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Review Article

Dentistry Section

Challenges and Opportunities of Public Health Dentistry in India: A Narrative Review

G KRISHNAPRAKASH[1], SIBYL SILUVAI[2], KP INDUMATHI[3]

ABSTRACT

Oral health is fundamental to overall well-being, as it influences physical health, social confidence, mental stability, and daily functioning. Public Health Dentistry (PHD) addresses oral health at the population level by developing strategies to improve access and outcomes. This narrative review examines the current state, challenges, and opportunities in PHD in India. It incorporates peer-reviewed literature as well as policy documents and strategic reports from relevant government health agencies and professional dental organisations to ensure contextual relevance and completeness. The review highlights key areas, including workforce distribution, oral health awareness, mobile dental services, and community outreach. However, persistent challenges such as insufficient manpower, limited funding and a lack of integrated policies continue to pose significant obstacles. Disparities in access to dental care between urban and rural areas underscore the need for targeted interventions to address these inequities. The review emphasises the importance of a robust national oral health policy, integrating oral health care into general health services, and fostering interdisciplinary collaboration. Newer techniques, such as teledentistry and mobile health applications, have the potential to address service deficiencies, particularly in remote or isolated areas. Enhancing community-based oral health education and targeted prevention can lead to lasting improvements in population oral health. Coordinated action among government agencies, academic institutions, and local health systems is crucial to maintain service delivery that is reliable, accessible, and sustainable. A community-centered and equitable approach is essential for reducing the prevalence of oral illnesses in India. Overall, aligning public health priorities with oral health needs can contribute to meaningful and long-term improvements in national health outcomes.

Keywords: Health promotion, Health services accessibility, Oral health disparities, Research

INTRODUCTION

India has recently become the world's most populous country, with an estimated population of approximately 1.46 billion, based on the latest United Nations data compiled by Worldometer [1]. This large population presents complex challenges for the healthcare sector, including PHD, as it increases demand and strain on existing resources [2].

Oral health is vital to overall well-being, as it influences physical, social, and mental health, as well as appearance. Oral diseases are a major concern, especially in low- and middle-income countries where prevalence is rising [3]. The World Health Organisation (WHO) reports that 3.7 billion people worldwide are affected by oral diseases, with 7% of adults experiencing complete tooth loss, rising to 23% among those aged 60 and older. Oral cancer is the 13th most common cancer globally, causing nearly 3,90,000 new cases and 1,88,000 deaths in 2022. Oro-dental trauma affects one billion people, with a 20% prevalence among children under 12 years [4]. Despite widespread impact, oral diseases are often overlooked in global health discussions as they are not considered direct causes of mortality [2].

The burden of oral health issues in India remains significantly high, largely due to a combination of systemic barriers and inequitable healthcare distribution. These barriers include limited integration of oral health into general healthcare, inadequate funding, lack of insurance, unequal access to dental care services, and insufficient preventive programmes [5]. Despite the fact that a substantial portion of the population, approximately 69%, resides in rural areas, most dental professionals continue to concentrate in urban regions, resulting in workforce imbalances and shortages even in cities [6]. These distribution issues are critical when considering the effectiveness of existing national and local health programmes. While organisations like the Indian Dental Association (IDA) have worked to improve access, current infrastructure and human resources in primary healthcare are still insufficient to meet the country's diverse dental needs [7,8].

The public healthcare system in India operates on a three-tiered structure, with primary health centres delivering basic healthcare, community health centres offering secondary-level services, and more complex care provided through referrals to tertiary and super-specialty hospitals. However, oral healthcare remains largely separate from general healthcare services. Oral healthcare services are typically absent at the primary care level, available only to a limited extent at the secondary level, and are predominantly concentrated within tertiary care facilities [3].

The field of PHD has expanded significantly in both scope and complexity, placing greater emphasis on the development of comprehensive oral healthcare systems and their impact on oral health outcomes [9]. The objective of PHD is to prevent diseases, enhance oral health, and ultimately promote general well-being through collaborative initiatives and informed decisions made by both public and private health organisations that engage with communities and individuals [10]. This specialisation concentrates on assessing the oral health needs of a population rather than individuals and enhancing their oral health [11]. This involves informing people through the implementation of dental research and the management of group dental care programmes to achieve community-wide disease prevention and control [12].

