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Ventilator Associated Pneumonia: Assessment of Nurses` Awareness and Self – Efficacy with Bundle Prevention Protocol

[1]Soad M. Hegazy, [2]Mohamed - Abdelrahman A. Hussein,
[3]Mohammed M. Abualruhaylah, [4]Samiyah M. Aljohani, [5]Saleh M. Mayyas

[1] Medical – Surgical Nursing, [2] Anesthesia and Critical Care Consultant, [3,4] Staff Nurses , [5]Diploma Program Director for Postgraduate Nursing.

. *Saudi Arabia: [1]Taibah University, Yanbu, Applied Medical Science, [2,3,4] King Fahad Hospital, [5]Madinah Cardiac Center.

* Egypt: [1]Ain Shams University, Faculty of Nursing and [2]Suez Canal University, Faculty of Medicine

Abstract: **Ventilator-associated pneumonia is a common problem in intensive care, and is a complex issue where prevention is both vital and multifaceted. Aim: This study aimed to assess nurses' awareness and self – efficacy regarding the bundle prevention protocol of ventilator associated pneumonia. Subjects and Method: A descriptive design was utilized in this study, that was conducted in the critical care unit (CCU) for adults at King Fahad Hospital. A convenience sample was composed of 80 nurses working at the previous mentioned settings, added to 60 critically ill patients with different diagnosis were recruited from the above mentioned settings. The study tools were: 1) Self-administered questionnaire sheet to assess nurses' knowledge about VAP and prevention bundle. 2) An observational checklist to assess the nurses' practices for mechanically ventilated patients regarding ventilator associated pneumonia bundle. 3) General self-efficacy scale. Results: More than half of the studied nurses had less than 5 years experiences in CCU, added to their awareness (knowledge and practices) and self- efficacy were unsatisfactory and need for more improvement. Conclusion: Overall, the present study concluded that more than two fifths of studied nurses had satisfactory awareness (knowledge and practices) as regards the bundle prevention protocol of ventilator associated pneumonia. In addition, less than half of them had high self – efficacy level during their work in the critical care units. Recommendations: Further studies should be carried out on a large number of critical care nurses with evidence of results and generalization.**

Keywords: **Ventilator Associated Pneumonia - Bundle Prevention Protocol - Staff Nurses`Awareness and Self – Efficacy.**

1. INTRODUCTION

Ventilator-associated pneumonia (VAP) is defined by infection of the pulmonary parenchyma in patients exposed to invasive mechanical ventilation for at least 48 h and is part of ICU-acquired pneumonia. Moreover, is one of the most frequent ICU-acquired infections with reported incidences vary widely from 5 to 40% depending on the setting and diagnostic criteria. The estimated attributable mortality is around 10%, with higher rates in surgical patients and severe cases at admission. VAP occurs because the obtunded, endotracheally intubated patient is at risk of lower respiratory tract inoculation with microorganisms. Potential inoculate source includes the oropharynx, subglottic area, sinuses and gastrointestinal (GI) tract. Access to lower respiratory tract occurs around endotracheal tube cuff **(Papazian et al., 2020 & Burja et al., 2018).**

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According to Centers for Disease Control and Prevention guidelines, patients must be mechanically ventilated for greater than 48 hours and exhibit at least three out of the five following symptoms: fever, leukocytosis, change in sputum (color and/or amount), radiographic evidence of new or progressive infiltrates, and worsening oxygen requirements . Interventions to prevent VAP aim either to prevent repeated micro-aspiration, colonisation of upper airway and GI tract with potentially pathogenic organisms, or contamination of ventilator/respiratory equipment **(Dewit et al., 2017 & Daniel et al., 2015).**

Ventilator associated pneumonia bundle prevention is defined as a series of interventions related to ventilator care that when implemented together, will achieve significantly better outcomes than when implemented individually to improve clinical outcomes. Recent evidence has challenged current widespread practice and so up to date recommendations on interventions for the prevention of VAP are needed. Previously, the introduction of a bundle for the prevention of ventilator-associated pneumonia (VAP) was associated with a decreased incidence of VAP **(Hellyer et al., 2016 & Lewis et al., 2014).**

Different measures for VAP prevention vary between institutions including: elevation of the head of bed to 30-45 degrees, daily sedation interruption, daily assessment for extubation, daily evaluation of the need for proton-pump inhibitors, and the use of endotracheal tubes (ETTs) with subglottic suctioning among others. The introduction of prevention measures can be incremental (i.e., one measure at a time) or simultaneous (i.e., all measures are introduced at the same time). Five key components for the VAP bundle : Elevate the head of the bed to 30 - 45° - Evaluate readiness for extubation daily - Use endotracheal tubes with subglottic secretion drainage - Conduct oral care and decontamination with chlorhexidine - Deep vein thrombosis prophylaxis and peptic ulcer disease prophylaxis **(Standring & Oddie , 2020 and Marini et al., 2016).**

