Preventive bacterial translocation and control of ventilator-associated pneumonia: A qualitative study

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Abstract

Background: Bacterial translocation is one cause of ventilator-associated pneumonia among patients treated in the Intensive Care Unit.
Purpose: The study aimed to observe critical nurses information about bacterial translocation prevention and ventilator-associated control in clinical settings.
Methods: A qualitative phenomenology design was undertaken from July to September 2021. We recruited 40 critical nurses in government and educational hospitals in Surabaya, Indonesia. The in-depth online interview was conducted during the interview process and analyzed using Colaizzi's technique.
Results: We emerged five themes that consist of 1) limited of nurse's competence, 2) unsupported work environment, 3) barrier of human resource management, 4) work motivation, and 5) development of bacterial translocation preventive tools.
Conclusion: Prevention of bacterial translocation is needed by developing tools and accessible by nurses, whereas, the capacity and ability need to be developed by training. Nurses and Hospital Managers should consider attention to evidence-based tools in clinical settings.

Keywords: bacterial translocation; ventilator-associated pneumonia; prevention; intensive care unit; nurse

Introduction

The increased risk of nosocomial infection is one of the problems faced by patients treated in the intensive care unit (ICU) (Kózka et al., 2020), one of which is Ventilator-Associated Pneumonia (VAP) in the lower respiratory tract. Comprehensive efforts are needed to deal with the problem of VAP because it causes increased morbidity. VAP is caused by various factors, including improper infection control and the transfer of bacteria from the external environment into the body (Bacterial Translocation) (Vance et al., 2010). VAP occurs in 5–40% of patients on invasive mechanical ventilation for more than two days (Atashi V Mahjobipoor H, Yazdannik A.Atashi, Vajihe, 2018). High mortality is the greatest risk of patient mortality where VAP can reach 70% (Torres et al., 2017) and the incidence of VAP in the ICU is about 5-15% of total patients (Klompas et al., 2014). Proper prevention of VAP can reduce the length of stay, lower treatment costs and increase patient satisfaction (Samra et al., 2017).

The quality of health services is determined by the primary role of nurses (Koch et al., 2020). The skills of nurses in nursing care and preventive measures are very important factors to minimize complications. ICU care requires complex observation, therapy, high-intensity intervention, and continuous observation (Vance et al., 2010). Currently, nursing care must minimize complications, including bacterial translocation and micro aspiration in the airways.

Efforts to prevent bacterial translocation from the oral cavity to the external Endotracheal Tube (ETT) can prevent VAP. The ETT is a link between the patient and the ventilator, which can mobilize the oral microbiota, and can be colonized by oral bacteria or commensal respiration (Alagna et al., 2019; Jaillette et al., 2015). Leakage of fluid around the ETT cuff into the airway is a form of micro aspiration and bacterial translocation that can cause VAP. (Hamilton & Grap, 2012; Jaillette et al., 2015). When the ETT tube cuff balloon pressure is at its maximum level, micro aspiration and bacterial translocation can be prevented (Hamilton & Grap, 2012). However, nurses may not permanently anticipate reduced ETT balloon pressure due to the workload in the ICU and the limited equipment.

Based on an initial study conducted at two hospitals in Surabaya, Indonesia, it shows that nurses still do not fully understand the condition of bacterial translocation, especially in patients who are attached to ventilators. Of the 60 nurses who were interviewed, only 40 nurses had a thorough understanding of bacterial translocation and how to properly apply a ventilator bundle to prevent bacterial translocation from occurring. Meanwhile, the other 20 nurses still had superficial understanding because they had only been in the ICU for no more than two months and had not received formal internal training. These new nurses are also still learning based on the experience gained from senior nurses in the ICU.

Previous studies also have shown that the cause of VAP is more often due to a lack of cleanliness from the surrounding environment, nurses, and oral hygiene (Gupta et al., 2016; Hua et al., 2016; Karakaya et al., 2021). Nurses who always provide care to patients with installed should have more information and skills related to this evidence practice. Therefore, this study aims to seek information with a qualitative approach from critical nurses in the ICU about bacterial translocation and control of VAP in patients on ventilators.

