Annals Journal of Dental and Medical Assisting
2025, Volume 5, Issue 1, Page No: 1-10

Available online at: www.tsdp.net

ISSN: 3062-3510

Original Article

Systematic Review of Clinical Practice Guidelines and Expert Statements on Oral Health Management During Intensive Care Unit (ICU) Admission

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Received: 17 September 2024; **Revised:** 08 January 2025; **Accepted:** 12 January 2025

ABSTRACT

This systematic review examined existing guidance from evidence-based clinical practice guidelines (CPGs), scientific statements (SS), and expert consensus concerning oral complication management in ICU patients. Databases including PubMed, Scopus, Ovid/Cochrane, and LILACS were systematically searched using the Canadian Agency for Drugs and Technologies in Health (CADTH) CPG identification filters. Both primary sources and cited references were considered. Quality appraisal was conducted with the AGREE-II tool for CPGs and SS (ideal scenario), while the AGREE-REX instrument assessed the recommendations in both ideal and local contexts. A total of 13 recommendations derived from four SS were analyzed. The mean AGREE-II score was 58.25, while AGREE-REX evaluations yielded average scores of 45.82 (ideal scenario) and 39.07 (local scenario). The guidance predominantly addressed oral care assessment and strategies for preventing and managing respiratory infections in ICU patients. Overall, there is a clear shortage of rigorously developed CPGs that offer structured oral care recommendations for ICU settings. Dentists are essential in advancing and refining these recommendations to help prevent oral complications in critically ill patients.

Keywords: Clinical practice guideline, Systematic review, Oral health, Intensive care unit

How to Cite This Article: Se-Eun K, Son SH. Systematic Review of Clinical Practice Guidelines and Expert Statements on Oral Health Management During Intensive Care Unit (ICU) Admission. Ann J Dent Med Assist. 2025;5(1):1-10. https://doi.org/10.51847/RfCSYOExLC

Introduction

Intensive care units (ICUs) provide urgent and specialized care for patients in critical conditions [1]. Patients are admitted daily due to a variety of medical complications, with arterial hypertension, diabetes mellitus, obesity, and chronic obstructive pulmonary disease (COPD) being among the most prevalent [2]. Beyond these life-threatening conditions, aspects such as oral health can have a long-term impact on a patient's quality of life (QoL) [3]. Effective interdisciplinary collaboration in the ICU aims to support decision-making by considering the patient's overall physiology, psychological status, and general health. Ensuring proper oral care during hospitalization is a key component of this approach [4]. In the United States, approximately 4.1 million patients are admitted to ICUs each year [5].

Oral health issues are frequently observed in ICU patients. For instance, mechanical ventilation often leads to xerostomia, which can cause discomfort and frustration due to an inability to manage thirst [6]. Reports have also highlighted the presence of plaque, tongue coating, dental caries, halitosis, mucosal lesions, periodontal disease, and fungal infections among these patients [3]. Reduced salivary flow, often associated with dental caries, can be linked to alterations in the oral microbiome, which encompasses the microbial communities residing in the human body, including the mouth [7]. Patients with periodontitis may have up to a threefold increased risk of developing nosocomial pneumonia compared to those without periodontal disease, particularly among older adults

who are more susceptible to pathogenic colonization [8, 9]. While the role of oral bacteria in systemic complications has been investigated, the impact of ICU stays on oral health and the subsequent effect on long-term QoL remain underexplored.

The absence of standardized oral care protocols in ICUs contributes significantly to the development of oral complications. Maintaining oral hygiene is crucial for all ICU patients; however, it is more challenging for those on mechanical ventilation, who cannot perform self-care, as well as patients with movement-limiting conditions such as arthritis [10, 11]. Studies have shown that structured oral hygiene programs, particularly when supervised by a dentist, can improve oral health outcomes in ICU patients by reducing plaque accumulation and Candida albicans colonization [12].

