

# Oral health inequalities among geriatric population: A systematic review

Aseema Samal, Ipseeta Menon, Kunal Jha, Gunjan Kumar, Arpita Singh

Department of Public, Health Dentistry, Kalinga Institute of Dental Sciences, Bhubaneswar, Odisha, India

## ABSTRACT

As per the World Health Organization, governments should aim to accomplish two significant global milestones by 2030: reducing health disparities and granting universal accessibility to healthcare. The aim of this article was to systematically review the inequalities and understand the multifactorial causation of oral health inequalities among the older adults. Methods: Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) standards were used to carry out the review and is documented in PROSPERO CRD42026695761. Two authors did the search and screening in accordance with the protocol. Electronic databases such as PubMed, Google Scholar, and EBSCOhost articles of the last 10 years were searched for research presenting data on oral health status and oral health related quality of life in the elderly population. Quality assessment was performed using the Newcastle Ottawa Scale (NOS) for retrospective and prospective research. Results: Only 24 studies fulfilled the eligibility criteria and were incorporated into the qualitative synthesis. Multiple aspects of oral health and the related variables influencing disparities in oral health in the elderly population living in institutions have a positive link. Conclusion: The findings support the notion that this demographic consists of weak, dependent individuals who have poor oral health. The vulnerable elderly institutionalized population was recognized and validated, thus helps in providing measures that will eventually focus the risk factors to improve their OHRQoL.

**Keywords:** geriatric population, oral health, quality of life, social inequality

## Introduction

Disparity in healthcare, also known as health inequity, is simply a type of health inequality that represent an imbalance in healthcare.<sup>[1]</sup> Appropriate healthcare measures can reduce this health inequity.<sup>[2]</sup> “Equity in health implies that, in an ideal world, everyone should have an equal opportunity to realise their full health potential, and more practically, no one should be hindered from doing so, if at all feasible”.<sup>[3]</sup> There is a large gap in health risk exposure. On a global scale, oral illness is a substantial health burden. It could be tooth decay, gum disease, tooth loss, oral cancer, oro-dental trauma, and congenital

malformations, including cleft lip and palate.<sup>[4]</sup> Since most oral diseases are avoidable, the global incidence and disability-adjusted life-years (DALYs) burden of oral diseases is enormous. Around 3.5 billion people worldwide are affected by oral disorders, according to the Global Burden of Disease Study 2019.<sup>[5]</sup>

Individual with more advanced stage of oral cancer belonged to lower socioeconomic scale which suggest a potential correlation exists between the gap in oral cancer burdens.<sup>[6]</sup> The incidence of oral cancer is significantly influenced by geographic location since individuals from lower socioeconomic backgrounds are more likely to acquire the disease because they are less aware of the harmful consequences of avoidable risk factors such as alcohol and tobacco use.<sup>[7]</sup> Low-income countries make up 35% of all the countries with socioeconomic differences in oral healthcare accessibility, followed by lower-middle-income countries (60%), upper-middle-income countries (75%), and high-income countries (82%).<sup>[1]</sup>

**Address for correspondence:** Dr. Aseema Samal, Kalinga Institute of Dental Sciences, Bhubaneswar, Odisha - 751 024, India.  
E-mail: draseemasamal@gmail.com

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Oral health-related quality of life (OHRQoL) is a major outcome that helps in psychosocial and functional assessment of oral health, but few researches have focused at this significant outcome in the context of older individuals and oral health inequalities.<sup>[8]</sup>

Looking at the evidence, it is clear that no study to date has provided a comprehensive qualitative analysis to understand the various factors responsible for oral health inequalities among the geriatric population. Hence, we improved our research by including relevant literature and carried out a systematic review to understand the multifactorial causation of oral health inequalities among older adults. We used these data in a recent study to identify discrepancies in daily usage by educational, socioeconomic, or occupational status, as well as gender, ethnicity, or area of residence. The review seeks to consolidate understanding regarding the oral health of elderly individuals living in institutions, by thoroughly examining the evidence reported over the last few decade. It aims to highlight these factors potentially linked to deteriorating oral health and oral health-related quality of life (OHRQoL). We expect that the findings from this review could stimulate the development of preventive measures or strategies for improving the care of this vulnerable minority population.

