RESEARCH ARTICLE

Effectiveness of Chlorhexidine (CHX) Mouthwash in the reduction of SARS-COV-2 Viral Load among COVID-19 Patients: A Systematic Review

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Abstract

Background: Public health was again at risk due to the appearance of new COVID-19 variants. Coronavirus Disease (COVID-19) transmission occurs mainly through the oral mucosa. Specifically, nurses who care for or interact with hospitalized patients directly have a higher risk of contracting the virus. In order to manage the viral load in respiratory secretions, nurses need to be aware of evidence-based practices as clinical care providers. The unsophisticated application and the effectiveness of Chlorhexidine (CHX) Mouthwash as an independent nursing intervention to mitigate cross-contamination and reduce SARS-CoV-2 transmission remains clinically significant.

Objective: The study's objective was to determine the effectiveness of Chlorhexidine (CHX) mouthwash in reducing SARS-CoV-2 viral load among COVID-19 patients.

Methods: A systematic review of effectiveness was conducted. The databases included the Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE, Google Scholar, Embase, The Cochrane Library, and BMJ Clinical Evidence and recruitment studies published between 2021-2023. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Randomized Controlled Trials was used to evaluate the risk of bias.

Results: A total of 523 patients from 10 clinical studies were included in this analysis. The review demonstrated the potential effectiveness of CHX Mouthwash in reducing SARS-CoV-2 viral load among COVID-19 patients admitted to a healthcare facility.

Conclusion and Recommendations: This review summarized current evidence on the antimicrobial and virucidal effects of chlorhexidine (CHX) in clinical settings. Findings indicated that CHX mouthwash may help reduce the SARS-CoV-2 viral load among hospitalized COVID-19 patients. However, variations in study design and outcomes, along with the narrative synthesis approach, limited causal interpretation. The results may guide clinical nurses and healthcare institutions in updating infection control practices and oral care protocols for patients with COVID-19..

Keywords: *Chlorhexidine Mouthwash, COVID-19, Health*

PROSPERO Registration: CRD42022307907

Introduction

The emergence of new COVID-19 variants has intensified the threat to global public health. Scientific evidence indicates that SARS-CoV-2, the novel coronavirus responsible for COVID-19, spreads through respiratory droplets, saliva, and direct contact, with the oral cavity serving as a significant reservoir for viral transmission (Jackson et al., 2022; Zeng et al., 2022). Consequently, nurses, who provide direct care to infected patients, face heightened risk of exposure. To minimize transmission, they must implement evidence-based practices that effectively control viral load in respiratory secretions.

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Among these, oral and throat hygiene represents a simple, independent, and cost-effective nursing intervention to prevent cross-contamination.

In the Philippines, the rapid spread of the Omicron variant has been of particular concern. This highly contagious strain quickly became the dominant cause of COVID-19 cases nationwide (Department of Health, 2022). Emerging evidence shows that Omicron more frequently infects the upper respiratory tract, including the throat, rather than the lungs (Chan et al., 2021; Peacock et al., 2021; Viana et al., 2021), underscoring the importance of oral and throat hygiene as a preventive measure. Oral care is an integral part of nursing practice and can positively influence patient outcomes. The use of antiseptic mouthwash or gargle has been identified as a potential adjunct in infection control. Studies have shown that antiseptic agents such as povidone-iodine (PVP-I), chlorhexidine gluconate (CHX), chlorine dioxide (ClO_2), cetylpyridinium chloride (CPC), and hydrogen peroxide (H_2O_2) can reduce SARS-CoV-2 viral load to undetectable levels (Naqvi et al., 2020; Ather et al., 2021; Chopra et al., 2021). Among these, PVP-I has demonstrated the ability to decrease viral particles in saliva and respiratory droplets, while CHX has shown promising laboratory evidence of antiviral properties but limited clinical data in hospitalized patients.