Assessing oral health in ICU patients allows for the identification of current conditions and guides interventions to prevent or treat oral diseases. Moreover, such assessments can inform the development of clinical practice guidelines (CPGs) and protocols that integrate oral health as a fundamental aspect of overall patient care. Despite its importance, there is a notable scarcity of CPGs offering comprehensive recommendations for oral care in ICU settings.

This study aims to critically examine recommendations reported in CPGs, scientific statements (SS), and expert consensus regarding the management of oral complications in ICU patients, using the AGREE-II and AGREE-REX instruments for evaluation.

Methods

Eligibility criteria

The inclusion criteria were structured using the PICAR framework [13]:

- Population: Patients admitted to ICUs
- Intervention: Any method, technique, or strategy aimed at preventing or treating oral complications associated with ICU stays
- Comparator: Any comparator was considered
- Guideline Attribute: CPGs or SS issued by national or international scientific societies or institutions, published in English or Spanish
- Recommendation: Any recommendation, whether evidence-based or based on expert consensus, relevant to the topic

No exclusion criteria were applied.

Information sources

The search included secondary databases such as PubMed, Scopus, Ovid/Cochrane, and LILACS, along with ICU-related CPGs and SS available in repositories from the Society of Critical Care Medicine (SCCM). The final search of the databases was conducted on August 24, 2021. Additionally, references cited within the included documents, as well as documents citing them, were also reviewed to ensure comprehensive coverage.

Search strategy

Documents were identified using the CPG filters developed by the Canadian Agency for Drugs and Technologies in Health (CADTH) [14], combined with oral health and ICU-related terms: (“dental” OR “oral health” OR “oral hygiene” OR “oral care”) AND (“critical care” OR “intensive care” OR “intensive unit” OR “ICU”). No alternative search strategies outside of the CADTH filters were employed.

Selection process

Two reviewers independently screened the search results by title and abstract to exclude irrelevant documents. The remaining full texts were then examined in detail by both reviewers, and inclusion decisions were finalized through consensus in cases of disagreement.

Data collection process

Extraction of relevant data from the included documents was carried out independently by two reviewers using a structured MS Excel file. Discrepancies were resolved through full-text re-evaluation and consensus discussion.

Data items

Information regarding the development process of each included CPG or SS was collected using the AGREE (Appraisal of Guidelines for Research and Evaluation) reporting checklist [15]. Variables extracted included the objectives of the guideline, target population, intended users, composition of the development team, and declaration of conflicts of interest.

Synthesis methods

The methodological quality of CPGs and SS was evaluated using the AGREE-II instrument, which covers six domains: scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability, and editorial independence, along with an overall guideline assessment. A CPG is considered to have high methodological quality if the overall score is ≥70 [16]. Both individual scores for each domain and overall scores were reported.

Practice recommendations were assessed using the AGREE-REX tool, which evaluates three domains: clinical applicability (evidence and relevance to users and patients/populations), values and preferences (of target users, patients/populations, policymakers, and guideline developers), and implementability (including purpose, local applicability, and adoption) [17]. Each recommendation was assigned an overall score for the ideal scenario (reflecting the original CPG/SS context) and for a local scenario, representing the Colombian healthcare context. Two reviewers independently assessed each CPG, while all recommendations were evaluated by the full review team. The reported scores reflect the mean of the reviewers' assessments. No CPG, SS, or recommendation was excluded based on methodological quality.

Results

Study selection

The initial search yielded 2,303 articles from PubMed and Scopus. After removing 307 duplicates, 1,996 articles were screened. Following a structured review of titles, objectives, methodology, and full texts, 17 articles were considered for detailed evaluation. Two articles could not be retrieved, 11 were excluded for not being CPGs or SS, and one was excluded for lacking oral care-related recommendations. Ultimately, three articles were included, from which eight additional references were identified. After applying the same inclusion protocol to these additional references, one more article was added, resulting in a total of four articles included in the study [18-21]. **Figure 1** presents the study flowchart.

