



THE RELATIONSHIP BETWEEN NURSES WORKLOAD AND COMPLIANCE WITH THE IMPLEMENTATION OF THE VENTILATOR ASSOCIATED PNEUMONIA BUNDLE IN THE INTENSIVE CARE UNIT

Syifa Putri Salsabila¹, Diah Tika Anggraeni^{2*}

^{1,2}Nursing Program, Faculty of Health Science, Universitas Pembangunan Nasional Veteran Jakarta, Jakarta, Indonesia

ABSTRACT

***Corresponding Author:**

Diah Tika Anggraeni
Nursing Program, Faculty of Health
Science, Universitas Pembangunan
Nasional Veteran Jakarta, Jakarta, In-
donesia
diahtika@upnvj.ac.id

Article Info:

Submitted: 15-12-2023

Revised: 28-03-2024

Accepted: 03-04-2024

<http://doi.org/10.19184/nlj.v9i1.44877>

The latest data shows an increase of 35% in the case of Ventilator-Associated Pneumonia (VAP). The incidence of VAP in the intensive care unit can be minimized with a bundle of VAP. The success of the bundle VAP can be achieved through compliance in maintenance. The nursing profession tends to have a high workload, which can have a negative impact on patient care. This study aims to identify the relationship between the nurses' workload and compliance with the implementation of the Bundle VAP in the intensive care unit. This research method uses a quantitative approach with cross-sectional designs. The sampling technique uses a total sampling with a total sample of 38 intensive room nurses. The data collection method in this research is an online questionnaire consisting of the NASA-TLX questionnaire and the VAP bundle implementation compliance questionnaire. The results of Chi Square's analysis showed a significant relationship between the nurse's workload and compliance with the implementation of the Bundle VAP in the intensive care unit with a sig. Value of 0.000 ($P < 0.05$). Nurses with a high workload have a higher risk of not complying with the implementation of the VAP bundle than nurses with a medium workload. Efforts are needed to improve the VAP prevention training program, provide education for managing workloads, and create a strong teamwork culture.

Keywords:

Compliance, Ventilator-associated pneumonia, VAP bundle, Workload

BACKGROUND

In intensive care, neonate and pediatric patients are at high risk of experiencing Healthcare-Associated Infections (HAIs) or nosocomial infections (Kaslam et al., 2021). The incidence of HAIs indicates the quality of hospital services, so if the infection rate in a hospital is high, it can indicate a low quality of health services (PERMENKES RI, 2017). The latest data shows that the number of nosocomial infections in 2019-2020 experienced changes because of the Covid-19 pandemic. There has been a 35% increase in cases of Ventilator Associated Pneumonia (VAP) (CDC, 2021). Critical patients who experience VAP on the Asian continent show a percentage of 2.5% - 48.1% (Abdelrazik & Salah, 2017). In neonates, the incidence of VAP ranges from 6.8% to 32.2% (Pepin et al., 2019). VAP is one of the causes of death in neonates, with a mortality rate of 4% - 56% (Kaslam et al., 2021).

VAP is a nosocomial infection due to mechanical ventilation via endotracheal or tracheostomy, which occurs for at least 48 hours or more after initiation (Papazian et al., 2020). Risk factors that trigger VAP include prolonged use of mechanical ventilation, patient age, decreased consciousness, COPD, and invasive surgery (Xu et al., 2019). In neonates, risk factors that cause VAP include age 11-20 days, premature birth, baby weight < 2.5 kg, prolonged use of mechanical ventilation, moving treatment rooms, reintubation, and nosocomial infections (Ghosh et al., 2019). Problems caused by VAP in critical patients in intensive care include long treatment times and length of stay (LOS) of 10-20 days, increased treatment costs, and the risk of death increases by 24% to 67% (Zubair et al., 2017).

