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Nursing interventions to prevent ventilator-associated pneumonia: an integrative review

Intervenções de enfermagem frente a prevenção de pneumonia associada à ventilação mecânica: uma revisão integrativa

Intervenciones de enfermería para prevenir la neumonía asociada a la ventilación mecánica: una revisión integradora

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ABSTRACT

Objective: to analyze the scientific evidence in the literature on nursing interventions for patients diagnosed with ventilator-associated pneumonia. **Methodology:** this research is configured as an integrative review of the literature, based on the PICo strategy, through the descriptors: Nursing, Nursing Interventions and Ventilator-Associated Pneumonia. The search for articles took place in the databases, Latin American and Caribbean Literature in Health Sciences, Nursing Database, Medical Literature Analysis and Retrieval System Online, via the Virtual Health Library, using the time frame of 2019 and 2024 as a filter, primary articles, available in full, in Portuguese. **Results:** A total of 5,046 articles were obtained using the descriptors. By applying the filters, 63 articles were obtained for preliminary reading. Of these, 42 were read in full, 30 were discarded, making up the final sample of 12 articles to compose this review. **Final considerations:** It was observed that nursing team interventions are fundamental for the prevention and reduction of ventilator-associated pneumonia, and that the implementation of actions aimed at improving patient safety is essential. The studies point out some identified obstacles, such as the lack of continuing education, team training, low adherence to sedation monitoring, and the shortage of nursing professionals in some institutions.

Keywords: Nursing care; healthcare-related infections; ventilator-associated pneumonia; prevention.

RESUMO

Objetivo: analisar na literatura as evidências científicas sobre as intervenções de enfermagem a pacientes diagnosticados com pneumonia associada à ventilação mecânica. **Metodologia:** esta pesquisa se configura como uma revisão integrativa da literatura, embasada na estratégia PICo, por meio dos descritores: Enfermagem, Intervenções de Enfermagem e Pneumonia Associada à Ventilação Mecânica. A busca dos artigos ocorreu nas bases de dados, Literatura Latino-Americana e do Caribe em Ciências da Saúde, Banco de Dados em Enfermagem, Medical Literature Analysis and Retrievel System Online, via Biblioteca Virtual em Saúde, tendo por filtro o recorte temporal de 2019 e 2024, artigos primários, disponíveis na íntegra, na língua portuguesa. **Resultados:** obteve-se um total de 5.046 artigos com a utilização dos descritores, com a aplicação dos filtros conseguiu-se 63 artigos que seguiram para

leitura prévia, destes, 42 seguiram para leitura completa, descartando-se 30, perfazendo a amostra final de 12 artigos para compor esta revisão. **Considerações finais:** observou-se que as intervenções da equipe de enfermagem são fundamentais para a prevenção e redução da pneumonia associada a ventilação mecânica, sendo imprescindível a implementação de ações voltadas para a melhoria da segurança do paciente. Os estudos apontam alguns obstáculos identificados, tais como a falta de educação continuada, treinamento da equipe, a baixa adesão ao monitoramento da sedação e a escassez de profissionais de enfermagem em algumas instituições.

Palavras-chave: Cuidados de enfermagem; infecções relacionadas à assistência à saúde; pneumonia associada à ventilação mecânica; prevenção.

RESUMEN

Objetivo: Analizar la evidencia científica existente en la literatura sobre las intervenciones de enfermería en pacientes diagnosticados de neumonía asociada a ventilación mecánica. **Metodología**: Esta investigación es una revisión bibliográfica integradora, basada en la estrategia PICo, utilizando los descriptores: Enfermería, Intervenciones de Enfermería y Neumonía Asociada a Ventilación Mecánica. La búsqueda de artículos se realizó en las bases de datos Literatura Latinoamericana y del Caribe en Ciencias de la Salud, Base de Datos de Enfermería, Sistema de Análisis y Recuperación de Literatura Médica en Línea, a través de la Biblioteca Virtual en Salud, filtrando el marco temporal de 2019 y 2024, artículos primarios, disponibles en su totalidad, en idioma portugués. **Resultados**: se obtuvo un total de 5.046 artículos utilizando los descriptores, después de aplicar los filtros, se seleccionaron 63 artículos para lectura previa, de los cuales 42 fueron leídos en su totalidad y 30 fueron descartados, dando una muestra final de 12 artículos para conformar esta revisión. **Consideraciones finales**: se observó que las intervenciones del equipo de enfermería son fundamentales para la prevención y reducción de la neumonía asociada al ventilador, siendo fundamental la implementación de acciones dirigidas a mejorar la seguridad del paciente. Los estudios señalan algunos de los obstáculos identificados, como la falta de educación continuada, de formación del personal, la baja adherencia a la monitorización de la sedación y la escasez de profesionales de enfermería en algunas instituciones.