Materials and Methods

Design
This study used a qualitative phenomenology design with a constructivist paradigm. Interpretative phenomenology was used to understand the experience and need of critical nurses about preventive bacterial translocation to prevent VAP (Mayer, 2015), while the constructivist paradigm involves the active role of the social and practitioner values in shaping the descriptions and statements expressed by the participants (Allen, 2008). The researchers were health professionals with expertise in the critical nursing and medical surgical nursing departments and had experiences in qualitative research. The research team consisted of men and women. No team member had a relationship with any participants in the study.

Settings and Participants
The study was conducted in the Non-Infectious Intensive Care Unit (ICU), Government and Educational Hospital in Surabaya, Indonesia. The data were collected from July to September 2021. The participants were recruited by purposive sampling. We collaborated with Nurse Unit Manager (NUM) to obtain the participants with the inclusion criteria being nurses in the ICU, working more than one year and having the clinical privilege to treat patients with ventilators from the hospital. Forty-four participants were recruited, and we asked informed consent to participate in the study.

Data collection
An in-depth interview was used to carry out the information from critical nurses, and four researchers conducted the interview process. Due to COVID-19 pandemic in Indonesia, and the higher incidence in the middle of 2021, we interviewed by online meeting with Zoom application. Before we conducted the interviewer, we sent the informed consent to participants to participate in the study. Furthermore, we asked for an agreement to record the Zoom meeting without video and only audio. All the recorded interviews were saved in the Zoom and only be accessed by the researcher to maintain privacy. The researcher designed the interview questions and got inspiration about the topic of study from clinical nurses who worked in the ICU. Before the questions were asked to participants, they were assessed by four experts (one expert in the critical nursing department, one medical doctor with a specialization in intensive care, and two nursing managers in the hospitals). To conduct the validity and reliability of the content of the questions, we performed interviews with three critical nurses. After that, we observed the question and where challenging to understand by participants, we revised them.

Furthermore, the interview process begins by building trust between the researchers and participants. Moreover, the research objectives were explained by the researcher. The questions during the interview process included *"How did you know about bacterial translocation and VAP?"; "How do you control the prevention of bacterial translocation?"; "What are the limitations faced to prevent VAP?"; "What is the hope for preventing bacterial translocation and VAP?".* Each participant was interviewed for approximately 20 minutes.

After the interview process was completed, the researcher conducted it verbatim. Then, the researcher re-confirmed to the participants regarding information that was still unclear and to obtain the correct information. Triangulation of the interview was undertaken to enrich the data (Heath, 2015). Recruiting additional participants ceased when the data reached saturation.

Data analysis
The transcription and verbatim processes were

Table 1. Respondent Characteristics

Participant Code	Gender	Age	Occupation Status	Nurse Level	Latest Education	Experience of Work (Year)	Experience of Work in ICU (Year)	Marital Status
P1	F	41	Civil Servant	CN 3	Diploma	20	18	Married
P2	F	37	Civil Servant	CN 3	Bachelor of nursing	15	11	Married
P3	M	34	Civil Servant	CN 2	Diploma	9	5	Married
P4	F	33	Contract Employee	CN 2	Diploma	9	9	Married
P5	F	31	Civil Servant	CN 1	Diploma	8	1	Married
P6	F	45	Civil Servant	CN 3	Bachelor of nursing	20	17	Married
P7	F	36	Contract Employee	CN 3	Bachelor of nursing	12	4	Married
P8	F	27	Civil Servant	CN 1	Diploma	5	1	Married
P9	F	27	Civil Servant	CN 1	Diploma	2	2	Married
P10	F	31	Freelance	CN 2	Bachelor of nursing	7	4	Married
P11	M	30	Civil Servant	CN 2	Bachelor of nursing	7	2	Married
P12	M	28	Contract Employee	CN 2	Diploma	5,5	4,5	Single
P13	F	48	Civil Servant	CN 3	Diploma	26	1	Married
P14	F	29	Civil Servant	CN 2	Diploma	8	8	Married
P15	M	34	Freelance	CN 2	Diploma	13	1	Married
P16	F	48	Civil Servant	CN 3	Diploma	24	14	Married
P17	F	45	Civil Servant	CN3	Diploma	21	1	Married
P18	F	26	Civil Servant	CN	Diploma	3	2	Single
P19	F	29	Contract Employee	CN 1	Bachelor of nursing	4	1	Married
P20	F	42	Civil Servant	CN 3	Diploma	21	14	Married
P21	F	27	Civil Servant	CN 2	Bachelor of nursing	4	4	Married
P22	F	29	Civil Servant	CN 2	Diploma	7	1	Married
P23	M	35	Contract Employee	CN3	Diploma	12	9	Married
P24	F	35	Civil Servant	CN2	Diploma	14	7	Married
P25	M	26	Contract Employee	CN 1	Bachelor of nursing	2	1,5	Single
P26	F	29	Civil Servant	CN 1	Bachelor of nursing	5	1,5	Married
P27	F	25	Contract Employee	CN	Bachelor of nursing	1	1	Single
P28	M	27	Civil Servant	CN	Bachelor of nursing	3	1	Single
P29	F	31	Civil Servant	CN 2	Bachelor of nursing	7	5	Single
P30	F	25	Civil Servant	CN2	Bachelor of nursing	1	1	Sngle