Chlorhexidine gluconate (CHX) possesses both bacteriostatic and virucidal effects against lipophilic viruses, fungi, and bacteria (Bezinelli et al., 2023). Preventive rinses containing 0.12% CHX have been found to reduce viral load in the oral cavity for up to two hours (Farhama et al., 2023). However, despite encouraging in vitro results, clinical trials validating CHX's efficacy in preventing SARS-CoV-2 transmission remain insufficient (Ebrahimi et al., 2021). Moreover, variations in concentration, duration, and frequency of use warrant further evaluation to ensure both safety and effectiveness.

The World Health Organization (WHO) has acknowledged the potential benefits of therapeutic mouthwashes as adjuncts to existing infection control measures, particularly for procedures generating aerosols or droplets. Nonetheless, the quantitative impact, duration of effect, and safety of oral antiseptics in vivo are still uncertain.

Given the continued risk of SARS-CoV-2 transmission and the absence of standardized nursing protocols for therapeutic mouthwash use, there is a need to synthesize current evidence. This systematic review, guided by the PEACE model of the Evidence-Based Nursing Practice Framework (Rivera & Fitzpatrick, 2021), aims to determine the effectiveness of chlorhexidine (CHX) mouthwash in reducing the SARS-CoV-2 viral load among COVID-19 patients.

Study Framework (PICO):

Population (P): Patients admitted to hospitals or health facilities diagnosed with COVID-19
Intervention (I): Chlorhexidine (CHX) mouthwash
Comparison ©: Placebo (distilled water), 0.075% CPC + 0.28% Zn, 1.5% hydrogen peroxide, or 0.9% sodium chloride
Outcome (O): Reduction in SARS-CoV-2 viral load as measured by RT-PCR or Ct values

Study Objectives. The study's objective was to determine the effectiveness of Chlorhexidine (CHX) mouthwash in reducing SARS-CoV-2 viral load among COVID-19 patients.

P (Population): Patients admitted to the hospital or health facility diagnosed with Coronavirus Disease, regardless of age, gender, and race.
I (Intervention): Chlorhexidine (CHX) Mouthwash
C (Comparison): a. Placebo - distilled water
b. 0.075% Cetylpyridinium chloride, 0.28% Zinc lactate (CPC + Zn)
c. 1.5% Hydrogen Peroxide (HP)
d. 0.9% Sodium Chloride
O (Outcome): SARS-CoV-2 viral load [determined by specific Real Time (RT)-PCR value expressed as the number of viral RNA copies per milliliter of viral transport medium or by the arbitrary test-specific Cycle threshold (Ct) value]

Methods and Procedures

This study utilized a Joanna Briggs Institute (JBI)-guided systematic review to collect, appraise, and synthesize data from primary studies addressing the effectiveness of chlorhexidine (CHX) mouthwash in reducing SARS-CoV-2 viral load. An effectiveness review emphasizing narrative evidence synthesis was conducted to qualitatively describe and summarize findings relevant to nursing practice (Aromataris & Munn, 2020).

Search Strategy

Prior to the review, the PROSPERO database was searched to confirm that no existing reviews had been registered on the same topic. A comprehensive, systematic, and reproducible search strategy was then developed to identify all relevant studies from August to November 2023.

An initial scoping search in MEDLINE helped refine key terms, followed by a full electronic search across MEDLINE, Embase,

CINAHL, and the Cochrane Library. Additional searches were conducted in Google Scholar and BMJ Clinical Evidence to capture gray and non-indexed peer-reviewed literature.

The search strategy combined controlled vocabulary (MeSH, Emtree, CINAHL Headings) and free-text keywords, including:*("chlorhexidine" OR "oral antiseptic" OR "mouthwash" OR "gargle") AND ("SARS-CoV-2" OR "COVID-19" OR "coronavirus") AND ("viral load" OR "viral reduction" OR "antiviral efficacy")*. Boolean operators ("AND," "OR") were applied to refine and expand results, ensuring sensitivity and precision across databases.