## Methods

The review was conducted according to Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines<sup>[9]</sup> and registered in Prospective Registration of Systematic Review (PROSPERO) CRD42026695761 with the following focused research question in the Participants (P), Exposure (E), Comparison (C), and Outcome (O) format was proposed “What are the factors associated with oral health inequalities among elderly population”? as given below in Table 1.

### Search strategy

The study selection criteria included English language articles published between 2000 and December 2022, studies on oral health status and quality of life in older populations, dental service utilization studies, comparative, prospective, open access journals,

oral healthcare improvement studies, and grey literature. The study utilized databases like EBSCOhost, Google Scholar, and PubMed to conduct a comprehensive electronic search of quantitative studies published between 2000 and 2022. Exclusion criteria include studies before 2000, articles in non-English languages, review articles, letter to editors, *in vitro* or animal studies, and articles not in open access journals. The study searched for pertinent data on “oral health inequalities”, “disparities”, “dental disparities”, “elderly population”, “oral health factors”, and “socioeconomic status” using Boolean keywords and Medical Subject Heading (MeSH) terms. Along with studies on the target demographic, determinants, and socioeconomic position, it also included observational, case-control, and cohort studies. For studies that were not identified by the computerized search, the reference lists of the full-text articles that were included were manually searched.

### Eligibility criteria

#### Inclusion criteria

1. Inclusion criteria were based on the PECO model and were used to formulate search strategies.
2. The search was restricted to the studies that were published within 10 years between 2012 and 2022.
3. Observational, case-control, prospective, and cohort studies were included.
4. Had available abstracts and were written in English in the e-database.

#### Exclusion criteria

1. Retrospective studies, reviews (Literature and systematic), editorial or reports of expert opinions, and unpublished preprints.
2. Articles whose full texts were not available or language other than English were not taken.

### Data extraction

Two independent reviewing authors (A.S. and I.M.) used pilot-tested tailored data extraction forms to get the following descriptive study details for all included studies and entered in Microsoft Excel sheets; the final analysis includes authors, year and location of study, population mean age, research design, and conclusion.

### Screening process

As per the protocol, 2 authors (A.S. and I.M.) did the search and screening. They worked simultaneously to remove any duplicate articles using EndNote reference management software. The articles were chosen in two phases in which articles that did not fulfill the inclusion criteria were eliminated in first phase. During phase two, the same reviewers assessed the full texts, abstracts, and titles of the articles. Any disagreements were settled through conversation. When two reviewers refused to agree, a third reviewer was brought in to arrive at the final decision. The eligibility of the included studies and the accuracy of the data extraction and analysis were confirmed by a third reviewer (K.J.). If further details were necessary, the corresponding authors of the study were contacted through e-mail.

**Table 1: PECO criteria and MesH term used**

	Primary research question	Mesh terms used in the search engines
Population	Older population aged > 65 years	“geriatric population”, “geriatrics”, “older adults”, and “elderly”
Exposure	socioeconomic inequalities, tooth loss, dental caries, periodontal problems	none
Comparison	Adults with or without specific oral health problems	None
Outcome	Oral health status, OHRQoL, dental service utilization, oral health inequalities	“oral health” “inequalities”, “disparities”

### Quality assessment of included studies

Based on the Newcastle Ottawa Scale, the quality of the included papers for observational studies was assessed, and a numerical score (NOS Score) was subsequently given.<sup>[10]</sup> With a maximum of four points available for selection, two for comparability, and three for the evaluation of the result or exposure, the NOS employs a nine-star rating system.

