Nurses' knowledge and compliance to infection control bundle of care in Ventilator-Associated Pneumonia cases in a tertiary hospital

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Abstract: Ventilator-Associated Pneumonia (VAP) is an infectious disease that can be prevented and managed using a care bundle intervention. However, it is very crucial to understand first the knowledge on VAP and compliance of the healthcare providers with the standard care protocol on preventing the occurrence of VAP. This study determined the relationship between nurses' knowledge and compliance towards the bundle of care in a selected tertiary hospital in Quezon City. This study utilizes a descriptive-correlation research design. It determined the level of awareness of the nurses on the VAP and the bundle of care. A total enumeration sampling was used in the study. There are only 36 who participated in the survey achieving a 90% response rate. Mean and standard deviation and Pearson-moment correlation were utilized to analyze the data. The results showed that most nurses have a moderate level of awareness (M=3.49, SD=0.88) about ventilator-associated pneumonia (VAP) bundle of care interventions. As to the compliance to the VAP bundle of care, the staff nurses' are not compliant to the elevation of the head and reported that they are sometimes compliant to daily sedation vacation (Mean=2.10; SD=0.47), peptic ulcer prophylaxis (Mean=2.03; SD=0.48), and deep vein thrombosis (Mean=1.83; SD=0.45). There is a significant negative relationship between nurses' knowledge and compliance to the bundle of care*)* it obtained (*$p= 0.004$; $r=-0.984$)* which is verbally interpreted as a very high negative correlation. This means that as the knowledge on the bundle of care interventions increases the compliance on a bundle of care interventions decreases.

Keywords: *knowledge; compliance; bundle of care; ventilator-associated pneumonia*

1. INTRODUCTION

1.1 Background

The Care Bundle is a set of key interventions derived from evidence-based guidelines that are expected to improve patient health outcomes by facilitating, encouraging changes in inpatient care, and encouraging compliance with the guidelines (Osti, Wosti, Pandey & Zhao, 2017) However, the care bundle protocols are different and contentious in different hospitals.

Ventilator-Associated Pneumonia (VAP) is one of the infectious diseases that use care bundle intervention. VAP is the result of the invasion by microorganisms of the lower respiratory tract and lung parenchyma. This causes damages the consistency of the oropharynx and trachea that causes oral and gastric secretions to penetrate the lower airways (Amanullah, 2015). According to Alcan, Korkmaz & Uyar (2016), this happens later than 48 hours after endotracheal intubation. Patients with VAP have been associated with prolonged periods of mechanical ventilation (Chen et al., 2015).

VAP bundle of care developed by the Institute for Healthcare Improvement (IHI) is aimed at achieving significantly better patient outcomes than when implemented individually. Essential bundle components defined as the global standard for the prevention of VAP are oral hygiene, HOB elevation, daily sedation vacations, spontaneous breathing trials, peptic ulcer, and deep vein thrombosis prophylaxis.

In middle-income countries such as the Philippines, there are high rates of hospital-acquired infections (HAIs). In addition to the prevalence of multi-drug organisms (MDROs), lack of HAI surveillance, overuse of antibiotics, and foreign migration of their health staff, this has presented a challenge for healthcare providers to achieve successful infection control. It is therefore important to evaluate and improve the consistency of infection prevention, hand hygiene, and HAI surveillance policies in these environments.

Moreover, nurses with lower workloads are more likely to comply with VAP prevention guidelines as compared to those with their counterparts (Abd& Mohamed, 2014). The latter brought a challenge to the quality of health care provided given that most hospitals in the Philippines are understaffed.

