

How Have Recent Pandemics Affected Oral Health: A Systematic Review using Narrative Synthesis of the Literature from 2011-2021

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ABSTRACT

Introduction: Pandemics have affected and will continue to affect humankind. Historically the Human Immunodeficiency Virus changed the way dental clinics operate and the COVID-19 pandemic led to an unprecedented closure of dental clinics leading to short- and long-term impact on oral health.

Aim: To assess the impact on oral health and related behaviours related to modern pandemics.

Method: A literature search across eighteen electronic databases was conducted. Three reviewers screened 2029 articles against inclusion criteria and assessed quality. Included articles underwent thematic analysis, followed by narrative synthesis to describe the results.

Results: Forty-eight articles were included that identified themes: (i) oral health related quality of life, (ii) stress and pandemics, (iii) oral health behaviours, (iv) social capital, (v) access to oral healthcare, (vi) fear as a barrier to accessing oral healthcare and (vii) teledentistry.

Conclusion: Pandemics present multiple challenges to both individuals and oral health professionals that impact on oral health and these challenges disproportionately affect the most vulnerable communities. However, with the right support, these impacts can be mitigated through social capital and support to establish healthy routines. The use of digital technologies should be promoted to reach all communities before the next pandemic arrives.

Keywords: Delivery of dental health, oral health, pandemics, public health dentistry.

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I. INTRODUCTION

Pandemics have affected humankind since the beginning of time. Notable pandemics in the 20th and 21st centuries include Human Immunodeficiency Virus (HIV), Influenza and Middle East Respiratory Syndrome (MERS), Ebola and most recently severe acute respiratory syndrome coronavirus 2 (COVID-19) [1].

Currently, oral diseases such as dental caries, periodontal disease and oral cancers affect over 3.5 billion people and the associations connecting these conditions with other systemic diseases such as diabetes, cardiovascular disease, chronic lung conditions are increasing [2]. Oral diseases share common risk factors with other non-communicable diseases and are impacted by the wider social and commercial determinants of health [3].

Parallels have been drawn between the HIV pandemic and COVID-19, both of which present oral manifestations and increased unmet dental needs [4], [5], and the wider implications of transmission through bodily fluids such as saliva that created fear of dental treatment, discrimination and stigma [6], [7].

Due to the closure of dental clinics and the subsequent backlog of patients requiring oral healthcare, in the United Kingdom alone there are estimated to be 40 million missed dental appointments [8] which has led to desperate patients carrying out do-it-yourself dentistry [9].

To create communities that have oral health which is resilient in the face of a future pandemic, it is essential to understand the impact that recent pandemics have had on oral health globally. Therefore, the aim of this study was to conduct a systematic review of the existing literature to understand how pandemics within the last ten years have impacted on oral health and oral health behaviours.

II. METHOD

Search Strategy and Data Sources

This systematic review was developed using the PRISMA guidelines and registered on PROSPERO (CRD42021248289). A systematic search to identify primary research papers that address the research question of “How do pandemics affect oral health” was conducted using the following databases: Elsevier, Wiley, Springer, Medline,

CINAL, Embase, Sage, Nature, Scopus, Cochrane, Science Direct, Psy Info and Proquest. Grey literature was searched using NICE Evidence Search, Open Grey, The Grey Literature Report, Bielefeld Academic Search Engine (BASE), and additional searches were carried out using Google Scholar and Google.

The search terms were identified from a search and entry terms from the Medical Subject Headings (MeSH) webpage to determine terms used in the titles, abstracts, and keywords (see supplementary material). The keywords were combined with Boolean operators to achieve a precise search. Only English language papers were retained.

A. Eligibility Criteria

Studies were included if they researched pandemics (including HIV, Acquired Immuno Deficiency Syndrome (AIDS), MERS, Severe Acute Respiratory Syndrome (SARS) and COVID-19) and oral health and oral health-related behaviours at all age groups during the last ten years. Studies published in peer-reviewed journals, unpublished research, and case reports were included.

Studies were excluded if they were opinion pieces, editorials, or older than 10 years. The time limit of 10 years was defined due to the significant lessons learned following the initial outbreak of the HIV/AIDS pandemic and to ensure only relevant current literature would be included in this study.

B. Study Selection and Quality Appraisal

Included studies were uploaded to the software Covidence, a cloud-based collaboration software. RE carried out an initial screen of the titles and abstracts and removed any duplicates. RE, BM and SB independently reviewed the remaining titles and abstracts and meet regularly to reach a consensus. RE, BM and SB then independently reviewed the full-text articles, meeting regularly to reach consensus. Quality assessment was carried out by RE and BM according to "Strengthening the reporting of observational studies in epidemiology" (STROBE) checklists.

