

Social Determinants of Untreated Dental Caries among Vulnerable Populations: A Scoping Review of Oral Health Inequalities

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ABSTRACT

Background: Dental caries remains the most prevalent non-communicable disease worldwide, yet its burden is disproportionately borne by socially and economically vulnerable populations. Untreated dental caries continues to represent a critical public health challenge that reflects deeper patterns of structural inequality embedded within health systems globally.

Objectives: This scoping review systematically examines the social determinants of untreated dental caries in vulnerable populations, including children, racial and ethnic minorities, immigrants, indigenous communities, homeless individuals, and incarcerated persons, with the aim of synthesizing evidence on how structural, socioeconomic, and behavioral factors intersect to perpetuate oral health inequalities.

Methods: Following the Arksey and O'Malley scoping review framework and PRISMA-ScR reporting guidelines, a comprehensive literature search was conducted across PubMed, Scopus, Web of Science, and Google Scholar databases. Peer-reviewed articles published between 2004 and 2026 examining social determinants of oral health, untreated dental caries, and oral health inequalities among vulnerable populations were included. Following screening and eligibility assessment, 32 studies were included in the final scoping review.

Results: The review identified six major categories of social determinants: (1) socioeconomic factors, including poverty, income inequality, and food insecurity; (2) access barriers, including dental insurance coverage, geographic availability, and financial affordability; (3) racial, ethnic, and indigenous disparities; (4) immigrant and refugee vulnerabilities; (5) neighborhood-level deprivation and area-level disadvantage; and (6) behavioral and psychosocial risk factors mediating socioeconomic gradients. Evidence consistently demonstrated that vulnerable populations experience two to four times higher rates of untreated caries compared to non-vulnerable counterparts.

Conclusions: Untreated dental caries in vulnerable populations is fundamentally a product of structural inequalities rather than individual behaviors alone. Addressing this burden requires upstream interventions targeting income inequality, universal health coverage, culturally appropriate service delivery, and community-level dental public health programs. Policy action must transcend individual-level approaches and integrate oral health into broader social justice frameworks.

Keywords: dental caries, oral health inequalities, social determinants of health, vulnerable populations, scoping review, health disparities

INTRODUCTION

Dental caries is the most widespread chronic disease affecting humanity, with over 2.5 billion individuals globally experiencing untreated carious lesions in permanent teeth (GBD 2021 Oral Disorders Collaborators, 2025; World Health Organization, 2024). Despite substantial advancements in preventive dentistry, untreated

caries continues to represent one of the most glaring examples of structural health inequality, with its burden concentrated among populations experiencing social marginalization, economic disadvantage, and restricted access to healthcare (Peres et al., 2019; Watt et al., 2019).

The global burden of untreated dental caries has been extensively documented. Kassebaum et al. (2015) estimated that untreated caries in permanent dentition affects approximately 2.4 billion people, while early childhood caries (ECC) remains prevalent in children under six years of age across all world regions. More recent analyses confirm that despite global progress in oral health promotion, inequalities in the distribution and treatment of dental caries have not diminished and, in some contexts, have widened (Qin et al., 2022; Wen et al., 2021).

The persistence of untreated dental caries cannot be separated from its deep embeddedness in the social determinants of health — the conditions in which people are born, grow, live, work, and age (Marmot, 2005; Solar & Irwin, 2010). Income level, educational attainment, racial and ethnic identity, immigration status, housing stability, geographic location, and insurance coverage have each been shown to exert powerful influences on oral health trajectories (Schwendicke et al., 2015; Northridge et al., 2020). Critically, these determinants operate not in isolation but through complex, intersecting pathways that compound disadvantage across the life course (Steele et al., 2015).

Vulnerable populations — including children living in poverty, racial and ethnic minorities, indigenous peoples, immigrants and refugees, homeless individuals, and incarcerated persons — consistently exhibit higher rates of untreated caries and greater unmet dental treatment needs compared to their more socially advantaged counterparts (El-Yousfi et al., 2019; Freeman et al., 2020; Venturelli et al., 2025). These disparities are not coincidental but reflect systematic patterns of exclusion from health systems, economic resources, and social protections that have been documented across high-, middle-, and low-income countries alike.

