintaining oral hygiene with Chlorhexidine, conducting spontaneous breathing tests, taking breaks from sedation, preventing peptic ulcers, and keeping the patient's head elevated at an angle of 30° to 45°. According to the Institute of Healthcare Improvement, this initiative has successfully stopped more than 122,000 fatalities and reduced the length of hospital stays and reliance on mechanical breathing.^[1] To completely eliminate cases of Ventilator Acquired Pneumonia (VAP), a compliance rate of over 95% with the VAP bundle is often necessary^[2]. Regular assessments of the medical and nursing personnel are also recommended to improve long-term adherence. However, despite implementing this approach, VAP still remains the most common form of hospital-acquired pneumonia^[3].

The health care worker working in critical care units are supposed to deliver high quality care by incorporating evidence-based practices related to VAP prevention^[4]. Studies have mentioned that despite having many evidence-based guidelines on VAP prevention; lack of knowledge and compliance in nursing practices is a noticeable cause of VAP^[5, 6]. This study aimed to assess the adherence of healthcare personnel regarding VAP prevention strategies and the VAP bundle.

2. Objectives

- To measure ICU health care workers' understanding and perceptions of VAP in P.T. Birta City Hospital and Research Center Pvt. Ltd.
- To measure ICU health care workers adherence to VAP bundle implementation in different ICU's of P.T Birta city Hospital and Research Center Pvt. Ltd.

Research design and study setting

It used cross-sectional quantitative study to measure health care worker's understanding and adherence while implementing the VAP bundle interventions in the ICU's of P.T. Birta City Hospital and Research Centre Pvt. Ltd.

Sample Population

The health care workers of medicine, neuro and neonatal intensive care units who were providing care to the patients who needed mechanical ventilators in the hospital

Inclusion criteria

- Health care workers who had attended at least one mechanical ventilation patient in the past month.
- Health care workers working at the hospital implementing VAP bundle care.
- Health care workers working in the ICUs of the hospital as full-timer and part-timer.
- Health care workers giving direct care to the patient in the ICUs.

Exclusion criteria

- Health care workers who did not took care of at least one mechanical ventilator in past month.
- Health care workers in the level of monitoring and supervision.
- Health care workers who were not available at the time of the study.

Sample size

Fifty health care workers were selected through simple random sampling method.

Conceptual Framework

It was based upon the Health Belief Model of Hochbaum, Rosenstock and Kegell.

Data Collection Tool

A self-administered questionnaire was used to collect data after signing the informed consent form by each individual. Section 1 consists of Demographic variables like age, gender, qualification, years of experience, Type of ICU and working Hours. Section 2 and 3 consists of 46 questions which assess the nurses understanding and perceptions of Ventilator associated pneumonia bundle and its implementation.

Content Validity of the Instrument

Validity: Validation of the tool was done by experts and modifications were made accordingly.

Reliability: The reliability of the tool was calculated to be 0.9538. Split half method and Inter rater method was used to find out the reliability which was analyzed using Karl Pearson coefficient correlation.

Ethical Considerations: Total support, assistance and approval was obtained from P.T. Birta City Hospital and Research Center Pvt. Ltd. Written Informed Consent were taken from each participant before participating in the study.

Data Collection Procedure

The questionnaire was distributed over a period of eight weeks from mid- November 2023 to mid-January 2023 by two research

facilitators; respondents had until end-January to return the questionnaire. Health care workers were given the option to complete the survey on their own time as they had signed a confidentiality agreement form to maintain anonymity and confidentiality.

3. Results

The socio-demographic characteristics of the health care workers employed by the hospital in the intensive care unit are displayed

in Table 1. The majority of the health care workers were in the age range of 21 to 30. With the exception of one male nurse, almost all of the nursing staff was female. 92 percent of them followed Hinduism. Additionally, it was found that 38% of them were married while the 62% were unmarried. It revealed that the majority of health care workers with the highest degree were staff nurses (SN) or health assistants (HA). Over half of the participants had worked as registered health care worker for six months to a year.

