



Impact of Global Warming on Oral Health

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(Received: 16 January 2026

Revised: 25 February 2026

Accepted: 30 March 2026)

KEYWORDS:

Climate change,
Global warming,
Oral Health,
Weather

ABSTRACT:

Energy of the sun not only warms the earth but much of that energy departs back into space, also, some is held within the atmosphere by greenhouse gases. In view of the facts related to human activities, emission of greenhouse gases have increased and led to rise in global temperature than normal, extreme weather changes, melting of glaciers leading to rising sea levels, droughts or flooding etc. Such drastic changes may lead to major health risks by way of heat waves, polluted or poor air quality, food/water scarcity, communicable illnesses, social implications etc. Global warming affects the lives of people belonging to a particular geographical area and affects their general health significantly. It also has a significant impact on oral health. Oral precancerous conditions and oral cancer are increasing amongst the Indian sub-continent population. Epidemiological evaluation & preparedness to manage health burden rising due to global warming needs to be reinforced. Oral health education, its promotion, preventive programs, different awareness campaigns or drives need to be emphasized to target high risk populations.

INTRODUCTION:

Global warming is perceived as a worldwide threat currently and mankind's deeds have largely contributed to this. Therefore, many difficult situations like climate sensitive infections or communicable diseases, natural calamities, malnutrition, air and water pollution related ailments or deaths have emerged as issues of significant importance.¹ Today one of the burning issues is global warming or damage to our planet

due to change in climatic conditions. The National Communications Report of India to the United Nations Framework Convention on Climate change (UNFCCC) stated that this climate change will most probably affect the natural ecosystems.^{1,2} Climate change is affecting the health of humans directly or indirectly. People are exposed directly to global warming (change in temperature & rise in sea-level) and to extreme events regularly. It is affecting standards of water, air, food, etc.



in the environment, agronomy, industrial land, human settlements & the finances indirectly. Compromised health may lead to an increase in vulnerability to adapt to change in climatic conditions or global warming.

A strong connection between the systemic and oral health is observed in the geriatric population. Oral health is related to general health also and poor oral health can affect growth, development and learning especially for younger generation, communication, nutrition status, assertiveness etc. Oral health can be considered as a determinant of quality of life. Oral health related epidemiological data depending upon consistent or uniform assessment criteria is not available for the Indian population as such a kind of survey has not been conducted. Previous literature suggests that change in climatic conditions has led to rise in viral infections like herpes group of viruses, human papilloma virus, cytomegalovirus etc.¹ The oral cavity manifestations can have an impact on the overall systemic health. Global warming is also responsible for oxidative stress in allergic reactions. Along with inflammation, it also causes environmental exposure to air pollution and cigarette smoke.

AIM OF THE PRESENT REVIEW: The present review aims to compile current available literature till 2025 about global warming and its impact on oral health. As, the data is evolving, and therefore the conclusions made here in the present review may change later.

METHODS: An intensive literature search was performed to understand and recognize the updates related to global warming and oral health. For the present review, we searched PubMed database, Google Scholar using the key terms 'global warming', 'oral health', 'climate change' and 'weather change' up to 2025. Research articles, Systematic reviews & meta-analysis, narrative and over reviews, etc., especially global warming and its impact on oral health. Articles reported only in English were considered, articles available with only abstracts and with weak methodology, not in English were excluded. The source of available literature was, electronic database PubMed, Google, Wiley online library, PMC and Manual Search using the key phrases 'global warming' and 'climate change'. After the removal of duplication/repetitions articles were selected. Independently 03 authors screened the collected data related to titles/abstracts, purpose or need of the study

and research question using the selection criteria. In case of any discrepancy, subject experts were consulted, and the issues were resolved.

