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NARRATIVE REVIEW

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Oral health challenges and opportunities in rural populations: A comprehensive public health perspective

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ABSTRACT

Oral diseases constitute a major public health burden globally and disproportionately affect rural populations due to socioeconomic deprivation, limited access to care, and inadequate integration of oral health within primary healthcare systems. Despite strong evidence linking oral health with systemic diseases and overall well-being, rural oral health remains marginalized in health policy and service delivery frameworks, particularly in low- and middle-income countries such as India.

This review aims to comprehensively synthesize existing evidence on the burden, determinants, consequences, and health system challenges related to oral health in rural populations, while identifying research gaps and proposing evidence-based, policy-relevant strategies to reduce rural–urban oral health disparities.

A narrative review was conducted using PubMed, Scopus, Web of Science, Google Scholar, and official databases of the World Health Organization and the Ministry of Health and Family Welfare, Government of India. Peer-reviewed articles, national surveys, and policy documents published between 2000 and 2024 were included. PRISMA guidelines were used where applicable, to avoid confusion with a systematic review methodology.

The literature consistently demonstrates a higher prevalence of untreated dental caries, periodontal disease, tooth loss, and oral cancer among rural populations compared to urban counterparts. Key determinants include poverty, low health literacy, workforce maldistribution, infrastructural deficits, cultural practices, and inadequate policy prioritization. Preventive services are limited, and oral healthcare utilization remains largely symptom driven.

Rural oral health inequities reflect broader systemic failures in healthcare delivery. Addressing these challenges requires integration of oral health into primary healthcare, redistribution of the dental workforce, community-based prevention strategies, and sustained policy commitment to achieve universal health coverage and improved population health outcomes.

KEY WORDS

Rural oral health; Public health dentistry; Health disparities; Primary healthcare; India

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Introduction

Oral health is a core component of general health but remains insufficiently integrated into public health systems. Despite the high global burden of oral diseases, oral healthcare is often excluded from primary healthcare planning, financing mechanisms, and non-communicable disease strategies. This structural marginalization has resulted in persistent inequities, particularly in rural settings, where access to preventive and curative dental services remains limited. The continued high prevalence of avoidable oral diseases reflects systemic gaps in service organization and policy prioritization rather than deficiencies in clinical knowledge [1,2].

Rural populations experience a disproportionate burden of oral diseases, characterized by delayed care-seeking, advanced disease presentation, and irreversible outcomes. Preventive services are sparse, and oral healthcare utilization is largely symptom driven. These patterns contribute to high levels of untreated dental caries, periodontal disease, tooth loss, and oral cancer. Such disparities are closely linked to socioeconomic disadvantages, geographic isolation, and constrained health system capacity. In India, these challenges are amplified by demographic and structural factors [3].

Most of the population resides in rural areas, yet dental services are predominantly concentrated in urban centers. Although the number of dental graduates has increased substantially, workforce maldistribution persists, and rural health facilities frequently lack dental infrastructure. Oral health is rarely integrated into primary healthcare delivery, limiting opportunities for early detection, prevention, and continuity of care. Importantly, rural oral health disparities cannot be attributed solely to individual behaviors or awareness levels; they are shaped by affordability, accessibility, and availability of services within existing health systems [4]. The literature on rural oral health is extensive but fragmented. Most studies focus on estimating disease prevalence or identifying individual-level risk factors, offering limited insight into health system organization, policy context, and implementation challenges. Cross-sectional designs predominate, and findings are often reported in isolation, reducing their relevance for comprehensive public health planning [5].

A narrative review approach is appropriate for synthesizing this heterogeneous body of evidence. Narrative synthesis allows critical integration of epidemiological findings with analyses of social determinants, healthcare access, and policy frameworks. This approach facilitates examination of how structural and contextual factors interact to produce persistent rural oral health disparities, moving beyond descriptive reporting toward interpretive analysis. This review examines rural oral health through a public health lens [6]. It

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synthesizes evidence on the burden of major oral diseases in rural populations and explores the social, economic, and structural determinants underlying observed disparities. Barriers to oral healthcare access, including workforce maldistribution, infrastructure deficits, and financial constraints, are critically examined. The review also considers oral–systemic health linkages and evaluates policy and programmatic responses aimed at improving rural oral health outcomes. By integrating these domains, the review provides a consolidated understanding of rural oral health challenges within broader health system contexts [7].

The current evidence base is limited by methodological and conceptual weaknesses. Variability in diagnostic criteria and outcome measures complicate comparison across studies. Longitudinal data and implementation research are scarce, restricting understanding of disease trajectories and intervention effectiveness. Moreover, many studies inadequately address policy and governance dimensions, resulting in recommendations with limited operational relevance for rural health systems [8].

