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Review

Nurse-led oral care implementation for prevention of non-ventilator hospital-acquired pneumonia in hospitalized adults: A systematic review

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ABSTRACT

Introduction: Non-ventilator hospital-acquired pneumonia (NV-HAP) is an important patient-safety problem in acute care. Oral care is increasingly recognized as a preventive nursing intervention, but implementation in routine practice remains insufficiently understood.

Methods: A systematic review with narrative synthesis was conducted in PubMed, EBSCOhost, and Scopus, supplemented by Google Scholar, citation tracking, and manual reference screening. Eligible studies involved hospitalized adults, nurse-led or nursing assistant-delivered oral care, and outcomes related to hospital-acquired pneumonia or NV-HAP. Study selection followed PRISMA 2020. Methodological quality was assessed using design-appropriate Joanna Briggs Institute (JBI) criteria.

Results: Fifteen studies and implementation reports were included. Four recurring strategies were identified: staff education, protocolized oral care, documentation and monitoring systems, and multicomponent prevention bundles. These approaches generally improved staff knowledge, adherence, oral care frequency, and documentation. Clinical outcomes were less consistent, although several controlled and quasi-experimental studies reported reductions in NV-HAP. Most studies had moderate-to-high risk-of-bias concerns because of nonrandomized designs, uncontrolled before-after methods, and the inclusion of oral care within broader prevention programs.

Conclusions: Nurse-led oral care is more likely to succeed when supported by education, standardized protocols, adequate supplies, documentation, leadership, and monitoring. However, the evidence remains heterogeneous and methodologically limited, so conclusions should be interpreted cautiously and generalized only to comparable acute care settings.

KEYWORDS

hospital-acquired pneumonia, inpatients, mouth hygiene, nursing care, patient safety, systematic review

INTRODUCTION

Non-ventilator hospital-acquired pneumonia (NV-HAP) is a clinically significant hospital-acquired infection associated with excess mortality, longer hospital stay, and increased healthcare utilization [1,2]. Unlike ventilator-associated pneumonia, NV-HAP affects general hospitalized populations and is linked more closely to routine care processes than to device-related exposures.

Oral hygiene has emerged as one of the most plausible modifiable risk factors for hospital-acquired pneumonia. Aspiration of oral secretions containing pathogenic bacteria is a biologically credible mechanism linking poor oral hygiene with lower respiratory infection [2]. Accordingly, oral care is increasingly positioned as a core preventive nursing intervention. Recent meta-analytic evidence has strengthened the association between routine toothbrushing and lower risk of hospital-acquired pneumonia in non-ventilated patients [1].

The existing literature, however, has an important limitation. Most previous studies and reviews have focused primarily on whether oral care or toothbrushing reduces pneumonia [1,2]. Much less attention has been given to how oral care is implemented in routine nursing practice. This distinction is important because oral care in acute settings is frequently inconsistent, poorly documented, and vulnerable to competing clinical priorities. Observational work on nurses' oral hygiene practices has shown that oral care is often treated as a low-priority activity despite its clinical relevance [3].

From a nursing science perspective, oral care should therefore be viewed not only as a clinical intervention but also as a care delivery process. The effectiveness of oral care is likely to be influenced by implementation factors such as staff education, standardized protocols, documentation systems, and monitoring strategies. Recent hospital-based studies increasingly describe oral care in these terms, especially when nurse-led or nursing assistant-delivered interventions are introduced as part of organized prevention efforts [4,5,6,7,8,9].

A more implementation-focused review is therefore warranted. Rather than asking only whether oral care is beneficial in principle, the more relevant nursing question is how oral care is delivered, standardized, and sustained in acute care systems.

The aim of this review was to identify implementation strategies used in nurse-led oral care programs for hospitalized adults and to synthesize their reported effects on NV-HAP and related care delivery outcomes.

METHODS

This study was conducted as a systematic review with narrative synthesis and was structured in accordance with PRISMA 2020 reporting principles [10].