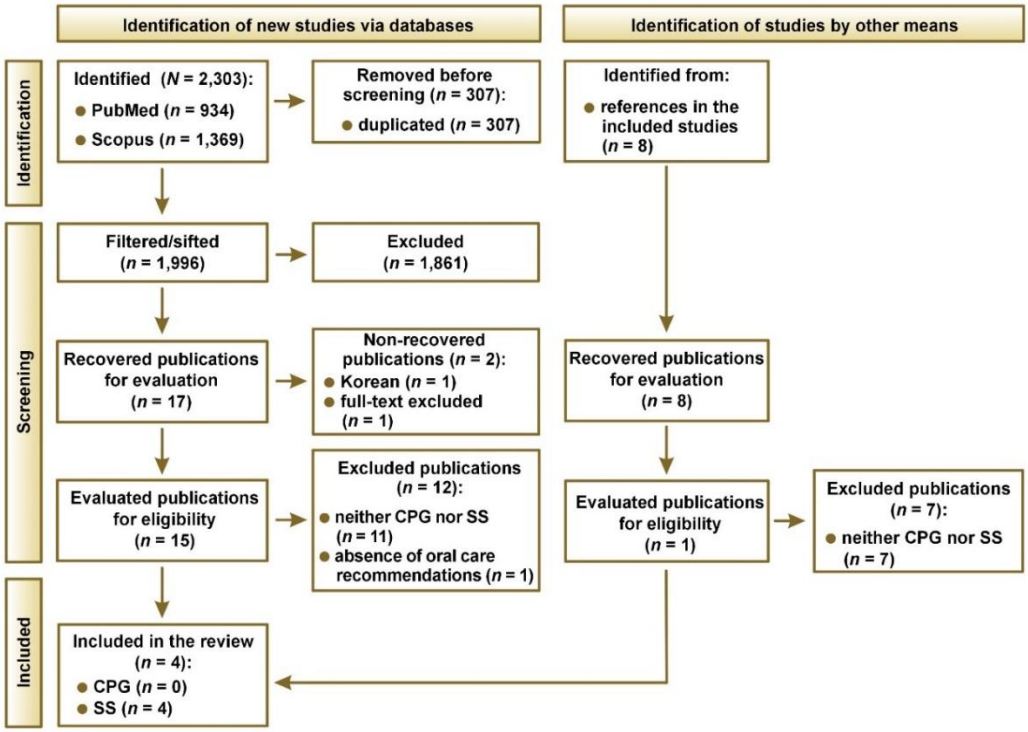

Figure 1. PRISMA flow diagram illustrating the study selection process
CPG – clinical practice guideline; SS – scientific statement

Study characteristics

The features and methodological quality of the included CPGs and SS are presented in **Table 1**.

Table 1. Overview and AGREE-II Methodological Quality of CPGs and SS Addressing Oral Care in ICU Patients

Study	Aim	Population	Target Users	Development Team	AGREE-II Score [%]
Collins *et al.* [18]	To provide a BACCN-endorsed consensus on evidence-based oral care practices aimed at enhancing patient comfort and minimizing hospital-	Adult ICU patients	ICU nurses	ICU nurses, BACCN representative	100

	acquired and ventilator-associated pneumonia in critically ill adults				
Johnstone *et al.* [19]	Conducted a survey to assess nurses' baseline knowledge and current practices in pediatric ICU oral hygiene, leading to the creation of an oral care guideline for children	Intubated and ventilated children in PICU	All registered PICU nurses	Not specified	50
Sedwick *et al.* [20]	Developed a ventilator care bundle and nursing practices to reduce ventilator-associated pneumonia rates in critical care units	ICU patients	ICU nurses	Nurses, physicians, respiratory therapists	50
Vollman *et al.* [21]	Provided guidance on ETT management and oral care to prevent oral, oropharyngeal, and tracheal trauma, promote hygiene and ventilation, and lower HAP and VAP risks	Ventilated and non-ventilated ICU patients	Not available	Not specified	33