The consequences of untreated dental caries extend well beyond oral pain. For children, untreated caries is associated with disrupted sleep, poor school performance, reduced quality of life, and diminished growth outcomes (Amer et al., 2021; Corrêa-Faria et al., 2018). For adults, it contributes to systemic health complications, reduced workforce participation, psychological distress, and substantial economic costs (Freire dos Santos et al., 2025; National Academies of Sciences, Engineering, and Medicine, 2021). These downstream consequences further entrench cycles of poverty and social disadvantage, underscoring the urgent public health imperative to address dental caries as a social justice issue.

Despite growing recognition of the social determinants of oral health, the literature remains fragmented, with studies examining specific population groups or geographic contexts without synthesizing the broader cross-cutting determinants that perpetuate inequalities across vulnerable populations. This scoping review addresses this gap by mapping the existing evidence on social determinants of untreated dental caries in vulnerable populations, identifying key thematic patterns, and highlighting implications for policy and practice.

Theoretical Background

The conceptual foundation of this review draws upon established theoretical frameworks in social epidemiology and oral health equity scholarship. The World Health Organization's Commission on Social Determinants of Health model (Solar & Irwin, 2010) distinguishes between structural determinants — including socioeconomic and political contexts, social position, and governance structures — and intermediary determinants, which encompass material circumstances, psychosocial factors, and health behaviors. This framework positions oral health as shaped by forces operating at macro, meso, and micro levels, providing a coherent lens for understanding why certain populations experience systematically worse oral health outcomes.

Marmot's (2005) foundational work on social gradients in health established that health outcomes follow a continuous socioeconomic gradient rather than a simple binary between poverty and affluence. Applied to oral health, this gradient manifests in the consistent finding that as socioeconomic position declines, the prevalence and severity of untreated caries increases, while access to dental treatment decreases (Schwendicke et al., 2015; Tsakos et al., 2023). This gradient exists not only between countries at different economic development levels

but within wealthy nations with advanced health infrastructure, suggesting that structural inequalities rather than absolute poverty alone drive disparities.

Singh et al. (2016) extended this framework by examining area-level social inequalities and their relationship to population oral health outcomes, demonstrating that neighborhood deprivation, social cohesion, and institutional capacity independently predict oral health trajectories beyond individual-level socioeconomic characteristics. Complementarily, Bastos et al. (2023) analyzed how systems of oppression — including racism, colonialism, and structural exclusion — shape oral care access in the United States, positioning oral health disparities as products of historically entrenched power relations rather than individual behavioral failings.

The concept of 'vulnerability' in health research is itself contested and requires careful definition. Ruof (2004) distinguishes between intrinsic vulnerability — arising from inherent human susceptibility — and situational vulnerability, which results from specific social, political, and economic conditions. This review adopts a situational vulnerability framework, recognizing that the populations examined experience heightened oral health inequalities not because of inherent characteristics but because of socially constructed circumstances that limit their access to resources, care, and protective social structures.

METHODOLOGY

Study Design

This scoping review was conducted following the methodological framework proposed by Arksey and O'Malley (2005), further refined by Levac et al. (2010), and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).

Search Strategy

A systematic literature search was conducted across four electronic databases: PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar. The search was performed between January and March 2026 to identify studies examining the social determinants of untreated dental caries, oral health inequalities, and barriers to oral healthcare among vulnerable populations.

Search terms included combinations of keywords and Medical Subject Headings (MeSH) such as: “untreated dental caries,” “oral health inequalities,” “social determinants of health,” “vulnerable populations,” “oral healthcare access,” “dental disparities,” “socioeconomic status,” “marginalized populations,” and “oral health inequities.” Boolean operators (“AND,” “OR”) were used to refine the search strategy and improve retrieval sensitivity.

In addition to database searching, reference lists of included studies and relevant review articles were manually screened to identify additional eligible publications. Studies published in English between 2004 and 2026 were considered for inclusion.

Inclusion and Exclusion Criteria

Studies were included if they: (1) examined social determinants of dental caries or oral health inequalities; (2) focused on or included data from vulnerable population groups; (3) were published in peer-reviewed journals or as systematic reviews, scoping reviews, or meta-analyses; and (4) were available in the English language. Studies were excluded if they: (1) focused exclusively on clinical dental treatment outcomes without reference to social determinants; (2) examined oral conditions other than caries as the primary outcome; or (3) were limited to non-human subjects.