Table 1: Socio-demographic variables of the health care workers working in the ICU.

Variables	Frequency	Percentage
Age		
21-30 yrs	44	88
31-40yrs	6	12
Gender		
Male	1	2
Female	49	98
Religion		
Hindu	46	92
Buddhist	4	8
Marital Status		
Married	19	38
Single	31	62
Highest Academic Courses		
ANM/CMA	15	30
SN/HA	34	68
Bsc/BN	1	2
Total years working as Registered Health Care Worker		
Less than 6 months	5	10
6 months- 1 year	26	52
1-2 yrs	1	2
2-4yrs	5	10
Above 4 yrs	13	26

Table two shows the types of ICU, period of working in the ICU and working hours per week by the health care workers. The sample had 58% of health care workers from the medicine ICU, 24% of them from neonatal ICU and 18% of them from the

neuro-surgical ICU. The majority (60%) of them had worked in the intensive care unit (ICU) for six months to a year, and nearly all of them worked 48 hours a week. In a given month, 48% of the health care workers attended to seven or more patients.

Table 2: ICU specific background variables

Variables	Frequency	Percentage
Type of ICU		
Medicine ICU	29	58
Neonatal ICU	12	24
Neuro-Surgical ICU	9	18
Total period working as an ICU Registered Nurse		
Less than 6 months	5	10
6 months- 1 year	30	60
1-2 yrs	3	6
2-4yrs	5	10
Above 4 yrs	7	14
Working hours per Week		
1-8 hrs	3	6
25-32 hrs	1	2
39-48hrs	45	90
others	1	2
Number of Mechanically ventilated patients taken care in a month		
1-2 patients	19	38
3-4 patients	5	10
7 or more patients	24	48
None	2	4

The study showed 80% of health care workers understand and have perception about VAP and VAP bundle within the hospital policy/guideline.

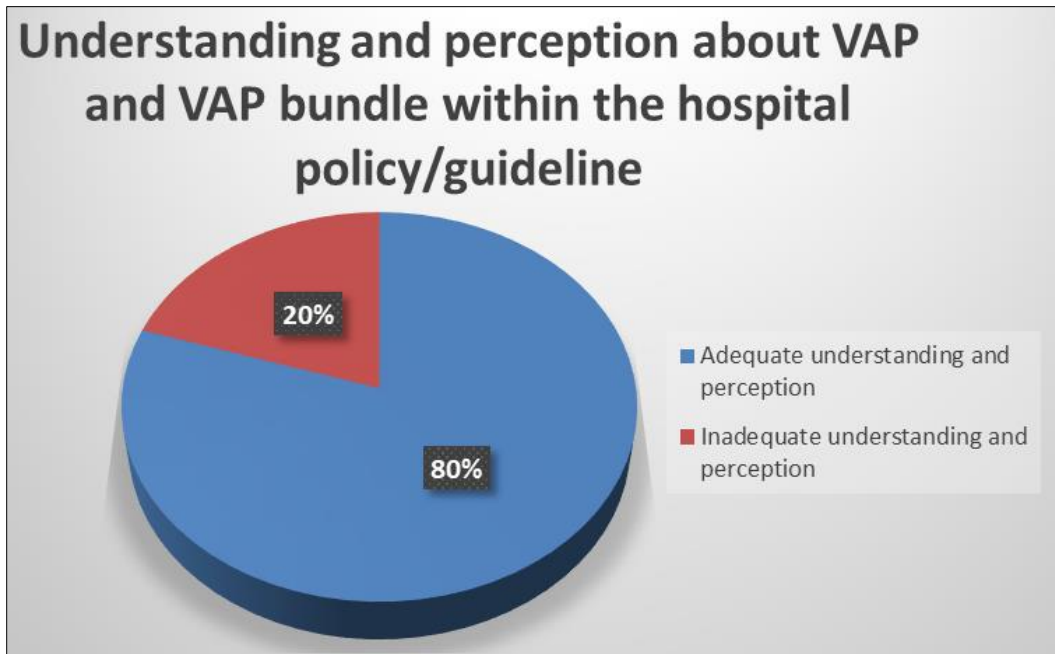


Fig 1: Understanding and Perception about VAP and VAP bundle within the hospital policy/guideline

