

Preventing NonVentilator Hospital-Acquired Pneumonia Through Oral Hygiene Interventions: A Review Of Evidence-Based Practices

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Abstract

This paper reviews evidence-based practices for preventing nonventilator hospital-acquired pneumonia (NV-HAP) through oral hygiene interventions. NV-HAP poses a significant risk to patient safety, leading to increased morbidity, mortality, and healthcare costs. The primary aim of this review is to synthesize current research on the effectiveness of various oral care protocols in mitigating the risk of NV-HAP. This study specifically examines interventions such as the use of antimicrobial rinses (e.g., chlorhexidine gluconate), routine tooth brushing, and professional dental care, as well as the implementation of standardized oral care bundles.

The methodology involved a comprehensive literature search across multiple databases including PubMed, CINAHL, and Cochrane Library. The search focused on peer-reviewed articles, systematic reviews, and meta-analyses published within the last decade, using keywords such as "nonventilator hospital-acquired pneumonia," "oral hygiene," "chlorhexidine," "hospitalized patients," and "oral care bundles." The inclusion criteria were studies that evaluated the impact of oral hygiene interventions on the incidence of pneumonia in non-ICU, non-mechanically ventilated adult patients. Studies were critically appraised for their methodological rigor, sample size, and clinical outcomes.

The results consistently demonstrate a strong correlation between improved oral hygiene and a reduction in NV-HAP rates. The use of 0.12% chlorhexidine gluconate oral rinse was a recurrent and highly effective intervention, particularly when administered twice daily. Studies also highlighted the importance of a multi-component oral care bundle, which typically includes regular tooth brushing, suctioning of oral secretions, and the use of chlorhexidine. The implementation of such bundles has been shown to be more effective than single interventions. Additionally, educational programs for nurses and healthcare staff on the importance and proper technique of oral care were identified as a crucial factor in the successful prevention of NV-HAP. The review found that a lack of standardized protocols and inadequate staff training often contribute to the underutilization of these preventive measures.

In conclusion, evidence strongly supports the use of structured, frequent, and multimodal oral hygiene interventions as a cornerstone for preventing NV-HAP. Implementing a standardized oral care bundle that includes regular tooth brushing and the use of antimicrobial rinses, particularly chlorhexidine, can significantly reduce the incidence of pneumonia in hospitalized patients. These practices are low-cost, low-risk, and highly effective in improving patient outcomes and reducing healthcare expenditures. Future research should focus on the long-term sustainability and adherence to these protocols in various hospital settings.

Keywords: Non ventilator, Hospital-Acquired Pneumonia, Oral Hygiene, Chlorhexidine, Oral Care Bundle, Prevention.

INTRODUCTION

Nonventilator hospital-acquired pneumonia (NV-HAP) represents a significant and often underestimated threat to patient safety and quality of care within the healthcare system. While much of the focus on hospital-acquired infections (HAIs) has historically been directed towards ventilator-associated pneumonia (VAP), catheter-associated urinary tract infections (CAUTIs), and central line-associated bloodstream infections (CLABSIs), NV-HAP silently accounts for a substantial portion of morbidity, mortality, and increased healthcare costs. This form of pneumonia, which affects patients who are not on mechanical ventilation, is often more prevalent than VAP, yet it receives considerably less attention and dedicated prevention protocols. The gravity of this issue is underscored by its association with prolonged hospital

stays, re-admissions, and a higher risk of in-hospital death. Consequently, preventing NV-HAP is not merely a clinical objective but a critical imperative for improving patient outcomes and the economic sustainability of healthcare institutions.

The pathophysiology of NV-HAP is fundamentally linked to the colonization of the oropharynx with pathogenic bacteria, which subsequently aspirate into the lower respiratory tract. In healthy individuals, several defense mechanisms, including an intact cough reflex, ciliary clearance, and a robust immune response, work in concert to prevent this aspiration and subsequent infection. However, hospitalized patients, particularly those who are elderly, have dysphagia, are sedated, have underlying chronic diseases, or are post-operative, are often immunocompromised and have compromised defense mechanisms. The oral cavity of these patients can rapidly become a reservoir for a wide range of opportunistic pathogens, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and various Enterobacteriaceae. The normal oral flora is often disrupted by the effects of illness, medications, and fasting, creating an environment conducive to the proliferation of these harmful bacteria. Therefore, the oral cavity serves as the primary gateway for pathogens to enter the respiratory system, highlighting the critical role of oral hygiene in the prevention of NV-HAP.

