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

Yulis Setiya Dewi1*, Arina Qona’ah1, Hidayat Arifin2, Rifky Octavia Pradipta1, Lizy Sonia Benjamin3

1Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia
2Department of Medical-Surgical Nursing, Faculty of Nursing, Universitas Padjadjaran, Bandung, Indonesia
3Department of Medical-Surgical Nursing, King Khalid University, Abha, Kingdom of Saudi Arabia

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 analysed 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. Whereases, the capacity and ability need to be developed by training. Nurses and Hospital Managers consider putting the attention of 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), and one of them 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 2 months and had not received formal internal training. This new nurse is 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 was 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 were 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 approached 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 incident was 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 could and only assessed by the researcher to keep the 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, it has been interviewed 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 whereas challenging to understand by participants, and 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 get 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

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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 was deidentified 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. A total of 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.

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

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and fifteen subcategories which reflected nurses’ perceptions to prevent bacterial translocation in order to control ventilator-associated pneumonia (Figure 1). 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, both time and energy limitations. 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 in measuring 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 have no standard, thus, the absence of a standardized 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, a lot of 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)
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 3 times a day now 2 times.” (P.19)

Lots of 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 3 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 cannot contact patients all the time, so being
voltage from a distance, saving energy and time.
order to minimize the incidence of infection. The
reporting is not manual either. If possible
be monitored remotely.
accurate in measuring the ETT cuff voltage and can
in the ICU. The tool used is expected to be more
work, especially when there are a lot of patients
Nurses want a tool that is easy to use and can ease
the patient’s condition gives the nurse the view that
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 an intensive care unit 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 and treating the underlying disease (Marshall et al., 2017). Nurses who work in the ICU are nurses who 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 to measure the ETT cuff not according to the Standard Operating Procedure (SOP). Lack of knowledge about bacterial translocation triggered by ETT cuff 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 hypoxaemia 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 take care of yourself or their family. The biggest motivation that nurses have is that it 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 with a heavy workload, nurses still carry out their actions carefully and 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 are needed based on nurses perspective. The development of real time monitor tools to observe the pressure of ETT cuff can be a promising to control the nosocomial infection especially VAP in the ICU and decreased the nurse’s workload. This evidence could be suggestion for the managerial in the hospital and clinical nurse to develop new guide and tools. Further researchers are expected to create the prototype of ETT cuff sensor monitor.

Ethics approval and consent to participate
We received ethical approval from the Health Commission Ethics Committee of Haji Surabaya Hospital (No.073/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 was deidentified 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

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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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