Study Selection

All retrieved records were exported and screened for duplication. Titles and abstracts were independently screened for relevance based on the predefined inclusion criteria. Full-text articles deemed potentially eligible

were subsequently assessed for inclusion. Disagreements during screening were resolved through discussion and consensus among the reviewers. The database search identified 486 records across the selected databases. After removal of duplicates and title and abstract screening, 84 full-text articles were assessed for eligibility. Following full-text review, 32 studies met the inclusion criteria and were included in the final synthesis. The study selection process is illustrated in Figure 1.

Figure 1. PRISMA-ScR Flow Diagram Illustrating the Study Selection Process for Included Studies on Social Determinants of Untreated Dental Caries and Oral Health Inequalities Among Vulnerable Populations

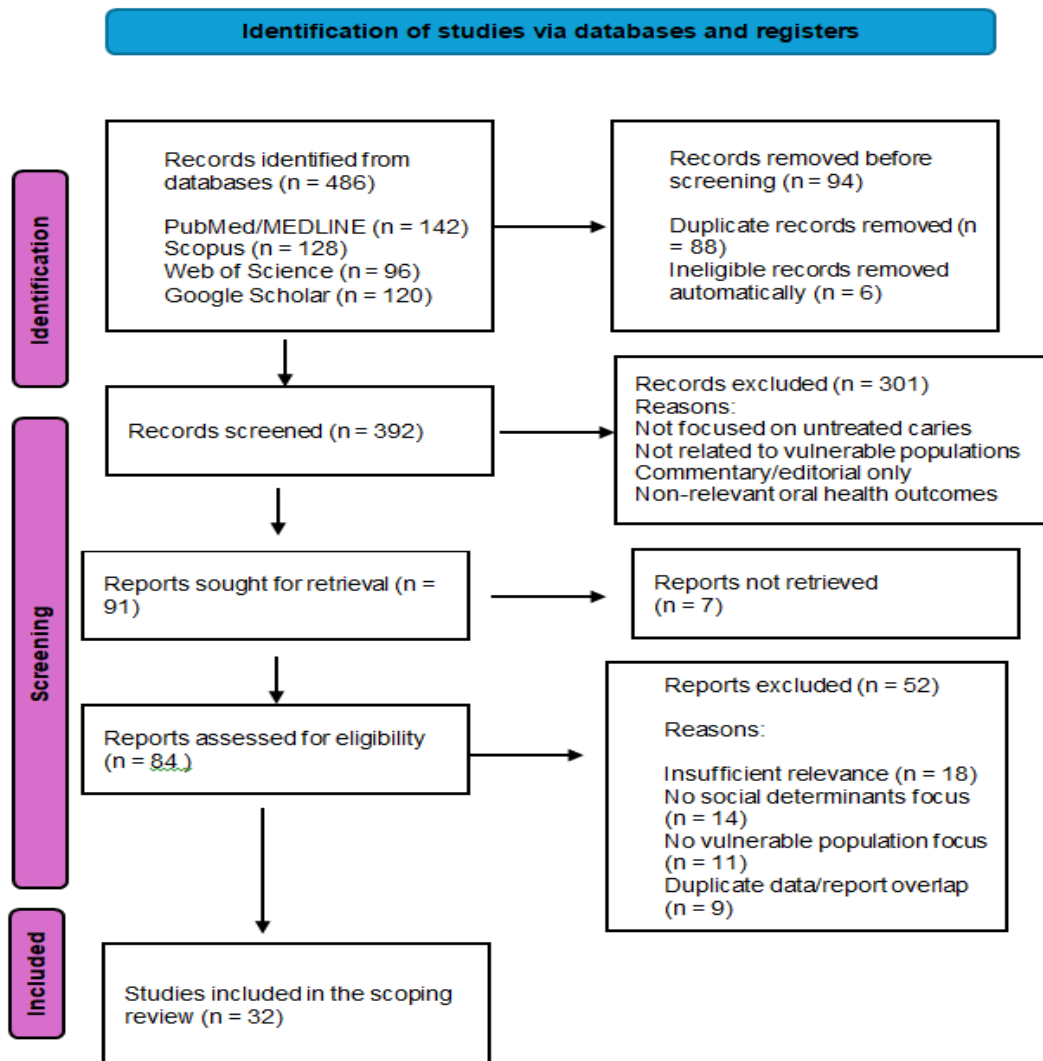


Table 1. Characteristics of Included Studies Examining Social Determinants of Untreated Dental Caries and Oral Health Inequalities Among Vulnerable Populations