VAP bundle implementation was seen in the five aspects such as: oral care with chlorhexidine, elevation of head of the bed, daily sedation vacation, spontaneous breathing trial, peptic ulcer prophylaxis and deep vein thrombosis prophylaxis. Almost all the aspects had more than 90% of adherence by health care

workers while about three quarter in terms of oral care with chlorhexidine. In overall, it showed good adherence to the VAP bundle implementation according to the hospital policy and guideline.

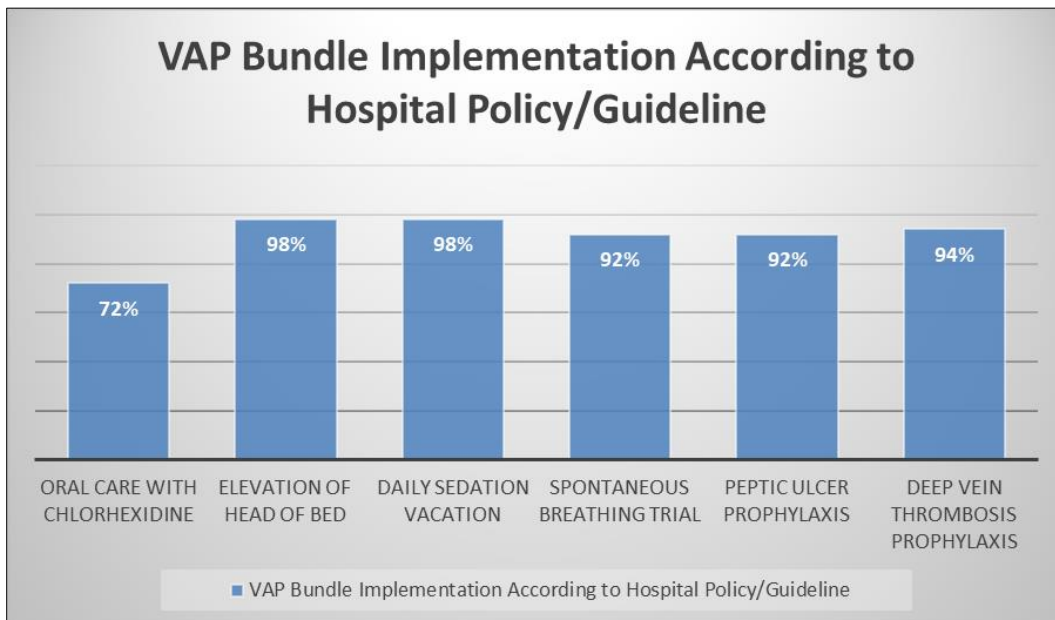


Fig 2: Adherence to the VAP Bundle Implementation according to Hospital Policy/Guidelines

Figure 3 shows different aspects of caring during the implementation of VAP bundle with adherence to the hospital policy and guideline. All the frequencies of delivery tend to be in similar range of 50% -20% with some exception of 2% while giving peptic ulcer prophylaxis. In regard to the degree of which

interventions are implemented, DVT prophylaxis, peptic ulcer prophylaxis, oral care with Chlorhexidine and SBT had the most responses to which the participants responded ‘all the time/100% of the time’ – 58% (n=29), 42% (n=21), 42% (n=21) and 42% (n=21) respectively.