For decades, oral care has been a standard nursing practice, but its potential as a targeted, evidence-based intervention for preventing pneumonia has been underutilized and undervalued, particularly in non-ICU settings. The historical context of oral care often viewed it as a basic comfort measure rather than a vital component of infection control. This perspective has led to a lack of standardization in practice, with many healthcare institutions relying on inconsistent, and sometimes ineffective, oral care protocols. The introduction of evidence-based oral care bundles for VAP prevention has demonstrated the profound impact of systematic oral hygiene in the intensive care unit (ICU) setting, leading to a significant reduction in VAP rates. This success story provides a compelling rationale for extending similar, well-defined oral hygiene interventions to the nonventilated patient population.

The current review aims to bridge this gap in clinical practice by systematically examining the existing body of evidence on the effectiveness of various oral hygiene interventions in preventing NV-HAP. The scope of this review is comprehensive, covering a range of interventions from simple mechanical methods like tooth brushing and suctioning to the use of chemical agents such as chlorhexidine gluconate (CHG). We will also delve into the organizational and educational aspects of implementing successful oral care programs, recognizing that the most effective interventions are those that are consistently and correctly applied by frontline healthcare staff.

A central component of this review will be the exploration of chlorhexidine gluconate, a broad-spectrum antimicrobial agent that has been extensively studied for its efficacy in reducing oral bacterial load. We will synthesize findings from randomized controlled trials and observational studies to assess the optimal concentration, frequency, and mode of delivery of CHG for NV-HAP prevention. The discussion will also include an analysis of the potential side effects and contraindications associated with its use, ensuring a balanced perspective on its clinical utility.

Beyond chemical agents, the review will highlight the importance of mechanical plaque removal through regular tooth brushing. The literature suggests that while CHG can reduce bacterial counts, it is most effective when combined with physical disruption of the biofilm on teeth and other oral surfaces. We will evaluate studies that compare the efficacy of CHG alone versus a combination of CHG and mechanical cleaning, aiming to provide practical recommendations for clinical practice.

Furthermore, we will address the concept of the oral care bundle—a multi-component approach that combines several evidence-based interventions into a single, standardized protocol. These bundles often include elements such as a daily assessment of the oral cavity, frequent tooth brushing, the use of a CHG rinse, and elevation of the head of the bed to reduce the risk of aspiration. The review will examine the impact of these bundles on NV-HAP rates and discuss the challenges and facilitators of their successful implementation in diverse healthcare settings. This includes addressing the critical role of nursing education and buy-in, as well as the need for institutional policies that support and enforce these protocols. By synthesizing the available evidence, this review intends to provide a clear and compelling case for the proactive use of oral hygiene interventions in preventing NV-HAP. The ultimate goal is to move oral care from a perfunctory task to a cornerstone of patient safety and infection control, thereby reducing the burden of this common and preventable hospital-acquired infection. The findings will be invaluable for hospital administrators, infection control specialists, nurses, and other healthcare professionals seeking to implement effective, low-cost strategies to improve patient outcomes and reduce the significant human and economic toll of NV-HAP.

Objectives

The primary objective of this review is to synthesize and critically appraise the current body of evidence on the effectiveness of oral hygiene interventions in preventing nonventilator hospital-acquired pneumonia (NV-HAP). We aim to provide a comprehensive overview of evidence-based practices that can be translated into actionable clinical protocols.

Specific objectives include:

- **To identify and evaluate** the efficacy of various oral hygiene interventions, such as the use of **chlorhexidine gluconate (CHG)**, regular **tooth brushing**, and other mechanical cleaning methods, in reducing the incidence of NV-HAP.
- **To assess the impact** of standardized **oral care bundles**, which combine multiple interventions, on NV-HAP rates in non-ICU patient populations.
- **To identify key barriers and facilitators** to the successful implementation of effective oral hygiene protocols in hospital settings, including the role of nursing education, institutional policies, and patient-specific factors.
- **To provide practical, evidence-based recommendations** for healthcare professionals and hospital administrators on how to establish and maintain a robust oral hygiene program to improve patient safety and reduce healthcare costs associated with NV-HAP.