C. Data Extraction

Data extraction from the included studies was carried out by RE and BM using a pre-developed Microsoft excel sheet adapted from the STROBE checklist which recorded variables including type of study, setting, country, funding source, conflict of interest, method, and limitations.

D. Data Analysis and Synthesis

As this study sought to understand behavioural changes and the influence of external pressures, telling the story of people and communities by examining contextual variables and outcomes, a narrative synthesis method was adopted.

Included studies underwent thematic analysis to identify common themes and patterns in addition to the social heterogeneity between cultural and socio-demographics between countries. The results are presented in textual narratives and explore similarities and differences in individual and community response to pandemics.

III. RESULTS

The search yielded a total of 2,029 papers, of which 48 met the inclusion criteria and were included in this review (Fig. 1).

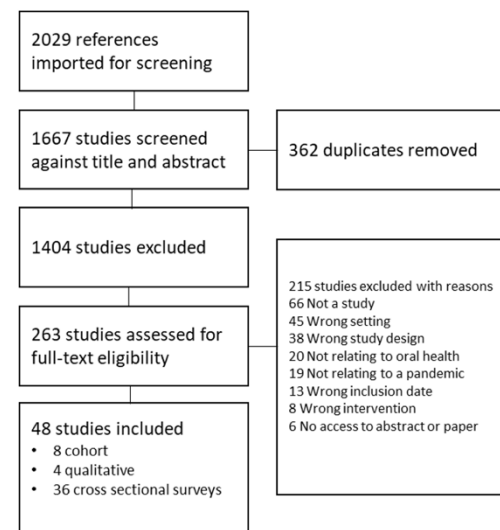


Fig. 1. PRISMA flow diagram for the selection of papers.

A. Study Characteristics

Of the included studies, 8 were cohort studies, 4 qualitative studies, and 36 cross-sectional surveys (see supplementary material).

B. Oral Health-Related Quality of Life (OHRQoL)

Both the HIV and COVID-19 pandemic have been shown to have a negative impact on the OHRQoL of individuals. OHRQoL was assessed among 88 HIV positive children in Brazil including the domains of oral symptoms, functional limitations, emotional wellbeing, and social wellbeing [10]. The latter study demonstrated that a lower cluster of differentiation 4 (CD4) count was associated with poorer functional limitations, oral symptoms and social and emotional wellbeing. Similarly in overcrowded households where children did not rely upon their mothers as primary caregivers, they scored lower on the social wellbeing scale [10]. A more recent study in Cambodia carried out in 2021, [11] confirmed a higher level of oral disease among HIV positive children and acknowledged the influence of the primary caregiver on oral health outcomes, however, did not associate OHRQoL with HIV positive status.

OHRQoL was assessed among 594 low-income people living with HIV or AIDS (PLWHA) in South Florida. In the four weeks before the baseline survey, 62.2% of the participants had experienced at least one negative oral health impact and was experienced increasingly in women (47.4%) compared to men (39.7%).

As the COVID-19 pandemic is a relatively new phenomenon the current research into OHRQoL is focused on the acute effects of inaccessibility of oral healthcare and dental pain experienced as a result. Studies on both children [12] and adults [13] carried out in an emergency care centre in India revealed the children attending appointments experienced a significantly high decayed missing filled deciduous teeth (dmft) score of 6.45 which was four times more likely to increase poor OHRQoL. Parental fear of COVID-19 was significantly associated with poorer

OHRQoL, and this was posited by the authors as a reason for delayed oral healthcare intervention. Likewise, the authors reported that among the 2966 adult patients surveyed, 79% had experienced dental pain for more than 15 days, reported greater fear of COVID-19 and were more likely to report poorer OHRQoL [13].

In contrast to the preceding studies, a cohort study of 207 adolescents carried out in Brazil [14] indicated a lower negative impact on OHRQoL during the first six months of the pandemic. Families affected by job loss and who were unable to socially distance were more likely to have poorer OHRQoL. These results indicate the wider determinants of health that have affected individuals' OHRQoL during the pandemic such as crowded housing and financial insecurity. These results were corroborated by a longitudinal study, also carried out in Brazil of 290 students in which the authors suggested that social distancing prevented daily contact with their peers and thus reduced their experiences of dental shame and bullying [15].

C. Stress and Pandemics

Over 70% of 380 participants reported “severe” and “very severe” stress during June and July 2020 in Bangdung, Indonesia. The authors concluded that high levels of stress were positively correlated with higher rates of xerostomia and stomatitis, this may be due to the effect stress and depression have on the parasympathetic nervous system which leads to a reduced salivary flow [16].