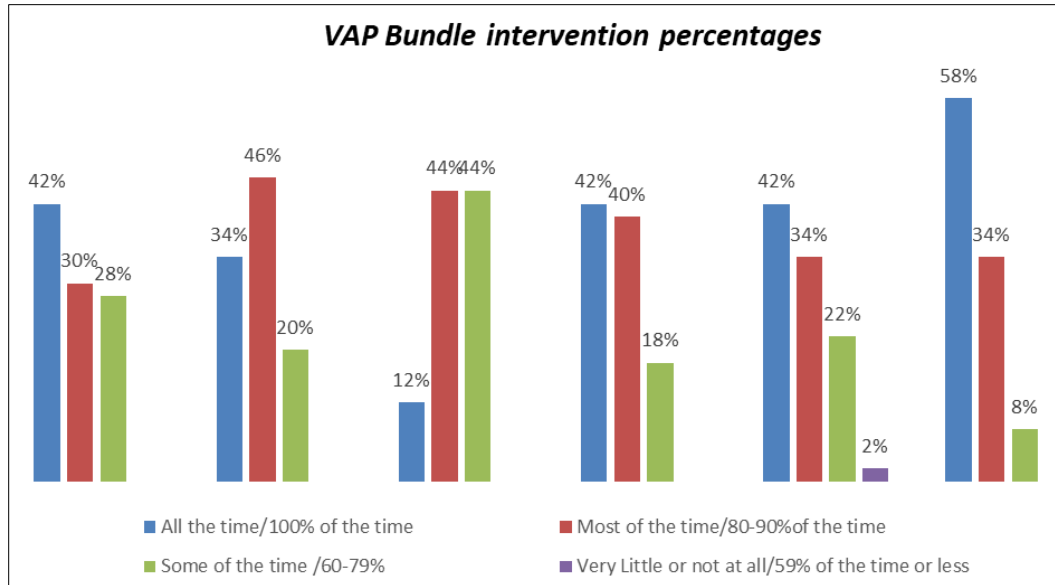


Fig 3: VAP Bundle intervention percentages

4. Discussion

ICU health care workers were well positioned to apply their knowledge effectively by being constantly present at the patient's bedside, providing care around the clock. This makes them crucial in preventing ventilator-associated pneumonia. However, it is essential for healthcare workers to be aware of the issue and have the necessary knowledge to follow the recommended practices [7].

The prevention and management of VAP in the ICU rely on educating and raising awareness among ICU staff about the issue, as well as ensuring the availability of equipment needed to prevent cross-infection between the environment, healthcare providers, and patients. In this study, 80% of health care worker demonstrated a good understanding and perception of the VAP bundle within the hospital's policy guidelines. Conversely, previous studies (Al-Sayaghi, 2014; Hasan & Wahsheh, 2017; Blot *et al.*, 2007) have reported that nurses generally have a lower level of understanding on this subject [8-10].

We also examined the adherence to institution specific VAP prevention guidelines for oral hygiene with chlorhexidine solution, head of the bed elevation, daily sedation vacation, spontaneous breathing trials, peptic ulcer prophylaxis and DVT prophylaxis. 72% of the respondents indicated adhering to the oral care guidelines, 98% to the head of the bed elevation to 30 to 45 degrees, 98% to daily sedation vacation, 92% for spontaneous breathing trials, 92% for peptic ulcer, 94% for DVT. In total 91% of the P.T. Birta City Hospital and Research Center PVT.LTD. Staffs had adherence to VAP Bundle implementation according to the hospital policy or guidelines.

In the current study, 98% of respondents adhered to the criterion of elevating the head of the bed. This adherence rate was higher compared to studies by Bird *et al.* (98%), Korhan *et al.* (29.7%), Kiyoshi *et al.* (65.9%), and Ali (more than 80% and 40.58%) [11-14]. The present study, similar to Bird *et al.*, demonstrated a satisfactory level of adherence to this criterion [14]. However, in the study by Eom *et al.*, despite intervention, the reported implementation rate of this criterion was lower than in the current study [15].