Regarding the importance of VAP prevention in ICUs , infection consequences , lack in nursing personnel, high workload and difficulties in conventional learning methods , it is necessary to design and implement effective measures to be enforced . it seems that implementing prevention of VAP guideline can be effective in improving nurses' performance . Most hospitals implement VAP prevention elements as part of a prevention bundle, but the components of such bundles may vary from hospital to hospital **(Zolfaghari et al., 2014).**

Self-efficacy can be broadly defined as "people's judgements about their capabilities to organize and execute courses of action required to attain designated types of performance; it is concerned not with the skills one has but with judgements of what one can do with whatever skills one possesses" .General self-efficacy is defined as "an individual's perception of their ability to perform across a variety of situations" **(Ludwigson & Boin , 2018 , Bandura, 2006 & Judge et al., 1998)**

Critical care nurses are required to have specialized skills and knowledge which enable them to rapidly assess and problem solve life or death situations. High level cognitive and emotional competencies are associated with technical and relational dilemmas encountered daily in critical care settings **(Goldsworthy, 2016).**

Aim of the study:

This study aimed to assess nurses' awareness and self – efficacy regarding the bundle prevention protocol of ventilator associated pneumonia. This aim was achieved through the following:

- Assessment of nurses' awareness (knowledge and practices) regarding the prevention of ventilator associated pneumonia bundle.
- Identifying self – efficacy level among nurses under the study.

Research questions:

- What is the level of nurses' knowledge about ventilator associated pneumonia bundle prevention protocol ?
- What is the level of nurses' practices regarding ventilator associated pneumonia bundle prevention protocol ?
- What is the level of self – efficacy among nurses under the study?

Operational definitions:

- Bundle: Institute for Health Care Improvement (IHI) defined a bundle as a structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices performed collectively and reliably to improve patient outcomes .
- Awareness : means knowledge and practices .
- Critical / Intensive care nurses : specialized registered nurses (RNs) who provide care for patients with life-threatening or life-limiting conditions or injuries .
- Intensive care unit (ICU): highly specialized area in the hospital in which seriously ill or injured persons receive care.
- Knowledge: combination of "facts, information, and skills acquired by a person through experience or education" that implies "theoretical or practical understanding of a subject" .
- Self-efficacy: subjective, self-reported assessment of a person's ability to respond in an expected way during a predefined situation .

2. SUBJECTS AND METHODS

Design:

A descriptive exploratory design was utilized in this study.

Setting:-

The study was conducted in the critical care unit (CCU) at King Fahad Hospital.

Subjects:

A convenience sample was composed of 80 nurses working at the previous mentioned settings, added to 60 critically ill patients with different diagnosis.

Inclusion Criteria: -

Nurses

- Nurses working in the critical care unit with year of experience not less than one year
- Nurses who are willing to participate in the study.

Patients

- Patients on mechanical ventilator
- Patients without VAP

3. TOOLS OF DATA COLLECTION

Tool (I): Self administered questionnaire:

It was developed by the researcher in simple Arabic language based on the extensive review of relevant and recent literatures to assess nurses' knowledge about VAP and prevention bundle. It was include the following:

- **Demographic characteristics** of the study nurses such as age, sex, qualifications and clinical experience.
- **Nurses' knowledge assessment sheet :**

It related to the prevention of ventilator associated pneumonia bundle: anatomy and physiology of respiratory system, information related to mechanical ventilation, definition, risk factors, clinical manifestations, diagnosis, complications and prevention of ventilator associated pneumonia bundle.

Scoring System:

Studied nurses knowledge responses were scored as (1) for correct response and (zero) for incorrect. The satisfactory level was considered from 70%, while the unsatisfactory level was less than 70%.

Tool (II): An observational checklist:

It was adapted from recent and relevant literatures to assess the nurses' practices for mechanically ventilated patients regarding ventilator associated pneumonia bundle in intensive care units. It includes the following: Hand washing and cleansing - Performing postural drainage - Percussion and vibration - Suctioning - Oral care of ventilated patient -Change patient's position - Endo tracheal tube care - Nasogastric tube feeding - Giving medication through nasogastric tube feeding and Ventilator care .