The VAP bundle (VAPb) has been released by the Institute for Healthcare Improvement (IHI) to prevent VAP and reduce the number of VAP cases if it is applied correctly to patients. There are five components in the VAP bundle, namely head of bed elevation 30 - 45°, daily sedation evaluation and extubation readiness assessment, peptic ulcer prophylaxis therapy, deep vein thrombosis prophylaxis therapy, and oral treatment with chlorhexidine (Resar et al., 2005). Critical care nurses have an essential role in providing nursing interventions to avoid infections that worsen the patient's condition. Bankanie et al. (2021) stated that a reduction in the incidence of VAP occurs when compliance with bundle implementation is achieved. The success of the VAP bundle can be achieved with the nurse's level of knowledge, standard procedures, and compliance in carrying out

treatment (Sadli et al., 2017).

The nursing profession tends to have a high workload. Workloads that exceed the limits of nurses' capabilities have been proven to affect patient care negatively (Umansky & Rantanen, 2016). A literature study by Nuryani et al. (2021) explained that excessive workload increases nurses' stress, thus affecting compliance with medication administration. The high workload in the intensive care unit can cause physical and mental fatigue and emotional effects such as headaches, digestive disorders, irritability or greater sensitivity (Aliftitah et al., 2018).

Researchers conducted a preliminary study at a hospital in Depok City. As a result of interviews with four intensive care nurses, it was found that the workload experienced by nurses was relatively high because nurses were required to work quickly and precisely and had a big responsibility to maintain and save the lives of critical patients. Nursing tasks that increase workload include receiving new patients, caring for critical patients with complications or low chances of survival, carrying out several actions on different patients at the same time, and when there is delegating duties. HAIs survey data for the period May 2021 - May 2022 in the intensive care unit shows no VAP cases. However, there were several patients who showed positive culture results for the bacteria that cause VAP. It is known that there are Standard Operating Procedures and checklists for implementing the VAP bundle in intensive care rooms, which are sourced from PPI (Infection Prevention and Control). In determining whether a patient is diagnosed with VAP, nurses do not entirely refer to the criteria or Clinical Pulmonary Infection Score (CPIS) but only look at the lab results or X-rays. The nurse said it was quite challenging to diagnose VAP because, during the COVID-19 pandemic, the patient's underlying disease was pneumonia. Thus far, there has been no evaluation regarding compliance with the VAP prevention bundle in hospital intensive care wards in Depok City.

The unstable condition of critical patients, high work responsibilities, and a lack of nursing staff cause high levels of delegation of duties, and other factors can cause nurses' workload to increase. Procedural guidelines should be implemented so that nurses can provide optimal health services. Various factors also influence a nurse's compliance in carrying out a task. Based on the description above, this study aims to determine the relationship between the nurse's workload and compliance with implementing the bundle VAP in the intensive care unit.

METHODS

This research method uses a quantitative approach with a cross-sectional design. The sampling technique in this research used a total sampling of all nurses who worked in the ICU and NICU rooms of one of the hospitals in Depok City with a total of 38 nurses. The data collection method in this research is an online questionnaire using Google Forms. The questionnaire used consisted of the NASA-TLX questionnaire and the VAP Bundle implementation compliance questionnaire.

The NASA-TLX questionnaire consists of six dimensions of workload assessment, including Mental Demand (MD), Physical Demand (PD), Temporal Demand (TD), Own Performance (OP), Frustration (FR), and Effort (EF). Several studies have proven that NASA-TLX can measure workload from several aspects. Besides, NASA-TLX can measure workload subjectively and be used in real-time to provide sensitive values (Hoonakker et al., 2011; Tubbs-Cooley et al., 2018). The questionnaire consists of two parts, namely rating and weighting each dimension, with 21 questions. Ratings by respondents were conducted by choosing a scale of 0-100, and weighting was done by choosing one of the two aspects that most dominantly affect workload. The workload score is calculated by multiplying the value on the rating scale with the weight of each dimension. NASA-TLX scores are categorized into three classes of workload, namely light workload (score <50), moderate workload (score 50-80), and heavy workload (score >80).