Abbreviations: BACCN – British Association of Critical Care Nurses; HAP – hospital-acquired pneumonia; VAP – ventilator-associated pneumonia; PICU – pediatric intensive care unit; ETT – endotracheal tube

The scientific statement (SS) by Collins *et al.* [18] addresses multiple aspects of oral care for adult ICU patients. The oral care practices and their supporting evidence were reviewed by a consensus committee from the British Association of Critical Care Nurses (BACCN). The evaluation aimed to enhance existing protocols and practices, with criteria established to classify recommendations as high- or low-quality. Within the study's "Findings" section, six key recommendations were outlined: assessment and frequency of oral care, toothbrushing, oral care techniques and equipment, selection of oral cleansing solutions, toothpaste use, and denture cleaning methods [18].

Johnstone *et al.* [19] developed guidelines focused on oral care and hygiene specifically for patients in pediatric intensive care units (PICU). These guidelines were formulated based on the analysis of 14 relevant studies, highlighting the strong link between inadequate oral hygiene, increased plaque accumulation, bacterial colonization, and a heightened risk of nosocomial infections. The study emphasized the importance of regular oral cleaning and inspection for children in PICU. To support implementation, informal discussions with nurses were conducted to promote improved oral health standards for pediatric patients [19].

The SS by Sedgwick *et al.* [20] incorporated recommendations from the U.S. Institute for Healthcare Improvement and extended them to include oral care protocols. The added procedures were developed collaboratively with respiratory therapists. Although ICU nurses were the primary users of these recommendations, responsibility for oral care was shared between nurses and respiratory therapists, highlighting the importance of interdisciplinary collaboration within the ICU team [20].

Vollman *et al.* [21] presented SS that focused on maintaining oral hygiene and preventing oral trauma in both ventilated and non-ventilated ICU patients. This statement provided detailed guidance for users, including a checklist of necessary equipment and tools. It also recommended involving non-ventilated patients and their relatives in oral care procedures, offering practical instructions to support adherence to the recommendations [21].

Results of individual studies

The methodological quality of the included CPGs and SS was assessed using the AGREE-II instrument, with results summarized in **Table 1**. A comparative overview of the scores is illustrated in **Figure 2**.

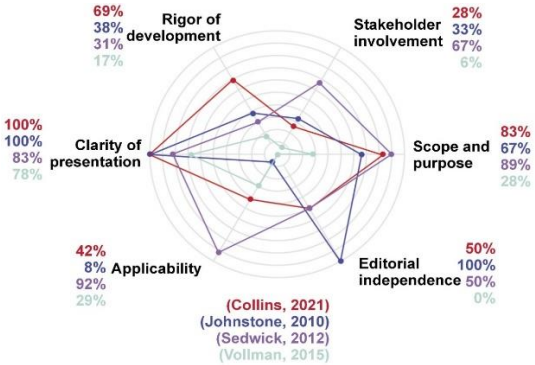

Figure 2. Average scores for the clinical practice guidelines (CPG) and scientific statements (SS) with regard to the AGREE-II dimensions

The SS by Collins *et al.* [18] was evaluated as high quality, achieving a total AGREE-II score of 100%. The main limitation was observed in the 'stakeholder involvement' domain (28%), indicating that patient

preferences were not incorporated into guideline development. Another limitation was noted in the 'applicability' domain (42%), reflecting the absence of strategies or methods to facilitate the implementation of the recommendations. Despite these shortcomings, the 'clarity of presentation' domain scored 100%, with the recommendations being precise and unambiguous. Detailed information was provided regarding duration, tools, and frequency of oral care practices, as well as categorization based on patient status, i.e., ventilated versus non-ventilated patients [18].

Johnstone *et al.*'s SS [19] was assessed as moderate quality, with an overall score of 50%. Its main strength was in the 'clarity of presentation' domain (100%), as a flowchart clearly outlined the procedures to be followed according to different pediatric age groups, specifying timing, frequency, and required tools. The primary limitation was identified in the 'applicability' domain (8%), due to the lack of guidance on how to facilitate implementation, potential barriers, or necessary resources to carry out the recommendations [19].