Study Selection and Data Extraction

All retrieved studies were screened for relevance by reviewing titles, abstracts, and descriptors. Inclusion criteria were limited to peer-reviewed randomized controlled trials (RCTs) published in English, involving patients diagnosed with COVID-19 who were admitted to hospitals or healthcare facilities. Only studies employing objective measures of SARS-CoV-2 viral load (e.g., RT-PCR or cycle threshold values) were included.

Exclusion criteria comprised non-peer-reviewed publications, non-English studies, reviews or editorials, and studies relying on self-reported outcomes. These parameters ensured methodological rigor, reproducibility, and the accuracy of data interpretation. Final data extraction adhered to JBI protocols, prioritizing transparency and quality appraisal in evidence synthesis.

A full-text report of eligible studies that met both the inclusion and eligibility was obtained.

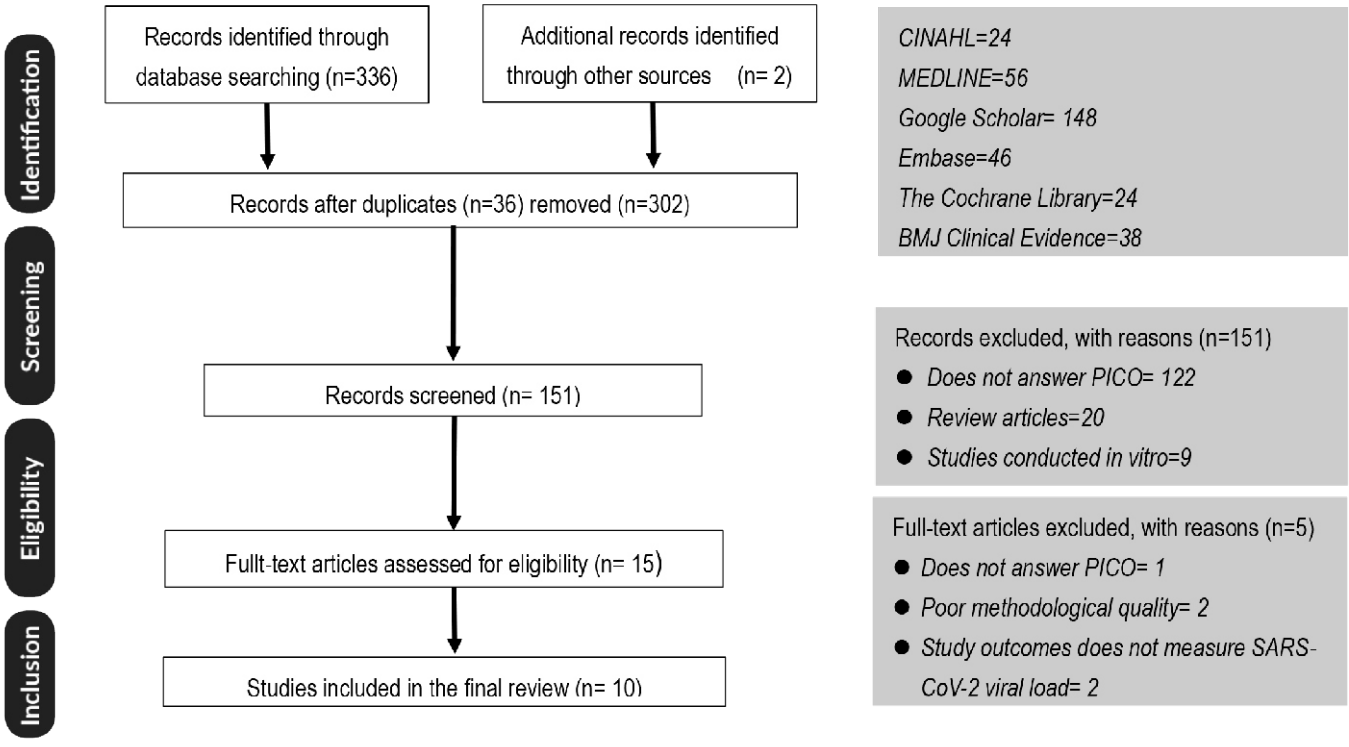
Data Extraction

An audit guide was employed to systematically extract and consolidate all relevant data from the included studies. This guide, adapted for randomized controlled trials (RCTs), organized the data extraction process to ensure completeness and consistency across studies. Data were recorded and stored in a restricted-access Google Excel sheet and Word file to maintain data integrity and confidentiality. To optimize access to scholarly materials, the researchers sought assistance from the Saint Louis University Libraries for open-access and institutional subscription support.

Critical Appraisal of Methodological Quality

The methodological quality of the included RCTs was evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Randomized Controlled Trials, a standardized 13-

Figure 1. *The PRISMA flow diagram.*



item tool assessing study rigor, potential bias, and generalizability of findings.

Three independent reviewers applied the inclusion criteria, conducted critical appraisals, and evaluated each study's methodological quality. Both the primary and co-reviewers independently screened records, with the primary author consolidating results and resolving discrepancies through consensus. Among the reviewed studies, seven were rated as high quality and three as moderate quality. Only studies with moderate to high methodological rigor were included in the final synthesis to ensure the reliability and validity of the evidence base.

Data Synthesis and Analysis

Given the heterogeneity in study populations, interventions, and outcome measures, a narrative synthesis approach was adopted. Quantitative meta-analysis was deemed inappropriate due to variability across studies. The findings were therefore presented descriptively, highlighting recurring patterns, methodological strengths, and areas of divergence.