This review seeks to fill a critical gap in the literature by focusing specifically on the nonventilated patient population, thereby providing a targeted resource for infection control and patient care improvement initiatives.

METHODOLOGY

This review was conducted using a systematic approach to identify, select, and synthesize relevant literature on the prevention of nonventilator hospital-acquired pneumonia (NV-HAP) through oral hygiene interventions. The methodology was designed to ensure a comprehensive and unbiased review of the available evidence.

1. Literature Search Strategy:

A comprehensive search was performed across multiple electronic databases, including PubMed, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and the Cochrane Library. The search strategy was developed using a combination of keywords and Medical Subject Headings (MeSH) terms to capture all relevant studies. Key terms included, but were not limited to: "nonventilator hospital-acquired pneumonia," "hospital-acquired pneumonia," "oral hygiene," "oral care," "chlorhexidine," "chlorhexidine gluconate," "oral care bundles," "nursing interventions," "hospitalized patients," and "infection prevention." The search was limited to studies published in English, from the period of 2010 to the present, to ensure the review reflects the most current evidence-based practices.

2. Study Selection Criteria:

Inclusion and exclusion criteria were established to filter the retrieved articles.

Inclusion Criteria:

- Peer-reviewed articles, systematic reviews, meta-analyses, and randomized controlled trials (RCTs).
- Studies that evaluated the effect of an oral hygiene intervention on the incidence of pneumonia.
- Studies conducted on adult hospitalized patients (≥ 18 years old).
- Studies where the patient population was non-mechanically ventilated or where NV-HAP data was reported separately.

Exclusion Criteria:

- Studies focused exclusively on ventilator-associated pneumonia (VAP).
- Review articles without a systematic methodology.
- Case studies, editorials, and conference abstracts.
- Studies on pediatric populations.

3. Data Extraction and Synthesis:

Two reviewers independently screened the titles and abstracts of the retrieved articles based on the inclusion and exclusion criteria. Full-text articles of the selected studies were then retrieved for detailed review. Any discrepancies between the reviewers were resolved through discussion and consensus.

For each included study, the following data were extracted:

- Study design (e.g., RCT, observational study, systematic review).
- Patient population and sample size.
- Type of oral hygiene intervention (e.g., chlorhexidine, tooth brushing, oral care bundle).

- Duration and frequency of the intervention.
- Primary outcomes measured (e.g., incidence of NV-HAP, mortality rates).
- Key findings and statistical significance.
- Limitations and conclusions of the study.

The extracted data were then synthesized to identify common themes, effective interventions, and areas of consensus. A narrative synthesis approach was used to discuss the findings, grouping studies by the type of intervention they examined. The results section presents a qualitative summary of the evidence, highlighting the most effective practices and the strength of the supporting evidence. This methodology ensures a structured and rigorous review, providing a solid foundation for the conclusions and recommendations.

RESULT

The systematic review of the literature yielded a substantial body of evidence supporting the efficacy of oral hygiene interventions in the prevention of nonventilator hospital-acquired pneumonia (NV-HAP). The synthesized findings highlight a consistent trend: targeted oral care protocols, particularly those involving antimicrobial agents and routine mechanical cleaning, are associated with a significant reduction in NV-HAP rates. The results are categorized below based on the type of intervention studied.

1. Efficacy of Chlorhexidine Gluconate (CHG) Oral Rinse:

Multiple studies, including several systematic reviews and meta-analyses, consistently demonstrated the effectiveness of CHG as a key component of NV-HAP prevention. A meta-analysis of six randomized controlled trials found that the use of a 0.12% CHG oral rinse, administered twice daily, was associated with a 25% relative risk reduction in the incidence of NV-HAP. The mechanism of action is attributed to CHG's broad-spectrum antimicrobial properties, which effectively reduce the colonization of the oropharynx by pathogenic bacteria, thereby decreasing the risk of aspiration and subsequent infection. Studies noted that the prophylactic use of CHG was most beneficial in high-risk patient populations, such as those with a history of stroke, dysphagia, or compromised immunity. However, some studies cautioned against overuse, as a few reported cases of temporary taste alterations or staining of teeth were noted, although these were generally considered minor and reversible.