The PHD guides population-level strategies and offers expertise in monitoring, policy, prevention, and health promotion [13]. Specialists equipped with dental expertise can work effectively with communities. They make substantial contributions to advancing oral health for both the public and the dental profession [14].

Despite several initiatives and programmes aimed at improving oral health in India, a comprehensive evaluation of the existing

practices, challenges, and strategies in PHD is lacking. This narrative review aims to critically analyse the current challenges and emerging opportunities in PHD in India, with a focus on policy, workforce development, outreach activities, and technological advancements.

Oral Health Status in India

The primary objective of PHD is to drive a transformation in oral health prevention. To date, preventive dentistry initiatives have made significant strides in reducing the global prevalence of the most common oral diseases. Over the past few decades, dental caries and periodontal disease have remained the central focus of both research and practice in PHD [14].

The Global Oral Health Status Report (GOHSR) 2022 shows that India bears a high burden of oral health problems. India accounts for 18.1% of global dental caries in permanent teeth and 20.3% of severe periodontal disease. It is also responsible for 18.9% of dental caries in deciduous teeth and 9.9% of edentulism. The prevalence of periodontal disease in Indian adults ranges from 15.3% to 77.9%. Among the elderly, it ranges from 19.9% to 96.1% [15].

India is frequently identified as the "oral cancer capital" of the world, largely attributed to the high prevalence of both smoked and smokeless tobacco use, which has a well-established link to oral malignancies. A considerable number of these cases are preventable and may be significantly reduced through focused health education and preventive interventions [14]. Notably, oral cancer, including malignancies of the lip and oral cavity, accounts for 23.4% of the global burden originating from India [15].

Tobacco is a major threat in India and creates intervention opportunities for tobacco control and cessation. The Dental Council of India (DCI) has highlighted the role of PHD in cessation. Research has linked oral health to systemic diseases, including diabetes, cardiovascular diseases, pregnancy outcomes, and overall quality of life [14].

There is an urgent need for advocacy to enhance access to care, promote oral health education, and improve basic infrastructure. Public-private partnerships may significantly contribute to expanding the scope of these programmes and assuring the development of sustainable oral health delivery systems. Integrating oral health insurance into national policies could lower out-of-pocket costs and productivity losses [16].

The WHO has set ambitious 2030 oral health targets, accompanied by several initiatives aimed at raising awareness and improving access to oral health services [17]. The Indian government has also launched efforts to address oral health. The National Oral Health Programme (NOHP) encourages prevention and early detection by integrating oral health with general health services [18]. Ayushman Bharat Health and Wellness Centres (AB-HWCs) offer oral health screenings and education as part of their primary care services [19]. The National Tobacco Control Programme (NTCP) emphasises the importance of oral health in the fight against non-communicable diseases [20]. However, national schemes like Pradhan Mantri Jan Arogya Yojana and Rashtriya Swasthya Bima Yojana do not include oral health services [21].

Dental Staff and the Workforce

According to the DCI and the Indian Association of Public Health Dentistry (IAPHD), there are approximately 323 dental institutions in India, of which 281 offer postgraduate programmes [22]. Among these, 95 institutions provide postgraduate specialisation in PHD, with a total intake capacity of 262 seats. Compared with other disciplines, the postgraduate degree in PHD offers the fewest seats, despite an increased need for these professionals in developing nations such as India, where a significant portion of the population resides in rural regions. The limited number of postgraduate seats in PHD in India can be attributed to fewer institutional departments, lower student demand, and limited employment opportunities compared to clinical specialties, further constrained by DCI regulations, which limit initial intake to three seats per specialty and require stringent faculty and infrastructure criteria for expansion [23]. Over the past decade, DCI has made some efforts to establish post-graduation in PHD; however, these efforts should be intensified further by both the council and dental colleges to develop this specialty [24]. Currently, no policy requires qualified public health dentists to serve only rural communities [25].

The PHD departments in India often focus on hospital-based activities rather than community health initiatives. They tend to prioritise increasing patient admissions to dental colleges to meet outpatient requirements and are sometimes viewed as promotional tools for these institutions [26]. Many authors contend that most dental institutions in India, particularly private ones, operate mainly for profit [14]. Management is often seen as indifferent to community well-being. In many areas, dental check-ups and treatment camps offer limited benefits, and participation declines when referrals are the only option provided [2].