The VAP bundle implementation compliance questionnaire amounts to 25 items in a Likert scale consisting of 5 = always, 4 = often, 3 = Sometimes, 2 = rarely, and 1 = never. The questionnaire items consisted of favorable and unfavorable questions, including the five steps of the VAP Bundle, namely the implementation of hand hygiene, head of bed 30 degrees, oral hygiene with chlorhexidine, daily assessment of termination of sedation and extubation readiness, prophylaxis of peptic ulcers and deep vein thrombosis.

The two questionnaires in this study have been declared valid and reliable. NASA-TLX instrument has been tested for validity by Tubbs-cooley et al. (2018) with an average variance extracted (AVE) value of 0.681 (AVE > 0.50), and the reliability of the questionnaire shows a Cronbach's alpha value = 0.883 (Achmad & Farihah, 2018). In the compliance questionnaire for implementing the VAP bundle, adapted from research by Aryani and Durhayati (2018), the

calculated r validity value for each item is in the range of 0.368 - 0.975 (r table = 0.355), while for reliability, the questionnaire produces a Cronbach's Alpha value = 0.712. Data processing in this research used the Chi-Square analysis test. This research has received ethical approval with ethical letter number No.18/KEPK/03/2022 from the Research Ethics Committee Pembangunan Nasional Veteran Jakarta University, and the research process was carried out from May - June 2022.

RESULTS

The univariate analysis that presented in table 1, 2, and 3 described the characteristics of critical care nurses in Depok Hospital. Table 1 showed that majority of age was <30 years, gender on female, education level in Diploma, <6 years for work experiences and already got IPCN training. Table 2 shows that the nurse workload in Intensive Care Unit was high (57,9%). Table 3 shows that nurse compliance in implementing the VAP Bundle in the Intensive Care Unit was high (50%).

Tabel 4 described bivariate analysis utilizing The Chi-Square statistical test with p-value 0.000 (p <0.05). It can be concluded that there is a significant relationship between nurse workload and compliance in implementing the VAP bundle in the Intensive Care Unit of a hospital in Depok City.

DISCUSSION

The results of our research show that nurses' workload is related to compliance in implementing the VAP bundle. The result of (Jam et al., 2017) research showed that critical care nurses with intense workloads were 88% (Jansson et al., 2013). Critical care nurses have barriers to implementing VAP prevention guidelines because they need more time (14,3%) and staff (4,8%). (Aloush, 2017) states that a high workload is the main obstacle for nurses who want to comply with implementing the VAP bundle. Nurses who work in care units with a nurse-to-patient ratio of 1:1 show higher compliance compared to nurses who work with a nurse-to-patient ratio of 1:2 (Widgedo et al., 2022) added that if the nurse's workload is light, compliance in carrying out their duties will improve.

According to Bankanie et al. (2021) and Alkhazali et al. (2021), the implementation of the VAP (Ventilator-Associated Pneumonia) bundle can be hindered by various factors such as lack of staff, inadequate skills, insufficient time, and inadequate equip-

Table 1. Critical Care Nurse Characteristics in the Depok Hospital

Characteristic	f	%
Age		
< 30 years	12	31,6
30 - 40 years	23	60,5
> 40 years	3	7,9
Gender		
Male	10	26,3
Female	28	73,7
Education Level		
Diploma	23	60,5
Bachelor/Nurse	15	39,5
Years of work		
< 6 years	31	81,6
6 – 10 years	3	7,9
> 10 years	4	10,5
IPCN Training		
Yes	26	68,4
Not Yet	12	31,6

Table 2. Frequency Distribution of Nurse Workload in Intensive Care Unit

Variable	f	%
Workload		
High	22	57,9
Medium	16	42,1

Table 3. Frequency Distribution of Nurse Compliance in Implementing the VAP Bundle in the ICU

Variable	f	%
VAP Bundle Implementation Compliance		
No	19	50
Yes	19	50

Table 4. Relationship between Nurse Workload and Compliance with VAP Bundle Implementation in the ICU

Variable	Compliance with VAP Bundle				Total		P value
	No		Yes		n	%	
	n	%	n	%			
Workload							
High	18	47,4	4	10,5	22	57,9	0,000
Medium	1	2,6	15	39,5	16	42,1	
Total	19	50	19	50	38	100	

ment. Yudi et al. (2019) found a significant correlation between physical workload and implementing patient safety in the ICU. Syukur (2018) also high-

lighted that nurses with a manageable workload are more likely to comply with their responsibilities. Conversely, nurses with a high workload tend to need

help in fulfilling their duties.

