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Oral Health Disparities: A Narrative Review of Global Public Health Interventions

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Abstract This narrative review synthesizes published evidence on global public health interventions intended to reduce oral health disparities across low-income communities, rural populations, racial and ethnic minorities, indigenous groups, migrants, children and older adults. For transparency, the review focuses primarily on literature published from 2010 to 2024 and organizes evidence across individual, community and policy/system levels. Evidence from community water fluoridation, school-based preventive programs, integration of oral health into primary care, culturally tailored community engagement models, workforce innovations and selected digital delivery approaches suggests that structural and multi-level interventions are generally more effective than education-only approaches in narrowing inequity gaps. However, the strength of evidence varies substantially across settings, particularly in low- and middle-income countries and many reports describe average improvement rather than explicit reduction in disparity gaps. Community water fluoridation, school-based fluoride/sealant programs and primary-care integration appear to offer the strongest and most scalable equity-oriented benefits, whereas technology-enabled approaches require careful attention to digital exclusion, privacy and implementation feasibility. As a narrative review, this paper provides an interpretive synthesis rather than a formal systematic review; therefore, selection bias and heterogeneity in outcome reporting should be considered when applying these findings to policy.

Key Words Oral Health Disparities, Health Equity, Public Health Interventions, Social Determinants of Health, Global Oral Health, Preventive Dentistry, Access to Care

INTRODUCTION

Oral health is fundamental to overall health, wellbeing and quality of life, yet profound disparities in oral disease burden and access to dental care persist globally. Oral diseases remain largely preventable but they continue to affect billions of people and are distributed inequitably across socioeconomic, racial, geographic and political lines [1-3].

Within this review, inequality refers to observable differences in oral health outcomes between population groups, whereas inequity refers to those differences that are avoidable, unfair and shaped by social and structural disadvantage. This distinction is important because many oral health gaps are not simply clinical variations; they reflect financing arrangements, provider distribution, educational opportunity, food environments, discrimination and policy failure [4-6].

Disparities persist despite preventability because oral health systems are often treatment-oriented rather than prevention-oriented, because oral care is frequently excluded from universal coverage packages and because commercial determinants such as aggressive marketing and easy availability of sugar-sweetened products continue to undermine prevention efforts. In many settings, these pressures are amplified by weak regulation, fragmented service delivery and limited public health financing [7-10].

The COVID-19 pandemic further exposed and intensified inequities through service disruption, delayed routine care, increased financial hardship and accelerated reliance on remote consultation models. Although teledentistry expanded during and after the pandemic, digital access remains uneven and may itself become a source of exclusion if implemented without equity safeguards [11-13].

Although previous reviews have examined selected interventions or specific populations, the evidence remains fragmented with respect to which approaches reduce average disease levels, which reduce inequity gaps and which are

feasible in low-resource settings. A broader narrative synthesis can therefore help organize the field while identifying persistent implementation and evidence gaps [14-16].

Rationale for the Review: A broad synthesis is needed to clarify which intervention categories show the strongest evidence for reducing oral health disparities, in which contexts they are most feasible and where critical gaps remain in implementation, sustainability and equity-focused outcome reporting.

Objectives

This narrative review aims to:

- Summarize the nature and structural drivers of global oral health disparities
- Evaluate which public health interventions show evidence of reducing disease burden and inequity gaps
- Compare barriers, implementation factors and likely sustainability across settings
- Identify priority directions for research, policy and practice

REVIEW APPROACH

This paper is a narrative review rather than a systematic review. To improve transparency, the synthesis was informed primarily by peer-reviewed literature, major public health reports and selected policy documents published between 2010 and 2024, with older landmark sources retained where necessary for conceptual framing [17-19].

Sources were identified from major databases and reference-list searching, with emphasis on oral health equity, public health prevention, financing and policy reform, school-based programs, workforce strategies, teledentistry and community-engaged interventions. Evidence was interpreted thematically rather than pooled quantitatively because of substantial heterogeneity in intervention design, population, setting, follow-up duration and reported outcomes [20-22].

The themes presented below were organized at three interacting levels: Individual and family level, community and service-delivery level and policy/system level. Because this is a narrative review, no formal risk-of-bias grading or PRISMA-style selection flow is presented; this should be considered when interpreting the breadth and certainty of conclusions [23-25] (Table 1).