Cont. Table 1. Respondent Characteristics

Participant Code	Gender	Age	Occupation Status	Nurse Level	Latest Education	Experience of Work (Year)	Experience of Work in ICU (Year)	Marital Status
P31	F	33	Civil Servant	CN 2	Master of Nursing	11	5	Married
P32	F	23	Contract Employee	CN	Diploma	1	1	Single
P33	F	29	Contract Employee	CN 1	Bachelor of nursing	6	6	Married
P34	F	27	Contract Employee	CN 1	Bachelor of nursing	2	1	Single
P35	F	30	Contract Employee	CN 1	Bachelor of nursing	6	2	Married
P36	F	24	Contract Employee	CN	Bachelor of nursing	2	1	Single
P37	M	27	Freelance	CN	Bachelor of nursing	3	1	Married
P38	M	29	Freelance	CN 2	Bachelor of nursing	5	5	Single
P39	F	27	Contract Employee	CN1	Bachelor of nursing	3	3	Single
P40	M	30	Contract Employee	CN 1	Bachelor of nursing	6	6	Married
P41	M	31	Contract Employee	CN2	Bachelor of nursing	7	6	Married
P42	M	25	Contract Employee	CN	Bachelor of nursing	1	1	Single
P43	F	25	Contract Employee	CN 1	Bachelor of nursing	5	5	Single
P44	M	29	Contract Employee	CN 1	Bachelor of nursing	5	3	Single

Abbreviation = P : participants; F : female; M : male; CN : clinical nurse; HCU : high care unit

carried out using Microsoft Word 365. After that, the researchers coded and analyzed using the NVivo 12 software (QSR International). The analysis of the interview results used Colaizzi's technique. The stages consisted of 1) familiarization with the transcript; 2) identifying significant statements; 3) formulating the meanings; 4) clustering the themes; 5) developing a detailed description; 6) producing the fundamental structure; and 7) seeking verification of the fundamental structure (Morrow et al., 2015). To enhance the quality and transparency of the study results and the associated reporting, the researchers applied the Standards for Reporting Qualitative Research (SRQR) (O'Brien et al., 2014).

Ethical consideration

We received ethical approval from the Health Commission Ethics Committee of Haji Surabaya Hospital (No. 073/16/KOM.ETIK/2021) and Universitas Airlangga Hospital (No. 154/KEP/2021). Participants were required to give their written consent to participate free of coercion. They could withdraw from the study without giving a reason, and with no impact on their health care, and could decline to answer any of the questions. Furthermore, the researchers maintained their privacy throughout the interview process. All of the data were de-identified at transcribing, with participants being named according to a number such as P1, P2 and so forth. The study did not have the potential to harm the participants physically or mentally.