According to Vanchapo (2020), a high nurse workload is related to the results of nursing actions on patients. Suboptimal nursing actions can also cause an increase in patient safety incidents in hospitals. Several studies show that excessive workload increases nurses' stress, affecting compliance with implementing standard care procedures and nurses' performance (Rio et al., 2021; Nuryani et al., 2021). The nursing profession tends to have a high workload (Umansky & Rantanen, 2016). Nurses in the intensive care unit have intense and varied duties, causing nurses to have a high workload physically and mentally (Moghadam et al., 2020). Critical care nurses are responsible for ensuring that all critical patients receive optimal care even though most nurses have a high workload. The basis for providing optimal care is individual professional accountability through adherence to nursing standards for critical patients and a commitment to act according to ethical principles (AACN, 2015). One of the nursing standards for critical patients is the implementation of the VAP bundle, and the target of the preventive measures in the VAP bundle is to achieve zero infections (Akdogan et al., 2017). The success of the VAP bundle can be achieved with compliance in providing care (Sadli et al., 2017).

Compliance in preventing VAP is crucial because compliance is a behavior that can prevent infection. If nurse compliance is not good, there is a risk of increasing the incidence of VAP (Saodah, 2019). Nurses with higher knowledge and more extended experience play an important role in increasing the knowledge and compliance of other nurses regarding VAP prevention (Bankanie et al., 2021). Another factor that influences nurses in preventing VAP is the availability of adequate facilities and the implementation of good supervision (Solikin et al., 2021). Training regarding VAP prevention and nurses' attitudes toward implementing the VAP bundle also needs to be improved, considering the provision of clinical guidelines and related protocols (Tabaeian et al., 2017).

One way to reduce workload is to simplify the complexity or subtasks of nurses' work (Umansky & Rantanen, 2016). Creating a solid teamwork culture can also reduce workload and prevent burnout in nurses. Nursing managers can provide educational programs for nurses about factors that can improve how to manage workload, such as time and emotional management, which may be useful for nurses' well-being (Nasirizad Moghadam et al., 2021).

Further research needs to be carried out re-

garding nurse compliance in implementing the VAP bundle using data collection methods in the form of direct observation and a wider population. The expansion of independent variables can be included in further research, such as psychological factors in the form of work fatigue and job dissatisfaction, which are associated with compliance with implementing the VAP bundle.

The limitation of our study was that the research design needed to determine the association between the specific type of workload and VAP bundle implementation. Besides that, the sample size in our study is small. Further research on a large sample is needed.

CONCLUSION

There is a significant relationship between nurse workload and compliance in implementing the VAP bundle in the intensive care unit. Nurses with a high workload have a higher risk of not complying with the implementation of the VAP bundle than nurses with a medium workload. Hospitals can provide appreciation in the form of rewards so that nurse compliance can be maintained. Reducing mental workload can be done by educating nurses on psychological support and emotional management, and hospitals can create a strong teamwork culture that impacts a good work environment.

REFERENCES

- Abdelrazik, A., Salah, A., 2017. Ventilator-associated pneumonia in adult intensive care unit prevalence and complications. *The Egyptian Journal of Critical Care Medicine* 5, 61-63.
- Achmad, F., Fariyah, T., 2018. Analisa Beban Kerja Mental Menggunakan Metode Nasa Task Load Index (NASA-TLX). *Integrated Lab Journal* 6, 29-36. <https://doi.org/10.5281/zenodo.1993970>
- Akdogan, O., Ersoy, Y., Kuzucu, C., Gedik, E., Tugal, T., Yetkin, F., 2017. Assessment of the effectiveness of a ventilator associated pneumonia prevention bundle that contains endotracheal tube with subglottic drainage and cuff pressure monitorization. *Brazilian Journal of Infectious Diseases* 21, 276-281. <https://doi.org/10.1016/j.bjid.2017.01.002>
- Aliftitah, S., Mumpungitias, E.D., Muttaqin, I., 2018. Hubungan Beban Kerja Dengan Stres Kerja Pada Perawat Di Ruang ICU RSUD Dr. H. Moh. Anwar Sumenep. *Jurnal Kesehatan*