GLOBAL WARMING AND ORAL HEALTH:

Increased risk of dental caries: Rising global temperatures and increased humidity are beginning to impact dental health in several ways. Higher heat and moisture levels can create an environment where harmful bacteria in the mouth multiply more rapidly, which may lead to a higher risk of tooth decay. Additionally, changes in weather and rainfall can affect the availability and quality of water; these shifts can further disrupt the natural balance of bacteria in the mouth, making people more susceptible to caries.³

Increased risk of oral cancer: Exposure to ultraviolet (UV) radiation is a significant environmental determinant in the pathogenesis of oral malignancy.^{1,4,5} Global climatic shifts have contributed to the depletion of the stratospheric ozone layer, which serves as a critical biological shield against harmful UV radiations emitted by the Sun.^{6,7} Thus increasing the prevalence of oral cancer. Oral cancer has emerged as a public health concern with over two hundred thousand new cases reported worldwide per year.⁸

In the Indian subcontinent, precancerous conditions like oral leukoplakia and oral submucous fibrosis commonly occur; chewing areca nut and betel quid could be known risk factors for the same.⁸ Increase in oral cancer cases in India has seen an increase as a result of change in the routine lifestyle such as increased tobacco and related products consumption as a result of rapid urbanization.

Increased risk of periodontal disease: Global warming increases the risk of periodontal diseases by change in distribution, temperature and humidity.^{9,10,11} Which can create conditions which may act synergistically for the growth and spread of bacteria, viruses, and fungi.^{12,13}

Dental erosion: Change in water quality or water pollution occur due to change in precipitation pattern which may lead to dental erosion.^{10,11} It is a condition in which the enamel on the teeth wears away. Dental erosion can lead to tooth sensitivity, discoloration, and other dental problems.^{12,14}

Effect on nutrition status: Food availability and quality affect nutrition status of a person which can affect oral



health, leading to an increased risk of dental caries, periodontal disease, and other oral health problems.^{1,8} Masticatory inefficiency can also cause malnutrition, anemia, weight loss and systemic health eventually.^{12,13}

Systemic diseases: Oral and systemic health is relatively associated. Some oral diseases have systemic manifestations and vice-versa. Oral manifestations of systemic diseases in geriatric population sometimes include oral lichen planus, autoimmune diseases, connective tissue disorders, HIV/AIDS lesions, and stress induced mucosal and musculoskeletal diseases.^{9,15,16}

Role of Oral Healthcare Professionals:

Sustainable practices in dental clinics: Oral healthcare professionals can play a significant role through the adoption of sustainable practices in dental offices. In spite of the fact that dentistry may seem to have a less environmental impact to heavy industries, dental clinics contribute to carbon emissions, plastic waste, and energy use comparatively.^{14,15}

Patient education and awareness: The role of oral healthcare professionals is very vital and impactful in addressing global warming through patient education and awareness. Oral healthcare professionals serve as credible sources of health information and can leverage their influence to educate and empower patients to make environmentally responsible choices in both oral health care and their overall lifestyle.¹⁶ They can promote awareness among patients about sustainable oral health routines. Also to train staff on green practices and involve them in sustainability initiatives is essential.^{17,18}

Lifestyle: The intersection of oral healthcare and environmental sustainability offers a powerful platform for preventative care. When practitioners align health recommendations with ecological responsibility, they don't just improve patient outcomes; they inspire a lifestyle shift that contributes to a more sustainable future for the planet.¹⁸

Policy makers: Oral healthcare professionals possess a unique clinical vantage point that is vital for shaping effective climate policy. By leveraging their frontline expertise, practitioners can move beyond the operator to advocate for systemic sustainability across healthcare and government sectors. Whether through public consultations, international task forces partnerships with

organizations like WHO and FDI, the dental community provides the evidence based insights necessary to develop, and successfully implement, sustainable practice guidelines that are both ambitious and achievable.^{16,19}

Climate change is likely to impact all natural ecosystems as seen in the National commissions report of India to the UNFCCC. This relationship between climate and dental health is multidisciplinary.¹⁶

Dental Professionals can also help to create, adopt and promote guidelines that influence how dental clinics operate:

- Promote green dentistry.
- Incentive programs/recognition for dental clinics that achieve sustainability targets.
- Promotion of tele-dentistry.

