Short Communication

Oral Health and Climate Change: Working Toward Adaptive Strategies to the Changing Environment

Saurabh RamBihariLal Shrivastava[1,2,3], Prateek Sudhakar Bobhate[4], Monal Kukde[5]

[1]Deputy Director (Research and Development), Off-Campus, Datta Meghe Institute of Higher Education and Research, [2]Department of Education Research, School of Higher Education and Research, Datta Meghe Institute of Higher Education and Research, [3]Department of Community Medicine, Datta Meghe Medical College, Datta Meghe Institute of Higher Education and Research, Wanadongri, Nagpur, Maharashtra, India, [4]Department of Community Medicine, All India Institute of Medical Sciences, Vijaypur, Jammu, India, [5]Department of Dentistry, Datta Meghe Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India

Received : 03-Dec-2024
Revised : 14-Mar-2025
Accepted : 18-Mar-2025
Published : 30-Apr-2025

ABSTRACT

Climate change has been acknowledged as one of the current's century most significant global public health challenges. Climate change has resulted in a multifaceted impact on oral health, including the exacerbation of periodontal diseases, enamel erosion, and the increased risk of oral cancers. At the policy level, oral healthcare initiatives should be incorporated into climate adaptation strategies. Key recommendations include promoting climate-resilient dental practices (like mobile clinics and tele-dentistry), integrating sustainable oral healthcare practices, and advocating for water conservation. To summarize, these findings offer a blueprint to mitigate oral health disparities and augment the resilience of dental care systems, emphasizing the linkages between environmental policies and oral health outcomes.

Keywords: *Climate, dental care, oral health*

Introduction

Climate change has been acknowledged as one of the current's century most significant global public health challenges.[1] These climate changes (viz. rising temperatures, extremes of weather conditions, and vector breeding) have played a remarkable

Access this article online

Quick Response Code:

Website: https://journals.lww.com/jpcd

DOI: 10.4103/jispcd.jispcd_228_24

Address for correspondence: Dr. Saurabh R. Shrivastava, Department of Community Medicine, Datta Meghe Medical College, Off-Campus Centre of Datta Meghe Institute of Higher Education and Research Nagpur, Hingna Road, Wanadongri, Nagpur 441110, Maharashtra, India.
E-mail: drshrishri2008@gmail.com

How to cite this article: Shrivastava SR, Bobhate PS, Kukde M. Oral health and climate change: Working towards adaptive strategies to the changing environment. J Int Soc Prevent Communit Dent 2025;15:192-5.

role in worsening existing health disparities, which predominantly affect vulnerable populations in low-income nations.[1,2] Multiple health hazards have been linked with climate change, including the spread of vector-borne diseases, respiratory illnesses due to air pollution, and heat-related illnesses.[1,2] Owing to the cascading consequences of climate change, the healthcare delivery system has encountered a wide range of challenges on a global scale, necessitating the implementation of proactive and multidisciplinary approaches.[1] The objectives of the current article are to ascertain the impact of climate change on oral health and identify the strategies for climate-adaptive oral healthcare.

Impact of Climate Change on Oral Health

Climate change has resulted in a multifaceted impact on oral health that needs careful consideration.[3-10] Saliva normally contains enzymes and buffers that neutralize acids and remove food debris, but rising temperatures results in decreased production of saliva, resulting in compromise over these natural defense mechanisms. In addition, there is an additional oxidative stress in oral tissues because of the overproduction of reactive oxygen species within the oral mucosa, which are usually neutralized by the saliva that acts as a natural antioxidant barrier. However, with diminished saliva production due to excessive heat, the balance shifts in favor of oxidative damage in the form of damage to cellular membranes and protein is oral epithelium and exacerbating conditions like cavities, gum diseases, and oral discomfort.[3] This dehydration coupled with humidity creates a conducive environment for microbial growth in the absence of sufficient saliva, resulting in the rising incidence of oral infections like periodontal diseases and fungal infections like oral candidiasis.[3,4]

In drought-prone areas, there is less access to clean water, which prevents people from maintaining basic oral hygiene practices (like brushing or rinsing), and thus there is an augmented risk of oral diseases due to the accumulation of dental plaque and bacteria.[5] Climate-related disruptions in agriculture contribute to the restricted availability of nutrition-rich food commodities, especially deficiencies in vitamins and minerals which are essential for oral tissue maintenance, weakens immune responses, and delays the healing process of oral tissues, thereby augmenting the risk of periodontal diseases.[6] The prolonged exposure to air pollution or ultraviolet radiation due to climate change might contribute to the development of oral cancers by inducing chronic inflammation and deoxyribonucleic acid (DNA) damage in oral tissues.[7] Based on the findings of a scoping review, where 14 articles were included, it was reported that the maximum brunt of climate change is faced by vulnerable people (refugees, migrants, etc.) due to the limited access to dental care in host nations, language barriers, cultural differences, lack of health insurance or financial support, poor hygiene facilities, and prevailing malnutrition in these temporary shelter homes.[8]

