

Prevalence of Periodontal Disease Among Indigenous and Non-indigenous Populations: Protocol for Systematic Review and Meta-analysis

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Protocol

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Abstract

Background: Indigenous populations globally experience worse health than their non-Indigenous counterparts. This includes oral health inequities, especially periodontal disease. Globally, the occurrence of periodontal disease such as gingivitis and chronic periodontitis are high among Indigenous people. This population encounters various barriers to accessing dental care as well as social and economic disadvantages, which results in higher disease burden compared to the general population. The aim of this systematic review is to quantify at a global level, the prevalence of periodontal disease among Indigenous populations compared to non-Indigenous populations.

Methods: An electronic search will be conducted using keywords and appropriate MeSH terms across several databases capturing both published and unpublished articles. The search will be conducted from the time of database inception to February 2021. After the initial search, duplicates will be removed, and remaining titles and abstracts will be assessed for eligibility. This review will consider studies that have reported prevalence of periodontal disease among Indigenous and compared against non-Indigenous populations. Studies that have no comparative population or lack of periodontal clinical assessment will be excluded. The full text of eligible studies will be assessed by two independent reviewers who will also complete the critical appraisals and data extraction. From the selected studies, we will conduct a random effects meta-analysis of observational data. Forest plots will be used for visualization of pooled prevalence of periodontitis. A subgroup analysis will be conducted based on definition of periodontitis, age, and geographical location. Heterogeneity among studies will be assessed by I^2 and chi-square test. Egger's test and funnel plots will be used to assess publication bias.

Discussion: Our systematic review and meta-analysis will facilitate increased understanding of the magnitude of periodontal disease inequalities that exist globally for Indigenous populations through pooled prevalence estimates. The findings will be helpful to design selective targeted preventive and interventional strategies for periodontal disease for reducing oral health inequalities at a global level.

Systematic review registration: PROSPERO CRD42020188531

Background

Across global geographic and cultural differences, Indigenous peoples experience similar difficulties in defending their sovereignty and are among the most disadvantaged populations [1, 2]. According to a United Nations (UN) report in 2009 there are 370 million Indigenous peoples in 90 countries around the world [3, 4]. The International Labour Organisation (1989) defines Indigenous people as “*tribal peoples in independent countries whose social, cultural, and economic conditions distinguish them from other sections of the national community and whose status is regulated wholly or partly by their own customs or traditions or by special laws or regulations; and peoples in independent countries who are regarded as Indigenous because of their descent from the populations who inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonisation or the establishment of*

present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural, and political institutions [5].” Despite variance in magnitude of health disparities, globally Indigenous peoples experience a higher burden of disease than their non-Indigenous counterparts [6]. Disadvantage, as a consequence of collective histories of oppression and marginalisation, has resulted in lower life expectancies for Indigenous peoples due to increased rates of infections and chronic diseases [7]. Continuing impacts of colonialism, community displacement and land appropriation combined with socioeconomic differences create complex barriers to accessing healthcare for Indigenous peoples [5].

Oral health is not exempt from health disparity trends between Indigenous and non-Indigenous populations [8]. Oral health is multidimensional, including emotional, physical, psychological and social realms that are vital to general well-being [9, 10]. Oral diseases have serious health and economic ramifications and are among the most widespread diseases globally [8]. Poor oral health does not only impact the oral cavity but can result in debilitating pain, limited social interactions, difficulties eating and speaking, embarrassment and reduced quality of life [11]. According to Global Burden of Disease estimates, severe periodontitis is the 11th most prevalent disease in the world [12]. The global prevalence rate for severe periodontal disease is gradually increasing despite efforts to prevent and control progression of the disease [13]. Several authors have reported that the pervasiveness of periodontal disease increases with age and that it is more common in high income countries [14]. Gingivitis and periodontitis are the most common oral infections with an overall global prevalence ranging from 20%-50% [13]. The initial form of periodontal disease, gingivitis, presents as gingival bleeding, clinical inflammation, redness of the gingiva and pain. If this condition is left untreated it progresses to clinical loss of connective tissue attachment, alveolar bone loss and subsequently loss of tooth structure [15]. Periodontal disease results from interactions between bacteria and a variety of host risk factors, such as poorly managed diabetes, long-term tobacco smoking, stress and genetic predisposition [16].