Results

Respondents Characteristics

Table 1 shows the characteristics of the research participants. The number of participants was 44 people consisting of 31 female participants and 13 male participants. All participants were at least 25 years old with the majority employee status being civil servants, while the other employee statuses were contract and honorary employees. As many as 26 participants were graduates of a bachelor of nursing and the rest were graduates of a nursing diploma. All participants had worked in the hospital for at least one year.

Analysis of the interview and the field observation

data resulted in the development of four main categories and fifteen subcategories which reflected nurses' perceptions to prevent bacterial translocation in order to control ventilator-associated pneumonia. Detailed explanations about the categories and subcategories are provided in what follows.

Theme 1: Limited of Nurse Competence

Nurses' understanding of bacterial translocation is still limited. This is associated with nurses' lack of knowledge about the term bacterial translocation and the mechanism of bacterial translocation. This theme is grouped into four subcategories, namely lack of knowledge, unexpected behaviour, lack of opportunity to practice new skills, and no standard VAP bundle.

Lack of knowledge of nurses regarding bacterial translocation and micro aspiration

The incidence of bacterial translocation is still not fully understood for most nurses, but nurses understand that bacterial translocation in patients who are on a ventilator is one of the triggering factors for the occurrence of VAP.

"Here, we rarely use the term bacterial translocation, so we don't really understand it. Maybe it means the transfer of bacteria from the mouth to the bottom, do you understand? Or how about it, basically it can trigger the occurrence of VAP if left alone." (P.12)

"I don't know yet, ma'am. Is that different from micro aspiration? As far as I know if it's the same as micro aspiration it can cause VAP." (P.19)

"As far as I know, bacterial translocation is the transfer of bacteria from A to B, from one patient to another. Maybe from poor oral hygiene then it could also be related to VAP because there are mucus that enters the lungs through small gaps." (P.2)

Unexpected behaviour from nurses

Nurse professionalism influences the implementation of VAP prevention measures. This action should still be carried out even though there are limitations of both time and energy. However, in some cases, VAP precautions such as measuring the ETT cuff voltage routinely can be missed or not carried out according to standards.

"We measure the air content, but it depends on the size of the contents. Usually there are those who report that the contents of the hot air balloon are 10 ml and some do not mention it."(P.15)

"… If the cuff meter doesn't exist yet, so we use instinct, we'll just estimate how many ml the ETT cuff balloon contains." (P.23)

"… it should be measured periodically, but in practice, only if there is an indication of the monitor." (P.5)

Have not received special training for ICU nurses

Information related to bacterial translocation is obtained from training that is routinely carried out from inside and outside the hospital. There are still many nurses who have just been placed in the ICU who have not received training.

"We have an ideal program for one nurse to have hours of education, so there is in-house training that needs to be done. So in-house training is often encouraged because during the pandemic it was neglected. So the facilities for the new siblings don't exist, so it's quite difficult." (P.11)

"Maybe it's more about socializing the VAP bundle because it's for new friends. We work with many people, but not all understand about the VAP bundle and I think there should be interference from the leadership either later to the PPI section to provide solutions so that we have the same understanding of VAP. I don't know how the PPI can find out, especially since there are a lot of new kids here and we can't teach them all" (P.23)

There is no standardized measuring of ETT cuff

Ventilator Associated Pneumoniae Bundle standards are needed so that nurses can act according to procedures and no action is missed. Checking the ETT cuff still has no standard, thus, the absence of a standard makes nurses have different ways of measuring the ETT cuff.

"In the ICU there has not been a clear standard, so we (nurses) only measure the ETT cuff according to each other's experience." (P.1)

"We usually do socialization via IPCLN and indeed there are no special tools to check the VAP bundle check list."(P.12)

"Yes, usually the VAP bundle is explained how the standard is, but at this time it has not been formally explained, only a few have just been submitted."(P.13)

Theme 2: Unsupported Work Environment

An unsupportive work environment includes several things that can hinder the work of nurses. There are four sub-themes including the situation during work, many workload, time constraints, and a lack of team approach.

Working situation during the pandemic

During the pandemic, the limited number of nurses and the available time became a barrier for nurses to be able to measure the ETT cuff. This action is often missed and is not a priority if the number of patients is large but the number of nurses is reduced.