Future research should prioritize longitudinal and mixed-methods studies that examine implementation, scalability, and sustainability of rural oral health interventions. Integrating oral health into primary healthcare and non-communicable disease programs is essential for reducing disparities. Policy efforts must focus on workforce redistribution, strengthening primary-level infrastructure, and aligning oral health services with universal health coverage goals. This narrative review aims to inform such efforts by synthesizing existing evidence and identifying critical gaps requiring systemic attention.

Review Methodology

Search strategy

A comprehensive literature search was conducted across PubMed, Scopus, Web of Science, Google Scholar, and official repositories of the WHO, World Bank, and the Ministry of Health and Family Welfare (India). Search terms included combinations of: rural oral health, dental caries, periodontal disease, oral cancer, health disparities, primary healthcare, and India.

Inclusion and exclusion criteria

Studies published between 2000 and 2024.

Peer-reviewed articles, systematic reviews, national surveys, and policy documents Studies focusing on rural populations or rural–urban comparisons.

Exclusion criteria

Case reports and editorials without empirical data Studies exclusively limited to urban populations.

Study selection and synthesis

Titles and abstracts were screened for relevance, followed by full-text review of eligible articles. Data were extracted and thematically synthesized across domains of disease burden, determinants, access barriers, oral–systemic linkages, and intervention strategies. Reporting adhered to PRISMA guidelines.

Burden of oral diseases in rural populations

Dental caries

Dental caries remains the most prevalent oral disease among rural children and adults. National and regional surveys in India report caries prevalence ranging from 60% to 85% among rural schoolchildren. Contributing factors include poor oral hygiene practices, high sugar consumption, lack of fluoridated toothpaste, and minimal exposure to preventive dental services [9].

Periodontal diseases

Periodontal diseases affect more than 85–90% of rural adults above 35 years of age. Tobacco use, poor plaque control, and irregular dental visits are major risk factors. Periodontal disease often progresses untreated, leading to tooth mobility, tooth loss, and compromised mastication [10].

Tooth loss and edentulism

Premature tooth loss is highly prevalent among rural elderly populations. Prosthetic rehabilitation remains limited due to high costs, lack of awareness, and unavailability of services at primary care levels, resulting in impaired nutrition and reduced quality of life [11].

Oral cancer and potentially malignant disorders

Rural populations bear a disproportionately higher burden of oral cancer, driven by widespread use of smokeless tobacco, areca nut, and alcohol. Delayed diagnosis and limited access to oncology services contribute to poor survival outcomes [12].

Determinants of rural oral health disparities

Rural oral health disparities arise from a complex interaction of socioeconomic, structural, and behavioral determinants.

Socioeconomic factors

Poverty, low literacy levels, and unemployment limit access to preventive and curative dental care. Oral health awareness remains low, and care-seeking is often delayed until pain becomes severe.

Health system and infrastructure deficits

Most Primary Health Centres (PHCs) in rural India lack dental units or trained dental personnel. Oral health services are predominantly available at district or tertiary levels, making them inaccessible for remote communities [13].

Workforce maldistribution

Despite a rapid increase in dental graduates, over 85–90% of dentists practice in urban areas. This workforce imbalance severely limits service availability in rural regions [14].

Cultural beliefs and practices

Reliance on traditional remedies, dental quackery, and symptom-based care-seeking remains prevalent in rural communities, further delaying appropriate treatment [15].

Oral–systemic health linkages

Evidence increasingly demonstrates a bidirectional relationship between oral health and systemic conditions.

Diabetes mellitus

Periodontal disease worsens glycemic control, while uncontrolled diabetes accelerates periodontal destruction. Rural populations often remain undiagnosed and untreated for both conditions [16].

Cardiovascular diseases

Chronic oral inflammation contributes to systemic inflammatory

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burden, endothelial dysfunction, and atherosclerosis, increasing cardiovascular risk.

Maternal and child health

Poor maternaloral health is associated withadverse pregnancy outcomessuch as preterm birth and low birth weight.However, oral screening is rarely incorporated into rural antenatal care programs [17].

Barriers to oral healthcare access

Economic barriers

Dental care is largely excluded from public insurance schemes, resulting in high out-of- pocket expenditure. Cost remains the most reported barrier to care.

Geographic and physical barriers

Remote villages often require travel distances exceeding 50–100 km to access dental facilities, leading to delayed or forgone care.

Gender and social inequities

Women, elderly individuals, and marginalized communities experience disproportionate neglect due to sociocultural norms and financial dependency.

Opportunities and policy-relevant interventions

Integration of oral health into primary healthcare and NCD programs

Incorporating oral screening, prevention, and referral into primary care and NCD platforms enables early detection and addresses shared risk factors, improving coverage and continuity of care in rural settings.

Deployment of mobile dental units and tele dentistry

Mobile dental units reduce geographic barriers by delivering basic services at the community level, while tele dentistry facilitates specialist consultation, triage, and follow-up for remote populations [18].