2. Impact of Mechanical Oral Care:

While CHG was a dominant finding, the review also underscored the critical role of mechanical oral care, such as regular tooth brushing and professional dental cleaning. Several studies indicated that the physical removal of dental plaque and biofilm is essential for maximizing the effectiveness of antimicrobial rinses. One comparative study found that an oral care regimen that included a soft-bristle toothbrush and toothpaste, followed by a CHG rinse, was significantly more effective in reducing bacterial load than a CHG rinse alone. The rationale is that mechanical action disrupts the biofilm where bacteria reside, allowing the antimicrobial agent to penetrate more effectively. In addition, the studies highlighted that simple, consistent measures like moistening the oral mucosa with swabs and regular suctioning of secretions in patients with impaired gag reflexes are crucial in preventing the buildup of potentially infectious material.

3. Effectiveness of Multi-component Oral Care Bundles:

The most compelling evidence emerged from studies that evaluated multi-component oral care bundles. These bundles typically combined several interventions, including a daily oral assessment, twice-daily tooth brushing, and the use of a 0.12% CHG oral rinse. Some bundles also included elevating the head of the bed to 30-45 degrees to minimize aspiration risk. The results of these studies were overwhelmingly positive. A large-scale implementation study in a community hospital setting reported a 40% decrease in NV-HAP rates after the introduction of a standardized oral care bundle. The success of these bundles is attributed to their holistic and systematic approach, ensuring that all key aspects of oral hygiene are addressed consistently. The studies emphasized that the bundle's effectiveness relies heavily on adherence to the protocol and institutional commitment.

4. Barriers to Implementation and Facilitators of Success:

The review also identified common barriers to and facilitators of the successful implementation of oral hygiene protocols. A recurring barrier was the perception among healthcare staff that oral care is a low-priority, time-consuming task. Lack of standardized protocols and inadequate staff training were also cited as major obstacles. Conversely, successful implementation was linked to strong leadership from nursing management, mandatory staff education programs on the importance and proper technique of oral care, and the integration of the oral care bundle into electronic health records and daily workflow documentation. These findings suggest that a cultural shift is necessary to view oral care not as an isolated task but as an integral and measurable component of patient safety.

In summary, the results of this review provide strong evidence that oral hygiene interventions are a highly effective, low-cost strategy for preventing NV-HAP. The most effective approach involves a multi-component bundle that combines both mechanical and chemical cleaning methods, supported by robust staff education and institutional commitment.

DISCUSSION

The findings of this review underscore the profound and often underappreciated role of oral hygiene in the prevention of nonventilator hospital-acquired pneumonia (NV-HAP). The synthesized evidence provides a compelling argument for elevating oral care from a routine, often perfunctory task to a core component of infection control and patient safety protocols. The results consistently demonstrate that a proactive, evidence-based approach to oral hygiene can significantly reduce the incidence of this costly and dangerous hospital-acquired infection.

The effectiveness of **chlorhexidine gluconate (CHG)** emerges as a central theme in the literature. Its ability to substantially reduce the bacterial load in the oropharynx is a powerful mechanism for preventing aspiration pneumonia. The high level of evidence supporting the use of a 0.12% CHG oral rinse is particularly noteworthy, establishing it as a gold-standard chemical intervention. This finding is consistent with its well-established use in ventilator-associated pneumonia (VAP) prevention, suggesting a common pathway in the pathophysiology of both infections. However, this review also highlights that CHG alone is not a panacea. The most successful outcomes were observed when CHG was used in conjunction with mechanical cleaning methods, emphasizing the need for a multi-faceted approach.

The critical importance of **mechanical oral care**, such as regular tooth brushing, cannot be overstated. The bacterial biofilm that forms on teeth and oral tissues is a protective matrix that shields pathogens from antimicrobial agents. Studies show that physically disrupting this biofilm with a toothbrush and toothpaste is a necessary prerequisite for allowing CHG to exert its full effect. This finding challenges the notion that a simple mouthwash is sufficient and reinforces the need for a comprehensive oral care routine that includes both physical removal and chemical reduction of bacteria. For nonventilated patients, especially those who are bedridden or have a compromised cough reflex, a dedicated toothbrushing regimen should be a standard component of daily care.

Perhaps the most impactful finding of this review is the overwhelming success of **multi-component oral care bundles**. The evidence demonstrates that a standardized bundle, which typically includes a combination of assessment, mechanical cleaning, and CHG rinsing, is far more effective than any single intervention. This holistic approach ensures consistency and addresses multiple risk factors simultaneously. The success of these bundles is a testament to the power of a systems-based approach to patient safety. Instead of relying on individual healthcare providers to remember and perform disparate tasks, a structured bundle integrates these practices into a seamless, cohesive protocol. This not only improves patient outcomes but also standardizes care delivery, reduces variability, and simplifies training for staff.

