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Effect of social isolation on oral health status - A systematic review

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Aim: To determine the magnitude of the association between social isolation and oral health in adults. ***Materials and Methods***: Systematic review based on PRISMA guidelines. Observational studies and clinical trials were obtained by searching the electronic databases of PubMed/MEDLINE, Web of Science, Scopus, Cochrane Library electronic, SciELO, Science Direct and Embase. Hand searches and gray literature were included. Two researchers independently selected the studies, extracted data, and analyzed and assessed their methodological quality. The Rayyan QCRI web-based tool was used to manage and cite references, and the risk of bias was estimated according to the Cochrane Handbook for Systematic Reviews of Interventions. Meta-analysis was not performed due to insufficient data. ***Results***: The search retrieved 2545 articles. Full texts of 14 articles were read, and 1 clinical trial and 3 cross-sectional studies were included. All the studies reported on oral function, but none assessed plaque or caries parameters. The cross-sectional studies presented high risk of bias. None of the studies associated social isolation with oral health. ***Conclusions***: There is no strong evidence for an association between social isolation and oral health in adults. Regular oral hygiene practice should be encouraged, recommended and maintained at this time of social isolation, to maintain oral health.

Keywords*: oral health, coronavirus, COVID-19, Social isolation*

Introduction

Social isolation is a multidimensional concept, defined as the total or partial abstention from social contact and interaction with family members, friends and the broader community. It is experienced most by elderly people, largely attributable to family dispersal, reduced mobility and income, loss of loved ones, and poor health. (Fakoya *et al.*, 2020). Quarantine is another type of social (or physical) isolation, used for centuries to contain the spread of infection, and isolate those who have (or may have) been infected by a contagious disease, in order to control or limit contamination.

Social relationships are widely recognized as important social determinants of health and social isolation, and are associated with health-risk behaviors, such as unhealthy diet, smoking, high alcohol intake, physical inactivity, and multiple health-risk behaviors (Algren *et al*., 2020; Arcury *et al.*, 2009). Psychosocial behaviors have proven influence on oral health (Thiruvenkadam *et al.*, 2016). Just as oral disease and tooth loss have a significant negative impact on the quality of life and well-being of adults, and pose functional, psychological, and social consequences, good oral health is important for social interaction and well-being. Loneliness and insufficient income can lead to the likelihood of not visiting a dentist, and have a negative impact on oral health (Rouxel *et al.*, 2016). Thus, social isolation may influence maintenance of oral health (Weyant, 2004).

In 2019, an acute respiratory disease (COVID-19) emerged, caused by a novel lethal strain of coronavirus (SARS-coV-2). It triggered a global pandemic, causing many people to remain in social isolation (Dos Santos *et al.*, 2021). COVID-19 led to the global imposition of modern quarantine strategies, such as midterm lockdowns, voluntary housebound seclusion, restrictions on the assembly of groups of people, cancellation of planned social and public events, closure of mass transit systems, and other travel restrictions. Imposed quarantine or isolation is an unfamiliar and unpleasant experience that involves separation from friends and family, and a departure from the usual, everyday routines. Many common activities are banned. In some settings, like prisons and correctional institutions, isolation becomes a form of punishment or censure, and is known to cause psychosocial problems (Usher *et al.*, 2020; Lippi *et al.*, 2020).

The current moment of social isolation and the need for concise and structured scientific studies to manage the several different situations encountered today led the authors to construct the present study, which aimed to determine the magnitude of the association between social isolation and oral health in adults.

Material and methods

The present systematic review was performed based on the PRISMA statement guidelines (Page *et al.*, 2021). This systematic review was registered on PROSPERO - CRD42020178325.

The review focused on whether there is an association between social isolation and oral health in adults? Included studies were obtained by searching the electronic databases of PubMed/MEDLINE, Web of Science, Scopus, Cochrane Library electronic, SciELO, Science Direct and Embase databases. The keywords were searched in Medical Subject Headings (MeSH), and in the related published manuscripts. The following terms were used: ("loneliness" OR "housebound" OR "social isolation"

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OR "quarantine" OR "going out" OR "confinement" OR "stay home" OR "seclusion") AND ("oral health" OR "oral function" OR "plaque index" OR "oral hygiene" OR "caries" OR "gingivitis" OR "periodontitis" OR "periodontal disease" OR "oral pathology").