Studies were eligible if they included hospitalized adults in acute care settings; evaluated an oral care or oral hygiene intervention; included a nurse-led, nurse-driven, nursing staff-delivered, or nursing assistant-delivered implementation component; reported outcomes related to hospital-acquired pneumonia or NV-HAP; and were published as peer-reviewed articles in English.

The literature search was conducted in PubMed, EBSCOhost (MEDLINE and Health Source: Nursing/Academic Edition), and Scopus. Google Scholar was searched as an additional source, and

backward and forward citation tracking and manual reference screening were performed. The search was updated and finalized on 10 July 2026. No explicit publication-date restrictions were applied. Web of Science was not available; this limitation is acknowledged because relevant multidisciplinary records may have been missed.

The search strategies combined controlled and free-text terms related to oral care or oral hygiene, hospital-acquired pneumonia or NV-HAP, nursing, and implementation concepts such as protocol, intervention, bundle, program, guideline, education, and documentation. The complete Scopus and Google Scholar search strings are reported under Search strategies. Reference lists and cited-by records of eligible articles were also screened for additional reports.

Across PubMed, EBSCOhost, and Scopus, 101 records were identified. After removal of 11 duplicates, 90 unique records underwent title and abstract screening. Sixty-four records were excluded, and 26 full-text reports were assessed for eligibility. Twelve full-text reports did not meet the eligibility criteria, leaving 14 studies identified through database searching. Google Scholar and citation searching identified one additional eligible study. The final synthesis therefore included 15 studies and implementation reports. Screening, eligibility assessment, and data extraction were performed by the author and checked for internal consistency during manuscript revision.

Data were extracted on author and year, country and setting, study design, population, intervention characteristics, implementation strategy, comparator where applicable, clinical outcomes, implementation outcomes, and key findings.

This review used only published literature and did not involve human participants or identifiable private information. Institutional review board review was therefore not required.

Narrative synthesis was used because the included studies were heterogeneous in design, intervention structure, implementation intensity, and outcome definition. Meta-analysis was not attempted.

Methodological quality was assessed using design-appropriate Joanna Briggs Institute (JBI) critical appraisal criteria for quasi-experimental, cohort, and related observational designs [11]. Appraisal focused on participant selection, comparability of groups or time periods, validity and reliability of exposure and outcome measurement, identification and control of confounding, completeness of follow-up or data capture, and appropriateness of statistical analysis. Quality-improvement and implementation reports were assessed against the same core domains, with additional attention to concurrent controls, secular trends, intervention fidelity, and the ability to isolate the effect of oral care from other bundle components. Judgments were summarized as low, moderate, or high

concern for risk of bias; studies were not excluded on the basis of quality because the purpose was to characterize the available implementation evidence.

Search strategies

Scopus (searched 10 July 2026): TITLE-ABS-KEY(("non-ventilator hospital-acquired pneumonia" OR "nonventilator hospital-acquired pneumonia" OR "non-ventilator-associated hospital-acquired pneumonia" OR "hospital-acquired pneumonia" OR "hospital acquired pneumonia" OR NV-HAP OR NVHAP) AND ("oral care" OR "oral hygiene" OR toothbrushing OR "mouth care") AND (nurs* OR "nursing assistant*" OR "nurse-led" OR "nurse driven" OR "nurse-driven" OR "nursing intervention*")). No date limit was applied. Eligibility was restricted to English-language peer-reviewed primary reports involving hospitalized adults.

Google Scholar (searched 10 July 2026): ("non-ventilator hospital-acquired pneumonia" OR "nonventilator hospital-acquired pneumonia" OR NV-HAP OR NVHAP OR "hospital-acquired pneumonia") AND ("oral care" OR "oral hygiene" OR toothbrushing OR "mouth care") AND (nurse OR nursing OR "nurse-led" OR "nurse-driven" OR implementation OR protocol). The first 200 results ranked by relevance were screened. Backward and forward citation searching was then performed for all eligible studies.