Nature and Extent of Global Oral Health Disparities

Oral health disparities manifest across multiple dimensions including socioeconomic position, race and ethnicity, geography, age, disability, migration status and country income level. The burden of untreated caries, periodontal disease, tooth loss and oral cancer remains concentrated in populations facing material disadvantage and limited access to preventive services [26-29].

These gradients are evident from early childhood through old age. Children in deprived communities commonly experience higher untreated caries levels, while older adults in long-term care and rural settings often face severe unmet need. In many low- and middle-income countries, oral disease burden coexists with minimal workforce capacity and constrained financing [30-33].

For policy purposes, it is useful to distinguish between average improvement and true disparity reduction. Many interventions improve outcomes overall but fewer demonstrate narrowing of the gap between advantaged and disadvantaged groups [34,35].

Social Determinants and Structural Factors

Oral health disparities are rooted in social determinants such as education, income, employment, housing, food environments, neighborhood infrastructure and social exclusion. These determinants operate alongside structural forces including racism, weak social protection, uneven provider distribution and underinvestment in public health prevention [36-39].

Commercial determinants are especially important in oral health. The concentration of cheap sugary foods and beverages in low-income environments, combined with marketing exposure and weak regulation, helps sustain preventable disease. Policy

Table 1: Summary of Intervention Categories and Equity Relevance

Intervention category	Typical settings	Common outcomes	Equity impact	Evidence note
Water fluoridation/fluoride delivery	Communities, schools, primary care	Caries prevalence, DMFT/dmft, untreated decay	Often pro-equity because benefits are population-wide and not visit-dependent	Strongest support among preventive interventions
School-based sealants and fluoride programs	Public schools, high-risk districts	Sealant uptake, caries reduction, unmet need	Can reduce gaps when targeted to high-risk schools	Evidence stronger than education-only models
Primary-care integration	Primary care clinics, maternal-child health services	Early preventive visits, varnish use, referral completion	Improves reach for young children and underserved families	Requires training, reimbursement, referral pathways
Workforce innovations	Rural services, community clinics, indigenous services	Access, preventive visits, basic restorative care	Potentially high equity impact where dentist shortages are severe	Dependent on regulation, supervision, retention
Technology-enabled models	Remote screening, teleconsultation, mHealth	Access, triage, adherence, monitoring	Mixed; may help remote groups but can widen digital exclusion	Evidence promising but uneven and context-dependent
Policy and financing reforms	Insurance systems, taxation, UHC packages	Utilization, emergency visits, affordability	Structural potential highest when financial barriers are reduced	Needs long-term implementation and political support

failure in these areas can therefore undermine even well-designed clinical prevention programs [40-42].

Because these determinants are upstream, education alone is rarely sufficient to close disparities. Interventions are more likely to be equitable when they reduce financial barriers, change environments and improve preventive reach independent of individual purchasing power [43,44].

Community-Based and School-Based Interventions

Community water fluoridation and community fluoride delivery remain among the best-supported population interventions. Their principal equity advantage is that benefits do not depend on appointment-seeking behavior, literacy or family income. Similarly, school-based preventive services can reach children who would otherwise have limited contact with dental care [45-48].

School-based sealant and fluoride programs are particularly important for high-risk populations but their impact depends on coverage, continuity, referral pathways and targeting strategy. Multi-component models that combine preventive services, oral health education, parental engagement and supportive school food environments appear more effective than education-only approaches [49-52].

Community health worker and community-engaged models strengthen cultural relevance and trust, especially in indigenous, migrant and low-resource communities. These models are promising when they are embedded in broader referral and financing systems rather than implemented as isolated short-term projects [53-56].

Minimally invasive approaches such as fluoride varnish and silver diamine fluoride deserve particular attention in underserved settings because they are relatively low-cost, scalable and suitable for community or primary-care delivery [57,58].

Policy, Workforce and Primary-Care Integration

Policy and systems reforms have the greatest potential to influence inequity at scale because they alter who can obtain care, what services are affordable and how prevention is embedded in public systems. Expanding oral health coverage, reducing copayments and integrating oral health into universal health coverage packages are therefore central strategies rather than optional add-ons [59-62].