No.	Author/ Year	Country/ Region	Study Population	Study Design	Key Focus/ Determinants	Main Findings
1	Kassebaum et al., 2015	Global	General population	Systematic review	Global burden, inequality	Untreated caries remains highly prevalent globally
2	Peres et al., 2019	Global	General population	Review	Oral health inequalities	Oral diseases are major public health challenges
3	Wen et al., 2021	Global	General population	Burden analysis	Inequality trends	Persistent inequalities in dental caries burden

4	Qin et al., 2022	Global	General population	Systematic analysis	Socioeconomic disparities	Caries burden disproportionately affects disadvantaged groups
5	Schwendicke et al., 2015	Multiple countries	Children and adults	Meta-analysis	SES and caries	Lower SES strongly linked to higher caries prevalence
6	Watt, 2007	Global	General population	Conceptual paper	Social determinants	Upstream determinants drive oral health inequalities
7	Watt, 2012	Global	General population	Review	Social inequalities	Structural action is required to reduce disparities
8	de Abreu et al., 2021	Global	General population	Review	Social/environmental determinants	Social environments influence oral health outcomes
9	Foley & Akers, 2019	Australia	Low-income populations	Review	Poverty	Poverty contributes significantly to dental caries
10	Ferreira et al., 2019	Brazil	Children	Cross-sectional study	Food insecurity	Household food insecurity worsens untreated caries
11	Ortiz et al., 2022	Brazil	Adolescents	Cohort study	Socioeconomic disadvantage	Lower SES associated with untreated caries
12	Lopez et al., 2023	Australia	Children	Population-based study	Social inequality	Early childhood caries linked to inequality
13	Bernabé & Hobdell, 2010	High-income countries	Children	Ecological study	Income inequality	Greater income inequality linked to childhood caries
14	Banihashem Rad et al., 2024	Global	Immigrants	Scoping review	Immigration status	Immigrants face higher oral disease burden
15	Lawrence et al., 2009	Canada	Indigenous children	Cross-sectional study	Indigenous inequality	Aboriginal children experienced poorer oral health
16	Nath et al., 2021	Global	Indigenous populations	Systematic review	Indigenous disparities	Significant oral health inequalities identified
17	Wang et al., 2024	Australia	Indigenous children	Literature review	Ethnic inequality	Indigenous children had higher caries prevalence
18	Rodriguez-Alvarez et al., 2022	Spain	Immigrant children	Cross-sectional study	Ethnicity and migration	Immigrant children had worse dental outcomes
19	Herndon & Ojha, 2022	United States	Medicaid children	Cross-sectional study	Racial disparities	Significant racial inequities in oral healthcare quality

20	Ogunbodede et al., 2015	Africa/Middle East	Rural and urban populations	Comparative review	Rural inequality	Rural communities experienced worse oral health
21	Northridge et al., 2020	United States	Vulnerable populations	Review	Access disparities	Major barriers limited oral healthcare access
22	Fisher-Owens et al., 2019	United States	Underserved populations	Review	Healthcare access	Structural barriers reduced care utilization
23	Proaño et al., 2024	Multiple countries	General population	Scoping review	Financial hardship	Dental costs contributed to oral health inequality
24	Winkelmann et al., 2023	Global	General population	Policy paper	Universal health coverage	Oral health should be integrated into UHC
25	Reda et al., 2018	Multiple countries	General population	Meta-analysis	Service utilization	Inequalities existed in dental service use
26	Amaral Junior et al., 2025	Global	General population	Burden analysis	Structural determinants	Structural inequalities influenced untreated caries
27	Sadjadpour et al., 2024	Global	Adolescents	Systems mapping	Multilevel determinants	Multiple interacting factors contribute to caries
28	Aida et al., 2008	Japan	Preschool children	Multilevel analysis	Social context	Community-level inequality affected dental caries
29	Priesnitz et al., 2016	Brazil	Preschool children	Multilevel study	Neighborhood determinants	Area deprivation influenced caries experience
30	Boyce et al., 2010	United States	Children	Observational study	Stress and disadvantage	Social stressors contributed to oral health disparities
31	Venturelli et al., 2025	United Kingdom	Vulnerable populations	Scoping review	Social vulnerability	Marginalized groups experienced oral health inequities
32	El-Yousfi et al., 2019	United Kingdom	Vulnerable populations	Rapid review	Access barriers	Vulnerable populations faced major oral healthcare barriers

Critical Appraisal of Sources

Consistent with scoping review methodology, formal critical appraisal or risk of bias assessment of included studies was not conducted, as the primary objective of this review was to map the available evidence regarding social determinants of untreated dental caries and oral health inequalities among vulnerable populations.