In the previous experience of the researchers at a tertiary hospital in Quezon City, Philippines where they were affiliated for the clinical rotation, they witnessed caring for a stuporous female patient with a tracheostomy tube is placed. Oronasal discharges were seen coming out of the patient's tube as they described, unfortunately, there was no specific care intervention given by the nurses on duty. This incident prompted the researchers to realize the need to observe infection control practices at most. This condition motivated the researchers to further investigate the implementation of the VAP bundle of care as it is said that they are

following the bundle of care protocol. Though the implementation of the VAP bundle of care has been highlighted as a priority, however, clinical practices are inconsistent. Thus, the researchers are interested to identify the nurses' level of knowledge and compliance on a bundle of care in reducing VAP in a government hospital setting.

Statement of the Problem

This study assessed the nurse's knowledge and compliance to infection control bundle of care VAP cases in a tertiary hospital in Quezon City. Moreover, the researchers intended to answer the following research questions:

1. What is the level of nurses' knowledge on VAP bundle of care intervention in terms of:
   1.1 elevation of the head of the bed
   1.2 daily sedation vacations
   1.3 prophylaxis of peptic ulcer diseases (PUD)
   1.4 prophylaxis of deep vein thrombosis (DVT)?

2. What is the level of compliance of the nurses to VAP bundle of care intervention in terms of:
   2.1 elevation of the head of the bed
   2.2 daily sedation vacations
   2.3 prophylaxis of peptic ulcer diseases (PUD)
   2.4 prophylaxis of deep vein thrombosis (DVT)?

3. What is the relationship between the knowledge and compliance level of the nurses to bundle of care interventions?

Theoretical Framework

Aizen and Fishbein's Theory of Planned Behavior (TPB) in 1967 describes how attitude and motivation affect human behavior. The theory implies that the "intent" is the most significant determinant of a person's "behavior", that the intention of an individual to perform depends on the behavior. It is based on the premise that human beings are rational and systematic use of the knowledge available to them and weigh the consequences of their decisions before they determine whether to participate in those behaviors. Therefore, the greater the intention of an individual to perform a specific task (behavior) is, the more likely the person is to perform the activity (Ajzen, 2006). In this study, compliance of the staff nurses to VAP is a result of prior basic knowledge about VAP and how it can be prevented.

Conceptual Framework

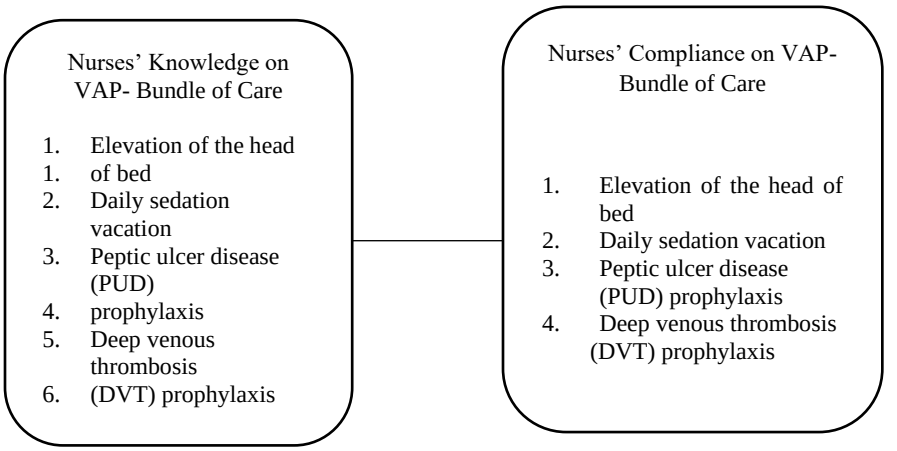

Fig.1. Relationship between Knowledge and Compliance of Nurses on VAP Bundle of Care

The framework above shows the relationship between nurses' knowledge and compliance to bundle of care to VAP specifically to head of bed elevation, daily sedation vacation, peptic ulcer disease prophylaxis, and deep venous thrombosis prophylaxis. It is assumed that nurses' knowledge of VAP will influence their compliance to the bundle of care. The independent variable of the study is the nurses' knowledge on VAP-Bundle of care while the dependent variable of the study is the nurses' compliance level on VAP- Bundle of care. If the nurses do not have adequate knowledge of the interventions, they will not have the confidence to act and to make decisions on those procedures, thus increasing the occurrence of VAP (Paula & Gomes, 2010)

