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The Role of Nursing Interventions in Preventing Ventilator-Associated Pneumonia in ICU Settings - A Descriptive Literature Review

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Abstrakti

Tässä opinnäytetyössä tutkittiin ventilaattoriin liittyvää keuhkokuumetta (VAP), joka on merkittävä hoitoon liittyvä infektio, jota esiintyy yleisesti teho-osastoilla ja joka lisää sairastuvuutta, kuolleisuutta ja terveydenhuollon kustannuksia. Kuvaileva laadullinen kirjallisuuskatsaus tehtiin käyttäen seitsemää vertaisarvioitua artikkelia, jotka julkaistiin vuosina 2015-2025. Tutkimukset valittiin relevanssikielen (englanti) ja merkityksellisyyden perusteella teho-osaston ja VAP:n ehkäisyn kannalta. Tutkimukset valittiin PubMedistä, CINAHLista, ProQuestista ja Google Scholarista. Tiedot analysoitiin ja luokiteltiin yleisten hoitotoimenpiteiden tunnistamiseksi ja potilastulosten parantamiseksi. Tämän tutkimuksen tarkoituksena oli kuvata hoitotyön toimenpiteiden merkitystä hengityskoneeseen liittyvän keuhkokuumeen (VAP) ehkäisemisessä tehohoitoympäristössä. Ja tavoitteena on tuottaa uutta käytännön tietoa erityisistä hoitotyön interventioista VAP:n ehkäisemiseksi. Hoitotoimenpiteet, joita tunnistettiin, sisälsivät muun muassa endotrakeaalisen (ETT) mansetin paineen ylläpitämisen, pään kohottamisen, suun hoidon klooriheksidiinillä, aseptisen imun, hengityskonepiirin ylläpidon ja sedaation arvioinnin. Nämä käytännöt olivat yhteydessä VAP:n esiintyvyyden vähenemiseen, komplikaatioiden vähenemiseen, sairaalassaoloaikojen lyhenemiseen ja kustannusten vähenemiseen. Tuloksissa korostettiin, että näyttöön perustuva hoitotyö on olennaisen tärkeää VAP:n ehkäisemiseksi ja potilastulosten parantamiseksi teho-osastolla. Tutkimuksessa korostettiin myös tarvetta tehostettuihin koulutusohjelmiin, standardoituihin protokolleihin ja institutionaaliseen tukeen, jotta voidaan ehkäistä tietämyksen.

Asiasanat	Hengityskoneeseen liittyvä keuhkokuume (VAP), Mehkanainen ventilointi, Hengityskonehoito, ICU, Tehtävä, Tehoosasto, Tehoosastoyksikkö
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Abstract

This thesis studied Ventilator-Associated Pneumonia (VAP), a significant healthcare associated infection commonly seen in ICUs, which contributes to increased morbidity, mortality, and healthcare costs. The descriptive qualitative literature review was conducted using seven peer-reviewed articles published between 2015 and 2025. Studies were selected based on relevance language (English) and relevance to ICU and VAP prevention. Studies selected from PubMed, CINAHL, ProQuest, and Google Scholar. The data were analyzed and categorized to identify common nursing interventions and improve patient outcomes. Purpose of this study was to describe the role of nursing interventions for preventing Ventilator Associated pneumonia (VAP) in Intensive Care settings. And the aim of this is to produce new practical knowledge about specific nursing interventions for preventing VAP. Nursing interventions identified, including maintaining endotracheal (ETT) cuff pressure, head-of-head elevation, oral care with Chlorhexidine, aseptic suctioning, ventilator circuit maintenance, and sedation assessment. These practices were associated with decreased VAP incidence, decreased complications, reduced hospital stay, and cost. The findings emphasized that evidence-based nursing care is essential in preventing VAP and improving patient outcomes in ICU settings. The study also emphasized the need for enhanced training programs, standardized protocols, and institutional support to prevent knowledge gaps. This study provides a foundation for VAP prevention and patient outcomes.

Key Words	Ventilator-associated pneumonia (VAP), Mechanical ventilation, Nursing Interventions, ICU Settings
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Contents

1	Introduction	1
2	Background and Key Terms	2
2.1	Ventilator Associated Pneumonia (VAP)	2
2.2	Mechanical Ventilation	2
2.3	Nursing Intervention	3
2.4	Intensive Care Setting	3
3	Purpose, aim, and research questions	3
4	Methodology and Methods	4
4.1	Data Collection Method	4
4.2	Data Search and Selection	4
4.3	Data analysis method	8
5	Result	11
5.1	Role of nursing interventions for preventing VAP in the ICU	13
5.1.1	Airway management	13
5.1.2	Oral hygiene	13
5.1.3	Positioning and Aspiration prevention	14
5.1.4	Use aseptic techniques.	14
5.1.5	Ventilators and equipment management	15
5.1.6	Sedation and weaning protocols	15
5.2	Effectiveness of nursing interventions	16
5.2.1	Clinical outcomes and reduction in VAP incidence	16
5.2.2	Complication prevention	16
5.2.3	Decrease infection rate	17
5.2.4	Routine nursing protocols	17
5.2.5	Training and knowledge in VAP prevention	18
6	Discussion of the result	19
7	Conclusion and recommendations	20
8	Ethics and Validity	21
9	References	22

10	Appendices	24
	Appendix 1: Database search table	24
	Appendix 2: Selected/evaluated studies	26
	Appendix 3: Analysis tables	29

1 Introduction

Ventilator-associated pneumonia (VAP) is one of the most common and serious hospital-acquired infections (HAI) in intensive care units (ICUs) that receive mechanical ventilation (Kollef et al., 2021). It occurs after intubation in 48 hours or more. It results in high morbidity and mortality rates, increases the duration of hospital stays, and increases hospital expenses. The prevention of VAP remains an important role in critical care settings, with studies indicating an incidence rate ranging from 10% to 25% among mechanically ventilated patients (Torres et al., 2017.)

Nursing interventions play an important role in preventing VAP through the implementation of evidence-based practice. Aimed at reducing microbial colonization and aspiration risks. The ventilator care bundle includes proper hand hygiene, head-of-bed elevation, daily sedation interval, oral care with chlorhexidine, and timely suctioning. The ventilator care bundle is a highly recommended evidence-based practice to prevent VAP (Klompas et al., 2022). Among these interventions, utilizing aseptic suctioning techniques, oral care with antiseptic solutions, and maintaining proper cuff pressure in endotracheal tubes are identified as critical nursing practices in minimizing infection risks (Marschall et al., 2019).

Understanding the role of nursing interventions in VAP prevention is essential in improving patient outcomes, reducing ICU-acquired infections, reducing hospital stays, and promoting best practices in critical care settings. This study aims to study and discuss the effectiveness of nursing interventions in preventing VAP, identify challenges in adherence, and explore strategies for optimizing patient care in ventilated ICU patients (Bassi et al., 2017).

ICU nurses are in continuous close contact with mechanically ventilated patients. They can apply these preventive measures effectively. Their role is central to minimize the risk of VAP and improving overall patient outcomes (Zhao et al. 2019).

This study explores the role of nursing interventions in preventing VAP in ICU settings by examining the effectiveness of current practices and identifying opportunities for improving nursing interventions.

2 Background and Key Terms

Ventilator-associated pneumonia (VAP) is a common and severe hospital-acquired infection that occurs in the ICU among invasively ventilated patients. It is influenced by increasing length of hospital stays, morbidity, mortality, and expense of hospitals (Kalil et al., 2016). VAP is primarily caused by the aspiration of microorganisms into the lower respiratory tract (Klomas, 2019). Nursing interventions play an important role in its prevention and management within ICU settings. Nursing care practices are essential for minimizing the VAP risk and improving patient outcomes.

Proper nursing interventions, including head elevation, daily sedation interruption, chlorhexidine oral care, sterile suction techniques, and early extubation, have demonstrated the effectiveness of preventive VAP (Munro & Grap, 2019). Despite advancements in infection control practices, VAP remains a persistent challenge in critical care settings, necessitating continuous education, multidisciplinary collaboration, and adherence to preventive guidelines (Papazian et al., 2020).