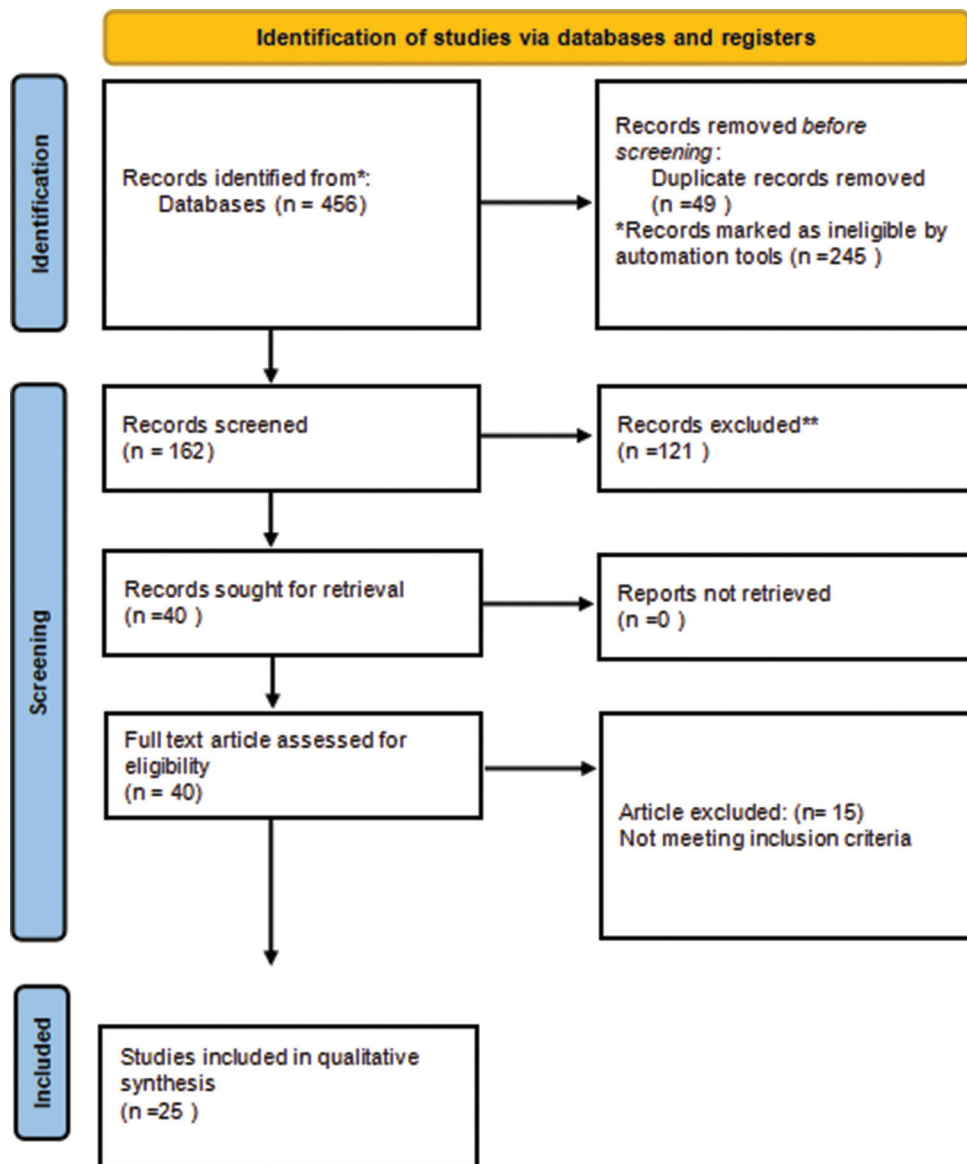
## Results

### Study selection

The duplicate articles were eliminated after examining the reference list. Around 121 articles were removed after title screening. After title screening, 15 articles got removed as they failed to meet the inclusion criteria. Only 25 articles those who met the eligibility criteria were included for the quality synthesis. Figure 1 depicts a flowchart according to the PRISMA guidelines.

### Data synthesis and analysis

Table 2 presents a summary of the descriptive characteristics of all the included studies. Twenty-five articles which met the inclusion criteria were included in qualitative synthesis. Among the included studies, twenty-one studies were of cross-sectional study design, among which three studies<sup>[11-13]</sup> were of case-control study design and one randomized controlled trial. Data from an overall population of 500,305 individuals were analyzed with a mean age of  $67 \pm 2.345$  years. Among the included studies, ten studies (Gaio *et al.* 2012, Machado *et al.* 2012, Silva *et al.*, Souza *et al.*, Andrade *et al.* 2016, Andrade *et al.* 2018, Andrade *et al.* 2019, Fagundes *et al.*, Galvão MHR *et al.*, and Amaral Júnior OL *et al.*, 2022) were conducted in Brazil.<sup>[11,14-22]</sup> Three studies (Montini *et al.*, Stephens *et al.*, and Schensul *et al.*) were conducted in the United States.<sup>[23-25]</sup> Two studies (Mariño *et al.* and Quinteros *et al.*) were conducted in Chile,<sup>[26,27]</sup> two studies (Bilder *et al.* and Warman *et al.*) were conducted in Israel,<sup>[28,29]</sup> two studies (Kiuchi *et al.* and