The synthesis integrated key outcomes from multiple RCTs, extending beyond traditional literature summaries by identifying common trends, explanatory factors for discrepancies, and relationships between study characteristics and reported results. This approach facilitated a deeper understanding of the evidence regarding the effectiveness of chlorhexidine (CHX) mouthwash in reducing SARS-CoV-2 viral load among COVID-19 patients.

Ethical Considerations

Ethical approval for this systematic review was obtained from the Saint Louis University Research Ethics Committee (Protocol No. SLU-REC 2023-14). In adherence to international research transparency standards, the review protocol was developed a priori and registered with the National Institute for Health Research's International Prospective Register of Systematic Reviews (PROSPERO).

Results and Discussion

A total of ten (10) clinical studies published between 2021 and 2023 met the eligibility criteria, encompassing 523 adult participants (aged 18 years and above) who were admitted to various hospitals and healthcare facilities. The methodological appraisal of these studies indicated fair to good quality evidence, with most randomized controlled trials (RCTs) demonstrating a low risk of bias. Collectively, the findings suggest that the use of chlorhexidine (CHX) mouthrinse contributes to a reduction in SARS-CoV-2 viral load in the oral cavity.

Across the included studies, significant viral load reductions were observed in the majority of cases. Specifically, six (6) RCTs reported the effectiveness of CHX mouthwash in lowering oral SARS-CoV-2 viral titers, supporting its potential antiviral activity and clinical utility. Conversely, three (3) in vitro RCTs reported no statistically significant effect, suggesting variability in outcomes depending on study design and methodological parameters. Notably, all in vitro investigations utilized 0.12% CHX concentrations, with one study documenting a >99.9% reduction in viral load within 30 minutes following mouth rinsing. Overall, CHX demonstrated strong virucidal activity without evidence of cytotoxicity or adverse effects at higher concentrations, reinforcing its potential as a safe adjunctive measure in infection control protocols.

Outcome Evaluation and Changes in SARS-CoV-2 Viral Load

Barrueco et al. (2022) conducted a randomized, double-blind clinical trial to evaluate the ability of oral antiseptics to lower the infectivity of SARS-CoV-2. Fifty COVID-19–positive patients were randomized to receive a placebo or one of four mouthwash formulations. Quantitative PCR analysis revealed that none of the tested mouthwashes significantly reduced salivary viral load, although a cetylpyridinium chloride (CPC) mouthwash demonstrated a transient reduction in viral infectivity one hour post-rinse. The authors cautioned that certain mouthwashes might create a false sense of security, as they may not produce immediate or sustained antiviral effects in vivo.