Similarly, patients who suffered temporomandibular dysfunction (TMD) before the pandemic were more like to self-report higher levels of stress and depression and a worsening of TMD pain and parafunction. Conversely, orthodontic patients showed no difference in stress levels compared to the general population. This indicates that patients with TMD are more vulnerable to psychological distress during periods of uncertainty and should be provided with additional psychological support [17].

D. Oral Health and Related Behaviours

Antiviral treatments for communicable diseases such as HIV, AIDS, Hepatitis C Virus (HCV) and COVID-19 are known to affect the oral tissues, leading to xerostomia, ulceration and stomatitis [5]. Oral discomfort has been identified as a factor in patients discontinuing treatment for HCV [18]. A quasi-experimental study with 34 patients was carried out to assess the effectiveness of one-to-one oral hygiene instructions and follow up home phone counselling. Despite the small sample size, this approach showed significant improvement in oral health behaviours which encouraged a sustained adherence to antiviral treatment. As in previous studies, the authors note that the administration of sugar-laden medications impacts negatively upon the oral disease levels of patients. Likewise, a cross-sectional study of HIV positive children in Kenya [19] noted that oral hygiene behaviours were poor with 57.3% of children brushing once daily and frequently consuming sugary snacks. These participants were also receiving medications in the form of sugary syrups and the combination of these factors resulted in 65% of the children suffering dental caries [19].

A small sample of twenty-two PLWHA participated in a study to measure the effectiveness of the Information-Motivation-Behavioural Skills (IMB). The results showed

that although self-reported knowledge improved there was little change in the intraoral signs of periodontal disease, thus, from this conclusion more research is needed to understand the impact of holistic health coaching in PLWHA [20].

At the epicentre of the COVID-19 pandemic, in Wuhan, China, a cross-sectional survey of 4495 preschool children revealed over 30% were suffering from a toothache during the first three months of the pandemic [21]. However, when compared with other cities parents and caregivers reported increasing the frequency which they brushed their child's teeth, possibly in an attempt to resolve the dental pain.

E. Social Capital

Social capital is the relationship between people within a society that enables it to function, this term can also be applied to the dynamic relationships within families and between children and caregivers. A survey of 142 dyads in Phnom Penh, Cambodia concluded that children with institutional caregivers had significantly better oral health and lower levels of oral disease and suggested this may be due to the regulation of dietary intake and established routines such as toothbrushing before bed [11].

The establishment of routines may go some way to explain the results of [22] who demonstrated that parental presence during periods of home working during the COVID-19 lockdowns improved the oral health of their children due to the increased time spent building a stable and positive relationship, this, in turn, improved the child's collaboration with their oral health professional during appointments. Interestingly, this result was supported in studies of children in Brazil, and in the U.S [23] that posited improved social capital during the pandemic as children stayed at home with their families and experienced feelings of protection and belonging leading to improved OHRQoL [14].

F. Access to Oral Healthcare

A study of 2,469 PLWHA across 12 states in the USA revealed certain characteristics of PLWHA who experienced unmet dental need included ethnicity, immigration status, history of illicit drug use, and lower educational attainment [24], [25]. Barriers and facilitators for PLWHA in Florida, USA, were identified by [26] that included dental fear, long waiting times, problem-focused care-seeking behaviour, stigma and a lack of financial support. Similar results were elicited from a cohort of PLWHA in Nigeria, [27] yet transgender PLWHA in India reported that stigma and a reluctance of dental professionals to treat them after learning about their HIV positive status was the greatest barrier to care [28]. Data from 1,499 PLWHA demonstrated that regular oral healthcare improved the overall wellbeing and mental health of PLWHA and the authors called for action to ensure that oral health promotion was prioritised for this population [29].

Despite the similarities, the COVID-19 pandemic is the only event that has led to a global closure of dental clinics due to the spread of the virus through aerosol droplets. This unprecedented closure caused a rapid shift in unmet need for oral healthcare across the global community. Countries rapidly established emergency dental centres (EDCs) to provide urgent dental care and the studies identified in this review were carried out in Turkey [30], Russia [31], Switzerland [32], Romania [33], Saudi Arabia [34], and Europe [35] revealed the limitations in the dental treatments

they were able to provide. Despite these limitations, the patient satisfaction with the care they had received at an EDC in Queen Mary's Hospital, U.K was high, which in turn improved their OHRQoL score. This result highlights the need to urgently set up EDCs at the outbreak of a pandemic [36].