Palabras clave: Cuidados de enfermería; infecciones relacionadas con la asistencia sanitaria; neumonía asociada a la ventilación; prevención.

1. INTRODUCTION

Mechanical Ventilation-Associated Pneumonia (MVAP) is the most common and severe of the Healthcare-Related Infections (HAIs). It develops at least 48 hours after endotracheal intubation, with an incidence of 23.2% to 36.01% in Brazil. This pathology has two phases: the early form, which is evident up to the fourth day of mechanical ventilation (MV) use, and the late form, after the fifth day of MV use. This second phase may be related to multidrug-resistant microorganisms, which favor an increase in patient morbidity and mortality (Campos *et al*., 2021).

The mortality rate of VAP varies between 24% and 50%, with invasive procedures performed on the respiratory tract, mechanical ventilation for more than 20 days, hospitalization for multiple traumas, sepsis, central nervous system diseases, and endocrine and respiratory diseases being the factors responsible. Considering these factors, the mortality rate can reach a maximum of 76%, with a high risk of developing this nosocomial infection, 3 to 10 times (Souza *et al*., 2023).

The diagnosis of VAP must be based on a thorough assessment of factors, as well as a careful analysis of specific etiological agents. Avoiding alternatives that can be associated with other clinical conditions, and false-positive diagnoses culminating in the indiscriminate use of antibiotics, leading to more resistant pathogens, as well as increased treatment costs and mortality rates. However, early treatment has been an option of choice for professionals, due to the delay in laboratory test results, resulting in therapeutic changes in almost 70% of cases after analysis results (Brasil, 2020).

According to COFEN Resolution No. 639/2020, nursing care for patients on mechanical ventilation involves continuous monitoring, infection prevention interventions and support to ensure the effectiveness of ventilatory support. It is up to nursing professionals to regularly assess the patient's respiratory condition, observe possible signs of complications, such as infections or injuries related to the endotracheal tube, and ensure proper maintenance of ventilation equipment (Brasil, 2020).

In addition, care includes the possibility of oral hygiene and aspiration of secretions, minimizing risks and promoting greater patient comfort. This comprehensive support, as provided for by COFEN, is essential for the safety and recovery of individuals undergoing this type of therapy. The aim of this study was to analyze the scientific evidence in the literature on nursing interventions for patients diagnosed with ventilator-associated pneumonia.

2. METHODOLOGY

This is an integrative literature review, which allows for the synthesis of knowledge, evaluation of important research for decisions and improvement of clinical practice, enabling knowledge of a given subject, as well as pointing out gaps in knowledge that need to be filled with new studies (Mendes; Silveira; Galvão, 2019).

The steps used in this review were: 1) elaboration of the review question; 2) search and selection of primary studies; 3) extraction of data from the studies; 4) critical evaluation of the primary studies included in the review; 5) synthesis of the review results and 6) presentation of the method (Mendes; Silveira; Galvão, 2019).

This study was guided by the following guiding question: what scientific evidence is available on nursing interventions and their influence on reducing the incidence of ventilator-associated pneumonia in critically ill patients? This question was based on the PICo strategy, in which 'P' refers to the patient, population or problem, 'I' to the intervention studied or interest and 'Co' to the context.

The Descritores de Ciências da Saúde (DeCS), in portuguese: P- Enfermagem; I- Intervenções de enfermagem Co- Pneumonia Associada à Ventilação Mecânica were used to complete the selected strategy.

It should be noted that in order to enable a greater number of articles to be retrieved, the authors opted to add the alternative terms linked in the DeCS to the search strategy, as described in Chart 1.

Chart 1 - Definition of controlled descriptors and alternative terms from DeCS, 2024.

PICo	Descritores Controlados (DeCS)	Termos Alternativos
P (Enfermagem)	Profissionais de enfermagem	Profissional de Enfermagem Praticantes de Enfermagem Praticante de Enfermagem
I (Intervenções de enfermagem)	Cuidados de Enfermagem	Assistência de Enfermagem Atendimento de Enfermagem Gestão de enfermagem
Co (Pneumonia Associada à Ventilação Mecânica)	Pneumonia Associada à Ventilação Mecânica	Pneumonia Associada a Respirador Pneumonia Associada a Respirador Mecânico Pneumonia Associada ao Ventilador

Source: authors, 2025.