2.1 Ventilator Associated Pneumonia (VAP)

Ventilator-associated pneumonia (VAP) is a hospital-acquired lung infection that occurs 48 hours or more after endotracheal intubation in mechanically ventilated patients (Torres et al., 2017). It is caused by microbial colonization of the respiratory tract, leading to lung inflammation and infection. VAP is associated with increased mortality, prolonged ICU stays, and higher healthcare costs (Klompas et al., 2022).

VAP develops when microorganisms colonize in the lower respiratory tract cause to micro aspiration of oropharyngeal secretions, biofilm formation in endotracheal tubes, or impaired immunity of the host (Kalil et al., 2016). Common risk factors are prolonged mechanical ventilation, supine positioning, prior antibiotic exposure, and the presence of underlying lung disease (Kollef et al., 2014).

2.2 Mechanical Ventilation

This method is a life-support intervention used in critically ill patients who are unable to maintain airway patency and adequate oxygenation on their own (Kollef et al., 2021). It involves the ventilator to deliver controlled breaths through the endotracheal tube or tracheostomy tube by ensuring proper gas exchange (Fan et al., 2017). This therapy is commonly required in acute respiratory distress syndrome (ARDS), respiratory failure,

neuromuscular disorders, and during surgical procedure requiring general anesthesia (McConville & Kress, 2019).

2.3 Nursing Interventions

As responsible healthcare professionals, nurses play an important role in acute care settings in managing ventilated patients by implementing evidence-based practice that optimizes ventilation, prevents complications, and promotes early weaning. They have close interaction with patients by involvement in monitoring, suctioning, and management of the patient's conditions. Airway Management and suctioning are essential in mechanically ventilated patients. Nurses ensure endotracheal tube placement and cuff pressure maintenance (Jansson et al., 2020). Oral care with chlorhexidine, head elevation, subglottic suctioning, and hand hygiene are included in nursing interventions (Kalli et al., 2016). Daily sedation interruptions allow for early assessment of neurological function, and they reduce the duration of mechanical ventilation (McConville & Kress, 2019). Nurses encourage passive and active range of mobility by positioning, changing, and progressive mobilization (Masip et al., 2020). Nursing interventions in mechanical ventilation are essential for patient safety and the duration of recovery. Airway management, infection prevention, early mobilization, and sedation control are contributed to by nurses to reduce complications and improve patient outcomes in ICU settings.

2.4 Intensive Care Setting

The Intensive Care Unit (ICU) is a specialized healthcare unit where seriously ill patients receive special treatment management, continuous monitoring, and life-support interventions (Coffin et al., 2020). Due to the high prevalence of invasive procedures, ICU patients are at increased risk of healthcare-associated infections, including VAP (Mody et al., 2018).

3 Purpose, aim, and research questions

The purpose of this thesis is to describe the role of nursing interventions in preventing ventilator-associated pneumonia in intensive care settings.

The aim of this study is to produce new practical knowledge about specific nursing interventions for preventing VAP.

Research Question

1. What is the role of nursing interventions for preventing VAP among ICU patients?
2. How do these nursing interventions effect patients' outcomes?

4 Methodology and Methods

4.1 Data Collection Method

The data collection method is a Descriptive Qualitative Literature review.

In this study, the method used is a descriptive qualitative review. A descriptive literature review is a type of literature review that provides a summary of a particular topic. A descriptive literature review is a research approach that systematically summarizes and synthesizes studies on a topic without coitizing and conducting new experiments (Snyder,2019). This approach is commonly used in nursing and healthcare research to explore human experience, perception, and behaviors (Sandelowski,2000). This method is valuable for exploring topics, patient experiences with mechanical ventilation, nurses' interventions for preventing VAP, and challenges in the ICU (Tong et al.,2012).

In this thesis, this method can be used in several sections. When concerned about VAP in ICU settings, a qualitative descriptive literature review provides a structural way to synthesize existing knowledge, identify best practices, and explore gaps that require further research (Sandelowski,2000)

4.2 Data Search and Selection

The PICO is a tool used to provide the study strategy. The PICO (Population, Intervention, Context) tool is utilized in structuring the study data and presents a clear definition of its content. It is a structured framework for research. This methodological approach contributes to identifying the target population and describing the intervention. According to the topic, nurses are the main population in this descriptive review, and the interest is the ventilated associated pneumonia. Eventually, the context is in intensive

care settings. Boolean operators “AND” and “OR” are used to obtain the accurate research articles needed for the review. The primary search is conducted by using the following databases. ProQuest, CINAHL, Google scholar and MEDLINE(PubMed).

Table 1. PICo Tool

P	Population	Nurses in the ICU
I	Interest	Nursing Intervention for VAP Prevention
Co	Content	Intensive Care Setting

Table 2. Search sentences

P- Population		I-Interest		Co-Content
Nursing care OR Nursing Role OR Nursing Interventions OR Nurses in the ICU OR Nurses in the Intensive Care Unit	AND	VAP OR Ventilated associated pneumonia OR Mechanical ventilation pneumonia OR Ventilation-acquired respiratory infection, artificial respiration	AND	ICU OR Intensive Care Units* OR Intensive Care Settings*

Then I use several search sentences to find suitable articles in several databases, and the search sentences are

(“Nursing Interventions” OR “Nursing care”) AND (“ventilated associated pneumonia” OR VAP OR “respiration, artificial” OR “mechanical ventilation”) AND (“ICU “OR “Intensive Care Unit””).

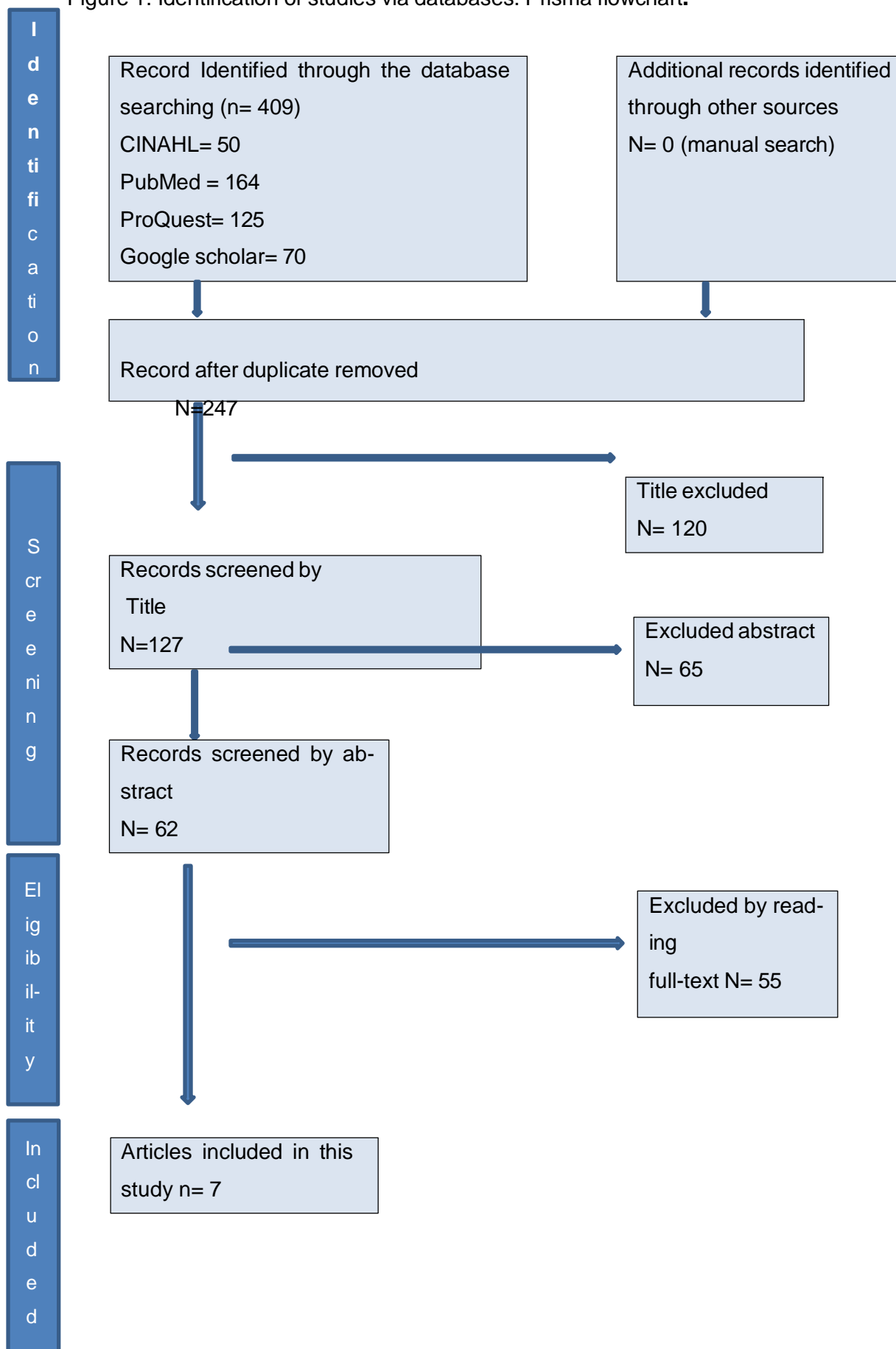
The search will be limited to peer-reviewed, full-text articles published in English with available abstracts from 2015 to 2025.