A general search strategy was adapted to fit the characteristics of each database in order to identify studies of interest. The databases were searched for articles and abstracts with no language restriction. A manual search of related journals was also conducted. The Cochrane Worldwide Handsearching Programme (http://us.cochrane.org/master-list) was checked to identify the relevant journals to be hand-searched. The references contained in all studies included were checked for additional papers.

Observational studies that met the inclusion criteria dated from the inception of the respective databases up to April 2020 were selected. Inclusion was based on an analysis of the title and abstract of the studies with regard to the following eligibility criteria.

Type of study: Observational studies or clinical trials of any design, reporting homebound status and oral health evaluations.

Participants: Housebound people aged 18 years or older.

Key independent variable: Social isolation: loneliness, housebound condition, quarantine, confinement or seclusion.

Exclusion criteria: Studies not clearly meeting the inclusion criteria, and not reporting oral health assessments, as well as those involving institutionalized patients (hospital, asylum, prisoner), people with special needs, patients in or requiring homecare, and community dwellers.

Outcomes: The primary outcome was oral health. Secondary outcomes were associations between the forms of isolation, and the issue of whether isolation impacts oral health.

Review method and data extraction

The study selection process was performed by two reviewers (FSL and DWDO) in two phases. First, the two reviewers identified all the relevant studies independently, using electronic and other search methods, by applying the inclusion criteria to the titles and abstracts. The full text was selected where studies appeared to meet the inclusion criteria, and showed insufficient data in the title and abstract to make a clear decision. In the second phase, selected studies were analyzed to determine whether the study met the inclusion criteria. Authors of source studies were contacted by email when needed to clarify issues related to the research. The studies excluded in this or subsequent stages were recorded along with the reasons for rejection. Observational studies meeting the inclusion criteria were included in the final analysis and submitted to data synthesis. Articles identified two or more times were considered only once.

The studies were analyzed independently and discussed by both researchers. Disagreements were resolved by consensus. This procedure was applied to all the steps. The reviewers were trained for each database before the study. The Rayyan QCRI web-based tool (https://rayyan.qcri.org/welcome) was used to manage the references throughout (Ouzzani *et al.*, 2016).

The data were recorded qualitatively to allow comparisons between selected studies. Each researcher assessed the studies using a bespoke form. The following data were collected: author; year of publication; country; study design; participants' characteristics; type of social isolation; edentulous condition; oral function; plaque index; oral hygiene; caries; periodontal index; oral pathology; conclusion.

Risk of bias assessment and meta-analysis

Risk of bias was estimated for selected clinical trials using the Cochrane Handbook for Systematic Reviews of Interventions (Higgins and Green, 2011). The Review Manager software program was used to scrutinize the following items: random generation, allocation concealment, blinding (participants and assessors), incomplete outcome data and other bias. Risk of bias was classified as: 1) low (when all criteria were met); 2) moderate (when ≥1 criterion was partially met); and 3) high (when≥1criterion was not met).

For observational studies risk of bias was estimated using the modified Newcastle-Ottawa scale (NOS) for cross-sectional studies (Herzog *et al.*, 2013). The following items were judged: selection, comparability, exposure and outcome. The NOS had a maximum possible score of 8 stars/points for each study.

Statistical analyses were performed using the R Studio Program, Version 3.2.5 for Windows (The R Foundation ©) "meta" and "metaphor" packages. Heterogeneity among included studies results was tested using I^2 statistics. $I^2 > 0$ and the random effect model were considered for all the analysis.

Results

The search identified 2545 articles. After removing the duplications (n=484), the electronic and hand search yielded 2061 potentially relevant sources. In the first stage, 2047 publications were excluded on examination of the title and abstract. The full texts of the remaining 14 articles were read. Two articles were excluded in this second stage, because they did not focus on evaluating oral health (Rouxel *et al.*, 2016; Landes and Holmes, 2012). Four articles were not observational studies (Weyant, 2004; Simons, 2003; Jain *et al.*, 2007; Critchlow, 2017), three articles reported a community dwelling-related study (Arcury *et al.*, 2009; Arcury *et al.*, 2012; Arcury *et al.*, 2013) and one did not report on social isolation (Merchant *et al.*, 2003). Thus, four studies met the selection criteria, and qualified for the qualitative analysis (Bates and Harrison, 1975; Tobias, 1988; Baker *et al.*, 2008; Mikami *et al.*, 2019) (Figure 1).