"Yes, actually there are enough nurses, but because of the pandemic, some nurses have been transferred to the COVID isolation room, so there are more nurses in their work rooms. If we measure only occasionally, when there is an alarm on the ventilator, we will check it" (P.12)

"In this time of a pandemic, there are people who are basically not in the ICU, if their staff is limited and they really want to be admitted to the ICU, it would be better to hold in-house training first. So friends who enter the ICU already know what to do." (P.13)

"The problem was that before the pandemic we could enter at any time, there was no time limit to enter if after this pandemic we were on guard. In the past, oral hygiene could be done three times a day now two times." (P.19)

Excessive workload

The disproportionate comparison between the number of nurses and patients makes nurses only do the work they can do during shifts. As a result, there are nurses who do not take action according to procedures.

"In fact, if there are many patients, we ourselves do not do it. Usually if oral hygiene is three times a day, but if there are many patients, we can do as much as we can." (P.26)

"We should have worked according to the procedure every shift. But when we have a lot to do, we usually do what we can. Sometimes late to do, sometimes forget." (P.35)

Lack of team approach

So far, junior nurses have only received training through actions exemplified by senior nurses. However, this assistance is not always possible, because senior nurses also have the responsibility to treat patients.

"Yes, it is routinely implemented, but socialization to new nurses is only when taking action. So at the same time give an example. But if there are a lot of patients, the nurse we just asked to see." (P.14)

"But because the previous PPI person was from the ICU, we often get knowledge about the VAP bundle from him, if it's from a PPI hospital, it's very rare, we've never had it." (P.12)

"It is undeniable that there are now many new nurses in the ICU who may not be exposed to this VAP bundle. Senior nurses also don't always have enough time to guide them." (P.26)

Theme 3: Barriers of Human Resource Management

Human resource management is one of the obstacles in the implementation of routine ETT cuff measurements. This is related to the limited number of nurses, lack of training activities for nurses, lack of supervision from the leadership and lack of collaboration with other units.

Limited number of nurses

The limited number of nurses makes actions that should be routinely missed and even not carried out. Three participants said that the small number of nurses could not carry out all the actions completely.

"The comparison between senior and junior nurses is not balanced. There is still responsibility to the patient so other actions may be neglected." (P.12)

"Perhaps the frequency is not routine, so it should still be three times a day. During the night service, it is often done, but in the morning service it

is rare. If there are many personnel on duty and not too busy, it can still be done."* (P.29)

"From me, the ratio of nurses and patients is urgent. From me, the ratio of those in charge has an effect." (P.20)

Lack of supervision from the head of the room

The head of the room still often skips supervision for checking the ETT cuff. Supervision is more focused on other priority actions. If there is no alarm from the ventilator, then the ETT cuff balloon is considered not problematic and measurements are not always taken.

"The problem so far is the lack of reminding each other to check the ETT cuff pressure." (P.11)

"If the ETT cuff pressure is rarely asked, yes, because it is considered routinely done, or if the ventilator alarm does not turn on, then it is considered that there is no disturbance in the ETT cuff." (P.30)

Lack of collaboration

Collaboration with the Infection Prevention and Control (IPC) section is needed to provide information and supervise the implementation of efforts to prevent bacterial translocation and micro aspiration.

"Perhaps the important thing is the socialization of the VAP bundle. Because not everyone understands about bacterial translocation and microaspiration and bundle VAP. I think there should be interference from the leadership or the PPI section to provide a solution so that we have the same understanding of VAP." (P.39)

"It seems that the knowledge is still lacking, but we always set an example. I hope the IPC department can provide training soon." (P.40)

Theme 4: Work Motivation

Most nurses stated various sources of motivation at work. Motivation comes from outside and from within the nurse. There are three sub-themes of work motivation, namely moral responsibility as a nurse, empathy for the patient's condition, and reflection on one's own condition.

Nurse's moral responsibility

Nurses consider work is a responsibility that must be carried out to help patients.