**Figure 1:** Flowchart according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

Table 2: Descriptive study characteristics

Author and year	Place	Study design	Conclusion
Gaio <i>et al.</i> , 2012 <sup>[11]</sup>	Brazil	Case-control	Elderly south Brazilian group was found to have poor dental health. The majority of the burden of illness and the requirement for treatment was caused by sociodemographic variations.
Kotzer <i>et al.</i> , 2012 <sup>[34]</sup>	Nova Scotia, Canada	Cross-sectional study	Findings indicate that the oral health and OHRQoL of both preseniors and seniors in LTC residents is poor. Preseniors living in the community scored significantly higher than community dwelling seniors on prevalence, extent, and severity of OHIP-14 scores.
Machado <i>et al.</i> 2012 <sup>[14]</sup>	Southern Brazil	Cross-sectional study	Inequalities were found in the regular use of dental services. Integrated approaches that raise awareness of oral health, improve self-care and expand access to dental services, may contribute to increase the use of dental services on a regular basis.
Silva <i>et al.</i> 2013 <sup>[15]</sup>	Southern Brazil	Cross-sectional study	The findings of the present study underscore the need for public policies aimed at reducing social inequalities and providing adequate dental treatment to improve OHRQoL among elderly individuals.
Bilder <i>et al.</i> 2014 <sup>[28]</sup>	Israel	Cross-sectional study	Oral health among LTC institutionalized patients in a geriatric and psychiatric hospital is poor and the majority of participants had unmet dental treatment needs.
Mariño <i>et al.</i> 2014 <sup>[26]</sup>	Chile	Cross-sectional study	Participants in this study appear to have lower missing teeth scores and less need for complex periodontal treatment. Inequities were apparent in the proportion of unmet restorative and prosthetics needs.
Montini <i>et al.</i> 2014 <sup>[23]</sup>	New York	Cross-sectional study	Older adults have a high burden of oral disease and access barriers remain.
Srisilapanan <i>et al.</i> 2014 <sup>[12]</sup>	Thailand	Case-control	Social inequality is related to the number of remaining teeth in elderly Thai people
Quinteros <i>et al.</i> 2014 <sup>[27]</sup>	Central Chile	Cross-sectional study	Adults and older adults from the Maule Region showed severe dental damage from caries. Although rurality and use of services do not seem to affect caries experience, they are associated with differences in fillings and missing teeth.
Souza <i>et al.</i> 2016 <sup>[16]</sup>	Brazil	Cross-sectional study	A high prevalence of oral problems impacting OHRQoL in older Brazilians was identified. Furthermore, the impact prevalence was related to a positive situation in contextual determinants and a negative situation for the individual, showing a social inequalities profile in relation to individual determinants.
Monaghan <i>et al.</i> 2017 <sup>[32]</sup>	Wales	Cross-sectional study	Compared with peers living in the community, both dentate and edentate care home residents are more likely to live with one or more impacts.
Olofsson <i>et al.</i> 2017 <sup>[13]</sup>	northern Sweden and western Finland	Case-control study	One-quarter of the total sample was edentulous, with a higher prevalence of edentulism in Finland than in Sweden and in rural than in urban areas. Edentulism was associated with socioeconomic, psychological and health-related factors. These findings could be used to inform preventive measures and identify people aged 65 years and older who are in need of oral care.
Andrade <i>et al.</i> 2016 <sup>[17]</sup>	Brazil	Cross-sectional study	The recent use of dental care and the use of preventive care are disproportionately concentrated among wealthier older adults, whereas the use of public services is more common among poorer individuals.
Andrade <i>et al.</i> 2018 <sup>[18]</sup>	Brazil	Cross-sectional study	Socioeconomic inequalities in the prevalence of functional dentition among older adults persisted significantly and even increased relatively in Brazil.
Andrade <i>et al.</i> 2019 <sup>[19]</sup>	Brazil	Cross-sectional study	There were significant socioeconomic inequalities related to the negative impact of oral health-related quality of life in Brazil among both age groups.
Stephens <i>et al.</i> 2019 <sup>[24]</sup>	North Carolina	Cross-sectional study	The oral health disparities between institutionalized and community-dwelling older adults reflect the need for policy
Granillo <i>et al.</i> 2020 <sup>[33]</sup>	Pachuca, Mexico	Cross-sectional study	In our study sample, 53.2% of participants reported brushing their teeth at least once a day, 50.4% always using toothpaste, 16.5% using mouthwash and 3.6% using floss for their oral hygiene. In general, younger and female respondents used oral hygiene aids more than the others.
Kim <i>et al.</i> 2020 <sup>[35]</sup>	Korea	Cross-sectional study	This study analyzed the factors related to the experience of OHSU among Korean adults by using the Anderson model with the sixth KNHANES data to eliminate obstacles to the OHSU among Korean adults and increase equity
Kiuchi <i>et al.</i> , 2020 <sup>[30]</sup>	Japan	Cross-sectional study	Income inequalities in access to dental care were smaller among older daily users of public transportation than in nondaily users.
Fagundes <i>et al.</i> , 2021 <sup>[20]</sup>	Sao paulo Brazil	Cross-sectional study	There are differences in the factors associated with SPOH between age groups, and these differences reflect social inequalities in health.
Warman <i>et al.</i> 2021 <sup>[29]</sup>	Israel	Cross-sectional study	The perceived status of oral health among the 65+age group is currently better than it was 22 years ago. However, despite the improvement in oral health and health behavior, there are still barriers to the utilization of dental services. The main barriers are a lack of awareness of the importance of proper health behavior, and the cost of care for people with financial difficulty