Statement of Hypothesis

The interplay of variables led the researchers to test the following hypothesis:

Ha- There is a significant relationship between nurses' knowledge on VAP and compliance to Bundle of Care interventions specifically on the following:

Ha_1. elevation of the head of the bed

Ha_2. daily sedation vacation

Ha_3. peptic ulcer disease (PUD) prophylaxis

Ha_4. deep venous thrombosis (DVT) prophylaxis

2. METHODOLOGY

2.1 Research Design

This is a descriptive-correlation, self-administered survey. It examined the level of knowledge and compliance of nurses to bundles of care intervention to VAP. Furthermore, it determined the relationship of knowledge and compliance to bundle of care interventions to head of bed elevation, daily sedation vacation, peptic ulcer disease prophylaxis, and deep venous thrombosis prophylaxis. The study is replicable in our DOH-tertiary hospital in the country since the implementation of a bundle of care interventions is reinforced by the guidelines and policies in the infection control programs of DOH.

2.2 Research Setting

The study was conducted in a 600-bed capacity hospital of the Department of Health (DOH) for nurses in various locations and selected tertiary hospitals. The said hospital is strictly implementing infection control measures.

2.3 Sample

The selected samples are registered nurses working at the medical-surgical and intensive care units handling patients attached to a mechanical ventilator and working in the same hospital for at least one year before the questionnaire was administered. Nurses holding supervisory positions were excluded.

2.4 Sampling Size and Design

A total enumeration sampling was used in the study. All possible respondents who met the criteria were part of the study. The total number of estimated staff nurses employed in the different areas is 40. At the time of the survey, there are only 36 who completed the survey achieving a 90% response rate.

2.6 Instrumentation

The modified tool underwent a pilot-test and was found to be valid and reliable. A reliability index score of Cronbach alpha 0.86 was achieved and is considered acceptable. Validation of the tool was established through the expert's opinion of the contents of the tool.

The tool is composed of three (3) sections. Section 1 asked the respondents about their profiles which include age, sex, highest degree received in nursing, current nursing specialty, total years as a registered nurse, area of assignment, and total no. of mechanically ventilated patients handled in the past month. Section 2 determined the perceived knowledge of the nurses on the VAP Bundle of Care specifically to Oral care with chlorhexidine, the elevation of the head of bed, daily sedation vacation, spontaneous breathing trials and, peptic ulcer disease (PUD) prophylaxis.

Each item was answered using a 5-Likert scale with the following responses: (5) highly knowledgeable, (4) knowledgeable, (3) some knowledge, (2) poor knowledge, (1) no knowledge at all. Section 3 determined the nurses' level of compliance to the same VAP Bundle of Care. To measure it, the answer to each item will be based on the magnitude of doing the procedure using 3- point Likert scale as to the following responses: (3) Always, (2) Sometimes, and (1) Not at all.

2.7 Data Collection Procedure

A paper-based data collection method was utilized to achieve maximum response rates. Surveys can be used as a screening method to help identify areas for progress, assess patient safety measures, monitor improvements over time, and compare them by external benchmarking (Nieva VF, 2003). They are an opportunity for 'inquiry and change' (Carroll JS, 2002).

After receiving the approval of the EAMC Review Ethics Board, the researchers obtained permission from the Chief of the Hospital and the Chief Nurses to perform the survey at their institution. After approval is gained from the hospital, the researchers began to hand over the brown envelopes to the various heads of the unit. An endorsement letter from the chief of the hospital regarding the conduct of the survey was shown to different unit heads for them to read. Each brown envelope contained a cover letter, the survey questionnaire, an informed consent form, and a pencil for their use. The purpose of the study was discussed in the cover letter. After two weeks of the distribution of survey questionnaires, the researchers returned to collect the questionnaires. Respondents who did not respond to the questionnaires within a given period were individually followed up.