Table 3. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Studies published within the last 10 years. (2015- 2025)	Studies that are published more than 10 years ago.
Primary articles and peer-reviewed articles.	Non-primary articles and non-peer-reviewed articles.
Articles are written in English.	Articles are written in a non-English language.
Studies which are related to VAP prevention in ICU patients	Studies that are not related to VAP prevention and other hospital settings.

The PRISMA method is used for this literature review for the main steps, which involve selecting suitable articles. It includes four stages: identification, screening, eligibility, and inclusion. During the identification stage, 409 articles are gathered through the academic database searches. 162 articles are removed as duplicates, and 247 articles move to the screening stage. At the screening stage, among the 247 articles, 120 articles are removed as titles are excluded, and 65 articles are removed as abstracts are excluded. The remaining 62 articles move forward to the eligibility phase. After reading the full text, 7 articles are deemed suitable and include the final review.

Figure 1. Identification of studies via databases. Prisma flowchart.



4.3 Data analysis method

Apply data analysis is the present research study that uses literature and theory-backed inductive content analysis, which is generating of data from various sources such as articles and journals which acceptable and understandable. Inductive content analysis is used when a qualitative study has an inductive starting or in other words, when the data collection approach is open and follows a loosely defined theme. A basic inductive content analysis is performed according to the phases, such as data reduction, data grouping, and the formation of concepts that can be used to answer the study questions. Therefore, content analysis is used for data evaluation (Helvi 2020, 13-14.)

Total articles are reviewed and published between 2015 and 2025. Articles are selected based on methodology, method, relevance, and nursing interventions for preventing VAP in ICUs. Not only that, but also according to the above study questions. This study identifies specific nursing interventions for preventing VAP and about patient outcomes in ICUs. The study recognizes and categorizes specific nursing interventions and improves patient outcomes in VAP prevention methods. Such as oral hygiene, head elevation, and maintaining proper cuff pressure are specific nursing interventions (Bruna & Evelyn, 2015). Using aseptic techniques during ET tube suctioning, sedation interval, monitoring clinical criteria (fever), and daily changes of the ventilator circuits are also essential nursing interventions to prevent VAP (Goncalves, 2015).

The combination of ventilator bundle care (oral hygiene, patient positioning, sedation interval, infection control, and secretion management) is associated with hospital stay duration, mortality rate, and health care costs. Preventing VAP leads directly to improving patients' outcomes. The coding table gives more details of the study results. The content analysis table is a structured framework used in this study to systematically categorize and analyze data. Determine what the similarities are among specific units of data by giving each reduced code. It reduces to a single broad category and is called a subcategory. All subcategories gather under the generic category that is the most leads to answer research questions. (Elo & Kyngäs, 2008.) Subcategories are combined with generic categories. After that, it is assigned to the main category. Coding helps to gather data into meaningful. And the content analysis results are reported by using the main categories. The researcher must refer to the original data several times while analyzing to make sure the results closely match the data to studied.

Table 4. Example of an inductive content analysis table

Analysis table for question no 01

What is the role of nursing interventions for preventing VAP among ICU patients?

Meaning unit	Code	Subcategory	Generic Category	Main category
01.Knowledge and Practices of Intensive Care Nurses on Mechanical Ventilation. (Serdar Saritas, Ayn Kaya, Sc Golkoy, Ordu, Niha Dolanbay, Turgut Ozal) Turkey. 2019. Article 01	<ul style="list-style-type: none"> • Care of Endotracheal Tube. • Maintain cuff pressure and monitor the cuff pressure. • Maintain oral hygiene with an antiseptic. (chlorhexidine). • Use aseptic suctioning. • Nurses apply ETT suctioning techniques. (Use saline.) 	<ul style="list-style-type: none"> • Airway management • Ensure the safety of ventilation. • Prevention of infection. • Safety suctioning methods. 	<ul style="list-style-type: none"> • Routing nursing practices. (standard monitoring procedures, bundle of ventilator care, and controversial suctioning methods) 	Role of nursing interventions for preventing VAP among ICU patients.

Table 5.

Analysis table for question no:02

Meaning unit	code	Subcategory	Generic category	Main category
01.Knowledge and Practices of Intensive Care Nurses	Lack of knowledge about alarming indicators.	Technical challenges.	Training deficiencies.	Effectiveness of nursing

<p>on Mechanical Ventilation. (Serdar Saritas, Ayten Kaya, Sc Golkoy, Ordu, Niha Dolanbay, Turgut Ozal) Turkey. 2019. Article 01</p>	<p>(Why alarming? what do they indicate?</p> <p>Poor understanding of mechanical ventilation (MV) settings.</p> <p>Inconsistent cuff monitoring. Do not use a manometer.</p> <p>Lack of training programs in VAP prevention.</p>	<p>(Do not know how to correct indicators.)</p> <p>Knowledge deficiency of ventilators.</p> <p>(do not know what the settings, values, and how to recognize measurements that indicate.)</p> <p>Use incorrect procedures.</p> <p>Education gap.</p>	<p>Lack of trained nurses.</p> <p>Need for training programs.</p>	<p>interventions.</p>
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The inductive content analysis method is used through the data analysis. The all findings according to 2 study questions, all 7 articles are pointed out both “role of nursing interventions for preventing VAP among ICU patients and effectiveness of nursing interventions.” The main categories divide in to 6 generic categories and again they divide in to 16 subcategories. The main categories and generic categories answer to the study questions.

5 Result

This literature review includes seven primary and peer-reviewed studies selected based on their relevance to the role of nursing interventions in preventing ventilator-associated pneumonia (VAP) in intensive care units (ICUs). The inclusion criteria focus on articles published in English within the last ten years. This literature review includes seven primary and peer-reviewed studies selected based on their relevance to the role of nursing interventions in preventing ventilator-associated pneumonia (VAP) in intensive care units (ICUs). The inclusion criteria focus on articles published in English within the last ten years and directly related to ICU nursing practices and VAP prevention strategies. The selected studies span a diverse geographical context, including Turkey, Brazil, Korea, Australia, Portugal, Saudi Arabia, and the United Kingdom, offering a global perspective on the issue.

All the studies involved nurses working in ICU settings, with sample sizes ranging from small qualitative groups to large-scale quantitative surveys. Most studies employed cross-sectional survey methods to assess nursing knowledge, preventive practices, and adherence to VAP prevention protocols (Saritas et al., 2019; Wagner et al., 2015; Kwak & Han, 2022; Celik et al., 2020; Madhuvu et al., 2021; Alhamad & Elsayed, 2024). One study (Cruz & Martins, 2018) incorporated clinical outcome evaluations related to VAP prevention behaviors.