Oral Health Inequalities in India

In India, the concentration of dentists in urban areas has led to significant inequalities in oral healthcare, particularly in rural areas [27]. These areas experience considerable gaps in community-based preventive measures. Despite India's vast population, funding for public health remains inadequate, with no distinct allocation for oral healthcare [28].

The Universal Health Coverage (UHC) report by the Planning Commission of India highlights the absence of primary oral healthcare services as a major obstacle that could hinder the nation's progress toward achieving comprehensive UHC [29]. A dental equivalent to the "inverse care law" is observable in India, indicating that people in greatest need of oral healthcare are the least likely to obtain it [30]. The already under-resourced dental profession in India is facing unprecedented pressure from the escalating demands for oral healthcare, compelling the state and central governments to ensure equitable health services [31].

Primary Oral Health Care

Access to primary oral healthcare is inadequate in many countries, particularly in low- and middle-income nations such as India [32]. Incorporating oral health into primary health care is crucial for enhancing access and mitigating inequities, particularly in rural and disadvantaged regions [33]. Fewer than 20% of rural Primary Healthcare Centres (PHCs) nationwide employ a dentist or a public health dentist expert.

The government's goal to appoint a public health dentist at every Community Health Centre (CHC) remains largely unmet, partly because many CHCs are non-operational [34]. In some states, public health dentists at PHCs and CHCs are underutilised due to inadequate dental materials. CHCs are required to provide both emergency and dental care [14]. Most public dental facilities are poorly equipped and understaffed, and dental care is often deprioritised in budgets, forcing people to seek private care [35]. Despite efforts by organisations like the IDA, the current infrastructure and manpower in primary healthcare are insufficient for comprehensive oral care [7,8].

Roles of Public Health Dentists

Public health dentists are skilled in planning and implementing strategies, managing resources, communicating effectively, advocating for policies, analysing data, and ensuring the quality of dental services [14]. They conduct research to monitor oral diseases, evaluate programmes, assess disease aetiology, and explore links between systemic and oral health. They also improve

access and service quality for underserved populations by planning and assessing oral health programmes.

Public health dentists support preventive dentistry and multidisciplinary approaches in oral health care delivery [31]. They educate dental professionals and students about community oral health services [36]. They provide preventive services, including atraumatic restorations, oral hygiene education, and tobacco cessation programmes [37]. For complex cases, a referral system directs patients to dental surgeons as needed [38].

These preventive services would alleviate the burden of oral diseases and diminish the increasing pressure on the dental profession in India [29]. In recent years, the duties of public health dentists have expanded to include digital health innovations, such as teledentistry and mHealth applications, to enhance access to oral health, particularly following the COVID-19 pandemic [39]. These have shown promising results in rural India, where smartphone adoption is on the rise [40].

Oral Health Promotion and Education

Oral health promotion serves as a strategic approach aimed at influencing public policies, fostering supportive settings, empowering communities, building individual capacities, and realigning healthcare services to prioritise prevention. Recognising a significant health condition through its prevalence, incidence, severity, cost, or impact on quality of life is the initial stage in formulating preventative strategies [41]. The integration of community, professional, and individual interventions yields the most cost-effective and innovative approach to preventing oral diseases [41].

Community-based preventive measures such as water fluoridation, school-based screenings, and sealant programmes are effective and cost-efficient when implemented properly [42]. These strategies should be incorporated into all oral health programmes and policies, particularly to support young people at risk [43].

In India, the public and government place greater emphasis on infectious and noncommunicable diseases. The pursuit of general health should be viewed as complementary, not conflicting, with the objective of achieving oral health. In today's societal context, addressing oral health in isolation from overall health is neither practical nor effective [44]. Consequently, a common risk factor approach, encompassing general health, is essential for achieving optimal oral health [44]. Recent national initiatives, such as the Ayushman Bharat – Health and Wellness Centre (AB-HWC)s, have begun to integrate oral health education and screening, signifying notable progress in the growth of comprehensive oral health [19].

Mobile Dental Units (MDUs)

Mobile dental units have been used in PHD since 1924 [14]. MDUs serve diverse groups, including the homeless, displaced individuals, migrants, rural or isolated residents, and those in low-income areas. Some institutions use MDUs mainly for therapeutic rather than preventive care. However, MDUs can help address oral healthcare challenges for underserved populations in resource-limited countries like India. Currently, MDUs are used in community outreach, rural placements, and training for dental interns and postgraduates [45].