Bezinelli et al. (2023) presented the results of a randomized clinical trial evaluating the impact of chlorhexidine (CHX)-based oral hygiene on viral load reduction among intubated COVID-19 patients. Two groups were compared: one used 0.12% CHX alone, and the other combined 1.5% hydrogen peroxide (HP) with 0.12% CHX. Findings indicated that CHX alone did not significantly lower viral load, whereas the combined HP+CHX regimen produced an immediate reduction. The authors concluded that combining HP and CHX may enhance oral viral load reduction among critically ill, intubated patients.

Similarly, Bonn et al. (2023) conducted an RCT involving 61 patients to evaluate the effect of CHX and CPC mouthwash on SARS-CoV-2 viral infectivity. Results revealed that only the test group (CHX+CPC) exhibited a statistically significant decrease in viral load. Notably, baseline infectivity was markedly lower among participants who had received a vaccination booster,

Table 1. *Summary of Included Studies*

Author, Year of Publication	Type of Study	Study Setting	Participants	Intervention and Control Group (Sample Size)	Key findings or results
Barrueco et al., (2022)	Double-blind, RCT	Spain	Age: 25-90, Days after the onset of COVID-19 symptoms and a positive SARS-CoV-2 PCR nasopharyngeal test conducted at the hospital.	50 paticipants *Treatment group* PVP-I: n=10 H2O2: n=10 CPC: n=10 CHX: n=10 *Control group* Distilled water (placebo):10	CHX mouthwash had no effect on the salivary viral load. Reducing viral infectivity in saliva and, consequently, SARS CoV-2 infectivity has only small beneficial benefits. Certain mouthwashes that are currently in use in hospitals may provide patients with a false sense of security while offering just mediocre protection against viral transmission.
Bezinelli et al., (2023)	Prospective, randomized, double blinded, single-center clinical trial	Brazil	Age: ≥18 years Diagnosed with COVID-19 and admitted into the ICU Undergoing orotracheal intubation for ≤4 days at the time of sample collection	43 participants *Intervention Group* 0.12 % CHX rinse: n = 19 *Control Group* 1.5% HP+ 0.12% CHX rinse: n = 24	A significant viral load reduction was observed thirty (30) minutes after the intervention in the HP+CHX group. No statistically significant differences between any time points were observed in the CHX group
Bonn et al., (2023)	Prospective RCT	Germany	Age, Median: 25, 42 Exhibit COVID-19–like symptoms for not longer than 72 h as well as a positive antigen point-of care test (SARS-CoV-2 Rapid Antigen Test; Roche)	61 participants *Test group* CHX & CPC: n=31 *Placebo group* 0.9% NaCl rinse n=30	There was a decrease in the viral load in both groups after the mouthwash, which was found significant in the test group (P = 0.0435) but not in the placebo group. Moreover, test mouthwash dramatically decreased viral infectivity; interestingly, gargling with 0.9% NaCl had a minor impact as well.
Costa et al., (2021)	Double-blind, RCT	Brazil	Age ≥18 years, presence of flu-like symptoms for 3 to 7 days, and a positive test for SARS-CoV-2.	100 participants *Intevention Group* CHX Mouthwash: n=50 *Control Group* Distlled Water: n=50	The test group's Ct values were significantly greater than the control group's between evaluations at 5 min and baseline (test group: 2.19 ± 4.30; control: −0.40 ± 3.87, p = 0.002) and 60 min and baseline (test group: 2.45 ± 3.88; control: 0.76 ± 4.41, p = 0.05), suggesting a greater reduction in viral load.
Eduardo et al., (2021)	Single Center RCT	Brazil	Age of 18-90 years Identifified to be positive for SARS-CoV-2 as determined by nasal swabbing and qRT-PCR. Length of hospitalization up to 3 days	60 participants *Intervention group* CHX group: n=12 HP+CHX group: n=12 HP group: n=12 CPC+Zn group: n=12 *Placebo group* Distilled water: n=12	The viral load was significantly lower after using CHX mouthwash. notable drops in the SARS-CoV-2 virus load in saliva for as long as 60 minutes following CHX rinse. On the other hand, HP mouthwash showed a significant decrease up to half an hour after washing. CHX mouthwash may be regarded as a risk-reduction measure for SARS-CoV-2 infected individuals.
Elzein et al., (2021)	Parallel group, blind, RCT	Lebanon	Age in years Mean ± SD (years) 45.3 ± 16.7 Laboratory-confirmed COVID-19 positive patients, through nasopharyngeal swabs	61 participants Chlorhexidine 0.2% group: n=29 Povidone-iodine 1% group: n= 27 Distilled water group: n=9	When utilizing 0.2% chlorhexidine in paired samples, a greater significant difference in means was seen (P <.0001). Mouthwash caused a 5.69 rise in the mean Ct. Preprocedural mouthwash containing 0.2% chlorhexidine shown notable effectiveness in combating SARS CoV-2.