Scoring System:

A correct practice was scored as (1), while the incorrect (zero). The satisfactory level was considered from 80%, while the unsatisfactory level was less than 80%.

Tool (III): General self-efficacy scale: It was developed by Schwarzer & Jerusalem (1995) to assess a general sense of perceived self-efficacy with the aim to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events.

Scoring system:

Responses are made on a 4-point scale. Sum up the responses to all 10 items to yield the final composite score with a range from 10 to 40 . Rating scale (1 = Not at all true , 2 = Hardly true , 3 = Moderately true and 4 = Exactly true) . Level of self-efficacy was considered high if the score 60% or more and low if it less than 60%. High internal consistencies were found in five sample studies using the GSES and the Cronbach's alphas ranged from 0.82 to 0.93.

Content validity:

It was assured by a group of experts from CCU and Nursing. . Their opinions were collected as regards to tools format layout, consistency and scoring system. Tools` contents were tested regarding to the knowledge accuracy, relevance and competence.

Ethical considerations:

In the planning stage approval was obtained from directors of the above mentioned settings. All nurses were informed about the study and their rights according to medical research ethics that they were free to decide whether or not they would participate in the study. Then a written informed consent was obtained from each nurse who agreed to participate in the study.

Pilot study:

A pilot trial was carried out on 10% of the total study sample to test the clarity and practicability of the tools, in addition to subjects and settings. Pilot subjects were later included in the study as there were no radical modifications in the study tools.

Field work:

- The study was started and expected to be completed within 3 months.
- Purpose of the study was simply explained to the nurses who agree to participate in the study prior to any data collection.
- The study tools was filled in and completed by the researcher once
- The researchers were available 2 days / week at morning and afternoon shifts.
- All studied nurses were assessed in groups that entail 3-4 nurses according to general physical and mental readiness using previously mentioned tools .

Administrative design

An approval to carry out this study was obtained from the director of the previously mentioned settings.

Statistical Design:

Data were organized, tabulated and analyzed using number, percentage, mean and standard deviation.

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4. RESULTS

Table 1: Characteristics of the studied nurses and patients in CCU

Items	**Studied Nurses (n= 80)**	
	No	**%**
Age	**33.3±25.1**	
Gender:		
Male	17	21.3
Female	63	78.7
Education:		
Diploma of nursing	41	51.3
Bachelor	27	33.7
Postgraduate	12	15.0
Years of experience:		
> 5yrs	59	73.7
5yrs. & more	21	26.3
Items	**Studied Patients (n=60)**	
	No	**%**
Age		
20 - < 30	32.0	40.0
30 & more	48.0	60 .0
Length of intubation and ventilation /days.	Min – Max (4-14)	

Table (1): Shows characteristics of nurses under the study, this table clarified that, mean age of them was (33.3±25.1). Considering gender, majority (78.7) of them were female. In relation to their experiences and educational level, more than half of them were less than 5 years experiences and had diploma degree (73.7 & 51.3 respectively).

As regards age of studied patients, three fifths (60.0) of them had the age of 30 yrs & more. Considering the intubation length, it was found as Min – Max (4-14).

Table (2): Distribution of study nurses' knowledge about ventilator associated pneumonia and prevention bundle

Items of knowledge	**Studied nurses (n=80)**	
	No	**%**
Definition / Causes of VAP	27	33.8
Investigation	39	48.8
Medical management of VAP	43	53.8
Manifestations of VAP	51	63.8
Complications of VAP	48	60.0
Definition / Importance of VAP prevention bundle	35	43.8
Components of VAP prevention bundle	33	41.3
Risk factors related to :		
Aspiration of secretion	43	53.8
Suctioning frequently	51	63.8
Incomplete infection control measures	27	33.8
Poor hand hygiene	33	41.3
Rubbing with alcohol when visible secretions	12	15.0
Multiple antibiotics	22	27.5
Malnutrition	20	25.0
$\overline{X}$ **No ± SD**	**34.6±12.0**	
% of Mean	**43.3%**	

Table (2): Reveals study nurses' knowledge about ventilator associated pneumonia and prevention bundle. Results revealed that manifestations of VAP and Complications of VAP were represent the highest percent of nurses' satisfactory knowledge (63.8 & 60.0 respectively) with mean = 34.6±12.0.