The probability of healthcare providers adhering to guidelines is affected by both individual caregiver factors and the environmental context in which care is given. Cason *et al.* assessed adherence to VAP prevention guidelines established by professional organizations like the Centers for Disease Control and Prevention and the Association of American Critical Care Nurses [16]. In a survey of 1285 nurses at a conference, approximately half of the respondents followed the oral care protocol, around half maintained the head of the bed elevation as per hospital policy, and only 15.2% of nurses adhered to the Spontaneous Breathing Trial (SBT) guidelines.

A sedation get-away is required to survey the patient's neurologic status and build up the need for the continuation of sedation. The evidence-based hone suggests giving the quiet a break from sedation at slightest day by day. This will lead to decreased mechanical ventilation time, diminished ICU remain length, and a lower chance of ventilator-associated pneumonia. Within the display ponder day by day sedation get-away adherence was appeared 98%.

Health care worker showed a very high adherence rate of 98% to the sedation vacation protocol, which was significantly higher than the 77.7% adherence rate reported in a study by Ricart *et al.* (2003) that focused on non-pharmacologic evidence-based guidelines for preventing VAP [17]. The difference in adherence rates could be due to the evaluation of non-pharmacologic interventions like hand-washing, tooth-brushing, and chest physiotherapy in the previous study. Despite this, the results of the current study may still reflect nurses' adherence to sedation vacations in other large metropolitan hospitals, as various studies have indicated that nurses' adherence to similar evidence-based practices is generally low internationally, typically ranging from 18-50%. (Cochrane *et al.*, 2007; Lam *et al.*, 2004; Mathai *et al.*, 2011; Pincock, Bernstein, Holst, 2012; Rao *et al.*, 2009; van Achterberg *et al.*, 2008) [17-21].

In a similar study conducted by Naveen *et al.* [22] it was found that only 39.5% of participants adhered to the DVT prophylaxis protocol, which was significantly lower compared to our study where 94% showed adherence. Madhuvu *et al.* reported a 99.6% adherence to DVT prophylaxis in their study [23, 24]. The Australian Commission on Safety and Quality in Health Care has included VTE prevention in clinical care standards due to the burden of venous thromboembolism in the Australian healthcare system. The recommended VTE prophylaxis is similar to DVT prophylaxis in the ventilation bundle. The presence of the Australian Commission on Safety and Quality in Health Care VTE standard during data collection may have contributed to better ventilation bundle compliance. Our study had an overall mean compliance rate of 91%, similar to Madhuvu *et al.*'s study where the overall ventilation bundle compliance rate was 88.3% for three consecutive mechanical ventilation days, and Baldwin *et al.* reported a compliance rate of over 85% [25, 26].

5. Conclusion

The hospital's ICU utilized ventilation bundle elements to avoid complications from mechanical ventilation. There was a satisfactory level of compliance with guidelines for preventing ventilator-associated pneumonia (VAP) in this study. Even though the interventions were being implemented at high rates, most nurses were not informed about their unit's latest VAP rate. Therefore, additional observational research is needed to evaluate health care workers' adherence as the effectiveness of VAP bundle implementation relies on awareness of the VAP rate. This suggests that health care worker might be carrying out the interventions without actively considering evidence-based practices and VAP prevention.