RESULTS

The combined searches of PubMed, EBSCOhost, and Scopus identified 101 records. After removal of 11 duplicates, 90 records were screened by title and abstract; 64 were excluded. Twenty-six full-text reports were assessed, of which 12 did not meet the eligibility criteria. Fourteen studies were included from the database searches, and Google Scholar and citation searching identified one additional eligible study. The final synthesis comprised 15 studies and implementation reports. The study selection process is presented in Figure 1.

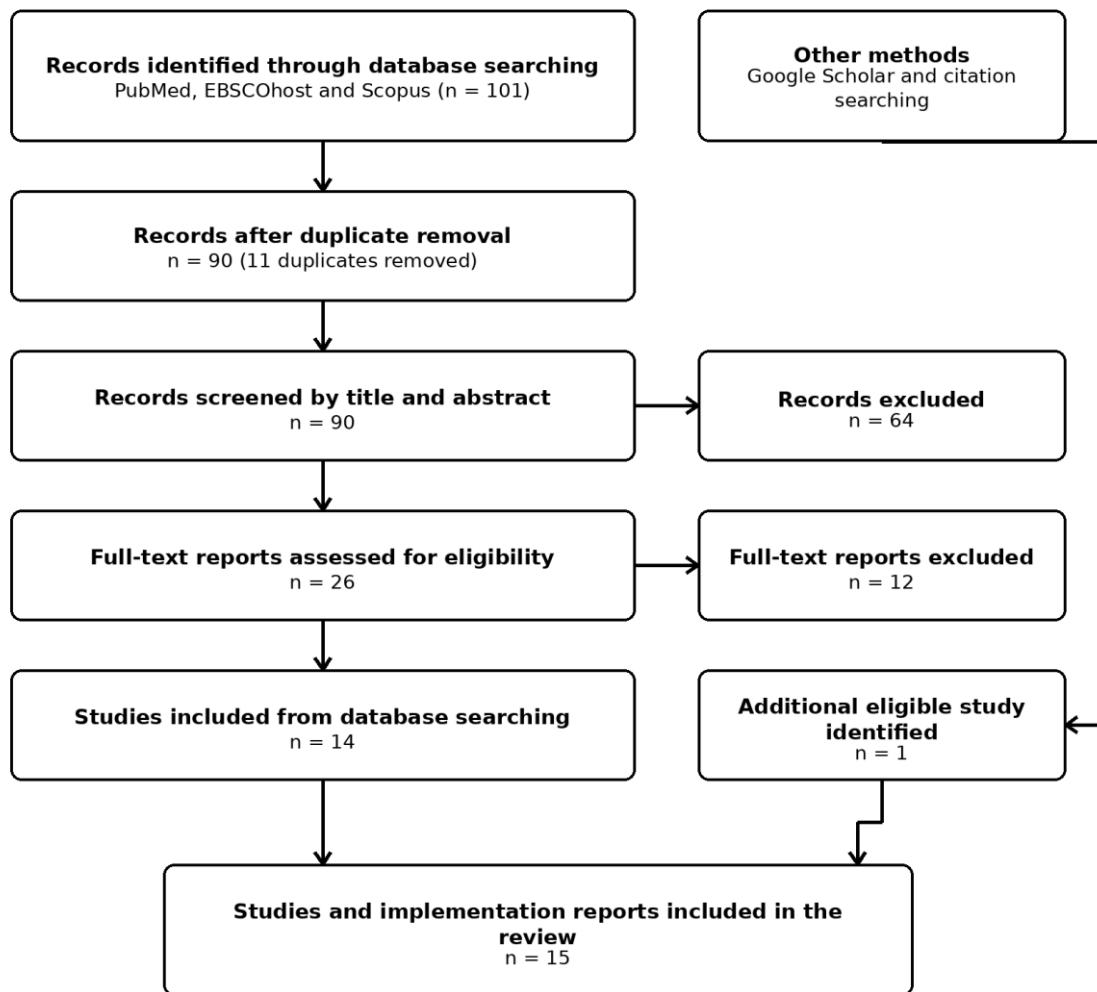


Fig. 1. PRISMA 2020 flow diagram of study identification, screening, eligibility assessment, and inclusion

The included evidence represented a heterogeneous but coherent body of acute care literature on nurse-led oral care implementation. It comprised stepped-wedge and cluster-randomized studies, nonrandomized controlled studies, quasi-experimental before-after studies, retrospective cohorts, quality-improvement projects, mixed-methods implementation evaluations, and system-level implementation reports. Their main characteristics are summarized in Table I.