2.8 Data Analysis

After assessing the completeness of the survey, the data were tabulated using Microsoft Excel and checked and analyzed using the Social Package Statistical Software (SPSS) version 23.

Both descriptive and inferential statistics were used to treat the gathered data. Frequency and percentages showed and described the demographic profiles of survey respondents. Respondents' responses will be expressed in percentages and means.

A Pearson-r moment correlation was used to determine the relationship between nurses' knowledge and compliance to VAP-Bundle of Care intervention. All tests were preset at $p<0.05$ level of significance.

2.9 Ethical Considerations

The researchers gained the basic course on Good Research Practice (GRP) from National University. Furthermore, an ethics approval was gained from East Avenue Medical Center Review (EAMC) Ethics Board

with protocol code EAMC IERB 2019-101. The researchers declared that there is no conflict of interest in conducting the study. An informed consent form indicating the purpose of the study, risks, and benefits, confidentiality, and voluntariness was emphasized to all respondents. They were given 1 week from the invitation to decide on their participation in the study. A data file was secured by placing them in a secured file case using sensitive codes that only the researchers have access to.

3. RESULTS AND DISCUSSION

3.1 Demographics

Table 1. Demographic

	Frequency (n=36)	*Percentage*
Gender		
Male	23	63.9
Female	12	33.3
Prefer not to answer	1	2.8
Academic Degree		
Bachelor	35	97.2
Masteral	0	0
Doctoral	1	2.8
Specialty Certification Status		
Neuro-Surgical	1	2.8
Critical Care	3	8.3
Acute Care Nursing	2	5.6
Others	2	5.6
None	28	77.8
Total number of years as RN		
1-5 years	15	41.7
6-10 years	9	25.0
11-15 years	6	16.7
16-20 years	5	13.9
21-25 years	1	2.8
Hospital Area/ Assignment (select all that apply)		
Medical	10	27.7
Surgical	10	27.7
ICU	10	27.7
PACU	6	16.7

Total no. of mechanically ventilated patients handled in the past month		
1-2 patients	4	11.1
3-4 patients	10	27.8
5-6 patients	9	25.0
7 or more patients	13	36.1

Table 1 above shows the distribution of the respondents in the study. The majority (63.9%) of the respondents are male, bachelor's degree holder (97.2%) no nursing specialty certification (77.8%), 41.7% have 1-5 years in nursing, same distribution with 27.7% are assigned in the medical, surgical ward and intensive care units and took care 7 or more patients within the past month (36.1%).

3.2 Level of Knowledge on VAP Bundle of Care

Table 2**.** Level of Knowledge on VAP Bundle of Care according to dimensions

Measures	*Mean*	*SD*	*Interpretation*
Elevation of the head of the bed (HOB)			
1. Implementation of the HOB elevation can help prevent VAP from occurring.	4.22	0.75	High
2. The HOB elevation policy/ guideline is transparent and precise.	3.94	0.94	Moderate
3. Some other policies/guidelines are in contrast with the HOB elevation guideline.	2.81	1.39	Some
Composite Mean	3.66	0.65	Moderate
Daily sedation vacations			
1. Implementation of frequent sedation vacations can help prevent VAP from occurring.	3.73	0.76	Moderate
2. The policy/guideline for daily sedation is transparent and precise.	3.77	0.93	Moderate
3. Some other policies/guidelines are in contrast with the regular sedation vacation policy/ guideline.	2.54	1.18	Poor
Composite Mean	3.35	0.96	Some
Peptic ulcer prophylaxis			
1. The use of peptic ulcer prophylaxis can help avoid VAP.	4.00	0.91	Moderate
2. The policy/ guideline for prophylaxis of peptic ulcers is straightforward and precise.	3.92	0.91	Moderate