Three included studies were conducted in the United Kingdom (Bates and Harrison, 1975; Tobias, 1988; Baker *et al.*, 2008) (Table 1). Three were cross-sectional (Bates and Harrison, 1975; Tobias, 1988; Mikami *et al.*, 2019), and one was a clinical trial (Baker *et al.*, 2008). All four reported on oral function parameters (Bates and Harrison, 1975; Tobias, 1988; Baker *et al.*, 2008; Mikami *et al.*, 2019) but none assessed plaque or caries. Dry mouth was reported in two studies (Baker *et al.*, 2008; Mikami *et al.*, 2019). No included studies reported an association between social isolation and oral health parameters.

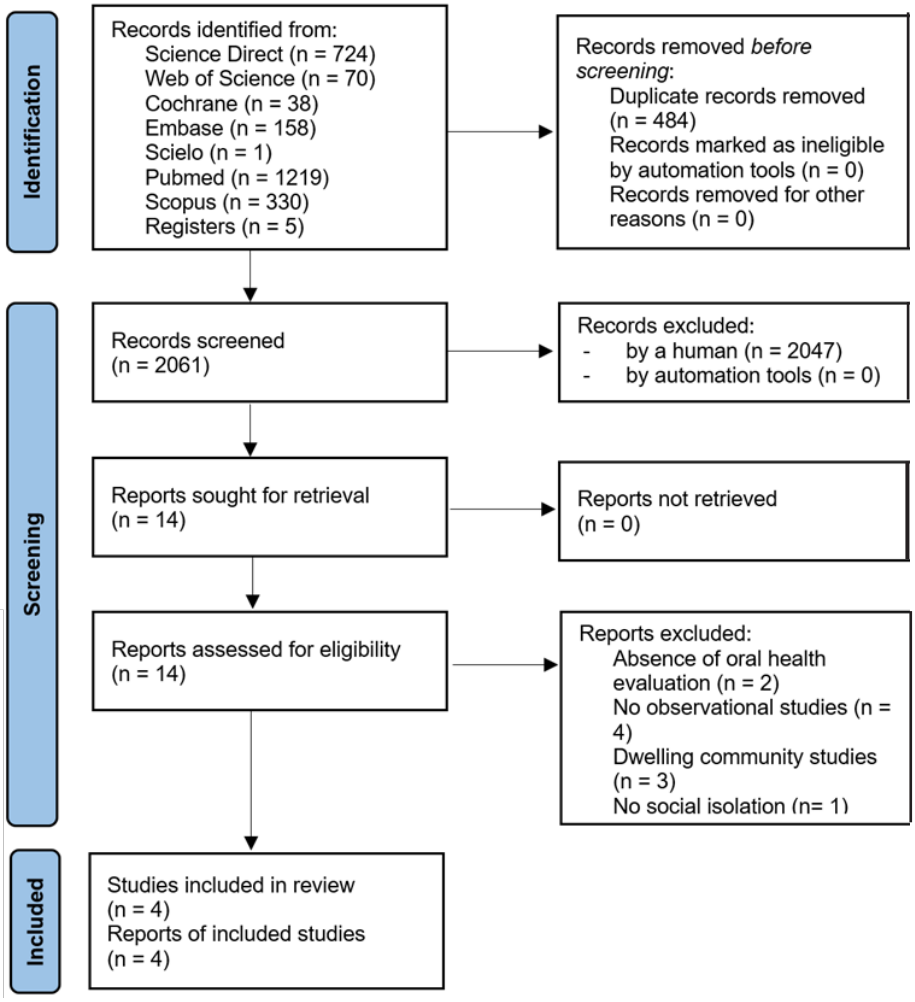

Figure 1. Flowchart of included studies.

One clinical trial mentioned randomization, but did not confirm it (Baker *et al.*, 2008). Baker et al. (2008) presented an appropriate report of incomplete outcome data, but had no randomization, allocation concealment or blinding, and risk of other bias was also found in this study. Cross-sectional studies showed risks of bias, with scores of 3, 4 and 5 from a possible total score of 8 stars (Bates and Harrison, 1975; Tobias, 1988; Mikami *et al.*, 2019 respectively). The domain least well addressed was "Sample size" followed by "Confounding factors are controlled" (Table 2).

Meta-analysis could not be performed, because there were no quantitative data, and because of the variability in the methods across studies.