References

- IHI proposes six patient safety goals to prevent 100,000 annual deaths. *The Quality Letter for Healthcare Leaders*. 2005;17(1):11-2. doi: 10.1111/j.1469-0691.2012.03808.x. PubMed PMID: 15745282.
- Rello J, Afonso E, Lisboa T, Ricart M, Balsera B, Rovira A, *et al.* A care bundle approach for prevention of ventilator-associated pneumonia. *Clinical Microbiology and Infection: The Official Publication of the European Society of Clinical Microbiology and Infectious Diseases*. 2013;19(4):363-9. doi: 10.1111/j.1469-0691.2012.03808.x. PubMed PMID: 22439889.
- Caserta RA, Marra AR, Durão MS, Silva CV, Pavao dos Santos OF, Neves HS, *et al.* A program for sustained improvement in preventing ventilator-associated pneumonia in an intensive care setting. *BMC Infectious Diseases*. 2012;12:234. doi: 10.1186/1471-2334-12-234. PubMed PMID: 23020101; PubMed Central PMCID: PMC3521195.
- Blot S, Rello J, Vogelaers D. What is new in the prevention of ventilator-associated pneumonia? *Current Opinion in Pulmonary Medicine*. 2011;17(3):155-9. doi: 10.1097/MCP.0b013e328344db65. PubMed PMID: 21326100.
- O'Keefe-McCarthy S, Santiago C, Lau G. Ventilator-associated pneumonia bundled strategies: an evidence-based practice. *Worldviews on Evidence-Based Nursing*. 2008;5(4):193-204. doi: 10.1111/j.1741-6787.2008.00140.x. PubMed PMID: 19076920.
- Khalil N. Critical care nurses' knowledge and compliance to ventilator associated bundle at Cairo university Hospitals. *Journal of Education and Practice*; c2013.
- Said AT, editor. *Knowledge and Practice of Intensive Care Nurses on Prevention of Ventilator Associated Pneumonia at Muhimbili National Hospital, Dar es Salaam, Tanzania*; c2012.
- Al-Sayaghi KM. Prevention of ventilator-associated pneumonia. A knowledge survey among intensive care nurses in Yemen. *Saudi Medical Journal*. 2014;35(3):269-76. PubMed PMID: 24623207.
- Al-Mugheed K, Bani-Issa W, Rababa M, Hayajneh AA, Syouf AA, Al-Bsheish M, *et al.* Knowledge, Practice, Compliance, and Barriers toward Ventilator-Associated Pneumonia among Critical Care Nurses in Eastern Mediterranean Region: A Systematic Review. *Healthcare (Basel, Switzerland)*. 2022;10(10). doi: 10.3390/healthcare10101852. PubMed PMID: 36292297; PubMed Central PMCID: PMC9602381.
- Labeau S, Vandijck DM, Claes B, Van Aken P, Blot SI. Critical care nurses' knowledge of evidence-based guidelines for preventing ventilator-associated pneumonia: an evaluation questionnaire. *American Journal of Critical Care: An Official Publication, American Association of Critical-Care Nurses*. 2007;16(4):371-7. PubMed PMID: 17595369.
- Tabaeian SM, Yazdannik A, Abbasi S. Compliance with the Standards for Prevention of Ventilator-Associated Pneumonia by Nurses in the Intensive Care Units. *Iranian Journal of Nursing and Midwifery Research*. 2017;22(1):31-6. doi: 10.4103/1735-9066.202073. PubMed PMID: 28382055; PubMed Central PMCID: PMC5364749.
- Akın Korhan E, Hakverdioğlu Yönt G, Parlar Kılıç S, Uzelli D. Knowledge levels of intensive care nurses on prevention of ventilator-associated pneumonia. *Nursing in Critical*