Primary-care integration is especially relevant for maternal-child health, early childhood caries prevention and underserved families who already attend medical services more often than dental services. Training non-dental clinicians to provide screening, anticipatory guidance and fluoride applications can improve early preventive reach when referral systems are functional [63-66].

Workforce reforms, including the use of mid-level providers, dental therapists, expanded-function personnel and rural incentive models, can improve access in underserved areas. However, success depends on supervision frameworks, career pathways, retention incentives and local acceptability [67-69].

Culturally Tailored and Technology-Enabled Approaches

Culturally tailored and community-engaged interventions are more likely to achieve acceptance and sustained participation than externally designed programs that do not account for language, identity, trust and local priorities. Community-based participatory models are particularly valuable where historical exclusion or mistrust shapes service use [70-73].

Teledentistry and mobile health tools can improve remote triage, continuity and referral support but their equity value is conditional. Where smartphone access, internet coverage, digital literacy, privacy safeguards and reimbursement are weak, digital tools may preferentially benefit already-connected populations [74-77].

Artificial intelligence tools may eventually support screening and risk prediction but current equity evidence remains limited. Bias in data sources, inadequate validation across diverse populations and governance concerns mean that AI should be framed as an emerging adjunct rather than a proven disparity-reduction strategy [78,79].

DISCUSSION

This narrative review suggests that the interventions most likely to reduce oral health disparities are those that combine structural prevention with broad reach: community fluoridation where feasible, school-based preventive programs targeted to high-risk populations and integration of oral health into primary care and public financing systems. By contrast, education-only interventions are generally insufficient to close inequity gaps when structural barriers remain unchanged [80,81].

For low-resource settings, the most practical priorities are likely to include affordable fluoride delivery, silver diamine fluoride for arrest of caries where appropriate, school or community outreach and oral health inclusion within primary-care packages. In higher-resource settings, these strategies remain important but can be complemented by stronger financing reform, digital support systems and targeted workforce redistribution [45,57,59,63,70].

At the same time, the evidence base has important limitations. Many studies emphasize average improvement rather than explicit gap reduction. Long-term sustainability, cost-effectiveness, implementation fidelity and contextual transferability remain insufficiently reported. The evidence is also uneven geographically, with relatively fewer robust intervention evaluations from low- and middle-income countries, humanitarian settings, migrant populations, prisons and people experiencing homelessness [14,20,80,81].

As a narrative review, this paper has methodological limitations of its own. The synthesis is interpretive rather than exhaustive, it does not provide formal risk-of-bias grading and selection bias is possible. These constraints should be considered alongside the heterogeneity of the underlying literature [17-19,80,81].

Policy Priorities and Future Directions

Policymakers should prioritize interventions with both strong preventive evidence and plausible equity impact. A practical starting package for many settings would include: Community or school-based fluoride delivery, school oral health services in high-risk areas, oral health integration into primary care and financing reforms that reduce out-of-pocket barriers for essential preventive and urgent care [45,49,57,59,63].

Future research should report outcomes not only by average change but by equity metrics such as socioeconomic position, rurality, ethnicity, disability and migration status. Implementation science, cost-effectiveness and sustainability studies are urgently needed, particularly in low-resource settings. More evidence is also needed on digital equity, privacy and the real-world performance of teledentistry and AI across underserved populations [71,74-81].

CONCLUSIONS

Oral health disparities remain a major global public health problem driven by inequitable social and structural conditions rather than by individual behavior alone. The strongest and most scalable evidence supports multi-level approaches that combine population prevention, school-based delivery, primary-care integration and financing or policy reform.

Education-only approaches are rarely enough to close oral health gaps. For many low-resource settings, a practical first-step package is likely to include fluoride-based prevention, school or community outreach and integration of oral health into primary care. For higher-resource settings, the same foundation should be reinforced by coverage reform, workforce redistribution and carefully governed digital innovation.

Because this paper is a narrative review, its conclusions should be interpreted as a structured synthesis rather than a formal effectiveness ranking. Nevertheless, the direction of the evidence is clear: oral health equity is most likely to improve when prevention, access and policy are addressed together.

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