These articles were analyzed using inductive content analysis. Subsequently, 29 sub-categories, 11 generic categories, and two main categories were created in the inductive analysis. Two main categories are 1) Nursing interventions for VAP prevention in the ICU, which resulted from six generic categories and 16 sub-categories, and 2) Effectiveness of nursing intervention, which was created from five generic categories and 13 sub-categories. These categories and results can be seen below in Figures 2 and 3.

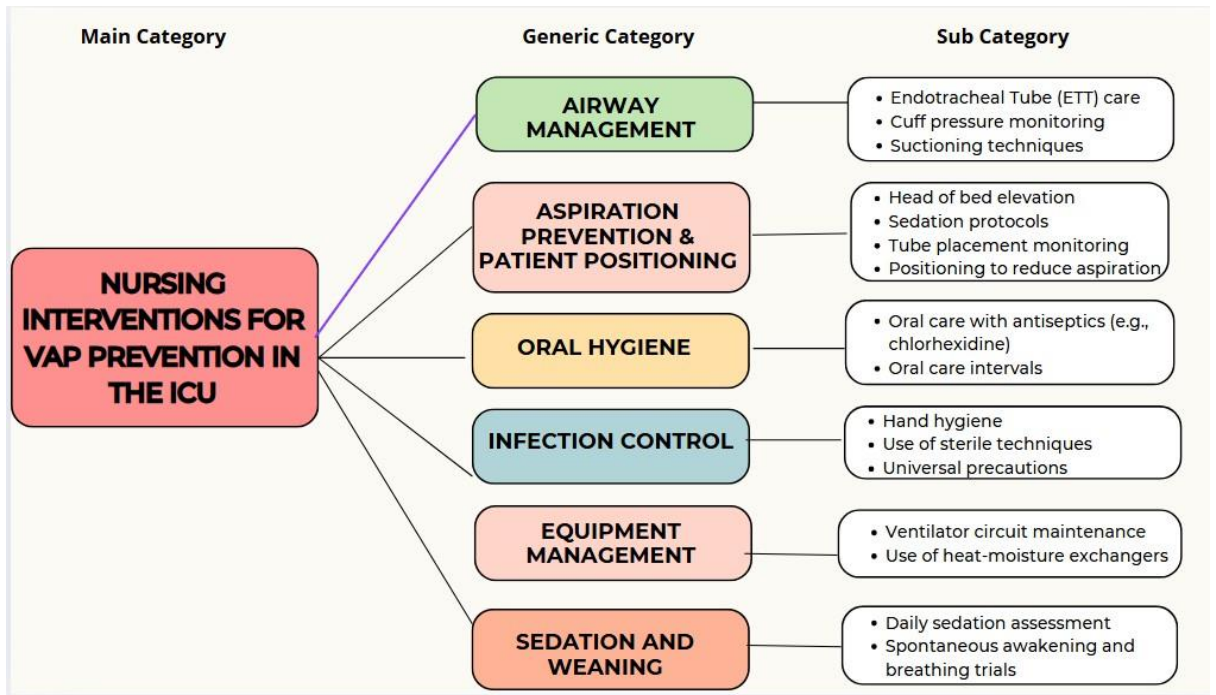


Figure 02: Result of Nursing interventions for VAP prevention in the ICU

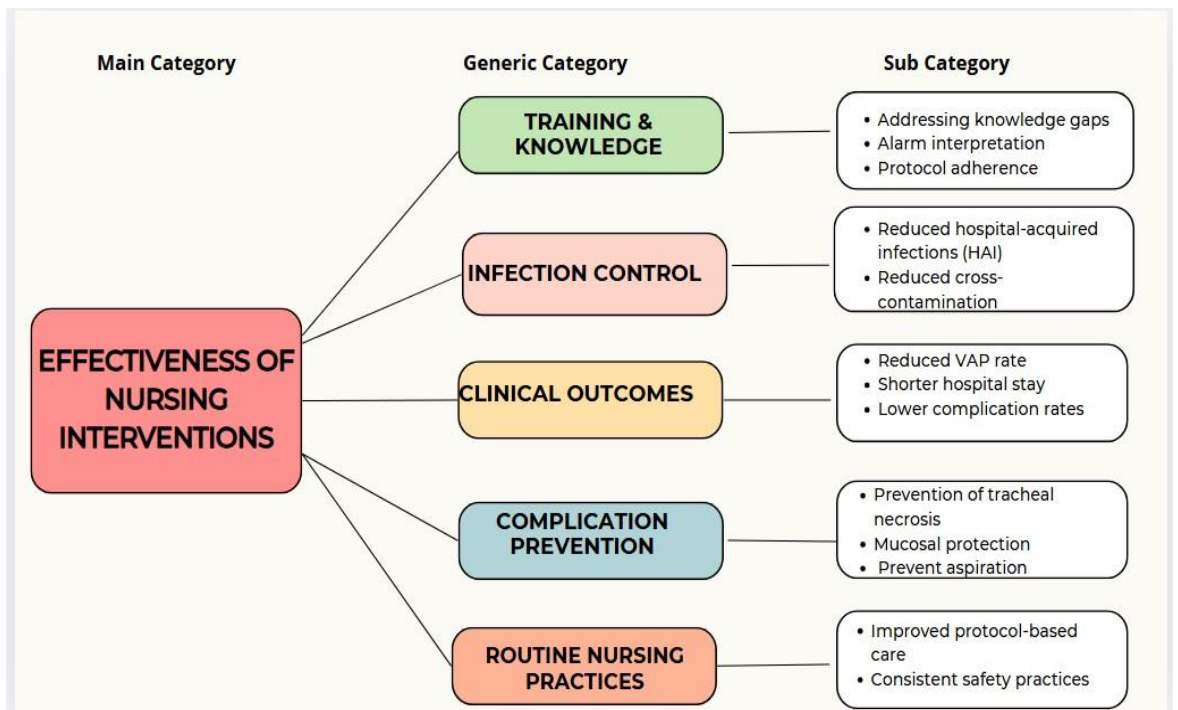


Figure 03: Result of Effectiveness of Nursing Interventions

5.1 Role of nursing interventions for preventing VAP in the ICU

According to the seven studies, nursing interventions play an important role in preventing VAP among ICU ventilator patients. These interventions are proven by routine care practice, evidence-based guidelines, and technical procedures. They contribute to reducing the VAP and improving patient safety.

5.1.1 Airway management

Regular evaluation of the ETT is essential to ensure its proper placement and function. It is a fundamental nursing intervention in the prevention of VAP among ICU ventilated patients (Saritas et al., 2019; Wagner et al., 2015). It is important to ensure and regularly monitor the cuff pressure within the endotracheal tube to prevent the secretion into the lower respiratory tract (Saritas et al., 2019). Inadequate cuff pressure can create a pathway to move pathogens that are harmful to the lower respiratory tract. It is increased the risk of VAP (Wagner et al., 2015). Not only that, but also low cuff pressure can lead to tracheal damage and necrosis. There for routing monitoring and maintenance of the cuff pressure within the standard range (20cmH₂O- 30cmH₂O) are essential nursing monitoring (Saritas et al., 2019).

Endotracheal tube suctioning with aseptic techniques is the most important. Improper suctioning techniques can introduce pathogens into the lower airway (Saritas et al., 2019.) Nurses use aseptic techniques during suctioning procedures. This includes using sterile catheters for each suctioning time, wearing sterile gloves, and avoiding inserting normal saline into the endotracheal tube (Wagner et al., 2015). This includes ensuring the tube is properly positioned and secured to prevent the accidental displacement of the tube. And it is a cause for reintubation. It raises VAP risk; therefore, regular assessment of the tube's position and the integrity of securing the tube are essential nursing interventions (Saritas et al., 2019.)