Table (3): Distribution of study nurses' satisfactory practices regarding patients general care and bundle prevention protocol for ventilator associated pneumonia VAP

Items of practices	Studied nurses (n=80)	
	No	%
Patients` general care		
Infection control measures	38	47.5
Using sterilized ambo bag / neubelizer device	36	45.0
Postural drainage	40	50.0
Percussion and vibration technique	38	47.5
Change patient's position	44	55.0
Care for endotracheal / Nasogastric feeding tube	45	56.2
Ventilator care	46	57.5
Bundle prevention protocol of VAP		
Head elevation 30-45 degrees	40	50.0
Mouth care with Chlorhexidine /8 hours	36	45.0
End tracheal suctioning care	44	55.0
Daily sedation vacation(break)	46	57.5
Assessment of readiness to extubate	45	56.2
Administration of DVT prophylaxis	46	57.5
Administration of peptic ulcer prophylaxis	47	58.7
$\overline{X}$ **No ± SD**	**42.2 ± 4.0**	
% of Mean	**52.7 %**	

Table (3): Reveals study nurses' satisfactory practices regarding patients general care and bundle prevention protocol for ventilator associated pneumonia VAP . Results revealed that Administration of PUD prophylaxis , DVT prophylaxis , assessment of readiness to extubate and end tracheal suctioning care were represent the highest percent of nurses' satisfactory practices (58.7 & 57.5 , 56.5 & 55.0 respectively) with mean = 42.2 ± 4.0.

Table (4): Distribution of study nurses' high self - efficacy level in CCU

Items of General Self - Efficacy Scale	Studied Nurses	
	High Self - Efficacy N= 80	
	No	%
Solve difficult problems if try hard enough.	38	47.5
Find means and ways to get what want	35	43.8
Easy to stick to aims and accomplish goals.	42	52.5
Confident to deal efficiently with unexpected events.	41	51.3
Know how to handle unforeseen situations	37	46.3
Solve most problems if invest the necessary effort	42	52.5
Remain calm when facing difficulties	38	47.5
Find several solutions when confronted with any problem .	37	46.3
Can usually think a solution , if I am in trouble	41	51.3
Can usually handle whatever comes my way	42	52.5
Mean No ± SD	**39.3± 2.6**	
% of Mean	**49.1%**	

Table (4): Shows distribution of study nurses' high self - efficacy level in CCU. Results revealed that easy to stick to aims and accomplish goals, solve most problems if invest the necessary effort, remain calm when facing difficulties and know how to handle unforeseen situations were represent the highest percent of nurses' self - efficacy (52.5 , 47.5 , 51.7 & 46.3 respectively). Moreover, mean of high self – efficacy was 39.3± 2.6.

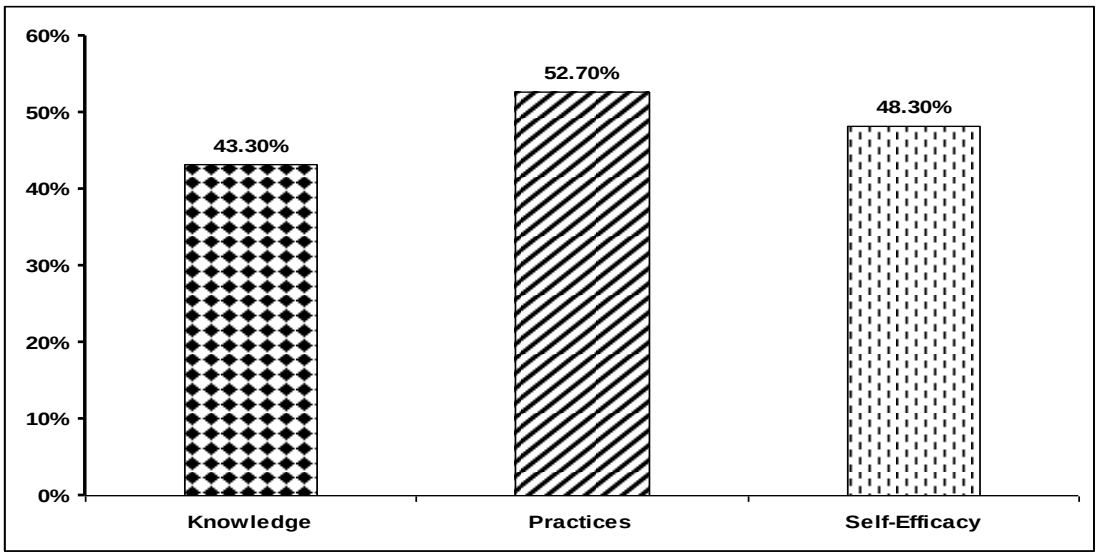

Fig.(1): Presentation of study nurses` awareness and self – efficacy as regards ventilator associated pneumonia bundle prevention protocol