"Because yes, the mindset is working and my job is like this. So you have to be responsible and later if you see a patient affected by VAP, I feel sorry for you. It really has to be taken care of." (P.14)

"The consequence of my job is to treat COVID patients like that. So it must really be done responsibly and sincerely." (P.31)

Empathy for the patient

Nurses' empathy encourages them to work earnestly to support the patient's healing process.

"Considering that patients are their own family. To avoid VAP, HAP or the other by doing the treatment

correctly and appropriately. Even though sometimes we forget and no one is watching for sure, we must still carry it out correctly." (P.25)

"Patients come in very hopeful to recover. Although we cannot promise to be cured, at least we must provide the best care. It's a shame his family is confused too." (P.32)

Reflection on self and family

The patient's condition gives the nurse the view that the condition experienced by the patient can also happen to themselves and their families.

"Yes, by helping patients recover, we can save ourselves too. So it's not only saving patients but also saving our lives like that." (P.26)

"I always imagined that it was my family who were sick. It's a pity if you have to stay in the hospital for a long time, so as much as possible you will be treated so that your condition will improve quickly." (P.29)

"The patient's family often asks me how the patient's condition is. I always feel sad when asked like that. Confused to answer how his condition." (P.22)

Theme 5: Development Bacterial Translocation Prevention Tools

Tool limitations

The tools used to measure the ETT cuff voltage are not yet available. The nurse only uses a syringe to fill the ETT cuff balloon by calculating the contents or size of the balloon volume.

"This check is carried out every time we take action. Usually when we are going to do oral hygiene or suctioning we also check the cuff, but we don't use a cuff meter and it's just an estimate that the cuff is inflated well or not." (P.14)

"Actually, it is measured using a tool, but here we don't have the tool so we measure it manually using an injection syringe," (P.17)

"There is a special tool to measure the ETT cuff balloon, but we don't have one. Usually we enter the air by looking at the plunger of the syringe. When the plunger has stopped it can't be pushed to enter the air, usually the volume is right." (P.19)

Easily accessible tools

Nurses want a tool that is easy to use and can ease the work, especially when there are a lot of patients in the ICU. The tool used is expected to be more accurate in measuring the ETT cuff voltage and can be monitored remotely.

"We want the tools not to be manual and the reporting is not manual either. If possible electronically at the same time with the recording." (P.25)

"Yes, I want to reduce contact with patients in order to minimize the incidence of infection. The hope can be easier by being able to see the cuff voltage from a distance, saving energy and time. Especially those in the ICU specifically for COVID,

we cannot contact patients all the time, so being able to monitor remotely will be very useful" (P.28)

"I want a more advanced tool, the image is like the one that is pumped first, then the needle goes forward and then back again. It's better if the form of numbers is more accurate or like digital tension like that" (P.30)

"Actually, it doesn't really add to the workload. The hope is that we can have a tool that can be used simultaneously and to make it easier for me and my friends to control the ETT cuff. It also has a number of tools that suit your needs, so that my friends and I don't have to take turns and it saves work time too." (P.37)

Discussion

The intensive care unit (ICU) is for patients who are, at risk or likely to experience acute organ failure and life-threatening problems. Treatment in the ICU aims to prevent further physiological deterioration by treating the underlying disease (Marshall et al., 2017). Nurses who work in the ICU must have high competence (Rathnayake et al., 2021). The basic competencies that ICU nurses must possess are knowledge, skills, attitudes and values and experience (Lakanmaa et al., 2015). One of the nurse's competencies is to treat patients who use mechanical ventilators. Patients who are on a ventilator are at high risk for infection, one of which is vaping. VAP can be prevented by reducing bacterial translocation in the supraglottic due to decreased ETT cuff tension (Gatt et al., 2007).

The results showed that nurses' knowledge about bacterial translocation was still limited. Nurses do not understand about bacterial translocation, the mechanism of its occurrence and how to prevent it. This limited knowledge makes nurses measure the ETT cuff not according to the Standard Operating Procedure (SOP). Lack of knowledge about bacterial translocation triggered by ETT cuff is because measurement standards are also not yet fully available in the ICU and not all nurses have received training on VAP prevention, especially ETT cuff measurement. Increased knowledge of nurses can be done through training. Training is carried out periodically, namely during the orientation program when workers start working in the ICU (pre-employment check) and periodic training (Esin & Sezgin, 2017). Some of the nurses who work in the ICU are not ICU nurses and 19% of those who receive an introduction to the ICU COVID-19 (Bergman et al., 2021). Head nurses need to increase training opportunities for implementing nurses to increase competence in providing care to patients (Rahmah et al., 2022; Suhariyanto et al., 2018).