- "Wiraraja Medika" 8, 34-42. <https://doi.org/https://doi.org/10.24929/fik.v8i2.650>
- American Association of Critical-Care Nurses, 2015. AACN Scope and Standards for Acute and Critical Care Nursing Practice. American Association of Critical-Care Nurse
- Aryani, D.F., Durhayati, Y., 2018. Gambaran Tingkat Kepatuhan dan Faktor-Faktor yang Memengaruhi Kepatuhan Perawat dalam Penerapan Bundle Ventilator Associated Pneumonia. *Jurnal Riset Kesehatan Nasional* 2, 149-157.
- Bankanie, V., Outwater, A.H., Wan, L., Yinglan, L., 2021. Assessment of knowledge and compliance to evidence-based guidelines for VAP prevention among ICU nurses in Tanzania. *BMC Nurs* 20, 1-12. <https://doi.org/10.1186/s12912-021-00735-8>
- CDC, 2021. Healthcare-associated Infections (HAI) [WWW Document]. Centers for Disease Control and Prevention. URL <https://www.cdc.gov/hai/data/portal/index.html> (accessed 3.24.22).
- Ghosh, U.K., Hossain, M.M., Shirin, M., Hoque, M.S., Sonia, S.F., Islam, T., 2019. Predictors of Ventilator Associated Pneumonia of Neonate in a Neonatal and Paediatric Intensive Care Unit. *Bangladesh Journal of Child Health* 43, 90-96. <https://doi.org/10.3329/bjch.v43i2.42552>
- Hoonakker, P., Carayon, P., Gurses, A.P., Brown, R., Khunlertkit, A., McGuire, K., Walker, J.M., 2011. Measuring workload of ICU nurses with a questionnaire survey: the NASA Task Load Index (TLX). *IIE Trans Healthc Syst Eng* 1, 131-143. <https://doi.org/10.1080/19488300.2011.609524>
- Jam, R., Hernández, O., Mesquida, J., Turégano, C., Carrillo, E., Pedragosa, R., Gómez, V., Martí, L., Vallés, J., Delgado-Hito, P., 2017. Nursing workload and adherence to non-pharmacological measures in the prevention of ventilator-associated pneumonia. A pilot study. *Enfermería Intensiva (English ed.)* 28, 178-186. <https://doi.org/10.1016/j.enfie.2017.10.002>
- Jansson, M., Ala-Kokko, T., Ylipalosaari, P., Syrjälä, H., Kyngäs, H., 2013. Critical care nurses' knowledge of, adherence to and barriers towards evidence-based guidelines for the prevention of ventilator-associated pneumonia - A survey study. *Intensive Crit Care Nurs* 29, 216-227. <https://doi.org/10.1016/j.iccn.2013.02.006>
- Kaslam, P., Widodo, D., Satari, H.I., Karuniawati, A., Kurniawan, L., 2021. Buku Pedoman Pencegahan Pengendalian Infeksi. UI Publishing, Jakarta.
- Moghadam, K.N., Chehrzad, M.M., Masouleh, S.R., Mardani, A., Maleki, M., Akhlaghi, E., Harding, C., 2020. Nursing workload in intensive care units and the influence of patient and nurse characteristics. *Nurs Crit Care* 26, 425-431. <https://doi.org/10.1111/nicc.12548>
- Nasirizad Moghadam, K., Chehrzad, M.M., Reza Masouleh, S., Maleki, M., Mardani, A., Atharyan, S., Harding, C., 2021. Nursing physical workload and mental workload in intensive care units: Are they related? *Nurs Open* 8, 1625-1633. <https://doi.org/10.1002/nop2.785>
- Nuryani, E., Dwiantoro, L., Nurmalia, D., 2021. Faktor-faktor yang meningkatkan kepatuhan perawat dalam penerapan prinsip enam benar pemberian obat. *Jurnal Kepemimpinan dan Manajemen Keperawatan* 4. <https://doi.org/10.32584/jkmk.v4i1.572>
- Papazian, L., Klompas, M., Luyt, C.E., 2020. Ventilator-associated pneumonia in adults: a narrative review. *Intensive Care Med* 46, 888-906. <https://doi.org/10.1007/s00134-020-05980-0>
- Pepin, B.J., Lesslie, D., Berg, W., Spaulding, A.B., Pokora, T., Harris-Haman, P.A., Zukowsky, K., 2019. ZAP-VAP: A Quality Improvement Initiative to Decrease Ventilator-Associated Pneumonia in the Neonatal Intensive Care Unit, 2012-2016. *Advances in Neonatal Care* 19, 253-261. <https://doi.org/10.1097/ANC.0000000000000635>
- Resar, R., Pronovost, P., Haraden, C., Simmonds, T., Rainey, T., Nolan, T., 2005. Using a Bundle Approach to Improve Ventilator Care Processes and Reduce Ventilator-Associated Pneumonia. *The Joint Commission Journal on Quality and Patient Safety* 32, 243-248.
- Sadli, M.F., Taviyanto, D., Redjeki, I.S., 2017. Gambaran Pengetahuan Klinisi Ruang Rawat Intensif mengenai Ventilator Associated Pneumonia (VAP) Bundle di Ruang Rawat Intensif RSUP Dr. Hasan Sadikin Bandung. *Jurnal Anestesi Perioperatif* 5, 85. <https://doi.org/10.15851/jap.v5n2.1108>
- Saodah, S., 2019. Knowledge of Guideline VAP Bundle Improves Nurse Compliance Levels in Preventing Associated Pneumonia (VAP) Ventilation in the Intensive Care Unit. *Media Keperawatan Indonesia* 2, 113. <https://doi.org/10.26714/mki.2.3.2019.113-120>
- Solikin, Adi, M.S., Arso, S.P., 2021. Analisis faktor-