Professional organization: Oral healthcare professionals have increasingly defined a dual responsibility that bridges clinical excellence with environmental stewardship. By leveraging their frontline expertise within professional associations, licensing bodies, and academic societies, practitioners serve as essential architects of systemic change, embedding sustainability into the very foundation of dental education and advocacy. These organizations function as the primary engines of professional standards; thus, active engagement of the dental community ensures that 'green' clinical practices are not merely peripheral considerations but are integrated into the ethical and regulatory frameworks of the field. Oral healthcare professionals provide the evidence based leadership necessary to align modern dentistry with urgent requirements of the global climate action.^{20,21}

Research and innovations: Beyond clinical practice oral healthcare professionals serve as essential catalysts for innovation and research aimed at mitigating the environmental footprint of the dental field. By utilising their deep understanding of clinical workflow and material science, these practitioners are uniquely positioned to pioneer sustainable systems and evidence based methodologies that do not compromise patient care. The integration of clinical led research into the foundation of dentistry ensures that the profession's



evolution is both scientific and operational. Few outcomes the practitioner can achieve are:

Developing Eco-Friendly Dental Materials

Oral health professionals can:

- Integrate their knowledge with dental material scientists and researchers to develop biodegradable or recyclable dental products (e.g. impression trays, floss, packaging).
- Innovate low-carbon alternatives to traditional materials (e.g. mercury-free fillings, non-toxic disinfectants).
- Evaluate the environmental footprint of materials to integrate sustainable sourcing.

Publishing and Sharing Knowledge

- Contribute to scientific journals, conferences, and workshops on dental sustainability.
- Develop clinical guidelines informed by environmental research.
- Disseminate findings to shape policy and industry practices.

Securing Funding and Collaborations

Dental researchers can:

- Apply for grants focused on climate and health to fund innovation in green dentistry.
- Partner with environmental scientists, engineers, and public health experts to advance interdisciplinary solutions.
- Champion sustainability as a core criterion for dental research grants.

Community Participation: Beyond the clinical setting, oral professionals serve as pivotal community anchors whose trusted status allows them to function as influential environmental health educators. By using the high frequency of public interaction inherent in dental practice, these practitioners are uniquely positioned to translate complex climate concerns into actionable, grassroots level sustainability initiatives. Ultimately the role of 'Community Educator' transforms the practitioner into a catalyst for environmental awareness, demonstrating that the promotion of systemic health is

linked to the stewardship of the local and global environment.

Health professionals can raise awareness about the connections between oral health, lifestyle, and environmental sustainability by:

- Conducting community outreach sessions in schools, community centers, and clinics.
- Teaching eco-friendly oral hygiene practices (e.g. conserving water, using sustainable products).
- Integrating climate-conscious messages into dental health campaigns and awareness days.

Example: Schedule 'Green Oral Health Weeks' in partnership with local schools or NGOs.

Promoting Preventive Care as Climate Action:

- Host free dental check-up camps that emphasize sustainability.
- Provide education on diet, tobacco cessation, and hygiene, which supports both personal and environmental health.
- Encourage routine care to minimize emergency visits and associated emissions from travel and treatment and educating the patients that climate change can increase the risk of caries⁽¹⁷⁾

Leading Community Based Sustainability Initiatives:

Dental professionals can initiate or support local sustainability projects, such as:

- Organizing dental waste recycling drives in the professionals neighborhood (e.g. for used toothbrushes or toothpaste tubes).
- Participating in / Leading clean-up drives or tree planting campaigns.
- Partnering with local schools or government bodies in order to conduct 'health talks'.

Interprofessional Collaborations:

The efficacy of oral healthcare in mitigating global warming is significantly amplified through interdisciplinary integration. By aligning with environmental scientists, policymakers and engineers, dental professionals ensure that oral health is a core



component of broader climate health strategies rather than an isolated clinical concern. These synergies allow for the exchange of unique clinical insights to address systematic challenges, such as medical waste and energy consumption. Ultimately it positioned the practitioner as a vital stakeholder in global health governance.²¹

Workshops/Training:

By organizing and participating in workshops or training sessions, oral healthcare professionals can bring light to the importance of sustainability in dentistry. These educational efforts bring about a hands on approach to the problem of ignorance and help in building environmentally responsible practices. They help empower dental teams by not only building awareness but also inculcating good workflow skills.²¹

Educating Dental Teams on Sustainable Practices: 20,21

Oral healthcare professionals can organize internal training for their teams to help them:

- Understand the environmental impact of dental practices
- Learn about green clinical techniques, such as using reusable instruments, proper waste segregation, and energy saving methods.
- Adopt digital workflows (e.g paperless systems, digital radiography) that reduce emissions.