A search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews and the *JBI Database of Systematic Reviews and Implementation Reports* revealed no current or proposed systematic reviews regarding prevalence of periodontal disease among Indigenous populations compared with non-Indigenous populations. To our knowledge, this will be the first evidence to highlight the disparities in the occurrence of periodontal disease among Indigenous populations and the first to report a comparative synthesis of results. A preliminary search of MEDLINE, Scopus and EBSCOhost identified published data that fits within the inclusion criteria for this review. This review aims to document the burden of periodontal disease that persists in Indigenous communities worldwide and to facilitate researchers, clinicians, policy makers and Indigenous communities in decision making approaches to improve oral health.

Methods

The proposed systematic review will be conducted in accordance with the Joanna Briggs Institute methodology for systematic reviews of prevalence [17]. The systematic review protocol has been

registered in the International Prospective Register of Systematic Review (PROSPERO), registration number CRD42020188531. For reporting of this systematic review, the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) Protocols guidelines (Additional file 1) will be followed [18].

Review question

Is there any and what is the magnitude of the disparity in prevalence of periodontal disease among Indigenous populations compared to non-Indigenous/general populations globally in observational studies?

Inclusion criteria

Participants

The review will include studies that have reported the prevalence of periodontal disease among Indigenous populations compared with non-Indigenous populations. This study will include Indigenous peoples from Australia (Aboriginal or Torres Strait Islanders), Canada (Inuit, Metes, First Nations), New Zealand (Maori), USA (American Indian and Alaskan Natives), Brazil (Amerindians, Xingu, Xavante Indians) and other countries, including but not limited to: China, South Asia, Southeast Asia, South America, Africa, Central America, Arabia, former Soviet Union, Scandinavia and the Pacific Islands [19]. Participants of all age groups, including children and adults, will be eligible for inclusion. The inclusion of studies will not be restricted by participant sex or geographical location.

Indigenous status of participants will be defined by guidelines that are outlined in Article 33 of the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) [20]. As such, Indigeneity identified through self-identification, parent reporting for children, and utilisation of country-specific identity registration systems will be eligible for inclusion.

Condition

This review will include all papers that have assessed prevalence of periodontal disease, regardless of the definition of periodontal disease used. The definition of periodontal disease can be based on periodontal probing depth (PPD), clinical attachment level (CAL) or both. Indices that assess periodontal disease would also be included such as community periodontal index (CPI) or periodontal index (PI). Measures of risk indicators for periodontal disease will be considered as secondary outcomes, such as prevalence of bleeding on probing (BOP) from gingiva, prevalence of calculus and prevalence of plaque.

Outcomes:

The primary outcomes of this review will be:

1. The mean pooled prevalence (%) of periodontitis among Indigenous people compared to non-Indigenous people according to different definitions of periodontitis.
2. The mean number of sites (%) associated with periodontitis.

The secondary outcomes of this review will be:

1. The mean pooled prevalence (%) of plaque index at a factor greater than 2.
2. The mean pooled prevalence (%) of gingival index at a factor greater than 2.
3. The mean pooled prevalence (%) of calculus present.
4. The mean pooled prevalence (%) of BOP.

Context

Our review will consider studies that report the prevalence of periodontal disease in Indigenous populations from all countries without any geographic restriction. Participants can be recruited from a variety of sites, such as community settings, hospital settings or school settings.

Types of studies

All articles from selected databases published from database inception until February 2021 will be included. This review will consider descriptive observational studies including descriptive cross-sectional studies that have comparative measures of periodontal disease between Indigenous versus non-Indigenous populations. Analytical observational studies will also be included. Data from national surveys, government reports, censuses and government registries will additionally be considered. Baseline data from clinical trials which report on prevalence of periodontal disease relevant to our inclusion criteria will be included. If a similar data set is used in more than one study for the same geographical area and periodontal outcome than the primary dataset will be used.

The inclusion criteria for this review will be as follows: (1) an original study with quantitative data; (2) comparison of prevalence between an Indigenous population and a non-Indigenous population; (3) periodontal disease assessed through clinical assessment, without any restriction to definition. Language of the article, age, sex and location of the participant will not be exclusion criteria for this systematic review. For articles in languages other than English, all authors of this review will be contacted for direct translation where possible otherwise online translating tools will be used, such as Google translate or Finereader.