Sedwick *et al.*'s SS [20] also achieved a moderate quality score of 50%. The primary weakness was in the 'rigor of development' domain (31%), as the statement did not provide a systematic search strategy or method for evidence appraisal. Conversely, the guideline's objectives, target population, and problem statement were clearly defined, earning an 89% score in the first domain. Additionally, the recommendations were precise and unambiguous, with a score of 83% in the 'clarity of presentation' domain [20].

The SS by Vollman *et al.* [21] was considered low quality, with an overall AGREE-II score of 33%. Major limitations were found in domain 2 ('stakeholder involvement', 6%) and domain 6 ('editorial independence', 0%), as the development team was not clearly specified, population preferences were not considered, and guideline users were not identified. In contrast, the 'clarity of presentation' domain scored 78%, representing the main strength of this SS, with recommendations presented in a clear, step-by-step format that avoided ambiguity [21].

Results of synthesis

Across the four included SS, a total of 13 recommendations related to oral care for ICU patients were identified **(Table 2, Figure 3)**.

Table 2. Summary of Oral Care Recommendations for ICU In-Patients and AGREE-REX Evaluation

Study	No.	Recommendation	Focus	Category	AGREE-REX Score [%]
Collins *et al.* (BACCN)	1	- For mechanically ventilated patients: Conduct an oral care assessment within 6 hours of ICU admission using a standardized tool, documenting findings. Reassess every 12 hours. - For non-ventilated patients: Perform oral assessment within 6 hours of admission. - Train all critical care staff to conduct oral assessments.	Oral assessment and frequency	Assessment	59.3
	2	- Ventilated patients: Brush teeth twice daily for at least 2 minutes, clean with swabs, suction, and moisturize every 2–4 hours. - Non-ventilated patients: Follow the same protocol, adjusting frequency based on patient condition, consent, and sleep patterns.	Toothbrushing	Prevention	
	3	- Use a pediatric or soft, small-headed toothbrush to remove plaque, followed by suction to clear secretions and debris. - Between brushing, clean and moisturize the oral cavity with swabs. Ensure foam swabs are not stored in liquid, moistened just before use, and checked for secure attachment. - Apply artificial saliva or lubricant to the oral mucosa and lips after cleaning.	Oral care techniques and tools	Tools	
	4	- Post-brushing, use an antiseptic rinse (e.g., chlorhexidine or cetylpyridinium chloride). - Use chlorhexidine cautiously, with decisions made in consultation with a multidisciplinary team.	Oral cleansing solution	Prevention	
	5	- Consider a debriding agent between brushing sessions to aid in plaque removal.	Toothpaste	Prevention	