Discussion

Quarantine is a broad and diverse concept seen as the separation of sick people with contagious diseases from non-infected people, to protect the non-infected from contagion, and usually occuring in hospital settings (Nishiura *et al.*, 2012). In certain situations, a broader social isolation occurs, and leads to total or partial abstention from social contact and interaction with family members, friends or the broader community (Fakoya *et al.*, 2020). The mandatory restriction in the movement of people as a measure to ensure public health by controlling communicable disease outbreaks is called quarantine (Wilder-Smith and Freedman, 2020). The term used for "mass quarantine" is lockdown, and the obligation to stay at home can be dictated by shelter-in-place ordinances set down by either a national or regional government or authority to impose social distancing, and limit or abolish the movement of the population inside and outside a specific area (Lippi *et al.*, 2020). All of these terms and conditions have the same outcome, namely, the person remains housebound as a safeguard to prevent the contamination and spread of the disease.

Participants investigated in the included articles were usually elderly people. The probable reason is that people in this age group tend to be more isolated naturally. This because of their limited mobility and social networking, based on the death of partners and relatives, and changes in their social roles, owing to retirement and loss of income (Miyawaki, 2015).

Several studies have evaluated housebound persons, addressing outcomes, such as social isolation, loneliness, seclusion and confinement, and how these relate to mental health, depression and other psychic illnesses (Fakoya *et al.*, 2020; Usher *et al.*, 2020; Algren *et al.*, 2020; Meng *et al.*, 2018; Perrin *et al.*, 2009). It is well established that social isolation augments the burden of neurocognitive, mental, cardiovascular and autoimmune problems, as well as depression and anxiety, especially in the elderly (Lippi *et al.*, 2020). However, with regard to evaluating the relationship of social isolation and

Table 1. Characteristics of four included studies

Study; Country	*Study design*	*Characteristics of participants*	*Social isolation*	*Edentulous condition*	*Oral function*	*Plaque index*	*Oral hygiene*	*Caries*	*Periodontal index*	*Oral pathology*	*Findings*
Baker, Pearson & Robinson, 2008; United Kingdom	Randomized clinical trial	65-101 years (mean age 80), 32 men, 101 women	44 lived with spouse or family member, 86 lived alone.	120 wore a complete denture on both jaws.	Chewing difficulty (12.08 @ baseline; 11.15@ 3m), eating impact (10.22 @ baseline, 7.99 @ 3m)	N/A	N/A	N/A	N/A	Dry mouth (1.07- baseline; 0.95- 3 months)	Domiciliary treatment improved global oral health perceptions
Bates & Harrison, 1975; United Kingdom	Cross-sectional study	50-100 years, 23 men, 57 women	Unable to leave home or garden without assistance	70 edentulous, 10 dentate	No patients were in pain although, 39 needed some non-urgent treatment	N/A	6 needed	N/A	6 with periodontal diseases	N/A	Dental state of housebound patients not markedly different to other elderly patients.
Mikami et al., 2019; Japan	Cross-sectional study	70-93 years old, 344 men and 441 women	154 decreased frequency of going out; 286 lived alone; 499 cohabitated	N/A	Difficulty chewing (n=155), difficulty swallowing (n=185)	N/A	N/A	N/A	N/A	Dry mouth (n=194)	Poor oral function might decrease frequency of going out.
Tobias 1988; United Kingdom	Cross-sectional study	60-97 years; 103 men, 311 women	319 lived alone, 270 were widowed.	323 edentulous.	Difficulty chewing (n=54), having pain all or most of the time (n=39), having pain occasionally (n=5), dissatisfied with oral state (n=65)	N/A	N/A	N/A	N/A	75% without oral disease. More edentate (29%) than dentate subjects (10%) had mucosal conditions	Not caring about oral hygiene associated with less ideal use of dental services and other poor dental behaviours

Table 2. Risk of bias assessment for cross-sectional studies

	Selection			*Comparability*	*Outcome*		Total
	Representativeness of the sample	*Sample size*	*Ascertainment of the exposure*	*Confounding factors are controlled*	*Assessment of outcome*	*Statistical test*	
Bates & Harrison, 1975	★	0	★	0	★	0	3/8
Mikami et al., 2019	★	0	★	★	★	★	5/8
Tobias, 1988	★	0	★★	0	★	0	4/8

oral health, fewer studies are found, and they are more subject-specific. Some are based on the same population (Arcury *et al.*, 2009; Arcury *et al.*, 2012; Arcury *et al.*, 2013), others are more targeted to the edentulous population (Tobias, 1988; Baker *et al.*, 2008), and yet others are not clinical studies (Simons, 2003; Jain *et al.*, 2007; Critchlow, 2017).