5.1.2 Oral hygiene

According to seven studies, all studies highlight oral hygiene as a very important factor of preventing VAP among intubation patients in the ICUs. The oral cavity is the best reservoir for developing micro-organisms that can colonize the ETT and can move into the lower respiratory tract, which leads to VAP. Maintaining good oral hygiene is the most important to reduce this risk (Madhuvu et al., 2021; Wagner et al., 2015.)

Several articles emphasize the use of aseptic solutions (Chlorhexidine) as an effective oral aseptic solution (Cruz & Martins,2018; Kwak & Han,2022; Saritas et al.,2019). According to studies, there are variations in the recommended concentration (0.12%-2%) and frequency of application, 6-12 hours (Cruz & Martins,2018). Oral secretions should be removed after the oral care procedure is essential to prevent aspiration of bacteria and fluids (Alhamad & Elsayed,2024; Kwak & Han,2022).

5.1.3 Positioning and Aspiration prevention

This is another nursing intervention strategy among ventilator bundle care. All seven studies emphasize the importance of maintaining head of the bed (HOB) elevation as a nursing intervention to prevent VAP. It is a primary method for preventing VAP. Elevating the upper body typically 30-45 degrees is a simple but highly effective method (Madhuvu et al.,2015; Wagner et al.,2015.) The primary mechanisms of HOB elevation prevent VAP by reducing the risk of aspiration of oropharyngeal and gastric contents into the trachea and lungs (Cruz & Martins,2018; Kwak & Han,2022; Saritas et al.,2019). In the supine position, gravity facilitates the reflux of these secretions, increasing the likelihood of them entering the airway, especially in patients with sedation (Kwak & Han,2022). Elevating the HOB promotes drainage and reduces the potential for aspiration (Cruz & Martins,2018).

Some studies highlight that HOB elevation can facilitate the removal of secretions from the lungs themselves. This is a secondary benefit of that. Sometimes this position can improve lung expansion, ventilation, and potentially aid in secretion clearance (Celik et al.,2020.) HOB elevation is a core component of standardized VAP prevention bundles (Alhamed et al.,2024; Madhuvu et al.,2021; Wagner et al.,2015).

5.1.4 Use aseptic techniques.

All seven studies consistently highlight the importance of strict aseptic techniques in various nursing procedures done on mechanically ventilated patients in the ICU to prevent VAP. And the risk of VAP increases during routine care, and it introduces pathogens into the patient's airway and respiratory system. Aseptic principles minimize the risk.

Seven studies emphasize the necessity of using sterile catheters for each suctioning time (Celik et al.,2020; Wagner et al.,2015.) Non-sterile catheters can directly introduce pathogens into the lower respiratory tract. Not only that, but also studies emphasize the

importance of using sterile gloves during an entire suctioning procedure to prevent contamination of the catheter and patient's airway (Kwak & Han,2022; Madhuvu et al.,2021). They discuss the use of the close suctioning system, which allows suctioning without disconnecting the ventilator circuit (Alhamad & Elsayed,2024).

It is important to use and maintain sterility while changing the ventilator circuit and its components (Kwak & Han,2022; Madhuvu et al.,2021). Utilizing hand hygiene, wearing sterile gloves, and preventing contamination are crucial during the change circuits (Celik et al.,2020). Not only the airway-related, but also when inserting and maintenance of other invasive lines (CVC, arterial lines) can be a source of systemic infection and potentially increase the VAP (Sartas et al.,2019).

Among all these nursing interventions, including those directly related to the airway, hand hygiene before and after any patient contact or procedure is emphasized as the most important fundamental aseptic technique. This includes proper hand washing with soap and water or alcohol-based hand sanitizers (Alhamad et al.,2024; Sartas et al.,2019).

5.1.5 Ventilators and equipment management

Effective management of equipment minimizes the risk of VAP. Unnecessary circuit changers prevent contamination risk. Instead of routine changes of circuit sets, the literatures suggest that ventilator circuits should be replaced when its visibly soiled (Madhuvu et al.,2020.) Proper equipment care is essential for maintaining a sterile ventilator environment for mechanically ventilated patients (Celik et al.,2020).

5.1.6 Sedation and weaning protocols

Sedation and weaning protocols are important to reduce the duration of mechanical ventilation and the risk of VAP (Alhamad & Elsayed,2024; Kwak & Han,2022). Daily sedation assessment involves regular evaluation of the patient's level of sedation. The goal is to avoid both over-sedation and under-sedation. Because over-sedation leads to prolonged mechanical ventilation, and under-sedation leads to patient agitation, increases the risk of self-extubating, and causes reintubation (Kwak & Han,2022). Studies show that effective sedation management, incorporating daily sedation assessments and spontaneous awakening and breathing trials are shortens the duration of mechanical ventilation and it causes to reduces VAP risk (Alhamad & Elsayed,2024; Kwak & Han, 2022).

The prolonged mechanical ventilation is a major risk factor for VAP. Prolonged intubation causes bacteria colonization. By effectively managing sedation and regularly assessing the sedation level and readiness of the independently breathing patient, can facilitate to early weaning from ventilation (Alhamad & Elsayed,2024).

5.2 Effectiveness of nursing interventions

All seven studies show that nursing interventions have a direct and measurable impact on patient outcomes in the VAP prevention. These interventions contribute to improving clinical, respiratory, and safety-related outcomes.

5.2.1 Clinical outcomes and reduction in VAP incidence

The studies report the very low incidence of VAP due to the contribution of standard nursing protocols, such as oral hygiene, bed head elevation, and airway management. This performs the protocols approach to effective care and can minimize the risk of VAP incidences (Aysegul et al.,2020; Madhuvu et al.,2021.)

According to one article, the VAP rate drops to as low as 0.3%. When using proper nursing interventions (Celik et al.,2020). VAP is associated with an increased length of stay in the ICU and the hospital. Patients recover faster by preventing VAP. Not only that, but it also reduces prolonged antibiotic therapy, mechanical ventilation, and management of VAP-related complications. Such as increased mortality rate, acute respiratory distress syndrome (ARDS), and the need for prolonged mechanical ventilation. These complications are minimized by effective VAP prevention (Celik et al.,2020; Madhuvu et al.,2021).

5.2.2 Complication prevention

Several complications can occur in patients with in mechanical ventilation. The main complication is the tracheal necrosis; tracheal necrosis is very rare but it is serious complication. It causes by prolonged endotracheal intubation and excessive cuff pressure. All studies emphasize the maintaining and monitoring cuff pressure. Nurse can minimize the risk of tracheal damage by checking the cuff pressure (Alhamad & Elsayed, 2024; Celik et al., 2020; Saritas et al., 2019.)

The other one is mucosal protection, by using antiseptic solution for oral care and proper suctioning techniques, can prevent oral mucosa from bacterial colonization (Celik et al.,2020; Cruz & Martins, 2018; Satitas et al.,2019; Wagner et al.,2015).

Aspiration of oropharyngeal secretion is a primary risk factor for VAP. There are several nursing interventions for it, and they help to prevent complications. Elevating the head of the bed is a fundamental strategy to reduce the risk of aspiration, proper suctioning techniques, and remove secretions before they can be aspirated. Maintaining appropriate ETT cuff pressure helps to seal the airway and prevent secretions from moving into the lungs. Those are helpful to prevent the main complication (Alhamad & Elsayed, 2024; Celik et al., 2020; Madhuvu et al.,2021; Wagner et al., 2015.)

5.2.3 Decrease infection rate

This is the main factor for VAP. Minimize the spread of infection, both from the environment to the patient and from patient to patient. Reducing hospital-acquired infections (HAIs) is the main goal of infection control to reduce VAP. Using proper hand hygiene and aseptic techniques demonstrates a significant role in achieving the above goal. It is leading to better patient outcomes and reducing healthcare costs (Celik et al.,2020; Cruz et al.,2018; Madhuvu et al., 2021; Saritas et al.,2019.)

Proper suctioning techniques minimize the risk of introducing new pathogens into patients' airways during suctioning. Proper hand hygiene practices among healthcare workers prevent the spread of microorganisms to patients and to the environment. The above factors can decrease the infection rate and which helps to prevent VAP and the cost of hospitals (Alhamed & Elsayed, 2024; Celik et al.,2020; Cruz et al.,2018.)