Contd...

Table 2: Contd...

Author and year	Place	Study design	Conclusion
Galvão MHR <i>et al.</i> , 2022 <sup>[21]</sup>	Brazil	Cross-sectional study	This study showed that contextual and individual factors induce inequity in dental appointments. Moreover, Andersen's behavioural model demonstrated inequitable access for dental services in Brazil, in which social structure and enabling characteristics, rather than the need for the service, determine who receives healthcare.
Harada <i>et al.</i> , 2022 <sup>[31]</sup>	Japan	Cross-sectional study	Income inequalities in denture use existed among older adults with severe tooth loss in Japan, and the inequalities appeared to be greater when the co-payment rate was higher.
Amaral Júnior OL <i>et al.</i> , 2022 <sup>[22]</sup>	Brazil	Cross-sectional study	The findings demonstrate that structural social capital in older Brazilian adults might partly mediate the pathways to socioeconomic inequalities in oral health behaviours.

<sup>\*</sup>OHRQoL- Oral health quality of life, LTC- Long term care, OHIP-Oral health impact factor, OHSU- Oral health care service utilization. KNHANES- Korea National Health and Nutrition Examination Survey, SPOH- Self perceived oral health

Harada *et al.*) were conducted in Japan,<sup>[30,31]</sup> one study (Srisilapanan *et al.*) was conducted in Thailand,<sup>[12]</sup> one study (Monaghan *et al.*) was conducted in Wales,<sup>[32]</sup> one study (Olofsson *et al.*) was conducted in Sweden,<sup>[13]</sup> one study (Granillo *et al.*) was conducted in Mexico,<sup>[33]</sup> one study (Kotzer *et al.*) conducted in Canada<sup>[34]</sup> and one study (Kim *et al.*) was conducted in Korea.<sup>[35]</sup> All the studies tried understanding the multifactorial causation of oral health inequalities among the older adults. The review concluded that there was an association between multiple components of oral health and the related variables. These variables had a direct impact on oral health disparities among the older aged population. It also confirmed that this population was predominantly vulnerable and dependent, characterized by poor oral health. Individual or environmental factors were found as unalterable and adjustable variables linked with susceptible oral health within this deprived group. Limited self-care ability was caused by physical or cognitive impairment and was a primary contributing factor to poor dental health.