Most articles included in this review concluded that there was an association between being housebound and oral status (Tobias, 1988; Baker *et al.*, 2008; Mikami *et al.*, 2019), suggesting that it may exacerbate this population's oral health. It is important that people in a state of social isolation practice regular oral hygiene habits to maintain their oral health, even in the absence of regular social interaction, or in the case of certain physical disabilities. One reason is that any dental treatment required during the pandemic poses a risk of SARS-coV-2 transmission to the dentist and subsequent patients (Izzetti *et al.*, 2020).

Prevention of any medical and dental disease is important at any time in life, but especially during quarantine, when dental visits should be avoided and may not be available. Most dental treatments are invasive, and may involve high-speed or ultrasonic instruments that aerosolize secretions, saliva or blood. Moreover, standard protective measures in daily clinical work, are not sufficiently effective to prevent the spread of COVID-19, especially as some patients may be in an incubation period, are unaware they are infected, or choose to conceal their infection. (Meng *et al.*, 2020).

Oral health is fundamental to general health and well-being, and enables an individual to speak, eat and socialize without experiencing an active disease, discomfort or embarrassment. Many oral health problems are preventable and reversible when detected at early onset, but most people have only limited knowledge of the causes and prevention of oral disease (Kwan *et al.*, 2005). Whilst awareness may have been sharpened during the pandemic, with a range of public health campaigns observed more attentively, there has been little attention to oral health.

The articles included herein did not report important clinical aspects of oral health, such as plaque or dental caries. There is a gap in the literature on the relationship between social isolation and oral health clinical parameters. Conversely, the included studies investigated oral health impairment and disease, especially chewing difficulty and dry mouth (Tobias, 1988; Baker *et al.*, 2008; Mikami *et al.*, 2019). This result corroborates the literature that reports that oral lesions and impaired oral function commonly occur in middle-aged and elderly patients (Miyazaki *et al.*, 2017). It is noteworthy that in none of these articles considered social isolation imposed by the government. Before 2020, social isolation was very much socially determined. Over the last two years social isolation has been established largely government-mandated; outcomes regarding oral health may differ depending on the cause of isolation.

All the selected sources recruited participants who were edentulous and data on periodontal diseases or caries were restricted. The consequences of these conditions accrue over time, and can lead to tooth loss (Fonseca *et al.*, 2019; Ramsay *et al.*, 2018). Another important factor that may be associated with edentulism is the physical or cognitive disability of elders (Marengoni *et al.*, 2011; Kang *et al.*, 2020), which can compromise dental hygiene, and lead to oral disease and tooth loss. In this respect, there may be a vicious cycle in which edentulism negatively influences oral functions and psychological health (Sharka *et al.*, 2019); so that affected individuals may feel upset and socially isolated (Shah *et al.*, 2015). As a result, oral hygiene may be deficient, thereby worsening the oral condition and increasing the negative psychological impact.

The included studies could be regarded of low methodological quality for the purposes of this review. This was mostly due to the absence of sample calculations and non-control of confounding. The difficulties implicit in performing research, such as cost, sample size and skilled staff are well known (Laterre and François, 2015). Studies of oral health and social isolation require a specific and appreciable sample, long-term evaluation and scrutinous examination of several oral parameters, steps that are difficult to take in pandemic times, and to apply in the context of different forms of social isolation.

The COVID-19 pandemic forced the suspension of dental treatment in many countries, except for dental emergencies (Meng *et al.*, 2020; Guo *et al.*, 2020). As discussed, there have been few campaigns to oral healthcare to motivate, guide and educate the population on the importance of careful oral hygiene in such times. People should be advised to reduce oral disease with healthy oral health behaviours, and must learn how to deal with nonacute oral diseases via sustainable and viable public health education (Guo *et al.*, 2020).

Although well-conducted, this study has limitations: some included studies did not recruit a non-isolated comparison group, and so compared their data against those from other studies. Meta-analyses could not be performed due to the scarcity of high-quality data relevant to the issue investigated.

In conclusion, there is no strong evidence for an association between social isolation and oral health in adults. However, the importance of self-care to maintain good oral health should be reinforced.

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