	6	- Dentures: Clean daily with a toothbrush or denture brush using a non-abrasive cleanser. - Soak dentures daily in a cleansing solution. - Remove dentures overnight unless specific clinical reasons require retention.	Denture cleaning techniques	Prevention	
Johnstone *et al.* (PICU Oral Hygiene)	7	- Assess oral health for bleeding, redness, ulceration, saliva, halitosis, debris, external factors, and brushed teeth.	Assessment tools	Oral assessment	42.6
	8	- For neonates/infants without teeth: Moisten the mouth every 2 hours with foam swabs or gauze soaked in water or saline. Apply Vaseline® to lips every 2 hours or as needed.	Mechanical and pharmacological care	Prevention	
	9	- For infants/children (<6 years) with teeth: Brush teeth every 12 hours with a soft toothbrush and a smear of fluoride toothpaste; do not rinse, but suction excess. Moisten the mouth every 2 hours with swabs soaked in water or saline. Apply Vaseline® to lips every 2 hours or as needed.	Mechanical and pharmacological care	Prevention	
	10	- For children (>6 years) with teeth: Brush teeth every 12 hours with a soft toothbrush and fluoride toothpaste; suction excess without rinsing. Use 0.1% chlorhexidine rinse (diluted) every 12 hours, at least 30 minutes after brushing, and suction excess. Moisten the mouth every 2 hours with swabs soaked in water or saline. Apply Vaseline® to lips every 2 hours or as needed.	Mechanical and pharmacological care	Prevention	
Sedwick *et al.* (Practice-Based Evidence)	11	- Provide mouth care every 2 hours (12 times daily), with responsibilities shared between respiratory therapists and nurses.	Oral care frequency	Prevention	37.0
Vollman *et al.* (Oral Care Practices)	12	- For ventilated patients: Remove bite block or oropharyngeal airway before oral hygiene. Brush teeth twice daily with a soft toothbrush, using toothpaste or cleansing solution, and suction secretions. Clean with 1.5% hydrogen peroxide swabs every 2–4 hours, followed by suction. Apply moisturizer to oral mucosa and lips. Use antiseptic rinses (e.g., chlorhexidine) after brushing or with comprehensive care.	Mechanical and pharmacological care	Prevention	44.4
	13	- Non-ventilated patients (self-care): Brush teeth gently for 1–2 minutes, use an oral rinse, and moisturize lips/mouth as needed, 4 times daily (after meals and bedtime). - Non-ventilated patients (dependent): Brush with a suction toothbrush and toothpaste/gel for 1–2 minutes, suctioning frequently. - Edentulous patients or those with dentures: Brush gums/tongue 4 times daily or every 6 hours if on tube feeding. Use antiseptic rinse with a swab and suction. Soak dentures in cleanser at night and rinse/swab with antiseptic rinse after meals. Apply moisturizer as needed.	Mechanical and pharmacological care	Prevention	

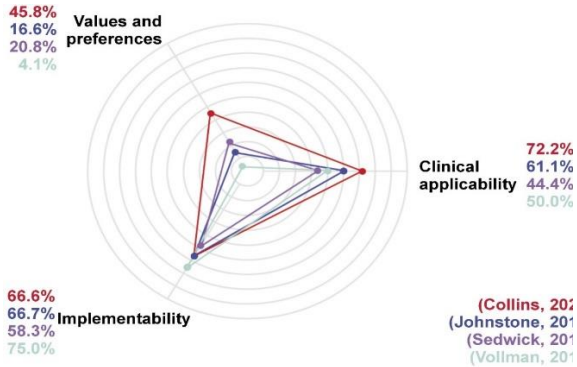

Figure 3. Average scores for the recommendations with regard to the AGREE-REX dimensions in the ideal case

Collins *et al.* reported mean AGREE-REX global scores of 59.3% for the ideal scenario and 40.7% for the local scenario, indicating generally minor limitations in the recommendations [18]. In the ideal scenario, the domain 'values and preferences' scored lowest (45.8%), as the perspectives of target users and patients were not incorporated during guideline development. In the local scenario, notable weaknesses were observed in 'values and preferences' (15.0%) and 'implementability' (41.6%). The recommendations suggest training for professional teams, which requires financial investment, making implementation challenging in settings with competing healthcare priorities. Strengths in the ideal scenario were evident in 'clinical applicability' (72.2%) and 'implementability' (66.6%), highlighting that the recommendations are precise, stepwise, and clearly specify the target population and health issue. In the local context, 'clinical applicability' received a score of 61.0%, reflecting that the recommendations are feasible within nurses' scope of practice [18].

In Johnstone *et al.*, both the ideal and local scenarios showed very low scores (approximately 16%) in the 'values and preferences' domain, due to the exclusion of patient, user, and population preferences in the scientific statement [19]. Conversely, 'implementability' was the strongest domain (around 67%) in both scenarios, reflecting that the recommendations were well aligned with the goal of improving oral health in children admitted to PICU. The statement also addressed the resources, training, and knowledge required for implementation. While resource limitations may pose challenges in some regions, the recommendations remain relevant and applicable locally [19].