### Quality assessment of included studies

#### 1. For cross-sectional studies

None of the studies attained the highest score on the Newcastle Ottawa Scale. The studies those having an estimated low probability of bias were (Kotzer *et al.*, 2012, Montini *et al.* 2014, and Granillo *et al.* 2020)<sup>[23,33,34]</sup> on the basis of the selection criteria of Newcastle Ottawa Scale as the studies were truly representative, with structured interview or secure record and the outcome of interest was not present at the start of the study; only three studies have a high risk of bias for comparability (Machado *et al.* 2012, Galvao *et al.* 2022, and Junior *et al.* 2022)<sup>[14,21,22]</sup> as they were mostly questionnaire study with secondary data analysis and had predetermined outcome of interests in their studies. In terms of outcomes, all the studies showed a low risk of bias as per Newcastle Ottawa Scale [Supplementary file].

Majority of the studies were of high quality. Table 3 presents the risk of bias among included studies using the Newcastle Ottawa Scale.

#### 2. For case-control studies

Only one study (Srisilapanan *et al.*, 2014)<sup>[12]</sup> attained the highest possible score in the selection criterion, indicating a high level of quality and a minimal risk of bias, and in the exposure result, as the population was truly representative of the cohort and the

exposure was assessed using a structured interview. All the other studies had a partial score with the lowest quality and a measured high risk of bias on the basis of selection criterion, as depicted in Table 4 below.

#### 3. For randomized controlled trial

The RCT study was essentially comparable in methodological quality with respect to all the domains. It was evidently impossible to blind the dental therapists and patients to the procedure. The study did not identify whether staff members who worked with patients were blinded to the order of randomization. The analysis found a high risk of bias for blinding of participants (performance bias) (in randomized controlled trials, but a low risk of bias in all other categories, as depicted in Figures 2 and 3.

## Discussion

The study aims to examine the correlation between various elements of oral health, factors associated with oral health concerns, and the overall health-related quality of life (OHRQoL) among hospitalized individuals. These findings demonstrate the direct association between socioeconomic status and oral health and oral health-related behaviors. The findings confirm that this group consists of a weak population with poor dental health due to social interdependence. There is existing literature showing direct association of income inequality with oral health. The studies emphasized on public transportation as an essential factor for reducing income inequalities and improving dental care access.<sup>[13,30,31]</sup> Poor oral health in this vulnerable population has been linked to both changeable and invariant individual and environmental factors. Individual characteristics are frequently the result of physical and/or mental illness, leading to inadequate self-care abilities. However, this review did not extract or report much of the information.

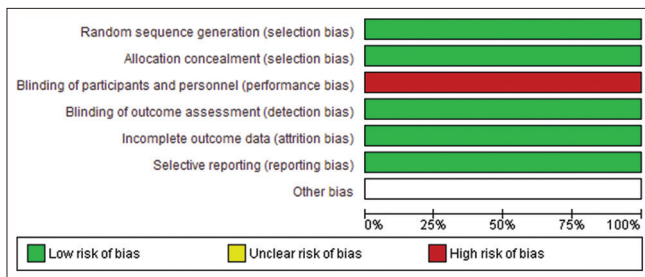
Oral health problems have increased in hospitalized people, according to evidence-based findings from research undertaken over the years, including dental, oral illnesses, oral mucosa, missing teeth, and temporomandibular joint disorders, as well as problems caused by poor oral functioning. Oral problems can lead to poor oral health, functional impairment, and ultimately poor OHRQoL.<sup>[18,19,24]</sup> Malnutrition risk and oral stress and dysfunction can both be detrimental to general health.<sup>[12,23]</sup> According to this review, elderly people's poor oral hygiene may