Farmaha et al., (2023)	RCT	United States	Age in years (mean ± SD)-40.7 ± 12.0 COVID-19 patients tested positive for SARS-CoV-2 virus in a PCR-based diagnostic test	32 participants 0.12% CHX (Peridex): n= 1.5% H2O2: n=5 PI mouthwash-1% Betadine: n=8 Listerine: n=7 Water: n=6	Sustained increase in Ct value for the CHX group and Listerine group suggests their efectiveness in reducing viral load in the oral cavity over the two-hour course compared to water control. There is clinical evidence in utilising prophylactic mouth rinses with CHX to reduce the oral load of the SARS-CoV-2 virus in Hospitals.
Giulia et al., (2023)	Monocentric, parallel-group, double-blind RCT	Germany	Age: 18-80 COVID-19 positive patients verified by laboratory testing (RT-PCR on salivary sample)	40 Participants Test group: 0.05% CPC + 0.05% CHX: n=20 Control group: Sterile water: n=20	There were no notable distinctions between the patient's vaccination status, time points, or groups. For the length of standard dental procedures, pre-procedural rinse may not have a substantial therapeutic relevance in lowering SARS-CoV-2 levels.
Perusollo et al., (2023)	Single-blind, parallel-group, RCT	United Kingdom	Age: ≥18 years Confirmed COVID-19 patients, with clinical signs	40 participants *Test Group* 0.2% Chlorhexidine digluconate: n= 10 1.5% Hydrogen peroxide: n=10 Cetylpyridinium chloride: n= 10 *Control group* No rinsing (not even water): n= 10	At any point in time (30 minutes, 1, 2, and 3 hours), there were no discernible differences between the means of any of the test or rinsing groups and the non-rinsing control group. Mouthrinses with 0.2% CHX, 1.5% H2O2, or CPC did not differ from the control group in terms of lowering the SARS-CoV-2 virus load in hospitalized COVID-19 patients' saliva at the time points under investigation.
Seneviratne et al., (2021)	RCT	Singapore	Age in years: 35-44 Patients with nasal swabs positive for SARS-CoV-2 based on reverse-transcription polymerase chain reaction (RT-PCR) assay	36 patients *Intervention Group* PI group: n=4 CHX group: n=6 CPC group: n=4 *Control group* (water): n=2	There were no significant differences observed in the CT readings of patients at the 5-minute, 3-hour, and 6-hour time points within each group of PI, CHX, CPC, and water. But after five and six hours, there was an apparent increase in the CPC group patients and the PI group patients.