Table I. Characteristics of included studies

Study / design	Setting and sample	Implementat ion focus	Main outcomes	Principal limitations
White et al. [12]; multicenter stepped-wedge cluster-randomized trial	Three Australian hospitals, nine inpatient units; 8,870 hospitalized adults	Enhanced oral care package with supplies, patient assistance, and staff education implemented	Oral care completion increased markedly and NV-HAP incidence was substantially reduced	Cluster-level implementation; potential contamination and temporal effects; intervention fidelity varied across units; generalizability outside

		sequentially across clusters	during intervention periods	participating hospitals requires caution.
Robertson and Carter [13]; quasi-experimental comparative study	Acute neurosurgical unit; 32 prospective and 51 retrospective patients	Enhanced prevention-based oral care protocol for care-dependent neurologically impaired adults	Significant reduction in pneumonia in the prospective group	Small single-unit sample; historical comparator; risk of secular and documentation bias.
Quinn et al. [14]; descriptive quasi-experimental study	Single U.S. hospital; organization-level pre/post population	Site-specific enhanced basic oral nursing care initiative	NV-HAP rate decreased from 0.49 to 0.30 per 100 patient-days; 37% fewer cases	Uncontrolled before-after design; multiple implementation components; potential surveillance changes.
Munro et al. [15]; implementation/dissemination report	Eight U.S. Veterans Affairs hospitals; system-level data	Nurse-led oral care initiative, education, supplies, and replication strategy	Pilot NV-HAP rate reportedly decreased by 92%; successful dissemination	No concurrent comparator; overlapping initiative reports; aggregate data and possible secular trends.
Munro and Baker [16]; single-arm pre/post intervention	VA geriatric units; retrospective baseline of 14,396 patient-days plus postimplementation population	Universal twice-daily standardized oral care	Pilot incidence decreased from 105 to 8.3 cases per 1,000 patient-days	Historical comparison; no randomization; unusually large effect vulnerable to surveillance and case-definition changes.
McNally et al. [7]; nonrandomized controlled trial	Non-ICU wards; 2,890 patients	Structured toothbrushing program	Higher brushing frequency; no statistically significant pneumonia reduction	Nonrandom allocation; underpowered; incomplete adherence; possible contamination.

Warren et al. [17]; quality-improvement pre/post study	Level 1 trauma hospital; 202 baseline and 215 intervention patients	Risk-stratified nurse-driven oral care protocol and new supplies	NV-HAP events decreased from 52 to 26; mean protocol adherence 76%	Historical comparator; ICD-based case ascertainment; variable monthly adherence; mixed ventilated/nonventilated program.
Pritts et al. [18]; quality-improvement report	Medical-surgical setting; sample size not clearly reported in indexed record	Standardized nurse-led oral care protocol	Improved adherence and decreased NV-HAP occurrence	Brief report; incomplete sample and analytic detail; uncontrolled design.
Lacerna et al. [6]; prospective observational program	21 hospitals in one integrated system; all hospitalized patients under surveillance	Multicomponent HAP prevention including oral care	Declining HAP rates, mortality, and antibiotic use	No concurrent control; multiple simultaneous interventions; oral care contribution cannot be isolated.
Giuliano et al. [19]; four-unit cluster-randomized study	Four units in an 800-bed tertiary center; 8,709 patients	Universal standardized oral care protocol	85% NV-HAP reduction on medical intervention unit; 56% nonsignificant reduction on surgical unit	Only four clusters; unit-level differences; possible contamination and surveillance effects.
Wilkinson et al. [9]; quality-improvement project	Elderly care wards; ward-level observations across three audit cycles	Mouth care within a multicomponent prevention bundle	Improved prevention processes and ward outcomes	Small local project; unclear denominator; no control; bundle effect not separable.
Munro et al. [8]; implementation report	U.S. Veterans Health Administration; system-level EHR data	Oral care protocol integrated into electronic documentation and HAP tracking	Improved documentation and national implementation capability	Descriptive aggregate design; no concurrent comparator; documentation changes may alter measured performance.
Stevenson et al. [20]; concurrent mixed-methods evaluation	Six high-complexity VA hospitals; 14 interviews and 91 staff survey responses	National HAPPEN implementation: education, supplies, leadership, and support	Identified barriers and facilitators; positive staff and veteran experiences	Implementation outcomes rather than comparative pneumonia effect; small interview sample; self-report.