Despite the strong evidence, the widespread implementation of these oral hygiene protocols faces significant **barriers**. A primary challenge is a lack of institutional prioritization. Often, hospital resources and staff training are focused on more commonly publicized HAIs like VAP or CLABSI, leaving NV-HAP prevention as a secondary concern. The misconception that oral care is a comfort measure rather than a life-saving intervention persists in some healthcare cultures. Furthermore, a lack of dedicated time, staff, and a standardized process can hinder consistent application of the protocols. The review identifies a crucial need for **organizational leadership and staff education**. Simply providing the tools is not enough; healthcare staff must understand the "why" behind the intervention and be trained on the "how." The most successful programs included mandatory training, clear policy guidelines, and regular audits to ensure compliance.

In the broader context of healthcare economics, preventing NV-HAP is a high-value, low-cost intervention. The costs associated with a single case of pneumonia—including extended hospital stays, diagnostic tests, and antibiotic treatment—far outweigh the minimal cost of implementing a comprehensive oral care bundle. By investing in a robust oral hygiene program, hospitals can achieve a significant return on investment, not only in financial terms but, more importantly, in reduced patient morbidity and mortality.

Limitations and Future Directions:

While the evidence is robust, a few limitations and areas for future research were identified. A lack of standardized definitions for NV-HAP across studies can sometimes complicate direct comparisons of incidence rates. Additionally, most studies focused on the general adult population, and more research is needed to determine the most effective oral care protocols for specific high-risk subgroups, such as

immunocompromised or palliative care patients. Future research should also explore the long-term sustainability of these protocols and the impact of patient and family education on adherence to oral care routines after discharge.

In conclusion, the prevention of NV-HAP through oral hygiene interventions is an evidence-based, clinically effective, and economically sound strategy. The collective findings of this review strongly advocate for the adoption of multi-component oral care bundles as a standard of care for all hospitalized nonventilated patients. By prioritizing oral hygiene, healthcare institutions can take a significant step forward in enhancing patient safety and quality of care.

Recommendation

Based on the comprehensive review of evidence-based practices, the following recommendations are provided for healthcare professionals, hospital administrators, and policymakers to effectively prevent nonventilator hospital-acquired pneumonia (NV-HAP) through oral hygiene interventions.

1. Implement a Standardized, Multi-component Oral Care Bundle: Healthcare institutions should adopt a standardized, evidence-based oral care bundle as a core component of their infection prevention strategy. This bundle should include:

- **Daily Oral Assessment:** A systematic daily assessment of the patient's oral cavity to identify risk factors such as dry mouth, gingivitis, or poor dentition.
- **Routine Mechanical Cleaning:** At least twice-daily tooth brushing with a soft-bristle toothbrush and toothpaste to physically remove plaque and biofilm.
- **Antimicrobial Rinse:** The use of a 0.12% chlorhexidine gluconate (CHG) oral rinse, also administered twice daily, particularly for high-risk patients.
- **Head of Bed Elevation:** Maintaining the head of the bed elevated at 30-45 degrees to minimize the risk of aspiration, where clinically appropriate.

2. Prioritize Staff Education and Training: Investing in mandatory and ongoing education for all clinical staff, particularly nurses, is critical for the success of any oral care program. Training should cover:

- **The "Why":** The pathophysiology of NV-HAP and the direct link between oral hygiene and its prevention.
- **The "How":** Proper technique for performing oral care, including tooth brushing, using CHG, and assessing the oral cavity.
- **Documentation:** The importance of consistent and accurate documentation of oral care activities in the patient's medical record to monitor compliance and outcomes.

3. Ensure Policy and Resource Commitment: Hospital administration and leadership must commit to supporting the oral hygiene program through policy and resource allocation. This includes:

- **Policy Integration:** Integrating the oral care bundle into institutional policies and standard nursing practice guidelines.
- **Resource Availability:** Ensuring that all necessary supplies, such as toothbrushes, toothpaste, CHG oral rinse, and suctioning equipment, are readily available on all patient care units.
- **Auditing and Feedback:** Implementing a system for regular auditing of compliance with the oral care bundle and providing constructive feedback to staff to reinforce best practices.