Facilitating Interdisciplinary Climate Health Workshops

Dentists can collaborate with other health professionals to:

- Deliver joint training on climate change and healthcare sustainability.
- Share strategies for reducing healthcare's carbon footprint across disciplines.
- Encourage participants to design interprofessional sustainability action plans.

Providing Continuing Professional Development (CPD) on Green Dentistry

As speakers or organizers, dental professionals can:

- Host accredited CPD courses or webinars focused on sustainable materials, technologies, and systems.
- Offer practical sessions on topics like amalgam separation, water conservation, or eco-friendly procurement.
- Include case studies and success stories from green dental clinics to inspire adoption.

Training Future Oral Health Professionals

Educators in dental schools can:

- Integrate sustainability modules into undergraduate and postgraduate curricula.
- Encourage students to conduct climate-related research or capstone projects.
- Promote student-led green initiatives and sustainability clubs within institutions.

Engaging the Community Through Public Workshops

Dental professionals can organize public awareness workshops to:

- Educate patients and families on eco-friendly oral care habits.
- Share tips on reducing waste and water use in home hygiene routines.
- Encourage sustainable lifestyles by connecting oral health to broader environmental concerns.

Emergency preparedness: Oral healthcare professionals can play a significant role in emergency preparedness related to global warming by helping their communities respond to climate-related health crises while ensuring that their own practices remain resilient in the face of environmental challenges. The dentistry profession has the responsibility to support emergency preparedness and response activities given the rising frequency of natural catastrophes, extreme weather events, and environmental changes brought on by global warming.

CONCLUSION:

Global warming has a very significant impact on oral health. Changes in climatic conditions like temperature, humidity, food availability, air and water pollution etc. can affect oral health significantly and may lead to



increased prevalence of dental caries, oral cancer, periodontal disease, dental erosion, changes in nutrition. It is a need of an hour to take essential actions to address the global warming associated issues so as to protect our oral health. Awareness is essential in recognition and management of environmental changes and their impact on oral health. Policy makers should assure that dental healthcare system can be reorganised in a manner that at least for the most disadvantaged people to get adequate

access to treatment and the oral health-care services are delivered in a coordinated manner.

Author contribution: All the authors in the present review have contributed equally.

Funding: Nil

Conflict of interest: None

Acknowledgment: Declared none

Review of recent literature published with regards to global warming/environmental changes and its impact on oral health

| Sr. No | Authors | Year | Key Finding |
|--------|----------------------------------|------|--|
| 1 | Arthur MK et al ¹ | 2019 | “The future of oral health of children appears to be in jeopardy in the face of the current climatic changes taking place, and paediatric dentists need to take cognizant of this fact and begin to mitigate the envisaged dental effects in children.” |
| 2 | Mauro HN et al ² | 2021 | This paper sought to give a perspective about the role of social and physical environmental factors on oral health conditions while discussing how the manuscripts published in this Special Issue could increase our knowledge of the topic. |
| 3 | Rawan A et al ³ | 2022 | “Daily cleaning with inter-dental cleaning aids has an environmental footprint that varies depending on the product used. Clinicians should consider environmental impact alongside clinical need and cost when recommending inter-dental cleaning aids to patients” |
| 4 | Arisson Rocha et al ⁴ | 2022 | “The extractive-productivist and linear economy system in which we are used to living is not sustainable and has been causing intense harmful changes to the environment and labor relations. Small achievements in micro-politics that are triggered by methods of collective reflection present the potential for major transformations necessary for a healthier world for all.” |
| 5 | Habib Benzian et al ⁵ | 2023 | “Oral health care professionals might take false comfort in assuming that their daily clinical work is far away from global health threats. Global pandemics have propelled global health threats to the forefront of media, public, political, and professional awareness. They also exemplified that oral health care is not shielded from such global threats. Oral health is part of global health, oral health care is an essential part of health care systems, and oral health care professionals are integral to the health care workforce. If there is anything that health care systems or health care professionals can do to address global health threats, then oral health care systems and oral health care professionals must be involved in such actions. It is important that we all sharpen our awareness, strengthen our vigilance, and act responsibly to protect the safety of patients, staff members, and communities at large.” |