Kluberg et al. [4]; retrospective multicenter cohort	144 acute care hospitals; 1,744,811 hospitalizations	Routine oral care exposure and mobility	Persistent oral care associated with 16% lower NV-HAP and 6% lower mortality	Routine documentation; residual confounding; reverse causation and healthy-patient bias.
Kozub et al. [5]; quasi-experimental pre/post study	Single quaternary hospital; admissions and nursing-assistant assessments	Structured nursing-assistant oral hygiene education	Unadjusted NV-HAP decreased from 0.74% to 0.25%; staff knowledge improved	No concurrent control; single center; secular trends and limited confounding control.

EHR – electronic health record; HAP – hospital-acquired pneumonia; HAPPEN – Hospital-Acquired Pneumonia Prevention by Engaging Nurses; ICD – International Classification of Diseases; ICU – intensive care unit; NV-HAP – non-ventilator hospital-acquired pneumonia; VA – Veterans Affairs

Four broad categories of implementation strategy were identified across the included studies: staff education, protocolized oral care, documentation and monitoring systems, and multicomponent prevention bundles.

Educational interventions were prominent in Kozub et al. [5], Warren et al. [17], and the Veterans Health Administration initiatives [8,15,16,20]. Education was usually combined with access to appropriate oral care supplies, unit-level champions, leadership support, and reinforcement of oral care as an infection-prevention activity rather than an optional comfort measure.

Protocol-based oral care delivery was evaluated in McNally et al. [7], Giuliano et al. [19], Quinn et al. [14], Warren et al. [17], Pritts et al. [18], Robertson and Carter [13], and Munro and Baker [16]. These studies formalized oral assessment, toothbrushing frequency, product selection, or care pathways and thereby reduced reliance on discretionary bedside practice.

Documentation and monitoring were especially prominent in the Veterans Health Administration initiatives, where oral care was integrated into electronic health record workflows and linked to pneumonia surveillance [8,15,16,20]. The mixed-methods Hospital-Acquired Pneumonia Prevention by Engaging Nurses (HAPPEN) evaluation further identified supply availability, completion of documentation, supportive formal and informal nurse leaders, and a shared safety culture as major determinants of implementation success [20].

Multicomponent approaches were reported by Wilkinson et al. [9], Lacerna et al. [6], and several Veterans Health Administration reports [8,15,16,20]. In these programs, oral care was implemented alongside positioning, mobility, swallowing-related measures, tube management, or

other pneumonia-prevention practices; consequently, the independent effect of oral care could not always be isolated.

Implementation strategies were consistently associated with improvements in process measures. Across studies, these included improved staff knowledge [5], increased oral care frequency [7,19], greater adherence to protocols [5,7,8,17,18], improved access to supplies [17,20], and better documentation and monitoring [8,20]. The findings indicate that education alone is unlikely to be sufficient unless supported by workflow redesign, equipment, leadership, audit, and feedback.