The exclusion criteria for this review will be as follows: (1) analytical or descriptive observational studies without a comparison group; (2) studies that do not measure periodontal disease through clinical assessment or have not reported the periodontal data separately for Indigenous and non-Indigenous populations; (3) studies that assess periodontal parameters through self-oral assessment; (4) studies with no extractable data; (5) case reports, literature reviews, including systematic reviews and scoping reviews, letters, commentaries, opinion pieces and editorials.

Search strategy

For our review, we will employ a three-stage search strategy. Firstly, a limited search of MEDLINE will be conducted to identify articles on this topic. The reviewers will analyse the text words contained in the title and abstract of the relevant articles and the index terms to describe the articles in order to develop an appropriate search string. The second step will involve using keywords and MeSH terms (Medical Subject Headings) to capture all relevant articles across MEDLINE, Scopus, and EBSCOhost (dentistry and Oral Sciences), University of New Mexico Native Health Database, Bibliography of Native North Americans and the Australian Indigenous HealthInfoNet. All electronic databases will be searched from review inception to February 2021. Finally, a reference list will be made of all selected articles and free hand bibliography searching of relevant articles will be done to identify additional studies that might have been overlooked during the electronic search. Narrative reviews and standard textbook related to the topic will be searched to identify relevant articles. The search strategy for MEDLINE has been described in appendix 1.

For unpublished data, a similar search will be conducted in Open Grey and ProQuest Dissertation. The authors will conduct an online search using a combination of keywords such as Indigenous or Aboriginal and periodontitis or periodontal disease or gingivitis or gingival disease to find relevant data from national oral health surveys, government reports, national censuses, and government registries. Websites and resources that have comparison data for periodontal disease among Indigenous and non-Indigenous population will be considered for inclusion. All websites from the search result would be screened by two reviewers for eligibility for inclusion and a table will be made in a spreadsheet recording the title, URL and date accessed (appendix 2). We will also contact experts in the field for additional unpublished data and advice on published work (for e.g., E Kruger, (Australia), R Arantes (Brazil), T Batliner (USA), J Broughton (New Zealand) and H Lawrence (Canada).

Reviewer Calibration

Calibration will be done prior to title and abstract screening and the study selection process. Both reviewers (SN & BR) will be calibrated for the screening process on a random sample of 5% of the total number of citations. Both reviewers will screen the selected articles independently and in duplicates. In case of any discrepancy, the outcome will be discussed among the reviewers until a consensus is reached and in case a consensus is not reached a third reviewer (LMJ) will be consulted. A kappa score will be calculated as a screening reliability score among the reviewers.

Study selection

Findings from the search strategy will be catalogued using EndNote X9 Version 3.3 (Clarivate Analytics, Philadelphia, PA, USA) and duplicate citations will be removed. The study selection process will be carried out in two steps: (1) title and abstract screening, (2) full text screening.

The abstract and titles will be screened against the inclusion and exclusion criteria. For inclusion, studies must include comparison of prevalence of any periodontal parameter between Indigenous and non-Indigenous populations. The next step will be to retrieve the full text of all potentially relevant articles and import them into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI)a. The two independent reviewers (SN & BR) will assess the full text in detail for eligibility. Any reason for exclusion will be recorded in JBI SUMARI. The results of the search will be represented in a flow diagram according to the PRISMA guidelines [21].

Assessment of methodological quality

Eligible studies will be critically appraised by two independent reviewers (SN & BR) at the study selection stage using the standardized critical appraisal instrument in JBI SUMARI for prevalence studies [17, 22]. Any appraisal disagreements will be resolved through mutual discussion or the use of a third reviewer (LMJ) where necessary. The JBI SUMARI instrument [17] consists of a standardised checklist to ensure consideration of factors such as: (1) sampling frame, technique and size, (2) subject and setting detail, (3) data analysis, (4) methods for identification of the condition, (5) reliability of methods used for measuring the condition, and (6) adequacy of response rate. If any publications have missing information, the authors will be contacted via email. The results of the critical appraisals will be reported in narrative and table form. All studies, regardless of the results of their methodological quality, will undergo data extraction and synthesis (where possible).