The scientific statement by Sedwick *et al.* demonstrated low AGREE-REX scores in both the ideal (37.0%) and local (29.6%) scenarios [20]. In the ideal scenario, the main strength was 'implementability' (58.3%), reflecting the recommendations' positive impact on patient outcomes and the detailed description of team training, including hospital cost savings. In the local scenario, 'clinical applicability' scored highest (44.4%) because the supporting evidence was locally available. Nevertheless, performing oral care every two hours is impractical in many local ICU settings due to staff shortages. The lowest scores in both scenarios were in 'values and preferences' (ideal: 20.8%; local: 12.5%) [20].

Vollman *et al.*'s scientific statement achieved medium-quality scores, with 44.4% in the ideal scenario and 39.7% locally [21]. The statement emphasized user prerequisites and suggested educational programs for patients and families, facilitating wider adoption. Its recommendations can also be tailored to different patient subgroups, which explains the high 'implementability' score (75.0%). However, the 'values and preferences' domain remained a significant weakness (around 4% in both scenarios), as patient and user perspectives were not explicitly included in the recommendation development, despite addressing nurses' knowledge requirements and patient education strategies [21].

Discussion

In ICU settings, patients are often critically ill, with life-threatening conditions that take precedence over oral care. Consequently, oral health issues tend to be overlooked and underestimated due to other pressing medical complications [20], which may partly explain the scarcity of studies evaluating clinical practice guidelines (CPGs) and scientific statements (SSs) on this topic. To date, there appears to be no published assessment of the quality of SSs addressing oral health in ICU in-patients, nor an evaluation of the recommendations they contain.

This gap presents a significant concern. Even after recovery and discharge from the ICU, patients may face long-term oral health problems, as hospital stays can contribute to the development of caries, gingivitis, and periodontitis, among other conditions [22, 23]. The SSs reviewed, however, do include several practices related to oral care, which could be strengthened and expanded to prevent or reduce these long-term oral complications [24].

The overall quality of the 13 recommendations identified for ICU oral care was low. None of the recommendations focused solely on preventing oral health issues; instead, most were primarily aimed at reducing the risk of ventilator-associated pneumonia (VAP) [25]. Furthermore, the recommendations often

lack methodological rigor, such as consideration of patient comorbidities, alignment with the scope of practice of the intended users, identification of necessary resources, and recognition of potential barriers. The absence of these critical elements makes practical implementation challenging.

Four potential roles for oral health professionals in ICU oral care have been outlined [23]. First, dentists can contribute to the development of recommendations. Existing SSs that focus on oral care to prevent respiratory infections offer an opportunity to incorporate strategies addressing broader oral complications. Second, dentists may be directly involved in implementing recommendations as part of the ICU care team, with evidence suggesting that their participation improves oral health outcomes and reduces respiratory infections [23]. Third, dentists can provide training to the users of CPGs and SSs. Nurses often perceive oral care in the ICU as a particularly difficult and low-priority task [21], highlighting the necessity of targeted training by dental professionals. Fourth, dentists can play a role in post-ICU care. Patients discharged from the ICU frequently experience post-ICU syndrome, encompassing both physical and psychological sequelae [26]. It is crucial to assess whether dentists' training—both theoretical and practical—adequately prepares them to address the challenges patients face during this recovery period.

Limitations

Several limitations should be acknowledged. As this study is a systematic review, it is subject to potential language bias, since only studies published in English and Spanish were included. Consequently, relevant reports from the gray literature may have been excluded.

Conclusions

Patients discharged from the ICU remain at considerable risk for developing oral health problems, even when oral care recommendations are followed. Current recommendations primarily target the prevention of ventilation-associated respiratory infections rather than addressing oral complications directly. This gap highlights an opportunity to expand existing guidelines to not only focus on infection prevention but also to reduce the risk of long-term oral health issues in the post-ICU period. Overall, dentists have a pivotal role in enhancing the quality and applicability of CPGs and SSs for ICU patients. Furthermore, successful implementation of these recommendations requires careful consideration of local healthcare system limitations, including resource availability, economic constraints, and coverage capacity.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

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