Abbreviations: RCT=Randomized Controlled Trials, CHX=Chlorhexedine, PVP-I= Povidone-iodine, H202=Hydrogen peroxide, CPC=Cetylpyridinium chloride, NaCl= Sodium Chloride, PI=Povidone Iodine

underscoring the influence of host immunity on outcomes. Further studies were recommended to establish the clinical significance of these findings.

Costa et al. (2021) assessed the effect of 0.12% CHX mouthwash on salivary viral load in 100 COVID-19–positive participants through a double-blind, randomized, placebo-controlled trial. RT-PCR analysis demonstrated a significant reduction in viral load at both 5 and 60 minutes post-rinse, with a greater proportion of participants in the CHX group exhibiting decreased viral titers.

In a pilot clinical trial, Eduardo et al. (2021) examined three mouthwash types—0.12% CHX gluconate, 1.5% hydrogen peroxide, and CPC with zinc lactate. All solutions produced immediate reductions in viral load, with CHX showing consistent efficacy at all measured intervals. The authors concluded that mouthwashes containing CHX, CPC+Zn, or hydrogen peroxide could serve as adjunctive risk mitigation strategies in clinical settings.

Elzein et al. (2021) compared 0.2% CHX and 1% povidone-iodine (PVP-I) against distilled water among 61 COVID-19–positive patients. Both CHX and PVP-I mouthwashes significantly reduced salivary SARS-CoV-2 load, supporting their use as pre-procedural prophylaxis to minimize viral transmission during dental and clinical procedures. Similarly, Farmaha et al. (2023) evaluated four commercial mouthwashes—1.5% hydrogen peroxide, 1% PVP-I, 0.12% CHX gluconate, and Listerine—against water among 32

COVID-19–positive participants. Saliva samples collected at baseline, immediately after rinsing, and two hours post-rinse showed sustained increases in Ct values for CHX and Listerine groups, indicating reduced viral load over time.

Giulia et al. (2023) performed a randomized, double-blind, controlled trial on 40 COVID-19–positive patients comparing a CPC–CHX combination mouthwash with sterile water. Although reductions in SARS-CoV-2 RNA copies were noted, differences between the test and control groups were not statistically significant, suggesting limited clinical benefit under the study conditions.

Perusollo et al. (2023) tested CHX, H_2 O_2 , and CPC mouthwashes among 40 hospitalized COVID-19 patients. Quantitative PCR results showed overall viral load reduction across all groups, including the rinse-free control, implying that the mechanical action of rinsing and spitting may contribute to viral clearance rather than chemical activity alone.

Seneviratne et al. (2021) compared four mouthwash formulations—1.5% hydrogen peroxide, 1% PVP-I, 0.12% CHX gluconate, and Listerine—against water among 32 COVID-19–positive individuals. All four formulations significantly increased Ct values relative to water immediately and two hours post-rinse, suggesting transient reductions in viral load.

Brookes et al. (2020) described CHX as a near-neutral solution (pH 5–7) recommended for topical use only. Supporting evidence from Tran and Butcher (2019) confirmed the clinical safety of CHX mouthwash in adults and adolescents aged 12 and above. Across the RCTs included in this review, no adverse effects were reported during or after CHX administration. However, none of the included trials examined the long-term relationship between reduced salivary viral load and improvements in patients' clinical symptoms or overall well-being. Notably, CHX has also been shown to be effective in oral care protocols for preventing healthcare-associated pneumonia among adults in intensive care units (Tran & Butcher, 2019), warranting further investigation into its broader infection control benefits.

Overall, this systematic review supports the effectiveness of CHX mouthwash in reducing SARS-CoV-2 viral load among hospitalized COVID-19 patients (Bezinelli et al., 2023; Bonn et al., 2023; Costa et al., 2021; Eduardo et al., 2021; Elzein et al., 2021; Farmaha et al., 2023). Recent meta-analyses corroborate these findings, highlighting the combined virucidal effects of CHX and PVP-I on oral SARS-CoV-2 viral load (Hasan et al., 2023; Zhang et al., 2023).