G. Fear as A Barrier to Accessing Oral Healthcare

Fear in the context of pandemics is multifaceted. On one hand, PLWHA has been shown to exhibit higher rates of dental anxiety and phobia [37]. On the other hand, the COVID-19 pandemic instilled fear among vulnerable groups of catching COVID-19 whilst attending the dental practice. A study in Madrid reported that 25% of participants delayed dental care however, people with a fear of COVID-19 were six times more likely to delay dental treatment, and those aged over 60 years were eight times more likely [38]. Similar results were reported in Indonesia (31.8%) [39], and Germany (22%) [40] where respondents chose to delay care due to their fear of catching COVID-19.

The figure was much higher in the U.S where 47.8% of 2,387 participants delayed dental treatment [41]. The authors examined the characteristics of these individuals and reported that despite this being a nationally representative sample they uncovered little difference in the educational attainment or ethnicity and only living in an urban area showed a significant association with delaying dental care [41]. Yet, parents in Indonesia displayed indifference to their child catching COVID-19 during dental care and did not exhibit the same response to delaying treatment [42].

H. Teledentistry

Due to the limited contact allowed between people at the height of the pandemic, EDCs also implemented teledentistry consultations and follow-ups [32], [43]. A study carried out early in the pandemic in Bihar, India revealed just 28% of their 100 participants [44] were aware of teledentistry, however, a further study in Rajasthan, India found 80.5% were in favour of using Teledentistry [45].

The role of digital technology was also highlighted by [46] who concluded that relative search volumes on the internet for "toothache" increased in 2020, compared to previous years. The latter study also showed that regions with lower human development index were more likely to seek advice online, indicating the socioeconomic factors associated with accessing oral healthcare before and during the pandemic [46].

IV. DISCUSSION

Little research exists that examines the impact of pandemics other than HIV and COVID-19 on oral health. Important lessons can be learned from the COVID-19 pandemic such as the significance of preventing oral diseases, early establishment of EDCs and supporting hard to reach communities with teledentistry.

This systematic review highlights the overall negative impact on OHRQoL caused by pandemics that are linked to dental pain, oral manifestations and unmet treatments needs. However, the included studies also highlight the wider social factors affecting the oral health of participants such as low

income, ethnicity, educational attainments and institutionalism [11], [25], [29], [37]. Similarly, the studies identified in this review highlight negative impacts on oral health behaviours affecting PLWHA and communities during the COVID-19 pandemic [19], [47] however, these studies are primarily set in low income or disadvantaged communities. The one study from Wuhan [48] that showed improved self-reported oral hygiene behaviours was set in an urban community that had a high level of dental attendance and awareness pre-pandemic and thus it can be posited that the respondents understood the importance of dental prevention.

Several studies highlighted the positive impact of lockdown as parents spent more time with their children and established good oral hygiene routines which in turn improved their OHRQoL, however, this could not be applied to families who were experiencing financial distress. Again, this demonstrates that pandemics disproportionately negatively impact people from lower socioeconomic and disadvantages communities.

The COVID-19 pandemic is the first major pandemic in many people's lifetimes; therefore, it is unsurprising that stress emerged as a factor affecting oral health. To date over six-million people [49] have died due to the COVID-19 pandemic and due to digital technology and social media people have received real-time updates on the global situation [50]. This constant stream of information has contributed to a global mental health crisis [51], heavily impacting people with existing mental health concerns and possibly exacerbating the symptoms of temporomandibular dysfunction [17].

Even at the height of the HIV pandemic in the 1980s dental clinics did not close; however, this period was pivotal in the shift towards personal protective equipment that oral health professionals are familiar with today [52]. What did emerge for PLWHA was stigma and fear of attending dental clinics, similarly, during the COVID-19 pandemic people experienced fear of attending dental treatment in case of catching COVID-19. The fear experienced during both the HIV and COVID-19 pandemic has led to an increase in unmet dental needs, and as the research suggests it is the most vulnerable or socially disadvantaged communities who are suffering the highest numbers.

The significant shift to embracing digital technologies including teledentistry has the potential to increase access to oral healthcare. Teledentistry could be engaged to address many of the challenges experienced during pandemics by providing remote consultations, oral health education and psychological support.

V. CONCLUSION

Pandemics present multiple challenges to both individuals and oral health professionals that cause an immediate and long-term impact on OHRQoL, oral health behaviours and psychosocial issues and these challenges disproportionately affect the most vulnerable communities. However, with the right support, these impacts can be mitigated through social capital and support to establish healthy routines. The use of digital technologies should be promoted to reach all communities before the next pandemic arrives.

AUTHOR CONTRIBUTIONS

Conceptualization RE, LN, VZ; methodology RE, LN, VZ; data collections RE; abstract review and quality assessment RE, BM, SM; analysis RE; original draft preparation RE; review and editing RE; BM, SM, LN; VZ.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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