3. Some other policies/guidelines contrasted with the peptic ulcer prophylaxis policy/ guideline.	2.38	1.25	Poor
Composite Mean	3.43	1.02	Moderate
Deep vein thrombosis			
1. Implementing deep vein thrombosis prophylaxis can help avoid VAP.	4.03	0.71	Moderate
2. The policy/guideline for prophylaxis of deep vein thrombosis is straightforward and precise.	3.80	0.75	Moderate
2. Some other policies/guidelines conflict with the policy/ guideline on prophylaxis for deep vein thrombosis.	2.67	1.19	Some
Composite Mean	3.5	0.88	Moderate

Table 2 presents the level of knowledge of staff nurses on the elevation of the head of the bed (HOB) to prevent VAP. Staff nurses perceived that they are highly knowledgeable in terms of its implementation (M=4.22, SD=0.75). Moreover, they claimed they are moderately knowledgeable on the policy and guideline on HOB elevation in terms of its clarity and specificity (M=3.94, SD=0.94. However, they assumed that some policies and guidelines conflict with the HOB elevation (M=2.81, SD=1.39) and interpreted it as having some knowledge. Overall, they perceived that their knowledge on HOB elevation is at a moderate level (M=3.66, SD=0.65) This contrasted with the study on VAP Bundle of Care at Cairo University Hospitals by Nahla (2013) which showed that staff nurses with varying levels of education have inadequate awareness of ventilator-related pneumonia and VAP bundle preventive measures. This incongruence in the results perhaps could be attributed to the distribution of the respondents according to their academic degree. Furtherly elaborated, the respondents of this study are all registered nurses compared to Nahla composed of some other nursing assistants who may need more training on the bundle of care. Zeb & Hasmain et al (2018) perceived that nurse's evidence-based recommendations for the prevention of ventilator-associated pneumonia in intensive care units were 51.92% and it suggests that further strategies through concerted effort should be done to increase the knowledge of the respondents. It is also well-noted that nurses have a moderate knowledge (M=3.73, SD=0.76) on the implementation of daily sedation vacations that will help prevent VAP, moderate knowledge (M=3.77, SD=0.93) on the policy or guideline for daily sedation vacations, poor knowledge (M=2.54, SD=1.18) on the other policies or guidelines that conflict with sedation vacations, can help avoid VAP. Overall, the nurses reported some knowledge on the VAP bundle of care in terms of daily sedation vacations (M=3.35, SD=0.96). The same

findings were observed with the implementation of peptic ulcer prophylaxis where it achieved moderate knowledge (M=4.00, SD=0.91) on the implementation of the peptic ulcer prophylaxis; on the policy or guideline on peptic ulcer prophylaxis (M=3.92, SD=0.91). However, poor knowledge of other policies or guidelines that conflict with the peptic ulcer prophylaxis (M=2.38, SD=1.25) was evident. This suggests the need to reorient the nurses on the policies and guidelines about VAP to peptic ulcer prophylaxis. The implementation of the deep vein thrombosis to prevent the occurrence of VAP shows that the nurses have moderate knowledge (M=4.03, SD=0.71). Similarly, the same findings were also observed on their knowledge on the policy or guideline on deep vein thrombosis was reported (M=3.80, SD=0.75). However, poor knowledge on other policies or guidelines that conflict with the deep vein thrombosis (M=3.5, SD=0.88) was noted.