This review provides an evidence-based foundation for developing oral care protocols for adult inpatients with COVID-19. Guided by the PEACE Model, nurses can bridge evidence, practice, and outcomes by integrating evidence-based interventions—such as routine oral care and CHX mouth rinsing—into daily clinical practice. Embedding such protocols into institutional policy and culture is crucial for ensuring sustainability and effectiveness.

Implications for Nursing Practice

The findings of this review have several implications for clinical nursing practice. The adoption of antimicrobial oral rinses, such as CHX, may offer a practical and evidence-based approach to reducing viral transmission in hospital settings. Nurse administrators and managers play a critical role in supporting the development and implementation of clinical protocols that emphasize oral hygiene as a stand-alone nursing intervention for infection control and patient well-being (Dagnew et al., 2020; Quinn, 2023).

Further studies are needed to determine the optimal concentration, duration, and frequency of CHX use. Nevertheless, incorporating CHX mouthwash into nursing routines may help mitigate SARS-CoV-2 transmission in healthcare facilities. As frontliners, nurses must remain current with evolving evidence and integrate validated infection control measures into patient care. Consistent oral hygiene practices—such as regular brushing and the use of CHX mouthwash—can preserve oral health, prevent secondary infections, and contribute to holistic well-being.

Study Limitations

Several limitations were identified in this review. First, the small number of eligible studies limits the generalizability and statistical power of conclusions. The scarcity of nursing-led CHX intervention studies highlights the need for future nurse-driven clinical research. Second, only English-language, full-text publications were included, introducing potential language bias and limiting the scope of available evidence. Future reviews should consider multilingual inclusion to enhance global applicability.

Third, the included studies exhibited heterogeneity in sample characteristics, including race, comorbidities, and disease severity, which precluded quantitative meta-analysis. In some trials, CHX was combined with other oral antiseptics, confounding its independent effect. These methodological variations underscore the importance of assessing risk of bias

and contextualizing results within each study's design and population.

Despite these limitations, the review contributes valuable insights into the role of CHX mouthwash as an adjunctive nursing intervention in infection prevention and control. Future large-scale, multicenter RCTs are recommended to validate these findings and guide evidence-based oral care practices in clinical nursing.

Conclusion and Recommendations

This systematic review synthesized current evidence on the antimicrobial and virucidal properties of chlorhexidine (CHX) in various clinical settings. Overall, the included studies provided fair to good evidence supporting the potential effectiveness of CHX mouthwash in reducing the SARS-CoV-2 viral load among hospitalized patients with COVID-19. However, heterogeneity in study designs, comparator agents, and outcome measures limits the ability to establish definitive causal inferences. As this review employed a narrative synthesis and did not generate a pooled effect estimate, findings should be interpreted with caution.

The results suggest that CHX mouthwash may serve as an adjunctive preventive strategy in infection control, potentially reducing viral load and transmission risk among patients in healthcare facilities. Clinical nurses and healthcare institutions are encouraged to consider the findings of this review in updating oral care protocols, infection prevention policies, and bedside practices for patients diagnosed with COVID-19. Integrating such evidence-based interventions into hospital systems reinforces nurses' critical role in mitigating infectious disease transmission through safe, independent nursing practices.

Future studies with larger and more diverse sample sizes, particularly in Asian populations, are warranted to validate and expand these findings. Researchers are also encouraged to include multilingual studies or translation support to minimize publication bias and enhance global comprehensiveness. Further well-designed randomized clinical trials are needed to determine the optimal duration, frequency, and concentration of CHX mouth rinsing and to evaluate its sustained effects on viral load reduction and patient outcomes.

Strengthening the evidence base through continued nursing-led inquiry will contribute to the advancement of evidence-based oral care protocols and reinforce nurses' central role in infection prevention and control within healthcare settings.

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"Justice in health is the quiet aspiration behind every ethical decision a nurse makes."