Data Extraction

The investigators (SN & BR) will perform data extraction from included articles using a customised data extraction form generated in an excel spreadsheet. The extraction tool will be pilot tested on a random sample (5%) of included studies and revised until a consensus is reached on the key variables and outcomes. Any disagreements that arise between the reviewers will be resolved through discussion, or by discussing with a third reviewer (LMJ). Authors of included papers will be contacted via email to request missing or additional data where required. The following fields will be included (appendix 3):

1. Study characteristics: Study unique reference number, last name of the first author, year and place of publication, study setting, sampling design, sampling frame, sample size calculations.
2. Participant characteristics: Total number of cases, total number of controls, definition of cases and controls, mean age, method of data collection, parameters of periodontal disease and periodontitis

definition used.

3. Outcome measures: The mean (%) pooled prevalence of periodontitis and mean (%) number of sites involved with periodontitis, mean (%) pooled prevalence of bleeding sites, mean (%) pooled prevalence of calculus, mean (%) pooled prevalence of plaque and mean (%) pooled prevalence of gingival inflammation.
4. Overall: The overall outcome of the study highlighting the main results.

Data Synthesis

Where appropriate, extracted data will be collated for meta-analysis using the JBI SUMARI software [22]. Where statistical pooling is not possible, findings will be presented in narrative form using tables to aid in data presentation. For this systematic review, Indigenous populations will be considered as the experimental group and non-Indigenous populations as the control group. Random effects models will be used for analysis and the effect size will be estimated and reported as the standardized mean difference for continuous variables with a 95% confidence interval. For individual studies, the weight will be calculated on the inverse of variance. To assess heterogeneity standard chi-squared, Tau squared and I^2 tests will be used. The I^2 index will be interpreted as low, moderate or high inconsistency, if the values are equal to 25%, 50% and 75% respectively [23]. A subgroup analysis will be done based on the use of different periodontal disease definitions, age and geographical location. Sensitivity analyses will be conducted to test decisions made during the process of conducting the review. Publication bias will be assessed using Egger's test and visualising the funnel plot asymmetry [24].

Discussion

This protocol describes a planned systematic review and meta-analysis to estimate the pooled prevalence of periodontitis among Indigenous and non-Indigenous populations. Previous systematic reviews [25-27] have shown the prevalence of periodontal disease only among Indigenous populations without any comparison to general populations, and has been restricted to specific countries without any global comparison. A comparative analysis is crucial in understanding the magnitude of the diseased condition affecting Indigenous peoples. The prevalence of periodontal disease affecting Indigenous adults is documented as being substantially higher among Indigenous than non-Indigenous groups [25, 28-30], reaching as high as 97.8% [30].

Exploration of the burden of periodontal disease experienced by Indigenous peoples is important due to the continuous nature of the disease and the possible result of bone loss. Identifying variances in experience of periodontal disease is critical due to the common experience of inflammatory response similar to other systemic conditions [31, 32]. There are established links between periodontal disease and heart and lung disease, diabetes, strokes and low birth weights among mothers with oral disease [33-36]. Individuals with destructive periodontal disease were associated with hypertension and diabetes among Indigenous Brazilians [30, 37]. Periodontal disease is irreversible and successful treatment only restores

periodontal health with reduced and compromised periodontium. The anatomical damage from previous periodontal disease continues to persist, and the inverse architecture of the soft tissues may impair further plaque control. This makes maintenance of periodontally compromised teeth very difficult and eventually leads to loss of tooth structure [38]. If Indigenous populations have higher burden of periodontal disease, such early tooth loss would impact overall quality of life and general health and thus increase economic burden of the country [39]. Findings of this systematic review will be relevant to policy makers and public health officials who inform oral health practices and interventions for Indigenous communities.

Abbreviations

BOP: Bleeding on probing

CAL: Clinical attachment level

CPI: community periodontal index

JBI SUMARI: Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information

PI: Periodontal index

PPD: Periodontal probing depth

PRISMA: Preferred Reporting of Items for Systematic Review

UN: United Nations

UNDRIP: UN Declaration on the Rights of Indigenous Peoples

Declarations

- Ethics approval and consent to participate: Ethics is waived for a systematic review for publication
- Consent for publication: Not applicable
- Availability of data and materials: The dataset that would be generated and analysed for the current systematic review will be available from the corresponding author on reasonable request.
- Competing interests: The author's declare that they have no competing interest.
- Funding: There are no funding contributions to declare for this study.
- Authors' contributions: SN & LMJ conceived the idea of the project; SN, BP, designed the protocol; XJ & SN developed the search strategy for the protocol; SN would overview subgroup and sensitivity analysis; KK, DH, oversaw all the stages of the manuscript. All the authors read and approved the final manuscript.

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