Regarding the inclusion criteria, primary articles were selected, available in full, within the time frame of 2019 and 2024. To capture studies in the Portuguese language, and that answered the guiding question and the objective of the study. Review articles, theses, dissertations, course completion papers and duplicate articles were discarded.

The Boolean operators OR and AND were used to cross-reference the descriptors in the databases and to include and exclude articles, which were associated in different ways in order to retrieve the largest number of related articles on the subject. Data was collected in September 2024, using the following databases: Latin American and Caribbean Literature in Health Sciences (LILACS), Nursing Database (BDENF), Medical Literature Analysis and Retrieval System Online (MEDLINE), via the Biblioteca Virtual de Saúde (BVS) described in Table 2.

Chart 2- Search strategies used in the respective databases during the search for studies, 2024.

BASE DE DADOS	ESTRATÉGIA DE BUSCA UTILIZADAS
LILACS, BDENF, MEDLINE (VIA BVS)	(Pneumonia Associada a Respirador) AND (Profissional de Enfermagem) OR (Assistência de Enfermagem) OR (Pneumonia Associada a Respirador Mecânico) AND (Praticantes de Enfermagem) OR (Atendimento de Enfermagem) OR

	(Pneumonia Associada ao Ventilador) AND (Praticante de Enfermagem) OR (Gestão de enfermagem)

Source: authors, 2025.

To ensure didactic and methodological rigor in conducting this review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method was used, as illustrated in Figure 1. This method consists of a minimum set of evidence-based items designed to optimize the reporting of systematic reviews and meta-analyses. In addition to focusing on evaluating the effects of interventions, its application extends to the reporting of reviews with varied objectives, offering broad methodological versatility (Tricco *et al.*, 2018).

Figure 1. Flowchart for selecting primary studies, according to the PRISMA recommendation.

Articles found in the databases N= 5.046		Lilacs= 241; Bdenf= 59; Medline = 233
Application of filters: N= 63		Lilacs= 33; Bdenf= 25; Medline = 19
Previous reading: N= 42		Lilacs= 18; Bdenf= 13; Medline = 11
Full reading of the final sample: N= 11		Lilacs= 7; Bdenf= 4 Medline = 1

Source: authors, 2025.

3. RESULTS AND DISCUSSIONS

As shown in figure 1, articles were searched for in the databases using the search strategies shown in table 2. This resulted in a total of 5,046 articles arranged as follows: Lilacs= 241; Bdenf= 59; Medline = 233. The inclusion and exclusion criteria set out in the methodology were then used and 63 findings were obtained, 33 in Lilacs; 25 in Bdenf; 19 in Medline. A total of 63 articles were obtained. The authors read the titles and abstracts of the articles beforehand, discarding duplicate research and aligning the others with the guiding question of this study, which resulted in a total of 42 articles eligible for the final analysis.

After reading them in full, 30 studies were discarded because they did not meet the objective of this review, resulting in a total of 12 articles. The database with the highest number of articles was Lilacs with 07 (58.33%), followed by Bdenf (n= 4; 33.33%) and finally Medline with only 01 publication (n=1; 8.34%).

In addition, for a better understanding of the articles included, a summary table was developed describing the research using their titles, authors, year of publication, journals, databases, type of research and methodological approach, see chart 3.

Chart 03 - Description of the articles included in the review.

TITLE	AUTHOR, YEAR AND PLACE OF PUBLICATION	JOURNAL AND DATABASE	TYPE OF RESEARCH AND METHODOLOGICAL APPROACH
Mechanical Ventilation-Associated Pneumonia: Pediatric Unit Nursing Staff Knowledge	(Oliveira, Ferrari, 2023) (Brasília)	Revista Enferm foco (BDENF)	This is a quantitative descriptive quasi-experimental study carried out in the pediatric units of a public university hospital in the northern region of the state of Paraná. (QUANTITATIVE)
The role of nursing technicians in the prevention of ventilator-associated pneumonia: a qualitative study.	(Mota *et al*., 2023) (Bahia)	Revista Baiana enferm (LILACS)	This is a descriptive and qualitative study carried out with nursing technicians from an Adult Intensive Care Unit in Porto Alegre. (QUALITATIVE)
The nurse's role in dealing with patients undergoing mechanical ventilation in the emergency room.	(Santos *et al*., 2022) (São Paulo)	Revista Nursing (LILACS)	This is a descriptive and exploratory study with a quantitative approach carried out with nurses. (QUANTITATIVE)
Profile of patients treated in private home care who developed ventilator-associated pneumonia.	(Cezar *et al*. 2024) (Brasília)	Revista brasileira de Enermagem. (LILACS)	This was a retrospective study of patients' medical records at a private institution. (QUANTITATIVE)
Education to prevent ventilator-associated pneumonia in the Intensive Care Unit.	Branco *et al*., 2020) (Brasília)	Revista brasileira de Enermagem. (MEDLINE)	This is a quasi-experimental, retrospective study of 302 mechanically ventilated patients admitted to the Intensive Care Unit. (QUANTITATIVE)
Good practices in the prevention of ventilator-associated pneumonia.	(Alecrim *et al*., 2019) (São Paulo)	Revista Acta Paulista de Enfermagem (Online) (BDENF)	This is a prospective cohort study carried out in an Intensive Care Unit of a university hospital. (QUANTITATIVE)
Analysis of quality indicators in an adult Intensive Care Unit: a descriptive study.	(Paz *et al*., 2023) (Rio de Janeiro)	Revista Online brazilian journal of nursing (BDENF)	This is a descriptive study with a retrospective analysis of indicator reports from an adult intensive care unit. (QUALITATIVE)