In urban settings, air pollution associated with climate change contributes to acidic precipitation, which interferes with oral health due to erosion of tooth enamel.[6] This is mainly due to the release of a wide range of toxic substances (such as particulate matter, polycyclic aromatic hydrocarbons, volatile organic compounds, and heavy metals) in the oral cavity.[6] All these toxic substances adhere to the oral mucosa and initiate the process of chronic inflammation and even promotes oxidative stress by producing excessive reactive oxygen species, which not only damages cellular DNA but even impairs repair mechanisms.[6] In addition, acidic pollutants disrupt the normal pH balance of the oral environment, which weakens cell membranes and initiates the process of mutagenesis.[6] In fact, extreme weather events (like floods, wildfires, and hurricanes) significantly interfere with access to routine dental care and delay treatment, which exacerbates oral health issues.[6,9] In a scoping review that was done with the aim to systematically summarize the impact of natural disasters on oral health, the oral health status of survivors was analyzed using questionnaire surveys, examination for fungal infection, and assessment of the teeth, periodontal, and oral hygiene conditions. Six of the included studies reported that natural disasters tend to have a negative impact on oral health; nevertheless, these consequences could be misleading due to the geographical areas in which the natural disaster was reported.[9] Finally, climate change affects the distribution of diseases like dengue, which can manifest with bleeding gums and mucosal lesions.[10]

Strategies for Climate-Adaptive Oral Health Care

Acknowledging the magnitude of oral lesions attributed to climate changes, there is an immense need to plan for the delivery of climate-adaptive oral healthcare practices.[11-20] To begin with, communities should be made aware of how climate-related factors can impact oral health, preventive measures to minimize these impacts, and the promotion of the use of eco-friendly oral hygiene products (like biodegradable toothbrushes or compostable floss).[1,11,12] The findings of a scoping

review done with the intention to identify the available literature on oral health community engagement programs for the benefit of rural populations, specifically identified four categories of interventions, namely, community-based, school-based, integrated dental-based, and non-dental volunteer oral health initiatives.[11] To save water, the general public should be encouraged to use minimal water while brushing and rinsing like using a cup instead of running water.[5] Specific measures should be taken to ensure access to clean water in drought-prone or disaster-affected regions as this will minimize the risk of oral infections.[13]

Furthermore, people should be encouraged to consume a diet rich in vitamins and minerals as this will support oral health, especially in communities that are facing food scarcity due to climate change.[6] At this juncture, we must not forget to prioritize preventive dental care, wherein emphasis is given to routine dental cleaning and fluoride treatment to minimize the progression of dental issues exacerbated by climate-induced barriers to care.[8,14] At the policy level, advocate for the inclusion of oral health in broader public health and climate adaptation strategies as this will prioritize the issue.[1,15] Moreover, policymakers should be convinced to sustain fluoride programs in regions with water scarcity as this can minimize the incidence of dental caries and other oral problems.[1,6,11] Further, targeted interventions should be taken to introduce specific interventions or strategies for the benefit of underserved communities in climate-vulnerable areas, and this will minimize oral health inequalities.[2,11]

Dental professionals should be trained with the desired knowledge and skills to respond to oral health needs during disasters.[16] Moreover, there is a definite scope to deploy mobile dental clinics to reach people who are affected by climate-induced disasters and have limited access to dental care services.[17] In these areas and those regions that are facing severe weather conditions, even the option of tele-dentistry must be explored as it can help people get remote consultations and guidance for their oral issues.[18] There is an indispensable need to develop climate-resilient dental clinics that can remain functional during extremes of weather, including components of disaster preparedness in dental care systems.[6,9] In addition, the use of energy-efficient technologies and sustainable dental practices like reducing the production of dental waste (zero-waste packaging) and promoting the use of eco-friendly materials in dental care should be envisaged.[12]

There is a definite need to liaise with different sectors (viz. environmental scientists, policymakers, and health sector) to efficiently and effectively address oral health challenges in the context of climate change.[6,19] In fact, for sustainable results, local communities should be engaged in oral health promotion programs customized to climate risks in specific regions.[11]

There is a definite need to conduct studies to identify climate-related trends in oral health diseases, the vulnerable population, and the role of various environmental factors in influencing oral health outcomes.[6,19] The implementation of these climate-adaptive preventive measures can significantly improve access to oral healthcare services and contribute to building resilience and sustainability.[2] With the findings of a scoping review that was done to study the association between the climate change (Sustainable Development Goal 13) and the development of early childhood caries, it was concluded that climate change might increase the risk of caries, and the management of the same might further augment environmental degradation.[20]

Conclusion

In conclusion, climate change has been linked with multiple oral health problems that need careful consideration. The need of the hour is to invest in sustainable dental care practices, implement adaptive public health policies, and educate and empower vulnerable populations for better dental practices.