Clinical outcomes were more variable than process outcomes. The multicenter HAPPEN stepped-wedge cluster-randomized trial reported a substantial reduction in NV-HAP following enhanced oral care implementation [12]. Giuliano et al. [19] reported an 85% reduction in NV-HAP incidence on the intervention medical unit and a nonsignificant 56% reduction on the surgical unit. Warren et al. [17] reported a reduction from 52 to 26 NV-HAP events, while Robertson and Carter [13], Quinn et al. [14], Munro and Baker [16], Kozub et al. [5], and Lacerna et al. [6] also reported lower pneumonia rates after implementation. McNally et al. [7] increased toothbrushing frequency without a statistically significant reduction in pneumonia. Kluberg et al. [4] found that persistent oral care for at least 3 days was associated with 16% lower NV-HAP and 6% lower in-hospital mortality. These differences likely reflect variation in study design, patient risk, intervention intensity, adherence, surveillance definitions, and co-interventions.

The methodological appraisal indicated that no study was free of important bias concerns. The multicenter stepped-wedge HAPPEN trial [12], the cluster-randomized study by Giuliano et al. [19], and the large retrospective cohort by Kluberg et al. [4] provided the strongest comparative evidence, although each remained vulnerable to cluster-level imbalance, implementation contamination, exposure misclassification, or residual confounding. McNally et al. [7] used a concurrent control group but was nonrandomized and underpowered. Most remaining studies were uncontrolled before-after, quality-improvement, mixed-methods, or implementation reports and were susceptible to secular trends, changes in surveillance, co-interventions, selective documentation, and limited causal attribution. Table II summarizes the appraisal.

Taken together, the expanded evidence base suggests that oral care is more likely to influence outcomes when implemented as a reliable clinical system. Recurrent components included education, standardized protocols, adequate supplies, documentation support, local champions, leadership engagement, surveillance, and feedback. The consistency of process improvements is stronger than the certainty of the clinical-effect estimates.

Table II. Methodological quality and risk-of-bias appraisal of included studies

Study	Overall concern	Main strengths	Main risk-of-bias concerns
White et al. [12]	Moderate	Large multicenter stepped-wedge cluster-randomized design; clinically relevant outcome; implementation and process measures	Possible temporal and cluster effects, contamination between periods, and variation in implementation fidelity.
Robertson and Carter [13]	High	Defined high-risk population and explicit protocol	Small historical-control study; selection, secular-trend, and ascertainment bias.
Quinn et al. [14]	High	Clinically relevant outcomes and economic evaluation	Uncontrolled pre/post design; co-interventions and surveillance changes.
Munro et al. [15]	High	Pragmatic multisite dissemination information	Aggregate implementation report; no independent control; overlapping initiative data.
Munro and Baker [16]	High	Large baseline denominator and clear implementation focus	Single-arm historical comparison; confounding and case-ascertainment changes.
McNally et al. [7]	Moderate	Concurrent control and specified intervention	Nonrandomized, underpowered, incomplete adherence, residual confounding.
Warren et al. [17]	High	Clearly described protocol, supplies, adherence and outcomes	Historical comparator, ICD-based ascertainment, variable adherence.
Pritts et al. [18]	High	Directly relevant nurse-led protocol	Limited reporting, unclear sample, uncontrolled design.
Lacerna et al. [6]	High	System-wide prospective surveillance	No concurrent control; multiple co-interventions; secular trends.
Giuliano et al. [19]	Moderate	Cluster allocation, large sample, process and clinical outcomes	Only four units; cluster imbalance and unit-level confounding.

Wilkinson et al. [9]	High	Repeated audit cycles and implementation measurement	Small local uncontrolled QI project; unclear denominator; bundle intervention.
Munro et al. [8]	High	Large-system EHR integration and pragmatic relevance	Descriptive implementation design; aggregate data; ascertainment affected by documentation.
Stevenson et al. [20]	Moderate	Mixed-methods assessment of barriers and facilitators	Small qualitative sample, self-report, no comparative clinical-effect estimate.
Kluberg et al. [4]	Moderate	Very large multicenter cohort and adjusted analysis	Exposure misclassification, residual confounding, reverse causation.
Kozub et al. [5]	High	Structured education and clinically relevant outcomes	Uncontrolled pre/post comparison; single center; secular trends.