Nursing care and epidemiological profile of patients with ventilator-associated pneumonia.	(Kich *et al*., 2023) (Santa Cruz do Sul)	Revista De Epidemiologia E Controle De Infecção (LILACS)	This is a retrospective quantitative cohort study carried out in the ICU of a hospital in the interior of Rio Grande do Sul. (QUANTITATIVE)
Educational intervention for a nursing team on the oral hygiene of critically ill patients in the intensive care unit.	(Teixeira *et al*., 2022) (Rio de Janeiro)	Revista Naval de Odontologia (LILACS)	This is an exploratory, descriptive and quantitative study carried out with nursing professionals at the Hospital's ICU in João Pessoa. (QUANTITATIVE)
Ventilator-associated pneumonia: perception of nursing professionals.	(Dutra et *al*., 2019) (Recife)	Revista de Epidemiologia e Controle de Infecção (BDENF)	This is a qualitative, descriptive and exploratory study carried out in a small private hospital. (QUALITATIVE)
Good practices for preventing ventilator-associated pneumonia in the emergency department.	(Frota *et al*., 2019) (São Paulo)	Revista Da Escola De Enfermagem Da USP (LILACS)	This is a cross-sectional, analytical study with a quantitative approach, carried out in a university hospital in the city of São Paulo. (QUANTITATIVE)
Perceptions and practices on superficial sedation in mechanically ventilated patients: a survey on the attitudes of Brazilian intensive care physicians	(Dantas *et al*., 2022) (São Paulo)	Revista brasileira de terapia intensiva (LILACS)	This is a cross-sectional cohort study based on the application of an electronic questionnaire focused on sedation practices. (QUANTITATIVE)

Source: authors, 2025.

The journals “Revista Brasileira de Saúde Materno Infantil” and “Revista Brasileira de Ginecologia e Obstetrícia” were repeated in two publications each. As for methodological approaches, 90% of the studies were quantitative, with the exception of the study by Motta and Moreira (2021), which refers to a mixed approach (quantitative and qualitative).

In a study carried out in a public hospital in the Federal District (DF), 63.1% of professionals stated that among the main complications in patients on MV, VAP is among the most common pathologies in the care context of the unit. In addition, an observational study carried out in the state of São Paulo with patients on home mechanical ventilation found that among 73 patients affected by VAP, 65.8% were male, 53.4% were adults with a mean age of 57 years (Cezar et al., 2024; Santos et al., 2022).

With regard to the main causes of VAP, data from an exploratory study carried out in a private hospital in the south of Minas Gerais highlights non-modifiable risk factors such as age and comorbidities. With regard to modifiable factors, the study highlights the insertion of the endotracheal tube as the main condition, since, as it passes through the patient's skin barriers, it facilitates the colonization of microorganisms. Other factors include the duration of mechanical ventilation, with an estimated risk of 3%

per day in the first five days. Also noteworthy is the high risk of colonization in the oral cavity (Dultra et al., 2019).

Texeira et al. (2022) highlight the risk caused by inadequate aspiration of the airways, resulting in excessive accumulation of secretion in the pulmonary structures, which can reduce the vagal nerve response, cause coughing and increase microbial proliferation. Therefore, the crucial importance of practicing oral hygiene in critically ill hospitalized patients can be seen, as a preventive action against the spread of infections in the oropharynx.