Acknowledgement

None.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Authors contributions

SRS: Conception or design of the work, drafting of the work, approval of the final version of the manuscript, and agreed for all aspects of the work. PSB: Literature review, revision of the manuscript for important intellectual content, approval of the final version of the manuscript, and agreed for all aspects of the work. MK: Literature review, revision of the manuscript for important intellectual content, approval of the final version of the manuscript, and agreed for all aspects of the work.

Ethical policy and Institutional Review board statement

Not applicable.

Patient declaration of consent

Not applicable.

Data availability statement

The data are contained in the article.

References

1. World Health Organization. Climate Change – Key Facts; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health#. [Last accessed on 3 Dec 2024].
2. Paavola J. Health impacts of climate change and health and social inequalities in the UK. Environ Health 2017;16:113.
3. Nagakubo D, Kaibori Y. Oral microbiota: The influences and interactions of saliva, IgA, and dietary factors in health and disease. Microorganisms 2023;11:2307.
4. Lee YH, Hong JY. Oral microbiome as a co-mediator of halitosis and periodontitis: A narrative review. Front Oral Health 2023;4:1229145.
5. Folayan MO, Obiyan MO, Olaleye AO. Association between water, sanitation, general hygiene and oral hygiene practices of street-involved young people in Southwest Nigeria. BMC Oral Health 2020;20:32.
6. Hackley DM. Climate change and oral health. Int Dent J 2021;71:173-7.
7. Yu P, Xu R, Yang Z, Ye T, Liu Y, Li S, *et al*. Cancer and ongoing climate change: Who are the most affected? ACS Environ Au 2022;3:5-11.
8. Asfari E, Rodriguez A, Dakessian A, Yuan S. Exploring refugees' experience of accessing dental health services in host countries: A scoping review. Front Oral Health 2024;5:1328862.
9. Matsuda S, Yoshimura H, Kawachi I. Impact of natural disaster on oral health: A scoping review. Medicine (Baltimore) 2023;102:e33076.
10. George AM, Ansumana R, de Souza DK, Niyas VKM, Zumla A, Bockarie MJ, *et al*. Climate change and the rising incidence of vector-borne diseases globally. Int J Infect Dis 2024;139:143-5.
11. Nghayo HA, Palanyandi CE, Ramphoma KJ, Maart R. Oral health community engagement programs for rural communities: A scoping review. PLoS One 2024;19:e0297546.
12. Mazur M, Ndokaj A, Bietolini S, Nisii V, Duś-Ilnicka I, Ottolenghi L, *et al*. Green dentistry: Organic toothpaste formulations. A literature review. Dent Med Probl 2022;59:461-74.
13. Tandlich R, Angala H, Vhiriri EP, Moropa K, Ngqwala NP, Zuma BM, *et al*. Disaster risk from diarrhoeal diseases and WASH in South Africa and Botswana in MDG time. Jamba 2024;16:1778.
14. Horst JA, Tanzer JM, Milgrom PM. Fluorides and other preventive strategies for tooth decay. Dent Clin North Am 2018;62:207-34.
15. Northridge ME, Kumar A, Kaur R. Disparities in access to oral health care. Annu Rev Public Health 2020;41:513-35.
16. Li G, Chang B, Li H, Wang R, Li G. The role of dental professionals in pandemic events and disaster responses. Disaster Med Public Health Prep 2021;15:785-9.
17. Bala R, Sargaiyan V, Rathi SA, Mankar SS, Jaiswal AK, Mankar SA, *et al*. Mobile dental clinic for oral health services to underserved rural Indian communities. Bioinformation 2023;19:1383-7.
18. Islam MRR, Islam R, Ferdous S, Watanabe C, Yamauti M, Alam MK, *et al*. Teledentistry as an effective tool for the communication improvement between dentists and patients: An overview. Healthcare (Basel) 2022;10:1586.
19. de Abreu MHNG, Cruz AJS, Borges-Oliveira AC, Martins RC, Mattos FF. Perspectives on social and environmental determinants of oral health. Int J Environ Res Public Health 2021;18:13429.
20. Foláyan MO, Schroth RJ, Abodunrin O, Al-Batayneh OB, Arheiam A, Mfolo T, *et al*. Early childhood caries, climate change and the sustainable development goal 13: A scoping review. BMC Oral Health 2024;24:524.