EHR – electronic health record; ICD – International Classification of Diseases; QI – quality improvement

DISCUSSION

This review examined oral care from an implementation and nursing care delivery perspective rather than solely as a clinical procedure. That distinction is important because the success of oral care programs appears to depend not only on biological plausibility, but also on the reliability with which oral care is delivered in routine practice.

Across the included studies, implementation strategies consistently improved care processes. Staff education, standardized protocols, reliable access to supplies, documentation support, leadership, and monitoring increased adherence to oral care practices and made delivery more visible within healthcare systems [5,8,16,17,18,19,20]. These findings suggest that oral care reliability is itself a meaningful nursing quality target.

The expanded review also helps explain why prior oral care studies have shown mixed clinical results. McNally et al. [7] increased toothbrushing frequency without reducing pneumonia, whereas Giuliano et al. [19] observed a marked reduction on the medical intervention unit but a smaller, nonsignificant effect on the surgical unit. Such variation suggests that task frequency alone may be insufficient and that effectiveness depends on patient mix, fidelity, supply availability, leadership, surveillance, and the wider implementation context.

From a nursing science perspective, oral care should therefore be reframed as a care delivery problem. In many hospitals, oral care remains variably performed, incompletely standardized, and insufficiently documented. The findings of this review suggest that oral care is most likely to influence NV-HAP when embedded in workflows, supported by training, and reinforced by measurement.

This implementation-focused framing complements efficacy reviews that ask whether oral care prevents pneumonia. The included studies suggest that the implementation architecture of oral care programs matters. Staff education, protocolization, documentation, and monitoring were not peripheral features; they were recurring elements in the more successful programs. For nursing practice, this indicates that oral care should be treated as a structured preventive process rather than an optional bedside comfort activity.

Despite methodological limitations, the review has practical relevance. It identifies recurring implementation strategies that may strengthen oral care delivery in acute care settings and supports a shift from isolated bedside instruction toward more reliable, system-supported preventive practice.

The evidence base remains limited. Fifteen heterogeneous studies and implementation reports are insufficient for precise estimation of effect or reliable subgroup analysis by ward type, patient risk, staffing model, or health system. Most studies were nonrandomized, and several evaluated oral care within broader prevention bundles, making it difficult to isolate the effect of oral care alone. Outcome definitions, surveillance methods, intervention intensity, exposure measurement, and reporting of sample size varied substantially. Several publications described different phases of related Veterans Health Administration initiatives, which increases the breadth of implementation information but not necessarily the number of independent patient populations. The concentration of evidence in selected hospitals and integrated systems limits generalizability to smaller hospitals, resource-constrained settings, and health systems with different nursing workflows. Although PubMed, EBSCOhost, Scopus, Google Scholar, and citation searching were used, the omission of Web of Science, reliance on a relevance-ranked subset of Google Scholar results, and restriction to English-language peer-reviewed reports may still have introduced database-selection and publication bias. These limitations reduce certainty and explain why pooled quantitative synthesis was not appropriate.

Future research should move beyond simple oral care efficacy questions and examine which implementation models are most sustainable in routine nursing practice. Comparative studies of training intensity, protocol fidelity, documentation systems, and audit-feedback approaches would

be particularly valuable. Additional studies are also needed in varied acute care environments and health systems, including contexts outside large integrated hospital networks.

CONCLUSIONS

Nurse-led oral care implementation strategies can improve the reliability of oral care delivery and may contribute to prevention of NV-HAP in hospitalized adults.

The most consistently reported components were staff education, protocolized care delivery, adequate supplies, leadership support, documentation, monitoring, and audit-feedback. Clinical effects were generally favorable but not uniform.

Further multicenter controlled studies with standardized NV-HAP definitions, explicit fidelity measurement, and transparent reporting of implementation context are needed before a specific model can be recommended for broad adoption.

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Conflict of interest

The author declares no conflict of interest.

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