(2022), the main cause of VAP is associated with aspiration of secretions in the upper airways or reflux of gastric contents. As sedation causes a reduction in patients' level of consciousness, secretions accumulate in the oropharynx, culminating in the proliferation of Acinetobacter baumannii, considered the main cause of VAP. To prevent and control the spread of this bacterium, professionals should sanitize their hands and equipment, use closed suction systems, culture the pathogen and surfaces, and isolate patients infected with multidrug-resistant microorganisms.

Another approach observed is in the study by Frota et al. (2019), whose focus was on peptic ulcer prophylaxis, associating the pH of gastric juice with the colonization of pathogens that predict VAP, reporting that this was the most widely used measure in the study, with an adherence rate ranging from 56.0% to 100%. However, this measure can be challenged in practice, as its application requires a careful assessment of the risks and benefits. The authors justify that the use of proton pump inhibitors alters the pH of gastric juice, changing the colonization pattern of different pathogens, which increases the risk of VAP. They also point out that gastrointestinal bleeding is a common complication in critically ill patients.

In order to assess the nursing team's adherence to the VAP prevention bundle, the authors Branco et al. (2019) observed that the most adopted actions included raising the head of the bed between 30° and 45°, depending on the patient's clinical condition; oral hygiene with 0.12% chlorhexidine and tooth brushing, recorded in the nursing evolution every 12 hours; and checking the balloon pressure between 20 and 30 mmHg, also recorded every 12 hours. The team also ensured that there were no impurities in the mechanical ventilator filter.

In addition, an observational study carried out by Ferrari and Oliveira (2023), highlights the importance of educational actions to improve patient safety, showing that the implementation of a prevention bundle resulted in a 64.8% reduction in cases of VAP in 2013. The adoption of risk management practices emerges as a key factor in reducing VAP, as well as reducing hospitalization time and hospital costs.

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A study aimed at evaluating nursing care and the epidemiological profile of patients diagnosed with VAP, calculated the average number of checklists with the care provided in the bundle, resulting in an average of 2.62 checklists per day by nursing professionals. The study highlights the importance of daily monitoring of the bundle, pointing out that among the patients in the unit, four who had no records of care during the period in IMV died, with data indicating a variable period of two to four days (Kich et al., 2022).

Still evaluating the care provided by nurses, a study carried out in 2023 highlighted VAP as having the highest incidence (37.8 × 1,000 patient-days on MV) among 444 hospitalizations. This context expresses the importance of daily data collection by nursing staff, allowing monthly indicators to be analyzed with the multidisciplinary team in order to improve the quality of the service provided (Paz et al., 2033).

An epidemiological study by Alecrim et al. (2019) found a 91% adherence rate to the practice of daily assessment of sedation and reduction when possible. According to the authors, this action proved to be effective and is recommended for the prevention of pneumonia. Based on this, an international multicenter study showed a reduction in patients with deep sedation from 55.2% to 44.0% after adopting a nurse-managed sedation and analgesia protocol.

Building on the previous point, a study by Dantas et al. (2022) revealed worrying data on the practice of sedation and monitoring in clinical environments. Although 92.6% of professionals reported using sedation protocols, only 48% actually monitored the level of sedation. Low adherence to monitoring was attributed, in part, to the mistrust of 31.8% of the participants regarding the effectiveness of superficial sedation as a strategy. In addition, significant barriers to optimal sedation practice were identified, such as: reduced number of nursing professionals (50%); Lack of staff knowledge or training in the use of scales for assessing pain, sedation or delirium (47%).

Mota et al., (2019), agree that, as an essential aspect, nursing professionals must always be up-to-date through continuing education in order to provide a qualified service. In addition, the research highlights the importance of nurses as team leaders, making it possible to pass on updates and guidance on the subject, contributing to better adherence to prophylactic measures and adhering to this practice, in order to obtain better results.

4. CONCLUSION

The results indicate that the implementation of interventions based on care bundles, such as elevating the head of the bed, oral hygiene with antiseptic solutions and maintaining the ideal balloon pressure, has a significant impact on reducing the incidence of VAP. In addition, there is evidence of the importance of permanent educational actions aimed at nursing teams, which not only improve adherence to safety protocols, but also foster a culture of care based on evidence-based practice. These findings confirm the essential role of nurses in preventing complications and ensuring quality care in highly complex contexts.

However, despite the robustness of the results, there are limitations inherent in the predominance of quantitative studies which, by prioritizing numerical indicators, may neglect qualitative nuances related to the subjectivity of care. Furthermore, the scarcity of recent literature in some databases compromises the comprehensiveness of the findings. It is therefore suggested that future research adopt mixed methodological approaches and explore the impact of integrated interdisciplinary strategies, expanding knowledge about the effectiveness of VAP preventive practices and strengthening their applicability in different care settings.

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