**Table 3: ROB (Risk of Bias) among included studies using the (NOS) Newcastle Ottawa Scale**

Author, year	Selection (Max=4)	Comparability (Max=2)	Outcome (Max=3)	Overall quality score (Max=9)
Kotzer <i>et al.</i> , 2012 <sup>[34]</sup>	****	**	**	8
Machado <i>et al.</i> , 2012 <sup>[14]</sup>	***	*	***	7
Silva <i>et al.</i> , 2013 <sup>[15]</sup>	**	**	***	7
Bilder <i>et al.</i> , 2014 <sup>[28]</sup>	**	**	**	6
Mariño <i>et al.</i> , 2014 <sup>[26]</sup>	***	**	**	7
Montini <i>et al.</i> , 2014 <sup>[23]</sup>	****	**	**	8
Quinteros <i>et al.</i> , 2014 <sup>[27]</sup>	**	**	**	6
Souza <i>et al.</i> 2016 <sup>[16]</sup>	**	**	***	7
Andrade <i>et al.</i> 2017 <sup>[17]</sup>	**	**	**	6
Monaghan <i>et al.</i> 2017 <sup>[32]</sup>	***	**	**	7
Andrade <i>et al.</i> 2018 <sup>[18]</sup>	**	**	***	7
Andrade <i>et al.</i> 2019 <sup>[19]</sup>	**	**	**	6
Stephens <i>et al.</i> 2019 <sup>[24]</sup>	***	**	**	7
Granillo <i>et al.</i> 2020 <sup>[33]</sup>	****	**	**	8
Kim <i>et al.</i> , 2020 <sup>[35]</sup>	**	**	***	7
Kiuchi <i>et al.</i> , 2020 <sup>[30]</sup>	**	**	**	6
Fagundes <i>et al.</i> , 2021 <sup>[20]</sup>	***	**	**	7
Warman <i>et al.</i> , 2021 <sup>[29]</sup>	**	**	**	6
Galvao <i>et al.</i> , 2022 <sup>[21]</sup>	***	*	**	6
Harada <i>et al.</i> , 2022 <sup>[31]</sup>	**	**	**	6
Junior <i>et al.</i> , 2022 <sup>[22]</sup>	**	*	**	5

**Table 4: ROB (risk of bias) for case-control studies**

Author, year	Selection (Max=4)	Comparability (Max=2)	Exposure (Max=3)	Overall quality score (Max=9)
Gaio <i>et al.</i> , 2012 <sup>[11]</sup>	**	**	**	6
Srisilapanan <i>et al.</i> , 2014 <sup>[12]</sup>	***	*	**	6
Olofsson <i>et al.</i> , 2017 <sup>[13]</sup>	**	**	**	6

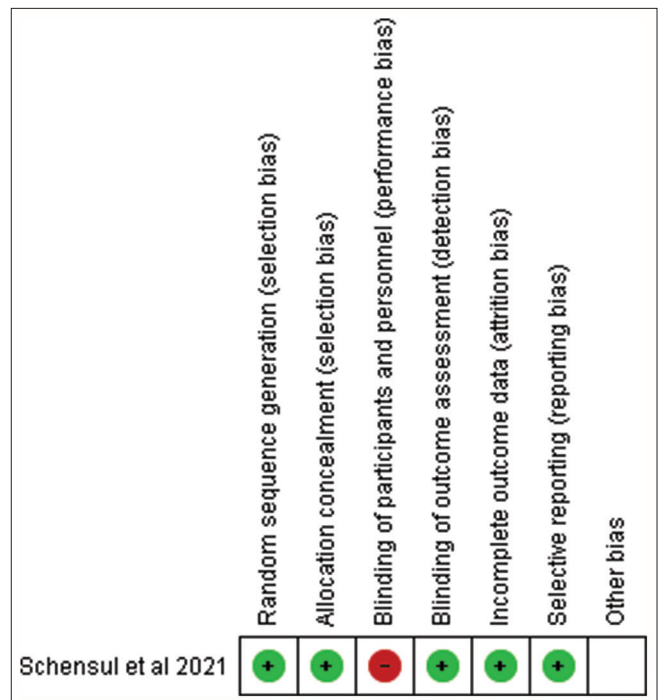


**Figure 2: Risk of bias for Randomized controlled trial study**

be caused by improper brushing or flossing, which increases their risk of dental treatment, disease, and other disorders.<sup>[24,33]</sup>

There was no reported or observed correlation between diseases/conditions and oral health due to differences in data collection, presentation, and analytical methodologies.<sup>[35]</sup> In addition to having an effect on psychological and physical well-being, poor oral health can result in malnutrition, a serious physical issue that is common in those with lower OHRQoL and poorer dental health.<sup>[30,33]</sup>

Additional research in this area is warranted to improve the oral health of geriatric care patients. According to recent research, the senior population with cognitive impairments often has poor oral hygiene and health because of a lack of awareness of the need



**Figure 3: Risk of bias for Randomized controlled trial study**

of oral healthcare, as well as inadequate knowledge and abilities, negative attitudes, and inappropriate care-giving behaviors.<sup>[29,21]</sup>

Hence, it is crucial to aware them regarding adequate oral health knowledge, skills, and practice. Primary care has an essential role in assisting older adults in attaining an adequate level of oral health and increasing their understanding of oral healthcare.