5.2.4 Routine nursing protocols

Routine nursing practices such as performing regular oral hygiene, maintaining endotracheal tube cuff pressure, positioning the patient properly, and following ventilator care for the ventilator patient in ICUs. These practices are linked with reductions in VAP incidence and other complications. Routine interventions such as, maintaining hand hygiene (98%), ETT cuff pressure, and sterile suctioning significantly contribute to infection control, elevation head of the bed, and airway protection (Celik et al.,2020.) One study shows that evidence-based protocols, such as head of bed elevation (99%) and regular oral care with chlorhexidine, lead to a noticeable reduction of aspiration risk and

improved patient respiratory outcomes (Madhuvu et al.,2021.) Routine practice includes daily monitoring tasks, like cuff pressure monitoring and ventilator circuit assessments. These are lowering contamination risk (Kwak & Han,2022).

Routine nursing practices are the foundation of patient safety when these interventions are applied regularly and correctly. They lead to improve clinical outcomes and reduce VAP incidence (Kwak & Han, 2022; Saritas et al, 2019; Wagner et al.,2015.)

5.2.5 Training and knowledge in VAP prevention

VAP prevention depends on ICU nurses' knowledge, training, and ability to apply clinical judgment. According to review studies, several studies discuss related to knowledge gaps, misinterpretation of ventilator alarms, and inconsistent adherence to standard protocols, which directly affect patient outcomes (Kwak & Han,2022).

When discussing knowledge gaps among nurses, many nurses demonstrate incomplete knowledge of ventilator-associated pneumonia prevention procedures. On the other hand, some nurses have a poor understanding of mechanical ventilation settings and do not consistently use manometers for cuff pressure monitoring. The lack of knowledge reduces the effectiveness of nursing interventions (Saritas et al.,2019.)

Alarm misinterpretation is another major issue identified by the review. Many nurses are unaware of the significance of ventilator alarms or respond to them correctly, which delays necessary interventions (Wagner et al., 2015.) One of the reviews confirms that ICU nurses often fail to identify what specific alarms indicate due to a lack of training on ventilator mechanisms and parameters, which influence patient safety (Saritas et al.,2019).

Reviews emphasize the importance of evidence-based practice and show that higher protocol adherence among nurses results in lower VAP incidence and improves patient outcomes (Celik et al.,2020; Madhuvu et al.,2021). The reviews clearly show that training and knowledge are the foundation for effective VAP prevention. When nurses are well-trained, they apply interventions more effectively to improve patients' outcomes. (Celik et al.,2020; Kwak & Han,2022; Madhuvu et al.,2021; Saritas et al.,2019.)

6 Discussion of the result

This study reviewed seven international articles to explore the role and effectiveness of nursing interventions in the prevention of Ventilator-Associated Pneumonia (VAP) among ICU patients. The results strongly emphasize that consistent, evidence-based nursing practices are central to reducing the incidence of VAP and improving patient outcomes in critical care settings.

Most of the reviewed studies agree that key interventions such as maintaining appropriate ETT cuff pressure, elevating the head of the bed, regular oral hygiene with chlorhexidine, aseptic suctioning techniques, and ventilator circuit care are essential to prevent the colonization of pathogens and aspiration, both of which are major contributors to VAP (Celik et al., 2020; Saritas et al., 2019; Wagner et al., 2015). These practices align with global evidence-based care bundles and are widely endorsed as standard preventative strategies (Kwak and Han 2022). The current findings are emphasized that interventions like proper cuff pressure management and spontaneous awakening trials reduce complications and promote early weaning from mechanical ventilation. Similarly, found that adherence to practices like head-of-bed elevation and proper oral hygiene was associated with lower rates of VAP, supporting the significance of these basic yet critical nursing actions (Madhuvu et al., 2021).

However, despite the existence of these well-known practices, the literature also reveals considerable gaps in nursing knowledge and compliance. Several studies noted that nurses often lacked formal training in VAP prevention or were unaware of proper procedures such as cuff pressure monitoring or the frequency of oral care (Saritas et al., 2019; Wagner et al., 2015). This education gaps not only affects consistency in practice but also contributes to higher risk of patient complications. Only one article discussed DVT prevention within the context of VAP-related care, highlighting a broader need for holistic critical care approaches that address co-morbid risks and emphasize total patient safety (Alhamad & Elsayed, 2024). While DVT may not be directly related to VAP, its inclusion illustrates the interconnectedness of ICU care measures and the nurse's responsibility in managing all aspects of critical care. The impact of nursing interventions on patient outcomes was clear across all reviewed studies. Proper oral care, suctioning techniques, and ventilator management were found to lower VAP incidence, reduce ICU stay, prevent hospital-acquired infections, and promote quicker weaning from mechanical support (Celik et al., 2020; Kwak & Han, 2022). These findings reaffirm that routine nursing interventions are not just procedural but are directly linked to saving lives.

This study's findings align well with existing literature, strengthening the understanding that ICU nurses play an important role in VAP prevention. However, the variation in knowledge and practices among nurses, as highlighted in several articles, points to a pressing need for standardized protocols, continuous training, and institutional support to bridge the knowledge-practice gap.

7 Conclusion and recommendations

Pneumonia (VAP) among patients in intensive care units, based on evidence from seven international studies. The findings confirm that nursing practices such as maintaining endotracheal tube cuff pressure, performing regular oral hygiene with antiseptics like chlorhexidine, elevating the head of the bed, and using aseptic suctioning techniques are crucial in reducing VAP incidence. The integration of these routine and evidence-based interventions has a direct influence on improving patient safety, reducing complications, and enhancing overall clinical outcomes.

Despite the clear benefits of these interventions, the reviewed literature also revealed several challenges, including variations in knowledge levels among nurses, inconsistent protocol adherence, and insufficient training on mechanical ventilation and VAP prevention. These gaps can limit the effectiveness of interventions and put patients at risk. Therefore, structured educational programs, regular competency assessments, and reinforcement of evidence-based guidelines are essential to empower ICU nurses and standardize preventive practices across healthcare settings.

Based on the findings according to my thesis, several recommendations are proposed to enhance nursing practice and patient outcomes in the preventing Ventilator Associated Pneumonia (VAP) in the ICU settings. Based on these findings, it is recommended that healthcare institutions prioritize continuous in-service training for ICU nurses, implement clear and accessible VAP prevention protocols, and promote a culture of accountability and evidence-based care. Further research is encouraged to evaluate the long-term impact of such interventions and explore the role of new technologies or simulation training in enhancing nurses' skills. Ultimately, strengthening nursing capacity in critical care settings is key to reducing VAP-related morbidity and improving patient safety outcomes globally.

8 Ethics and Validity

When we are conducting a literature review for a thesis, ethical considerations and validity remain important. But they are applied differently. All relevant information should be presented in a balanced manner. Avoiding evidence, misleading readers, and is considered unethical (Resnik,2018). It should be done ethically and respectfully without criticizing researchers or their work. When we are doing a qualitative descriptive literature review that does not involve direct human participants, ethical considerations primarily focus on proper citation, avoiding bias, avoidance of plagiarism, and maintaining transparency in study selection. (Creswell & Creswell,2018).

In this thesis, ethical considerations apply, ensuring that all sources' intellectual property is respected. I present relevant context and balance analysis to avoid misrepresentation, and a transparent search strategy is employed to avoid bias, including a wide range of studies to provide a comprehensive review (Brown & Smith,2020). All sources are appropriately credited to respect intellectual property, and inclusion and exclusion criteria are clearly defined to prevent selection bias (Polit & Beck,2021).

Validity is the relevance of the topic. The topic of ventilator-associated pneumonia is highly relevant, well-documented, and valid. Enhance the validity and trustworthiness of the findings the study following those, ensuring credibility, transferability, dependability, and confirmability. Validity in a literature review is achieved by including a wide range of high-quality, peer-reviewed studies. Those findings are included to enhance the review's trustworthiness and must follow a transparent review process (Booth et al.,2016.)