Table 3. Level of compliance on VAP Bundle of Care

VAP Bundle of Care	*Mean*	*SD*	*Interpretation*
Elevation of head	1.37	0.48	Not at all
Daily Sedation Vacation	2.10	0.47	Sometimes
Peptic ulcer prophylaxis	2.03	0.48	Sometimes
Deep vein thrombosis	1.83	0.45	Sometimes

Table 3 shows the level of compliance on VAP Bundle of Care. It is noted that nurses are not compliant with the elevation of the head (M=1.37, SD=0.48). The low HOB elevation rate >30° in this suggests that health care providers, including physicians and nurses, may have overestimated HOB (Hamisheshehkar et al. 2014) Nurses may more likely overestimate HOB elevation possibly because they rely on the significant others who care for the patient after instructions are given to them. This implies also that nurses should follow up with the caregiver after initiating care. It is also noted that nurses would sometimes comply with daily sedation vacation (M=2.10, SD=0.47). Similarly, a Brazilian study found out that only 59.2% of the staff nurses are implementing the protocol on sedation interruption. It is worst to note in the study by Ali (2013) that daily sedation vacation is not done by all nurses in the studied unit and they never initiate winning trials. In the present study, it can be seen also that nurses are sometimes compliant to peptic ulcer prophylaxis (M=2.03, SD=0.48. This contrasted to 91% compliance among staff nurses in the study of Zeb et al., (2018). This shows that nurses on many occasions are not strictly implementing the said intervention and may require to remind them of its application. DVT prophylaxis (M=1.83, SD=0.45) is to be seen to be done sometimes by staff nurses to prevent VAP. DVT remains an outstanding procedure in the general treatment of ventilated patients. DVT prophylaxis, as defined in several studies using anti-embolic stockings, found that less than 50% of nurses did not comply with the guideline. This

suggests the need to allow staff nurses to initiate DVT prophylaxis. Overall, this study found that while the bundle of care is seen as an easy-to-use measure, however compliance to the intervention needs to be intensified.

Table 4. Relationship between the nurses' knowledge and compliance to the VAP bundle of care.

Knowledge & Compliance on VAP Bundle of Care	*Pearson coeff.*	*Magnitude of correlation*	*p-value*
Elevation of head	-0.113	Weak	0.48
Daily sedation	-0.154	Weak	0.42
Peptic ulcer prophylaxis	-0.533	Moderate	0.00
Deep vein thrombosis	0.182	Weak	0.34
Overall	-0.984	Negative very High	0.00

<0.05 level of significance

Table 4 reveals the relationship between knowledge and compliance on VAP bundle of care. Knowledge on peptic ulcer prophylaxis has a significant moderate negative correlation to compliance. This means that a reverse relationship exists between knowledge and compliance. As the knowledge towards peptic ulcer prophylaxis increases, the compliance towards peptic ulcer prophylaxis decreases. On the other hand, the knowledge on the elevation of HOB and daily sedation were seen to have a no significant, weak negative correlation with compliance with the said interventions. This also supports the theory that, if the nurse does not have adequate knowledge of the interventions that have been shown to minimize the VAP rate, likely he does not dare to act and make decisions those procedures (Paula & Gomes, 2010) Overall, nurses' knowledge and compliance have shown a significant reverse relationship. This means that as the knowledge on the bundle of care interventions increases the compliance level on a bundle of care interventions also increases. Therefore, a reverse relationship between knowledge and compliance to VAP interventions is observed. This finding does not support the rational relationship between knowledge and compliance to VAP bundle of care. There may be a need to explore possible other factors that may inhibit the nurses to comply with VAP measures even though they have shown to know it.

4. CONCLUSION

This study concludes that nurses dealing with VAP patients have moderate knowledge of VAP prevention. However, they are not

judiciously compliant with its implementation. There is a need to increase the knowledge of the nurses on VAP prevention and compliance to bundle of care interventions. There may be a need to conduct follow-up studies exploring the factors influencing nurses' compliance with standard precautions on VAP. It is recommended to investigate the specific barriers that hinder nurses to comply with the VAP bundle of care.

Even though the response rate is high, still the generalizability of the findings cannot be assumed because there are only a few respondents compared to other tertiary hospitals. It is suggested that a similar study be conducted in other tertiary hospitals. The findings of the study open the consciousness of the administrators and stakeholders in taking part in revisiting the current programs in infection control for the has a crucial implication in revitalizing the current policy.

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