- Care. 2014;19(1):26-33. doi: 10.1111/nicc.12038. PubMed PMID: 24400606.
13. Kiyoshi-Teo H, Cabana MD, Froelicher ES, Blegen MA. Adherence to institution-specific ventilator-associated pneumonia prevention guidelines. *American Journal of Critical Care: An Official Publication, American Association of Critical-Care Nurses*. 2014;23(3):201-14; quiz 15. doi: 10.4037/ajcc2014837. PubMed PMID: 24786808.
 14. Bird D, Zambuto A, O'Donnell C, Silva J, Korn C, Burke R, *et al.* Adherence to ventilator-associated pneumonia bundle and incidence of ventilator-associated pneumonia in the surgical intensive care unit. *Archives of Surgery (Chicago, Ill: 1960)*. 2010;145(5):465-70. doi: 10.1001/archsurg.2010.69. PubMed PMID: 20479345.
 15. Eom JS, Lee MS, Chun HK, Choi HJ, Jung SY, Kim YS, *et al.* The impact of a ventilator bundle on preventing ventilator-associated pneumonia: a multicenter study. *American Journal of Infection Control*. 2014;42(1):34-7. doi: 10.1016/j.ajic.2013.06.023. PubMed PMID: 24189326.
 16. Cason CL, Tyner T, Saunders S, Broome L. Nurses' implementation of guidelines for ventilator-associated pneumonia from the Centers for Disease Control and Prevention. *American Journal of Critical Care: An Official Publication, American Association of Critical-Care Nurses*. 2007;16(1):28-36; discussion 7; quiz 8. PubMed PMID: 17192524.
 17. Ricart W, Fernández-Real JM. [Impact of hormonal deficit and cardiovascular risk factors on life expectancy in hypopituitarism]. *Medicina Clinica*. 2003;120(16):630-7. doi: 10.1016/s0025-7753(03)73792-0. PubMed PMID: 12732130.
 18. Lam BC, Lee J, Lau YL. Hand hygiene practices in a neonatal intensive care unit: a multimodal intervention and impact on nosocomial infection. *Pediatrics*. 2004;114(5):e565-71. doi: 10.1542/peds.2004-1107. PubMed PMID: 15492360.
 19. Pincock T, Bernstein P, Warthman S, Holst E. Bundling hand hygiene interventions and measurement to decrease health care-associated infections. *American Journal of Infection Control*. 2012;40(4 Suppl 1):S18-27. doi: 10.1016/j.ajic.2012.02.008. PubMed PMID: 22546269.
 20. Gopal Rao G, Jeanes A, Russell H, Wilson D, Atere-Roberts E, O'Sullivan D, *et al.* Effectiveness of short-term, enhanced, infection control support in improving compliance with infection control guidelines and practice in nursing homes: a cluster randomized trial. *Epidemiology and Infection*. 2009;137(10):1465-71. doi: 10.1017/s0950268809002210. PubMed PMID: 19257913.
 21. Paliwal N, Bihani P, Mohammed S, Rao S, Jaju R, Janweja S. Assessment of Knowledge, Barrier in Implementation, and Compliance to Ventilator Bundle among Resident Doctors and Nurses Working in Intensive Care Units of a Tertiary Care Center of Western India: A Cross-sectional Survey. *Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine*. 2023;27(4):270-6. doi: 10.5005/jp-journals-10071-24434. PubMed PMID: 37378029; PubMed Central PMCID: PMCPCMC10291653.
 22. DuBose JJ, Inaba K, Shiflett A, Trankiem C, Teixeira PG, Salim A, *et al.* Measurable outcomes of quality improvement in the trauma intensive care unit: the impact of a daily quality rounding checklist. *The Journal of Trauma*. 2008;64(1):22-7; discussion 7-9. doi: 10.1097/TA.0b013e318161b0c8. PubMed PMID: 18188094.
 23. Parikh KC, Oh D, Sittipunt C, Kalim H, Ullah S, Aggarwal SK. Venous thromboembolism prophylaxis in medical ICU patients in Asia (VOICE Asia): a multicenter, observational, cross-sectional study. *Thrombosis Research*. 2012;129(4):e152-8. doi: 10.1016/j.thromres.2012.01.012. PubMed PMID: 22326367.
 24. Baldwin F, Gray R, Chequers M, Dyos J. Audit of UK ventilator care bundles and discussion of subglottic secretion drainage. *Nursing in Critical Care*. 2016;21(5):265-70. doi: 10.1111/nicc.12146. PubMed PMID: 27531399.
 25. Madhuvu A, Endacott R, Plummer V, Morphet J. Nurses' knowledge, experience and self-reported adherence to evidence-based guidelines for prevention of ventilator-associated events: A national online survey. *Intensive & Critical Care Nursing*. 2020;59:102827. doi: 10.1016/j.iccn.2020.102827. PubMed PMID: 32151484.

Creative Commons (CC) License
<p>This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY 4.0) license. This license permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.</p>