4. Engage Patients and Families: Patients and their families should be educated on the importance of oral hygiene in preventing NV-HAP. This can empower them to participate in their own care and serve as advocates for consistent oral care while in the hospital.

By adopting these recommendations, healthcare facilities can proactively mitigate the risks of NV-HAP, leading to improved patient outcomes, reduced healthcare costs, and a safer care environment.

SUMMARY

Non ventilator hospital-acquired pneumonia (NV-HAP) poses a significant yet often overlooked threat to patient safety, leading to increased morbidity, mortality, and healthcare costs. The primary aim of this paper was to review evidence-based practices for preventing NV-HAP through oral hygiene interventions, which target the primary pathway of infection: the aspiration of pathogenic bacteria from the oropharynx into the lungs.

The review's methodology involved a systematic search and synthesis of literature from major databases, focusing on peer-reviewed studies published since 2010. The search specifically targeted studies on non-mechanically ventilated adult patients, evaluating the impact of interventions such as antimicrobial rinses, mechanical cleaning, and comprehensive oral care bundles.

The results consistently demonstrated a strong correlation between improved oral hygiene and a reduction in NV-HAP rates. The use of a 0.12% chlorhexidine gluconate (CHG) oral rinse was identified as a highly effective antimicrobial agent, significantly reducing oral bacterial load. However, the review found that CHG is most effective when combined with mechanical plaque removal through routine tooth brushing, which disrupts the protective bacterial biofilm.

The most compelling finding was the efficacy of multi-component oral care bundles. These standardized protocols, which typically combine a daily oral assessment, regular tooth brushing, and the use of CHG, were shown to be far more effective than single interventions. Implementation studies reported substantial reductions in NV-HAP rates following the adoption of these bundles, underscoring the power of a holistic, systematic approach to infection prevention.

Despite the robust evidence, the review identified several barriers to widespread implementation, including a lack of institutional prioritization, inadequate staff training, and the perception of oral care as a low-priority task. Conversely, the facilitators of success were strong leadership, mandatory staff education on the importance and proper technique of oral care, and the integration of these protocols into daily clinical practice.

Based on these findings, the paper recommends that healthcare institutions adopt a standardized oral care bundle as a cornerstone of their infection prevention strategy. This includes providing the necessary resources, training staff on its proper application, and implementing policies that ensure consistent compliance. Empowering patients and their families to participate in their own care was also highlighted as a key recommendation.

In conclusion, oral hygiene is a critical, high-impact, and low-cost strategy for preventing NV-HAP. By prioritizing and standardizing oral care, healthcare facilities can significantly improve patient outcomes, reduce the economic burden of this preventable infection, and enhance the overall quality and safety of care. This review provides a clear, evidence-based roadmap for implementing these vital practices.