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| 6 | Deshmukh C et al ⁶ | 2023 | “Oral health indicators have the potential to form early warning systems for systemic disease surveillance. By bringing dental discipline expertise to the table, oral health professionals will collaborate with medical, nursing and public health colleagues to tackle these unprecedented challenges and reinforce the status of oral health as part of overall health.” |
| 7 | Patil VS et al ⁷ | 2023 | “There is increasing evidence that the climate crisis can have a significant impact on oral health. Climate change can cause changes in temperature, humidity, and precipitation patterns, leading to the emergence and spread of infectious diseases and other health problems.” |
| 8 | Julian Fisher et al ⁸ | 2024 | “Advancing the concept of global oral health can help tackle the triple planetary crises of climate change, nature and biodiversity loss, and pollution and waste. A model for oral and planetary health places more explicit focus on understanding the state of the Earth’s systems, changing environment in relation to planetary health boundaries and their impact on human well-being. This can facilitate a planet-centric critical thinking for equity in global oral health that contributes to UN 2030 Agenda for Sustainable Development.” |
| 9 | Nadeer T et al ⁹ | 2024 | “There are several direct and indirect ways that global warming puts oral health at risk. The repercussions might include everything from an increase in cancer and oral infections to the exacerbation of illnesses caused by insufficient food and water. Those in low-income groups, elderly individuals, and children are among the most susceptible demographics. To address these concerns, technological improvements, international collaboration, and integrated public health initiatives are needed. As the environment changes, proactive measures must be taken to safeguard oral health, ensuring that dental care systems are strong and open to all people.” |
| 10 | Adeishvili T et al ¹⁰ | 2024 | “The recent Climate Change and Clinical Practice conference aimed to demonstrate clinical implications of climate change on human health, to suggest schemes that boost clinical practice resilience in the face of climate-related events, and to urge engagement of health professionals in the climate crisis discussion. Similarly, oral healthcare providers must strategies for clinical practice resilience and consider clinical manifestations of climate change in their dental patients.” |
| 11 | Nicolas Martin et al ¹¹ | 2024 | “The provision of all oral healthcare carries an environmental impact in the form of carbon footprint and SUP waste. The cumulative lifetime environmental impact of oral healthcare is proportional to the disease and treatment experience of the individual person for these preventable diseases; with a x8 difference between the two extremes of experience.” |
| 12 | Moréniké Oluwátóyìn Foláyan et al ¹² | 2024 | “The evidence on the links between SDG13 (Sustainable Development Goals) and ECC suggests that climate change may increase the risk for caries, and the management of ECC may increase environmental degradation. However, there are caries prevention strategies that can reduce the negative impact of ECC management on the environment. Context specific and inter-disciplinary research is needed to generate evidence for |



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| | | | mitigating the negative bidirectional relationships between SDG13 and ECC.” |
| 13 | S. Huang et al ¹³ | 2024 | “There is a recent and growing interest in “one health” in the oral health context. Qualitative synthesis of data highlighted the interconnectedness between the health of animals and environment with human health with implications for consideration and action by dentistry.” |
| 14 | Upendra BS et al ¹⁴ | 2025 | “A total of 10 papers were included in the final review. The findings from different papers have reported direct/indirect associations of climate change with oral diseases and conditions such as dental caries, dental erosion, and oral cancer; developmental defects of enamel; early childhood caries; periodontal disease; and dental trauma, skeletal, and dental fluorosis.” |
| 15 | Saurabh RB et al ¹⁵ | 2025 | “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.” |

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