Data Extraction and Synthesis

Following title and abstract screening, full-text articles were retrieved and assessed for eligibility. Data were extracted using a standardized extraction form capturing study design, population characteristics, geographic setting, social determinants examined, key findings, and policy implications. Thematic synthesis was employed to organize extracted evidence into coherent conceptual categories, following the approach described by Thomas and Harden (2008). Given the heterogeneity of included studies, a narrative synthesis rather than meta-analysis was conducted.

Thematic categories were developed through an iterative, inductive process. During the initial coding phase, key concepts and determinants were identified line-by-line from each included study and assigned descriptive codes. Related codes were subsequently grouped into broader analytical categories through discussion and comparison across studies. Emerging thematic categories were then refined through constant comparison — returning to the original data to verify that categories were grounded in the evidence and remained conceptually distinct. This process resulted in the six major thematic categories presented in the results: socioeconomic factors, access barriers, racial and indigenous disparities, immigrant vulnerabilities, neighborhood determinants, and behavioral-psychosocial mediators.

RESULTS

Global Burden and Distribution of Untreated Caries

The global burden of untreated dental caries has remained stubbornly high despite decades of preventive efforts. The GBD 2021 Oral Disorders Collaborators (2025) reported that untreated caries in permanent teeth remained one of the most prevalent health conditions globally between 1990 and 2021, affecting an estimated 2.5 billion people. Qin et al. (2022) analyzed trends from 1990 to 2019, finding that while age-standardized prevalence rates declined modestly in high-income countries, absolute case counts increased in low- and middle-income countries due to population growth, reflecting deepening global inequalities.

Critically, this burden is not uniformly distributed. Wen et al. (2021) demonstrated that untreated caries disproportionately affects populations in sub-Saharan Africa, South and Southeast Asia, and Oceania, with pronounced inequalities by sex, age, and urbanization status. Amaral et al. (2025) demonstrated through GBD data that structural determinants — including Human Development Index, Gini coefficient, and access to essential health services — were the strongest predictors of national-level variations in untreated caries burden, confirming that political economy and governance structures are primary drivers of oral health inequalities at the global level.

Socioeconomic Factors

Income, poverty, and socioeconomic status emerged consistently as the most robustly evidenced social determinants of untreated dental caries across the reviewed literature. Schwendicke et al. (2015) conducted a systematic review and meta-analysis of 91 studies and found that individuals of low socioeconomic status had significantly higher caries experience and untreated caries rates compared to higher-income counterparts, with evidence of a dose-response gradient across income levels. Costa et al. (2012) reinforced these findings specifically for adult populations, documenting that low income, low education, and occupational status each independently contributed to higher rates of untreated caries.

Poverty operates on oral health through multiple mechanisms. Material deprivation limits access to dental services, preventive products such as fluoride toothpaste, and nutritious diets that support oral health (Nath & Akers, 2019; Setiawan et al., 2025). Food insecurity has been identified as a particularly important pathway: Ferreira et al. (2019) found that household food insecurity significantly explained income-related inequalities in untreated caries in Brazilian children, operating independently of dental service access. Dietary sugar consumption, which is disproportionately high in populations experiencing food insecurity due to the relative cost and availability of processed foods, is a direct behavioral mechanism linking poverty to caries risk (Sabbah et al., 2008).

Longitudinal evidence from cohort studies provides important insights into the temporal dynamics of poverty and dental caries. Ortiz et al. (2022) found that sustained socioeconomic disadvantage during adolescence predicted higher rates of untreated caries in young adulthood, demonstrating cumulative effects across developmental periods. Cousins et al. (2025) used longitudinal data linkage in Scotland to show that early life trajectories of household poverty and area-level deprivation predicted childhood dental caries rates, with persistent poverty having the strongest association. Karam et al. (2022) tracked socioeconomic inequalities in early childhood caries across three birth cohorts in southern Brazil spanning two decades, finding persistent and widening gaps in untreated caries between the lowest and highest socioeconomic quintiles despite overall

improvements in average oral health. The major social determinants consistently associated with untreated dental caries across the reviewed literature are summarized in Table 2.