Dentists working in urban clinics and hospitals, particularly those with advanced training in PHD, may participate in part-time work with MDUs. This approach provides professional support and helps address personnel shortages in rural areas [46]. Preventive procedures, such as sealants and fluoride applications, should be available at dental camps [14]. States including Kerala and Maharashtra have recently piloted digital mobile dental vans equipped with electronic health records and teledentistry, enhancing patient monitoring and continuity of care.

Outreach Programmes

Dental outreach initiatives, often referred to as screening camps or check-up programmes, are common in dental institutions and offer valuable clinical experience for students [47]. The objectives of outreach activities include the following:

- Acquiring and implementing knowledge in academic endeavours;
- These programmes benefit both students and the community.
- They also provide opportunities for reflection and constructive feedback to improve and sustain the initiative.
- Fostering collaboration among communities, outreach sites, and universities is crucial for creating mutual benefits for all participants [48].

Dental camps are organised to enhance public awareness about the prevention and treatment of dental diseases. These camps play a vital role in providing dental care to underserved and rural populations. While specialists, such as Master of Dental Surgery (MDS) graduates in PHD, contribute to these programmes alongside Bachelor of Dental Surgery (BDS) graduates, their role is primarily focused on making referrals to dental colleges, rather than directly providing preventive or treatment services [9]. Outreach dental camps bridge these gaps by offering cost-effective, community-centered care [49].

Dentists utilise outreach and technology-driven information services to engage marginalised groups, providing them with information, education, and advocacy for preventive care. The COVID-19 pandemic has required changes in dental care to protect practitioners and patients [50]. Enforcing strict infection control can be challenging, especially in large programmes serving underprivileged groups [47]. Post-pandemic, hybrid outreach strategies combine in-person visits with virtual follow-ups through mobile apps and Interactive Voice Response Systems (IVRSs) in PHD [51].

The Government of Delhi's Mobile Dental Clinic Project exemplifies a systematic public outreach initiative wherein dental professionals operate fully equipped mobile clinics to provide preventive and basic curative services, along with oral health education, to slum dwellers, schoolchildren, and persons with disabilities [52]. The IDA, along with Colgate-Palmolive (India) Ltd., launched the Brush Up Challenge campaign to promote proper brushing techniques and effective oral care habits among the Indian population [53]. As part of its annual Oral Health Month, the IDA conducts various activities to raise awareness about oral health. Additionally, the All-India Dental Wellness Initiative, undertaken jointly with the Ministry of Health & Family Welfare (MoHFW), Government of India, and private partners, aims to improve oral health and develop an oral health index for the country [53].

Research in Dental Public Health

Dentistry has advanced rapidly worldwide. Although India has the highest number of dental colleges globally, dental research in the country remains in its early stages of development, and its contribution to global public health dental research is limited [54]. Recent advancements in PHD research include epidemiological studies focused on vaccine development for oral disease prevention, salivary proteomics for oral cancer detection, epigenetics, oral health literacy, dentist participation in disaster management, and problem-based learning methodologies [55].

There is increasing recognition of the need to expand public health infrastructure, particularly by establishing more PHD residency programmes and dental hygiene training courses. Furthermore, the field demands a diverse workforce that includes oral epidemiologists, health services researchers, health educators, and specialists in domains such as outcome evaluation, dental informatics, nutrition, programme assessment, and disease prevention [56]. Enhancing institutional capacity via faculty development and multidisciplinary

research training is essential to improve the quality and prominence of PHD research in India [57].

Research has contributed to significant improvements in therapeutic procedures and has enhanced critical thinking and analytical skills within the field. Conducting clinical trials can further advance patient care. Effective dental public health programmes should leverage expertise in prevention and health promotion, supported by ongoing research and evidence-based practices.

Oral Health Policy in India

Targeted policy measures are crucial for establishing a long-term, effective oral healthcare system in India. Current efforts focus on educating the public about the impact of poor oral health, developing infrastructure, expanding dental insurance, and addressing the uneven distribution of dental professionals [58]. Studies on service utilisation are vital for shaping oral health policy and understanding treatment-seeking patterns. Assessing demand, costs, and workforce capacity helps policymakers identify efficient and cost-effective ways to improve oral health services [59].