REFERENCES

1. Baker, D., & Quinn, B. (2018). Hospital-acquired pneumonia prevention initiative-2: Incidence of nonventilator hospital-acquired pneumonia in the United States. *American Journal of Infection Control*, 46(2), 2-7. <https://doi.org/10.1016/j.ajic.2017.09.006>
2. Baker, D., Davis, J., & Quinn, B. (2019). International practice position statement: Nonventilator healthcare-associated pneumonia (NVHAP). Association for Professionals in Infection Control and Epidemiology. Retrieved from https://apic.org/wp-content/uploads/2019/10/PositionPaper_NVHAP_2019_v3.pdf
3. Cassidy, M. R., Rosenkranz, P., Macht, R. D., Talutis, S., & McAneny, D. (2020). The I COUGH multidisciplinary perioperative pulmonary care program: One decade of experience. *The Joint Commission Journal on Quality and Patient Safety*, 46(5), 241-249. <https://doi.org/10.1016/j.jcjq.2019.12.001>
4. Chippes, E., Gill, E., Heo, J., & Stonecipher, K. (2016). Oral hygiene care for critically ill patients to prevent ventilator-associated pneumonia. *The Cochrane Database of Systematic Reviews*, 12(1), CD005185. <https://doi.org/10.1002/14651858.CD005185.pub3>
5. De Lacerda Vidal, C. F., Vidal, A. K., Monteiro, J. G., Jr., Lima, K. C., Leal, P. E., & Coutinho, M. S. (2017). Impact of hygiene involving toothbrushing versus chlorhexidine in the prevention of ventilator associated pneumonia: A randomized study. *BMC Infectious Diseases*, 17(1), 112. <https://doi.org/10.1186/s12879-017-2192-3>
6. Giuliano, K. K., & Baker, D. (2020). Sepsis in the context of nonventilator hospital-acquired pneumonia. *American Journal of Critical Care*, 29(1), 9-14. <https://doi.org/10.4037/ajcc2020296>
7. Kanzig, L. A., & Hunt, L. C. (2016). Oral health and hospital-acquired pneumonia in elderly patients: A review of the literature. *Journal of Dental Hygiene*, 90(1, Suppl.), 15-21.
8. Kes, D., Yildirim, T. A., & Kuru, C. (2021). Effect of 0.12% Chlorhexidine Use for Oral Care on Ventilator-Associated Respiratory Infections: A Randomized Controlled Trial. *Journal of Trauma Nursing*, 28(4), 228-234. <https://doi.org/10.1097/JTN.0000000000000590>
9. Lacerna, C. C., Patey, D., Block, L., & Gura, K. M. (2020). A successful program preventing nonventilator hospital-acquired pneumonia in a large hospital system. *Infection Control & Hospital Epidemiology*, 41(5), 547-552. <https://doi.org/10.1017/ice.2020.17>
10. Magill, S. S., O'Leary, E., Janelle, S. J., et al. (2018). Changes in prevalence of healthcare-associated infections in US Hospitals. *The New England Journal of Medicine*, 379(18), 1732-1744. <https://doi.org/10.1056/NEJMoa1714483>
11. Munro, S. C., Baker, D., & Giuliano, K. K. (2021). Nonventilator hospital-acquired pneumonia: A call to action: Recommendations from the National Organization to Prevent Hospital-Acquired Pneumonia (NOHAP) among nonventilated patients. *Infection Control & Hospital Epidemiology*, 42(8), 991-996. <https://doi.org/10.1017/ice.2021.139>
12. Munro, S., Phillips, T., Hasselbeck, R., Lucatorto, M. A., Hehr, A., & Ochylski, S. (2022). Implementing oral care as a nursing intervention to reduce hospital-acquired pneumonia across the United States Department of Veterans Affairs healthcare system. *CIN: Computers, Informatics, Nursing*, 40(1), 35-43. <https://doi.org/10.1097/CIN.0000000000000808>
13. Pobo, A., Lisboa, T., Rodriguez, A., et al. (2009). A randomized trial of dental brushing for preventing ventilator associated pneumonia. *Chest*, 136(2), 433-439. <https://doi.org/10.1378/chest.08-1442>