Table 2. Major Social Determinants of Untreated Dental Caries Identified in the Literature

Social Determinant	Evidence Identified in Literature	Associated Oral Health Outcome
Poverty/Low income	Strongly associated with untreated dental caries across multiple studies	Higher untreated caries prevalence
Low educational attainment	Reduced oral health literacy and preventive care utilization	Poor oral hygiene and delayed treatment
Rural residence	Limited access to oral healthcare services	Increased untreated dental disease
Lack of dental insurance	Reduced affordability of dental care	Lower dental service utilization
Food insecurity	Associated with poor nutrition and cariogenic diets	Increased childhood caries
Ethnicity/Race	Marginalized ethnic groups experienced disproportionate oral disease burden	Oral health disparities
Immigration/refugee status	Language, financial, and systemic barriers reduced access to care	Higher untreated caries burden
Homelessness	Poor access to preventive and restorative dental services	Severe untreated oral disease
Social exclusion	Reduced healthcare engagement and delayed treatment-seeking	Poor oral health outcomes
Healthcare system inequities	Unequal distribution of oral health services	Persistent population-level inequalities

Access Barriers to Dental Care

Access to dental care is a critical proximal determinant of untreated caries, and access barriers operate through financial, geographic, systemic, and psychosocial pathways. Sahab et al. (2022) demonstrated that inability to afford dental care was significantly associated with untreated caries in adults, with cost being the most commonly cited reason for forgoing care across multiple national datasets. Griffin et al. (2020) analyzed US data and found substantial disparities in both dental service use and untreated caries prevalence by income level, with low-income individuals both using fewer dental services and having significantly higher rates of untreated caries.

Insurance coverage plays a pivotal mediating role in access to dental care. Borrell et al. (2023) examined access to dental insurance and oral health inequities in the United States, demonstrating that lack of dental insurance was strongly associated with untreated caries, particularly among racial and ethnic minorities and low-income adults. Jamieson et al. (2024) tracked social inequities in dental care access among Australian adults over time, finding persistent socioeconomic gradients in access that were not resolved by universal healthcare coverage alone, as dental care remained outside the publicly funded system. Sadjadpour et al. (2018) conducted a systematic review demonstrating substantial inequalities in dental service utilization across income groups, with low-income populations consistently less likely to access preventive and restorative dental care.

Geographic barriers compound financial access barriers, particularly for rural, remote, and indigenous populations. Fisher-Owens et al. (2019) documented how geographic maldistribution of dental workforce creates

systematic access barriers for underserved populations in the United States. Ogunbodede et al. (2015) highlighted pronounced oral health inequalities between rural and urban populations in Africa and the Middle East, where dental infrastructure is disproportionately concentrated in urban centers. Marquillier et al. (2021) conducted a cross-sectional study in France examining determinants of pediatric dental care access, identifying parental socioeconomic status, urban-rural geography, and cultural barriers as independent predictors of unmet dental treatment needs in children.

Racial, Ethnic, and Indigenous Disparities

Racial and ethnic minorities experience disproportionate rates of untreated dental caries across multiple national contexts, reflecting both the socioeconomic disadvantages associated with racial stratification and additional barriers rooted in systemic racism, cultural incongruence in healthcare systems, and historical exclusion. Flores and Tomany-Korman (2008) documented significant racial and ethnic disparities in dental health and access to dental services among US children, with Black and Hispanic children having higher rates of untreated caries and lower rates of dental service use compared to White children even after controlling for income. Herndon and Ojha (2022) confirmed that racial and ethnic disparities in oral healthcare quality persisted among children enrolled in Medicaid and the Children's Health Insurance Program (CHIP), indicating that insurance coverage alone does not resolve racially patterned disparities.

Indigenous populations globally experience some of the most severe oral health inequalities documented in the reviewed literature. Wang et al. (2024) conducted a literature review on inequalities in dental caries among Indigenous and non-Indigenous children in Australia, finding substantially higher caries rates and unmet treatment needs among Aboriginal and Torres Strait Islander children across multiple states and territories. Lawrence et al. (2009) documented significant oral health inequalities between young Aboriginal and non-Aboriginal children in Ontario, Canada, with Aboriginal children having markedly higher rates of severe early childhood caries. Christian and Blinkhorn (2012) characterized dental caries among Australian Aboriginal children as a health inequalities crisis rooted in historical dispossession, ongoing socioeconomic marginalization, and systematic underinvestment in community-based oral health infrastructure.