This systematic review is strengthened by its adherence to PRISMA criteria, extensive and unrestricted literature search, use of reliable methodology for the qualitative data synthesis, and quality assessment of evidence using the Newcastle Ottawa Scale for included studies.<sup>[10]</sup> All the included studies' quality assessments indicated low-to-moderate bias risk, but overall quality was rated as average, citing a lack of potential risk of bias with little variation and inadequate reporting.

## Conclusion

The impact of dental care is demonstrated in this study by regulating or improving interventions to promote oral health. The review's conclusions help legislators and medical professionals become more knowledgeable about oral health. The lack of consistency in research design, data collection, and analysis methods is another point the paper highlights. Most importantly, it highlights the scarcity of long-term studies and randomized controlled trials. On the other side, this method helps identify and confirm high risk in the geriatric hospital and serves as the foundation for developing initiatives that eventually aim to improve the associated impact to enhance the OHRQoL and oral healthcare of high-risk, low-income individuals. Numerous barriers can be encountered in this population including cost of treatment and lack of awareness among this population. Integration of oral health into geriatric healthcare is challenging due to lack of policies and guidelines. Recent studies show by improving oral health outcomes and reducing healthcare costs through preventive routine check-ups. In nations where older adults lack access to routine dental care, managing unmet dental needs in emergency and critical medical conditions has been found to be significant driver of expense. Effective oral health care programs and interventions are warranted in geriatric medical care to improve their oral health status and address their oral health needs. There is an urgent need to minimize global oral health disparities by dramatic reforms in health policy and the existing healthcare system.

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## Conflicts of interest

There are no conflicts of interest.

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## Supplementary file

# Newcastle-Ottawa Quality Assessment Form for Cohort Studies

Note: A study can be given a maximum of one star for each numbered item within the Selection and Outcome categories. A maximum of two stars can be given for Comparability.

### Selection

- 1) Representativeness of the exposed cohort
  - a) Truly representative (*one star*)
  - b) Somewhat representative (*one star*)
  - c) Selected group
  - d) No description of the derivation of the cohort
- 2) Selection of the non-exposed cohort
  - a) Drawn from the same community as the exposed cohort (*one star*)
  - b) Drawn from a different source
  - c) No description of the derivation of the non exposed cohort
- 3) Ascertainment of exposure
  - a) Secure record (e.g., surgical record) (*one star*)
  - b) Structured interview (*one star*)
  - c) Written self report
  - d) No description
  - e) Other
- 4) Demonstration that outcome of interest was not present at start of study
  - a) Yes (*one star*)
  - b) No

### Comparability

- 1) Comparability of cohorts on the basis of the design or analysis controlled for confounders
  - a) The study controls for age, sex and marital status (*one star*)
  - b) Study controls for other factors (list) \_\_\_\_\_ (*one star*)
  - c) Cohorts are not comparable on the basis of the design or analysis controlled for confounders

### Outcome

- 1) Assessment of outcome
  - a) Independent blind assessment (*one star*)
  - b) Record linkage (*one star*)
  - c) Self report
  - d) No description
  - e) Other
- 2) Was follow-up long enough for outcomes to occur
  - a) Yes (*one star*)
  - b) No

Indicate the median duration of follow-up and a brief rationale for the assessment above: \_\_\_\_\_

- 3) Adequacy of follow-up of cohorts
  - a) Complete follow up- all subject accounted for (*one star*)
  - b) Subjects lost to follow up unlikely to introduce bias- number lost less than or equal to 20% or description of those lost suggested no different from those followed. (*one star*)
  - c) Follow up rate less than 80% and no description of those lost
  - d) No statement

Thresholds for converting the Newcastle-Ottawa scales to AHRQ standards (good, fair, and poor):

**Good quality:** 3 or 4 stars in selection domain AND 1 or 2 stars in comparability domain AND 2 or 3 stars in outcome/exposure domain

**Fair quality:** 2 stars in selection domain AND 1 or 2 stars in comparability domain AND 2 or 3 stars in outcome/exposure domain

**Poor quality:** 0 or 1 star in selection domain OR 0 stars in comparability domain OR 0 or 1 stars in outcome/exposure domain