5. DISCUSSION

Ventilator-associated pneumonia VAP is a significant contributor to patient morbidity and mortality in Intensive Care Units (ICU) and makes up 86% percent of nosocomial pneumonias . Nurses have great role in preventing the ventilator associated pneumonia. . The ventilator bundle consists of a group of evidence-based practices that implemented together to dramatically reduce VAP incidence in mechanically ventilated patients ***(*Russell et al. ,2016 & Blot et al. ,2014)** . This study aimed to assess nurses' awareness and self – efficacy regarding the bundle prevention protocol of ventilator associated pneumonia**.**

In the present study as regards studied nurses` satisfactory knowledge and practices for ventilator associated pneumonia (VAP **)** bundle prevention protocol **.** Results showed that less than half of study nurses had satisfactory knowledge and nearly half of them had satisfactory practices. Previous studies have shown that education and awareness of health care providers are effective in VAP prevention. In several studies surveyed the impact of VAP prevention protocol on infection incidence, it was seen that this protocol could reduce VAP significantly. In addition, nurses are expected to play an important role in prevention of nosocomial infections, particularly VAP. Nurses' lack of knowledge in field of mechanical ventilation is an obstacle to VAP prevention principles. Clinical guidelines in form of posters served as reminders and could improve care quality of ventilated patients. Moreover, comprising of nurses' education, reminding them to follow guideline and giving feedbacks can highly increase care quality **(Zolfaghari et al., 2014).**

In addition , nurses` orientation should include adequate information about VAP care such as : definition , causes investigation , signs and symptoms , risk factors , management , VAP prevention bundle and complications are most important to decrease occurrence of VAP rate . **Shaban et al. (2016) and Al - Ashry & Modrykamien (2014) in Khalil et al. (2018)** reported that more than three fifths of the sample had average knowledge about VAP and care bundle, infection control methods, routine oral care, enteral feeding, sterilizing respiratory instruments and devices, suction systems , semi-recumbent position , kinetic beds , cuff pressure should be maintained above 20 cm H2O to prevent the aspiration and below 30 cm H2O to prevent tracheal mucosa injury . Furthermore , nurses should oriented that VAP is associated with an estimated mortality rate between 20% and 70% and increased lengths of stay in ICU by 4-13 days for mechanically ventilated patients . Increased lengths of stay and additional treatments that occur as a result of VAP contribute to high hospital costs (**Luna, 2015)**.

On the same line, **Mohamed (2014) in Khalil et al. (2018)** found that less than half of nurses under study had adequate practices on : hand Washing, performing postural drainage, percussion and vibration, suction , oral care for, endotracheal tube care, nasogastric tube feeding, change position and ventilator care for patients with VAP . In addition, some interventions had very high percentages: elevated head of bed between 30-45° (92.7%), oral care to (95.1%), or mobilization (86.6%), spontaneous breathing trials (72%), maintain cuff pressures on endo tracheal tube. **Wolfensberger et al. (2018) & Luna (2015)** stated that research has demonstrated that treatment within the first 48 hours can significantly reduce mortality by at least 30% . Preventative measures such as the VAP bundle can be taken to reduce the incidence of VAP during hospitalization. In doing so, the health and wellness of patients who are already in critical condition can be protected and improved.

In relation to high self - efficacy level among the studied nurses in CCU. Results revealed that less than half of the study nurses had high self – efficacy , added to finding several solutions when confronted with any problem , confident to deal efficiently with unexpected events and solve most problems if invest the necessary effort were represent the highest percent of nurses' self - efficacy . **Du Toit (2020) & Worldometers (2020)** recognized that attention to general population education regarding transmission modes, prevention methods and treatment options are of most extreme significance. Effective implementation is as important as choosing the right bundle components. Adherence to and knowledge about VAP prevention measures were shown to be poor in several studies **(Wolfensberger et al., 2018) .** Self-efficacy can be enhanced through formal education and training programs, particularly when the individual perceives the training to be like the work environment where they will apply their learned skills (**Ludwigson & Boin, 2018).**

6. CONCLUSION

Overall, the present study concluded that more than two fifths of studied nurses had satisfactory awareness (knowledge and practices) as regards the bundle prevention protocol of ventilator associated pneumonia. In addition, less than half of them had high self – efficacy level during their work in the critical care units.

7. RECOMMENDATIONS

- The study reinforces the need for sustained education and training regarding VAP prevention bundle.
- An orientation program for the newly assigned nurses in the critical care units.
- Further studies should be carried out on a large number of critical care nurses with evidence of results and generalization.

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