In this thesis, validity was ensured by selecting a broad range of studies to ensure that the review is relevant to various nursing contexts, and by using transparent selection criteria. Credibility is ensured by systematically reviewing and synthesizing findings from multiple peer-reviewed studies on nursing interventions for preventing ventilator associated pneumonia in ICU settings. Comparing results from different studies can enhance accuracy. (Polit & Beck,2021) Transferability is achieved by providing detailed descriptions of the themes and context analyzed. This allows readers to determine the relevance of findings in different ICU settings. (Creswell & Creswell,2018).

By following these validity measures, this study ensures that nursing interventions for VAP prevention are credible, applicable, and rigorously analyzed. Ethical consideration focuses on respecting intellectual property, accurate reporting, and ensuring fairness.

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10 Appendices

Appendix 1: Database search table

Database/ Data/ Limit	Search Terms	Number of Hits.	Selected based on Title	Selected Based on Abstract	Selected Based on Whole Text
CINAHL 20.02.2025 10 years.	("Nursing Intervention" OR "Nursing care") AND ("ventilated associated pneu- monia" OR Vap OR "respiration, artifi- cial "OR "mechani- cal ventilation") AND ("ICU "OR "In- tensive Care Unit*").	50	14	06	03
PubMed 19. 02. 2025 10 years	("Nursing Intervention" OR "Nursing care") AND ("ventilated associated pneu- monia" OR Vap OR "respiration, artifi- cial "OR "mechani- cal ventilation") AND ("ICU "OR "In- tensive Care Unit*").	164	52	32	02

ProQuest 18. 02. 2025 05 years.	("Nursing Intervention" OR "Nursing care") AND ("ventilated associated pneu- monia" OR Vap OR "respiration, artifi- cial "OR "mechani- cal ventilation") AND ("ICU "OR "In- tensive Care Unit*").	125	41	20	01
Google scholar 05.03.2025 05 years	("Nursing Intervention" OR "Nursing care") AND ("ventilated associated pneu- monia" OR Vap OR "respiration, artifi- cial "OR "mechani- cal ventilation") AND ("ICU "OR "In- tensive Care Unit*").	70	20	04	01
Total		409	127	62	07

Appendix 2: Selected/evaluated studies

Topic/ Title	Author(s), Years, Country	Methodology & Meth- ods	Participants	Main outcome
01. Knowledge & Practice of Intensive Care Nurses on Mechanical Ventilation.	Serdar Saritas, Ayten Kaya, Sc Golkoy, Ordu, Niha Dolanbay, Turgut Ozal Turkey. 2019.	Descriptive literature review.	108 ICU Nurses.	Nurses want to improve their understanding in VAP preventing.
02. Knowledge of Nurses about the Intervention for the Prevention of Pneumonia Associated with Mechanical Ventilation.	Bruna Vanessa Wagner, Evelyn Francini Alves, Christiane Brey, Maria Caroline Waldrigues, Cristiano Caveião. Brazil. 2015.	Descriptive literature review.	Nursing professional in ICU.	The nurses demonstrated adequate knowledge of preventing VAP. But emphasized the importance of updating.
03. Development of a Tool for Measuring Ventilator-Associated Pneumonia Prevention Behaviors of Intensive	Sungjung Kwak and Sujeong Han Korea. 2022	Descriptive literature review.	452 nurses in ICU	This study is developing implementation of VAP preventing behaviors in ICU.

<p>Care Unit Nurses.</p> <p>04. Evidence Based practices for Preventing Ventilator-Associated Pneumonia in Intensive Care Nursing.</p> <p>05. Healthcare Professional Views on Barriers to Implementation of Evidence-Based Practice in Prevention of Ventilated Associated events.</p> <p>06. Pneumonia associated with invasive. Mechanical ventilation: nursing care</p>	<p>Celik Aysegul, Usta Yesilbalkan Oznur Akyol Asiye Turkey. 2020.</p> <p>Auxillia Madhuvu, Ruth Endacott, Virginia Plummer, Julia Morphet 2021. Australia</p> <p>João Ricardo Miranda da Cruz, Matilde Delmina da Silva Martins 2018 Pruthugal</p>	<p>Descriptive literature review.</p> <p>Descriptive literature review.</p> <p>Descriptive and longitudinal literature review.</p>	<p>102 nurses in ICU</p> <p>16 nurses, 04 doctors.</p> <p>20 nurses in the ICU and 102 observations.</p>	<p>ICU nurses have adequate knowledge in VAP prevention method.</p> <p>Prevention of VAP is needed focus in ICUs to promote quality care and prevention of HAI</p> <p>When the ICU staff followed the ventilator bundle care, the frequency of pneumonia patients was reduced in the ventilator care.</p>
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07. Nursing Knowledge and Preventive Practices of Ventilator-Associated Pneumonia as Perceived by Intensive Care Nurses in Hail City, KSA	Nuran M. Alhamad, Wessam A. Elsayed. 01.2024. Saudi Arabia.	Descriptive cross-sectional.	84 nurses in the ICU	Over one-third of nurses had poor knowledge about VAP. And need training and practices regarding the VAP guideline.
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Appendix 3: Analysis tables

Question no: 01

What is the role of nursing interventions for preventing VAP among ICU patients?

Meaning Unit	Code	Sub Category	Generic Category	Main category
01. Knowledge and Practices of Intensive Care Nurses on Mechanical Ventilation. (Serdar Saritas, Ayten Kaya, Sc Golkoy, Ordu, Niha Dolanbay, Turgut Ozal)Turkey. 2019. Article 01	Care of Endotracheal Tube. Maintain cuff pressure and monitor the cuff pressure. Maintain oral hygiene with an antiseptic. (chlorhexidine). Use aseptic suctioning.	Airway management Ensure the safety of ventilation. Prevention of infection. Safety suctioning methods.	Routing nursing practices. (standard monitoring procedures, bundle of ventilator care, and controversial suctioning methods)	Nursing interventions for VAP prevention in the ICU
03. Development of a Tool for Measuring Ventilator-Associated Pneumonia Prevention Behaviors of Intensive	Aspiration prevention, including endotracheal tube cuff pressure management.	Airway safety Equipment hygiene Respiratory care and weaning protocol.	Critical care techniques. Best practice in the ventilator.	Role of nursing interventions

<p>Care Units nurses.</p> <p>(Sungjung Kwak and Sujeong Han)</p> <p>Korea.</p> <p>2022</p> <p>Article no 3</p>	<p>Ventilator management, ventilator circuit handling.</p> <p>Spontaneous awakening and breathing trials.</p> <p>Use of oral care and interval of oral care 4-8 hours.</p> <p>Use standard precautions as a factor in prevention.</p>	<p>Maintain oral hygiene.</p> <p>Infection control.</p>	<p>Sedation and extubation practices.</p> <p>Oral hygiene protocol.</p> <p>Safety management.</p>	
<p>04. Evidence Based practices for Preventing Ventilator Associated Pneumonia in Intensive Care Nursing.</p> <p>(Celik Aysegul, Usta Yesilbalkan Oznur Akyol Asiye)</p> <p>Turkey 2020</p>	<p>Maintained hand hygiene. (98% of nurses' use)</p> <p>Use heat moisture exchanger. (100% used).</p> <p>Used bed head elevation position. (use 30-40 angle)</p>	<p>Basic infection control.</p> <p>Used humidification method.</p> <p>Positioning the patient.</p> <p>Airway safety.</p> <p>Oral hygiene.</p> <p>Aseptic techniques.</p>	<p>Evidence-based practice.</p> <p>Airway management.</p> <p>Aspiration prevention, infection prevention.</p> <p>Aspiration prevention.</p>	<p>Role of nursing in VAP prevention.</p>