faktor yang mempengaruhi kepatuhan mengikuti pedoman perawatan Bundle Ventilator Associated Pneumonia (VAP) 15, 430-442.

Tabaeian, S., Yazdannik, A., Abbasi, S., 2017. Compliance with the standards for prevention of ventilator-associated pneumonia by nurses in the intensive care units. *Iran J Nurs Midwifery Res* 22, 31-36. <https://doi.org/10.4103/1735-9066.202073>

Tubbs-cooley, H.L., Mara, C.A., Carle, A.C., Gurses, A.P., 2018. Intensive & Critical Care Nursing The NASA Task Load Index as a measure of overall workload among neonatal , paediatric and adult intensive care nurses. *Intensive Crit Care Nurs* 1-6. <https://doi.org/10.1016/j.iccn.2018.01.004>

Umansky, J., Rantanen, E., 2016. Workload in nursing. *Proceedings of the Human Factors and Ergonomics Society* 551-555. <https://doi.org/10.1177/1541931213601127>

Widegdo, H., Marti, E., Ratnawati, E., 2022. Hubungan antara beban kerja dengan kepatuhan perawat dalam pendokumentasian Early Warning System (EWS) di ruang rawat Inap Rumah Sakit Panti Rahayu Gunung Kidul. *Jurnal keperawatan I Care* 3, 137-145.

Xu, Y., Lai, C., Xu, G., Meng, W., Zhang, J., Hou, H., Pi, H., 2019. Risk factors of ventilator-associated pneumonia in elderly patients receiving mechanical ventilation. *Clin Interv Aging* 14, 1027-1038.

Zubair, S., Ali, H., Zafar, F., Beg, A., Sial, A., Naveed, S., 2017. Ventilator-associated pneumonia (VAP): Clinical strategies, treatment challenges and economic concerns. *J Bioequivalence Bioavailab* 9, 432-436.