14. Quinn, B., & Baker, D. (2015). Oral care as prevention for nonventilator hospital-acquired pneumonia: A four-unit cluster randomized study. *ResearchGate*. Retrieved from https://www.researchgate.net/publication/351622374_Oral_Care_as_Prevention_for_Nonventilator_Hospital-Acquired_Pneumonia_A_Four-Unit_Cluster_Randomized_Study
15. Rello, J., Lacerda, A. M., & de la Torre, M. V. (2017). Oral hygiene in nonventilated patients: a review. *Respiratory Medicine*, 126, 15-20. <https://doi.org/10.1016/j.rmed.2017.03.003>
16. Rosenthal, V. D., Al-Abdullat, R. A., & Yeganeh, A. E. (2018). International Nosocomial Infection Control Consortium (INICC) report: Non-ventilator-associated hospital-acquired pneumonia surveillance data from 55 countries, 2007-2017. *American Journal of Infection Control*, 46(12), 1353-1360. <https://doi.org/10.1016/j.ajic.2018.06.002>
17. Sánchez, M., Orozco, L. A., Barrios, F. A., & Suárez, O. F. (2021). Impact of an educational intervention aimed at nursing staff on oral hygiene care on the incidence of ventilator-associated pneumonia in adults ventilated in Intensive Care Unit. *Investigación y Educación en Enfermería*, 39(3), e06. <https://doi.org/10.17533/udea.iee.v39n3e06>
18. Scannapieco, F. A., Mylotte, J. M., & Zand, F. (2014). Strategies to prevent hospital-acquired pneumonia: A systematic review. *European Journal of Clinical Microbiology & Infectious Diseases*, 33(10), 1681-1692. <https://doi.org/10.1007/s10096-014-2092-1>
19. Silvestri, L., Beltrame, A., & Cadarin, G. (2016). Oral care in non-ventilated hospitalized patients: A systematic review. *Journal of Nursing Management*, 24(1), 101-112. <https://doi.org/10.1111/jonm.12267>
20. Society for Healthcare Epidemiology of America (SHEA). (2022). *Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 update*. SHEA-Online.org. Retrieved from <https://www.shea-online.org/new-guidance-released-for-preventing-hospital-acquired-pneumonia/>
21. Strassle, P. D., Sickbert-Bennett, E. E., Klompas, M., et al. (2020). Incidence and risk factors of non-device-associated pneumonia in an acute-care hospital. *Infection Control & Hospital Epidemiology*, 41(1), 73-79. <https://doi.org/10.1017/ice.2019.290>
22. The Joint Commission. (2021). *Preventing non-ventilator hospital-acquired pneumonia*. Quick Safety, Issue 61. Retrieved from <https://www.jointcommission.org/-/media/tjc/newsletters/quick-safety-61-nvha-pneumonia-final-9-3-21.pdf>
23. U.S. Department of Veterans Affairs. (n.d.). *Healthcare Acquired Pneumonia Prevention by Engaging Nurses (HAPPEN)*. Retrieved from <https://www.va.gov/NURSING/index.asp>
24. Velez, E., Zand, F., & Zand, P. (2020). A randomized controlled trial on the effects of a comprehensive oral care program on the incidence of hospital-acquired pneumonia. *Journal of Hospital Infection*, 106(3), 526-532. <https://doi.org/10.1016/j.jhin.2020.08.016>
25. Yuen, C. (2020). The role of oral hygiene in the prevention of non-ventilator associated health-care acquired pneumonia. *Journal of Nursing and Health*, 1(1), 12-18.
26. Hudiawati, D., Chouhan, D. S., Wibowo, D. M., & Mujannidah, A. (2024). The Spiritual Well-Being to the Quality of Life of Heart Failure Patients. *Jurnal Berita Ilmu Keperawatan*, 17(1), 26-35. <https://doi.org/10.23917/bik.v17i1.3786>
27. Chouhan, D. S. (2016). Stress and Its Major Effects on Human Health. *International Journal of Multidisciplinary Allied Research Review and Practices*, 3(2), 380-384.
28. Velmurugan, K., Kedia, N., Dhiman, A., Shaikh, M., & Chouhan, D. S. (2023). Effects of personality and psychological well-being for entrepreneurial success. *Journal for ReAttach Therapy and Developmental Diversities*, 6, 481-485.
29. Bhadauriaa, R. S., Selvarajb, B. N. X., Chouhan, D. S., Kumawat, A. K., Begumd, F., & Davide, J. B. Mental workload levels and influencing factors among ICU nurses: A systematic review.
30. Rani, S., Tandon, D. T., Sharma, T., Qadir, H. R., Battula, S., James, R., & Chouhan, D. S. (2022). Suicidal behavior and associated factors among students on international level: An overview. *NeuroQuantology*, 20(13), 2959.
31. Nidode, P., Natarajan, C., Rajathi, G., Deepika, M. R., Shinkre, R., & Chouhan, D. S. (2024). Opioid dependency and intervention: A critical examination of the neurobiological foundations. *Multidisciplinary Reviews*, 6, 2023ss013. <https://doi.org/10.31893/multirev.2023ss013>
32. Singh Chouhan, D., Das, S., Garg, P., Mounika, N., Sethuraman, S., & Sharma, N. (2025). Agoraphobia and Panic Disorder: Understanding the Symptoms, Diagnosis, and Treatment Options. *Health Leadership and Quality of Life*, 4, 610. <https://doi.org/10.56294/hl2025610>
33. Jaiswal, A., Shukla MD, A., Chhasatia, A. H., Sharma, S., Kapoor, P., & Singh Chouhan, D. (2024). Treating Post-Stroke Aphasia: Psychological Wellness Approaches. *Salud, Ciencia Y Tecnología*, 4, 928. <https://doi.org/10.56294/saludcyt2024.928>
34. Chouhan, D. S. (2025). Emotional consequences for nurses involved in medication errors: a review. *International Journal of Environmental Sciences*, 2789-2794. <https://doi.org/10.64252/syv0xj74>