Article no: 4	<p>ETT cuff pressure maintained.</p> <p>Use chlorhexidine for oral care.</p> <p>Use a sterile suctioning method.</p>		<p>Infection prevention.</p> <p>Universal precautions.</p>	
<p>05. Healthcare Professional Views on Barriers to Implementation of Evidence-Based Practice in Prevention of Ventilator Associated Events.</p> <p>Auxillia Madhuvu, Ruth Endacott, Virginia Plummer, Julia Morphet 2021.</p> <p>Australia.</p>	<p>Head bed elevation. (used 99%).</p> <p>Regular oral hygiene with chlorhexidine.</p> <p>Ventilator circuits are replaced only when visibly soiled.</p> <p>Maintained ETT cuff pressure control. (monitored 89.2%).</p> <p>Use aseptic techniques for suctioning.</p>	<p>Positioning the patient.</p> <p>Oral health.</p> <p>Airway management and infection prevention.</p> <p>Prevent cross-contamination.</p>	<p>Nursing protocol procedure.</p> <p>Infection prevention.</p>	<p>Nursing interventions in VAP prevention.</p>

06. Pneumonia associated with invasive mechanical ventilation: nursing care- João Ricardo Miranda da Cruz, Matilde Delmina da Silva Martins 2018.Pruthugal	<p>Bed head elevation.</p> <p>Maintained oral hygiene with chlorhexidine.</p> <p>Maintained hand hygiene, use suctioning method.</p> <p>Maintained ETT cuff pressure. (checked once per shift.)</p> <p>Maintained ventilator circuits.</p>	<p>Patient positioning.</p> <p>Infection control.</p> <p>Aseptic suctioning.</p> <p>Airway protection.</p> <p>Proper equipment management.</p>	<p>Nursing care.</p> <p>Routing nursing care.</p> <p>Universal precautions.</p> <p>Routing nursing practice.</p> <p>Technical nursing task, ventilator-associated practice.</p>	<p>Role of nursing in VAP prevention.</p>

<p>07. Nursing knowledge and Preventive Practices of Ventilator Associated Pneumonia as Perceived by Intensive Care Nurses in Hail City , KSA</p> <p>(Nuran M. Alhamad, Wesam A. Elsayed.)</p> <p>01.2024.</p> <p>Saudi Arabia.</p>	<p>Proper hand washing.</p> <p>Only 41.7% practiced proper oral care.</p> <p>83.3% elevated head of bed > 30</p> <p>Daily sedation assessment- 50%</p> <p>Use of DVT stockings 64.3%</p> <p>97.6% assessed tube placement correctly.</p>	<p>Basic infection control.</p> <p>Oral hygiene.</p> <p>Maintained prop-up positioning.</p> <p>Sedation interval.</p> <p>DVT prevention.</p> <p>Monitoring tube placement.</p>	<p>Target prevention measures.</p> <p>Mechanical VAP reaction.</p> <p>Sedation protocols. (ventilator weaning)</p> <p>Holistic critical care.</p> <p>Airway management.</p>	<p>Role of nursing in VAP prevention.</p>
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Question no 2

How do these nursing interventions affect patient outcomes?

Meaning unit	Code	Sub category	Generic category	Main category
01.Knowledge and Practices of Intensive Care Nurses on Mechanical Ventilation. (Serdar Saritas, Ayten Kaya, Sc Golkoy, Ordu, Niha Dolanbay, Turgut Ozal)Turkey. 2019. Article 01	Lack of knowledge about alarming indicators. (Why alarming, what do they indicate?) Poor understanding of mechanical ventilation (MV) settings. Inconsistent cuff pressure monitoring. Do not use a manometer. Lack of training programs	Technical challenges. (do not know how to correct indicators.) Knowledge deficiency of ventilators. (do not know what the settings are, values, and how to recognize measurements that indicate.) Use incorrect procedures. Education gap.	Training deficiencies. Lack of training nurses. Need for training programs.	Reduce patient outcomes because of lack of training nurses and lack of knowledge. Impact of nursing interventions. Effectiveness of nursing interventions.

	in VAP prevention.			
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<p>02. Knowledge of Nurses about the Intervention for the Prevention of Pneumonia Associated with Mechanical Ventilation. (Bruna Vanessa Wagner, Evelyn Francini Alves, Christiane Brey, Maria Caroline Waldrigues, Cristiano Caveião.)</p> <p>Brazil. 2015</p>	<p>Use proper oral hygiene. (reduce microbial colonization and risk of VAP)</p> <p>Lack of knowledge about alarming.</p> <p>Knowledge deficiency.</p> <p>Airway safety by maintaining cuff pressure,</p>	<p>Reduce VAP</p> <p>Alarm misinterpretation.</p> <p>Variation in adherence to protocols.</p> <p>Improved patients' stability</p>	<p>Impact of nursing intervention on patient outcomes</p>	<p>Effectiveness of nursing interventions.</p>
<p>03. Development of Tool for Measuring Ventilator Associated Pneumonia Prevention Behaviors of Intensive Care Units nurses. (Sungjung Kwak and Sujeong Han) Korea.2022</p>	<p>Maintaining cuff pressure prevents tracheal ischemia and damage.</p> <p>The circuit replaced only when visibly contaminated, avoiding</p>	<p>Cuff pressure protection.</p> <p>Evidence-based practice.</p>	<p>Complication prevention.</p> <p>Improved patient handling.</p>	<p>Effectiveness of nursing interventions</p>

Article no 3	unnecessary replacement.			
04. Evidence Based practices for Preventing Ventilator Associated Pneumonia in Intensive Care Nursing. (Celik Aysegul, Usta Yesilbalkan Oznur Akyol Asiye)Turkey. 2020. Article no: 4	Reduce cross-infection risk. (hand hygiene 98%). Maintains airway moisture. (used heat moisture exchange 100%) Bed head elevation. Used 98%. Cuff pressure maintained above 20 cmH2O Oral care with chlorhexidine (88.2%)	Infection control. Mucosal protection. Positioning the patient. Prevent air leak aspiration. Reduce bacterial colonization. Used aseptic techniques. And equipment hygiene.	Clinical outcomes. Improve pulmonary hygiene. Complication prevention. Prevent HAI	Effectiveness of nursing interventions

	Used a sterile catheter for suctioning and used sterile water for the humidifier.			
06. Pneumonia associated with invasive mechanical ventilation : nursing care (João Ricardo Miranda da Cruz , Matilde Delmina da Silva Martins) 2018 Pruthugal.	Low VAP incidence. (0.3% rate of VAP) Reduced aspiration risk. (because of bed head elevation). Airway safety. (Proper cuff pressure prevents tracheal necrosis) Oral flora control. (reduce colonization and aspiration of gastric contents)	Reduce infection rate. Positioning. Reduce bacteria growth. Basic nursing care practice.	Clinical outcomes. Complication prevention. Equipment-related outcomes. Reduce hospital stays and prevent HAIs.	Effectiveness of nursing intervention.

	<p>Prevent cross-infection (prevent contamination).</p> <p>Hand hygiene (to prevent hospital-acquired infection, HAI)</p>			
<p>07. Nursing Knowledge and Preventive Practices of Ventilator Associated Pneumonia as Perceived by Intensive Care Nurses in Hail City, KSA</p> <p>(Nuran M. Alhamad, Wes-sam A. Elsayed.)</p> <p>01.2024.Saudi Arabia</p>	<p>Assessed elevation and checked tube placement.</p> <p>Maintained oral care decreases microbial colonization risk.</p> <p>Proper hand hygiene practice to prevent nosocomial infection.</p> <p>Use of suctioning</p>	<p>Aspiration prevention.</p> <p>Oral hygiene.</p> <p>Infection barrier control.</p>	<p>Mechanical ventilation.</p> <p>Control infection sources and reduce the spread.</p> <p>Pulmonary hygiene.</p>	<p>Effectiveness of nursing intervention.</p>

	<p>and secretion management for airway patency.</p> <p>Daily sedation and weaning assessment reduce mechanical ventilation duration.</p> <p>Use DVT stockings.</p>	<p>Airway clearance.</p> <p>Weaning facilitation.</p> <p>Reduce complications.</p>	<p>Sedation protocol.</p> <p>Complication management.</p>	
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