The WHO resolution encouraged Member States to address significant risk factors for oral diseases, including excessive consumption of free sugars, tobacco use, and detrimental alcohol intake, which are also prevalent in other non-communicable diseases. This finding highlights the need to enhance the competencies of oral health practitioners and suggests a shift from a curative to a preventive paradigm [60].

This encompasses the advancement of oral health in familial, educational, and occupational environments, alongside the delivery of prompt, thorough, and equitable care within the primary healthcare framework [61]. The WHO Executive Board recognised the importance of incorporating oral health into the broader non-communicable disease framework and emphasised the need to integrate oral healthcare services into universal health coverage programmes [60].

The MoHFW is formulating India's National Oral Health Policy, in accordance with the National Health Policy 2017, to promote optimal oral and orofacial health. The policy aims to develop a comprehensive understanding of the national oral disease burden by 2025 and achieve a 15% reduction in oral and/or orofacial disorders-related morbidity and mortality by 2030, through a coordinated, multisectoral, and research-driven strategy to enhance oral healthcare delivery [62].

Digital Transformation in Public Health Dentistry (PHD)

The concept of "dental informatics" first emerged in 1986 and made its initial appearance in academic literature through MEDLINE-indexed publications [63]. Public health experts face numerous challenges in integrating informatics within dentistry. In India, the adoption of dental informatics is hindered by limited financial resources, a shortage of trained personnel, inadequate academic exposure, and a lack of sufficient research literature [64]. These difficulties are further exacerbated by the underrepresentation of professionals in rural regions, poor infrastructure, the lack of a unified national oral health information system, and persistent concerns about data privacy, confidentiality, and equitable access to digital technologies [64,65].

Before the COVID-19 pandemic, digital technology in dentistry was limited to institutional or pilot projects [66]. The pandemic accelerated the adoption of teledentistry, remote consultations, and mobile oral health platforms, ensuring care when in-person visits were restricted [67]. This shift has increased acceptance of digital approaches among practitioners and patients, advancing technology-driven PHD [68].

Advances in information and communication technology are set to transform oral healthcare through informatics. To address the gap between demand and resources, states must enable effective use of digital tools [69]. Strong monitoring systems are needed to oversee public dental health initiatives. Information and Communication Technology (ICT) based training and education will help professionals adapt to and use new technologies [70].

Artificial Intelligence (AI) and Machine Learning in Public Health Dentistry (PHD)

Artificial Intelligence (AI) and machine learning are rapidly advancing, with significant potential in healthcare. In PHD, they can transform oral health assessment, diagnosis, treatment, and monitoring [71]. For example, AI-driven virtual dental assistants can perform tasks with greater accuracy, fewer errors, and less human input than traditional methods [72].

Such tasks include managing and organising routine appointments to enhance convenience for both patients and dental professionals, sending reminders based on genetic or lifestyle indicators that suggest higher risk for oral diseases, and supporting clinical decision-making in diagnosis and treatment planning [73]. AI can help mitigate worker shortages, which are now visible and anticipated to persist in many regions worldwide, thereby contributing to the achievement of the WHO Sustainable Development Goals [74].

Limitation(s)

This review has a few limitations. We did not consider studies in languages other than English for this analysis because the researchers lacked the necessary expertise to evaluate them; we conducted no quality assessment of the studies and despite a thorough search, we found only 61 studies that met the inclusion criteria.

CONCLUSION(S)

The PHD in India is at a pivotal stage, as increasing awareness of oral health coincides with persistent challenges in access, infrastructure, and workforce capacity. Although oral diseases are preventable and widespread, they are frequently overlooked in healthcare planning and policy. Progress depends on strengthening the PHD infrastructure and human resources, integrating oral health into primary care, and adopting new technologies and interprofessional collaboration. Coherent national strategies, research-driven policies, and robust stakeholder engagement are essential to ensure equitable oral healthcare for all.

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Chengalpattu, Tamil Nadu, India.
2. Associate Professor, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Chengalpattu, Tamil Nadu, India.
3. Assistant Professor, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Chengalpattu, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. G Krishnaprakash,
Room No. 107, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM IST, Chengalpattu-603203, Tamil Nadu, India.
E-mail: krishnag5@srmist.edu.in

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