The COVID-19 pandemic has increased the number of patients being treated in the ICU. Some patients are classified as critical patients who have severe hypoxemia and require mechanical ventilation. Some of the problems experienced in

the ICU during the pandemic are the limited number of competent nurses, the low ratio of patients and nurses, the limited number of consumables, oxygen and medicines and PPE (Semedi, 2020). This study shows that the unfavourable work situation during the pandemic contributes to the quality of patient care in the ICU. The limited number of nurses and the large number of patients and limited working time make nurses not optimal in carrying out care, including patients who are on a ventilator. The ratio between the number of nurses and patients in the ICU is not comparable. In several hospitals in Surabaya, nurses who have never served in the ICU room before will be assigned to help in the room so that the workload can be evenly distributed. On the other hand, this can make it easier for nurses to work, but the expertise to provide care, especially for patients who are attached to a ventilator, is lacking. As a result, nurses who are at the CN 3 level must simultaneously teach new nurses in the midst of being busy caring for patients. In addition, supervision from the team leader during office hours is also considered to be lacking. During the pandemic, ICU nurses are responsible for caring for more than three patients in one shift. Patient safety during the early phase of a pandemic is compromised. Nursing care is highly prioritized during the pandemic, which is associated with a lack of time, resources, and required competencies (Bergman et al., 2021). The recommended nurse-patient ratio for patient care on a ventilator is 1:1 (Esin & Sezgin, 2017).

Nurses who work in the ICU need high motivation. In this study, nurses have a high motivation to treat patients. They think the job is a part of moral responsibility as a nurse. Feeling empathy with the conditions experienced by patients in the treatment room and reflection that caring for patients is considered as a taking care of yourself or your family. The biggest motivation that nurses have is that which comes from within themselves (internal motivation). In a study on "Nurses' perspectives of taking care of patients with Coronavirus disease 2019: A phenomenological study," it was stated that the motivation that underlies nurses to provide care for COVID-19 patients is professionalism as a nurse (Rathnayake et al., 2021). Motivation to work based on morality, empathy and a sense of responsibility, makes nurses comply with work procedures. So that even with a heavy workload, nurses still carry out their actions carefully and do not just carry out their obligations because they have considered the patients being treated as their own family. This is reflected in the large number of actions in patients who are attached to a ventilator.

Conclusion

Controlling VAP though preventive bacterial translocation is needed based on nurses' perspective. The development of real-time monitor tools to observe the pressure of ETT cuff can be promising to control the nosocomial infection especially VAP in the ICU and decreased the nurse's workload. This evidence could be a suggestion for the management in the hospital and clinical nurses to develop a new guide and tools. Further researchers are expected to create a prototype of ETT cuff censor monitor.

Ethics approval and consent to participate

We received ethical approval from the Health Commission Ethics Committee of Haji Surabaya Hospital (No.073/16/KOM.ETIK/2021) and Universitas Airlangga Hospital (No. 154/KEP/2021). Participants were required to give their written consent to participate free of coercion. They could withdraw from the study without giving a reason, and with no impact on their health care, and could decline to answer any of the questions. Furthermore, the researchers maintained their privacy throughout the interview process. All of the data were de-identified at transcribing, with participants being named according to a number such as P1, P2 and so forth. The study did not have the potential to harm the participants physically or mentally.

Consent for publication

Not Applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

None

Author contributions

YSD

contributed to the conceptualization, investigation, and methodology.

AQ

contributed to data curation, resources, validation, visualization, writing – original draft, and writing– review & editing.

HA, ROP

contributed to formal analysis, software, writing – original draft, and writing– review & editing.

LSB

contributed to writing – original draft, and writing– review & editing

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