Elwell et al. (2021) employed a formative assessment approach to examine social determinants of early childhood caries in two American Indian communities, identifying poverty, food insecurity, limited access to dental services, historical trauma, and institutional distrust as intersecting determinants of elevated caries rates. Nath et al. (2023) conducted a systematic review and meta-analysis of dental caries among racially minoritized children globally, finding consistently higher caries experience across diverse racial and ethnic minority groups compared to dominant group counterparts, with evidence of substantial heterogeneity in the magnitude of disparities across geographic and policy contexts. The vulnerable populations identified in the reviewed studies and the major oral health inequalities affecting these groups are summarized in Table 3.

Table 3. Vulnerable Populations and Reported Oral Health Inequalities

Vulnerable Population	Common Oral Health Issues	Major Reported Barriers
Low-income populations	Untreated dental caries	Financial barriers and affordability
Indigenous populations	Severe childhood caries	Geographic and structural inequities
Refugees and immigrants	Untreated oral disease	Language and access barriers
Rural populations	Limited preventive care	Workforce shortages and distance
Homeless populations	Advanced dental disease	Lack of stable healthcare access
Children in disadvantaged households	Early childhood caries	Food insecurity and low oral health literacy

Elderly vulnerable adults	Tooth loss and untreated decay	Limited mobility and affordability
Socially excluded groups	Delayed treatment	Stigma and healthcare exclusion

Immigrant and Refugee Vulnerabilities

Immigrant and refugee populations face compounded vulnerabilities in oral health access and outcomes, arising from language barriers, legal status uncertainties, poverty, cultural barriers, and fragmented healthcare entitlements across host countries. Rad et al. (2024) conducted a scoping review of oral health inequalities in immigrant populations globally, finding consistently higher rates of dental caries and periodontal disease compared to host country native-born populations across Europe, North America, and Australia. Banihashem Rad et al. (2024) confirmed these patterns, identifying language barriers, unfamiliarity with host country health systems, and lack of dental insurance as primary access barriers for immigrant populations.

Soares et al. (2024) examined additive effects of immigrant status, education level, and neighborhood disadvantage on oral health outcomes, introducing the concept of 'triple jeopardy' — wherein the intersection of immigration, low education, and residential disadvantage confers substantially higher oral health risk than any single factor alone. Rodriguez-Alvarez et al. (2022) documented immigrant status and ethnic inequities in dental caries among children in Bilbao, Spain, finding that children from immigrant backgrounds had significantly higher caries experience than native-born Spanish children, with socioeconomic factors explaining only part of this disparity. Bhusari et al. (2020) reviewed dental caries rates among refugees in Europe, finding high prevalence of untreated caries and substantial unmet dental treatment needs attributable to restricted access to publicly funded dental services, language barriers, and psychological challenges associated with displacement and trauma.

Homeless and Economically Marginalized Adults

Homeless and extremely economically marginalized adults represent one of the highest-risk groups for untreated dental caries and severe oral disease, reflecting the culmination of multiple intersecting social determinants including absolute poverty, housing instability, substance use, mental health conditions, and exclusion from mainstream healthcare systems. Freitas et al. (2019) documented high rates of untreated dental caries and poor access to dental services among older homeless adults in San Francisco, with findings demonstrating that dental caries was one of the most prevalent unmet health needs in this population. Daly et al. (2010) assessed oral health care needs and oral health-related quality of life in homeless people in the United Kingdom, finding severe levels of untreated caries alongside dramatically impaired oral health-related quality of life.

Csikar et al. (2019) identified the specific barriers faced by homeless individuals in achieving oral health, including shame and stigma associated with dental appearance, lack of stable address required for dental registration, competing survival priorities, and negative past healthcare experiences. Patel et al. (2018) similarly documented how poverty, homelessness, and complex social needs created systemic barriers to dental public health services among vulnerable adults in Plymouth, United Kingdom, highlighting the need for flexible, outreach-based dental service models that reduce structural access barriers.

Incarcerated Populations

Incarcerated individuals represent a particularly underexamined vulnerable population in the oral health literature, despite evidence of substantially elevated rates of untreated dental disease. Mostafa et al. (2026) conducted a scoping review of oral health in incarcerated young people, identifying high rates of untreated caries alongside significant barriers to dental care within correctional facilities, including limited service provision, staff shortages, and inadequate resources for preventive dentistry. Pre-incarceration socioeconomic deprivation, histories of substance use, and limited access to dental care in the community before incarceration all contribute to elevated dental care needs among this population.