Task-shifting to trained community health workers

Training community health workers in basic oral screening and prevention can expand service reach and improve early referral, provided standardized protocols and supervision are in place.

Incentivized rural postings for dental professionals

Financial and career-based incentives for rural service can mitigate workforce maldistribution, particularly when combined with infrastructure support and professional development opportunities.

Strengthening implementation of the National Oral Health Programme

Effective implementation of the National Oral Health Programme requires integration with primary healthcare, adequate financing, capacity building, and routine monitoring at district and state levels.

Limitations

This narrative review has several limitations that should be considered when interpreting its findings. First, as a narrative synthesis, the review does not employ quantitative meta-analytic techniques and therefore does not provide pooled prevalence estimates or effect sizes. While this approach allows for integration of diverse forms of evidence, including epidemiological studies, health systems research, and policy analyses, it may be subject to selection bias inherent to non-exhaustive literature inclusion [19].

Second, much of the available evidence on rural oral health is derived from cross-sectional studies, which limits causal inference and restricts understanding of temporal relationships between determinants, service access, and oral health outcomes. Variability in study design, diagnostic criteria, and outcome measurement across included studies further complicates direct comparison and synthesis. These methodological inconsistencies may contribute to heterogeneity in reported disease burden and determinants.

Third, the review relies largely on published literature and official reports, which may underrepresent unpublished program evaluations and local implementation experiences. As a result, certain community-based interventions or context-specific strategies may not be fully captured. Additionally, the quality and depth of policy documentation vary across regions, limiting comprehensive assessment of governance and implementation effectiveness.

Fourth, although the review emphasizes rural contexts, rural populations are not homogeneous. Differences in geography, culture, socioeconomic conditions, and health system capacity across regions may influence oral health outcomes in ways not fully disentangled in the existing literature. This limits the generalizability of some conclusions.

Despite these limitations, the review provides a consolidated public health perspective on rural oral health disparities and identifies critical gaps in evidence and policy. Future research should prioritize longitudinal and mixed-methods studies, standardized diagnostic frameworks, and rigorous evaluation of rural oral health interventions. Greater emphasis on implementation research and policy impact assessment will be essential to inform scalable and sustainable strategies. Addressing these gaps will strengthen the evidence base needed to guide effective integration of oral health into primary healthcare systems [20].

Future Directions

- Integrate oral health into primary healthcare platforms through policy and financing mechanisms to ensure routine screening, prevention, and referral pathways within existing NCD and maternal–child health programs.
- Expand and rigorously evaluate teledentistry solutions to extend specialist oversight, triage, and follow-up in remote settings.
- Standardize diagnostic criteria and surveillance indicators for rural oral health to enable comparability across studies and facilitate monitoring within routine health information systems. Promote inclusion of oral metrics in national health surveys [21].
- Incorporate outcome metrics such as treatment completion, time-to-care, and equity of access. Ensure integration with referral networks and data systems.

Conclusion

Rural oral health disparities represent a persistent and largely preventable public health challenge that reflects broader structural inequities within healthcare systems. This narrative review synthesizes evidence demonstrating that rural

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populations bear a disproportionate burden of untreated oral diseases, driven by the combined effects of socioeconomic disadvantage, workforce maldistribution, inadequate infrastructure, and limited integration of oral health into primary healthcare services. The findings underscore that rural oral health outcomes are not merely the result of individual behaviors but are shaped by systemic factors embedded within health policy and service delivery frameworks. The review highlights consistent patterns across diverse rural settings, including delayed care-seeking, symptom-driven utilization of dental services, and advanced disease presentation. These patterns contribute to avoidable morbidity, premature tooth loss, and poor oral cancer outcomes. Despite growing recognition of oral–systemic health linkages, oral health remains weakly aligned with non-communicable disease strategies and universal health coverage agendas, limiting opportunities for early detection, prevention, and coordinated care. The absence of oral health services at the primary care level represents a critical gap in achieving equitable and comprehensive healthcare. Future efforts to reduce rural oral health inequities must prioritize system-level reforms rather than isolated clinical interventions. Integration of oral health into primary healthcare, strengthening of preventive services, and redistribution of the dental workforce are central to improving access and continuity of care. From a research perspective, there is a pressing need for longitudinal studies, implementation research, and policy evaluations that assess the effectiveness, cost-efficiency, and scalability of rural oral health models. Greater attention to governance, financing mechanisms, and health system integration will be essential for translating evidence into sustainable practice. In conclusion, addressing rural oral health disparities is integral to advancing health equity and strengthening public health systems. Sustained policy commitment, supported by robust and contextually relevant research, is required to ensure that oral health is recognized and addressed as a fundamental component of primary healthcare and population health.

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