Baker et al. (2019) documented oral health inequalities among socially vulnerable population groups in the United Kingdom, including individuals with criminal justice system involvement, finding that these groups

shared common structural risk factors including poverty, housing instability, and social exclusion that collectively drove elevated rates of untreated caries. The oral health of incarcerated populations reflects both the pre-existing disadvantages that disproportionately affect incarcerated persons — who are overwhelmingly drawn from marginalized socioeconomic groups — and the additional deprivation imposed by incarceration itself, including restricted access to dental care, substandard nutrition, and limited preventive resources.

Neighborhood and Contextual Determinants

Beyond individual and household-level socioeconomic characteristics, neighborhood-level and contextual determinants independently shape oral health outcomes. Priesnitz et al. (2016) conducted a multilevel study demonstrating that neighborhood-level socioeconomic characteristics predicted dental caries in preschool children after controlling for individual family factors. Aida et al. (2008) used multilevel analysis of Japanese children to demonstrate that social context — including neighborhood social cohesion and collective efficacy — contributed independently to inequalities in dental caries experience. Pellegrom et al. (2024) examined the Social Vulnerability Index and dental caries in US children, finding that children residing in neighborhoods with higher social vulnerability had significantly elevated rates of untreated caries.

The mechanisms through which neighborhood context affects oral health operate through multiple pathways: access to dental services is shaped by the density and distribution of dental practices within neighborhoods; availability of fresh, nutritious food versus energy-dense, cariogenic processed foods is determined by neighborhood food environments; social norms and peer behaviors influence oral hygiene practices; and cumulative stress associated with living in disadvantaged neighborhoods activates biological pathways affecting oral health (Boyce et al., 2010). Sadjadpour et al. (2024) used systems mapping to visualize the multilevel, interconnected factors contributing to dental caries in adolescents, demonstrating how neighborhood, family, and individual factors interact within complex adaptive systems.

Behavioral and Psychosocial Mediating Factors

While structural determinants are primary drivers of oral health inequalities, behavioral and psychosocial factors function as important mediating pathways. Sabbah et al. (2008) demonstrated that oral health behaviors — including tooth brushing frequency, dental attendance, and smoking — mediated a substantial portion of the socioeconomic gradient in oral health outcomes, though a residual gradient persisted after behavioral adjustment, indicating that behaviors do not fully explain structural inequalities. Peres et al. (2019) similarly found that modifiable factors — dietary sugar intake, fluoride exposure, and dental attendance — explained a significant portion of socioeconomic inequalities in children's dental caries, providing a behaviorally-mediated pathway for intervention.

Psychosocial stress constitutes a particularly important mediating pathway between socioeconomic disadvantage and dental caries. Boyce et al. (2010) proposed that social inequalities in childhood dental caries arise through the convergent roles of stress, cariogenic bacteria, and socioeconomic disadvantage, with stress-related neuroendocrine dysregulation altering saliva composition, mucosal immunity, and oral biofilm dynamics in ways that increase caries susceptibility. This biopsychosocial pathway helps explain why socioeconomic gradients in dental caries persist even after controlling for behavioral risk factors, as stress operates through biological mechanisms independent of individual oral health behaviors. The principal policy recommendations and proposed strategies for reducing oral health inequalities identified across the reviewed literature are summarized in Table 4.

Table 4. Recommended Strategies to Reduce Oral Health Inequalities

Recommended Strategy	Target Determinant	Expected Public Health Impact
Universal oral healthcare coverage	Financial barriers	Improved access to dental services
School-based oral health programs	Childhood vulnerability	Early prevention and education

Community fluoridation initiatives	Geographic inequality	Reduced caries prevalence
Mobile/community dental clinics	Rural and underserved populations	Expanded service accessibility
Oral health literacy campaigns	Low education and awareness	Improved preventive behaviors
Integration of oral health into primary healthcare	Fragmented health systems	Better continuity of care
Workforce expansion in underserved regions	Rural workforce shortages	Increased healthcare availability
Policies addressing social inequalities	Structural determinants	Long-term reduction in oral health disparities

DISCUSSION

This scoping review provides comprehensive evidence that untreated dental caries in vulnerable populations is fundamentally a product of structural inequalities operating across multiple intersecting social determinants. Evidence across diverse geographic contexts and population groups converges to demand a reconceptualization of dental caries from a biomedical condition amenable to individual behavioral change toward a social disease requiring structural intervention.

The evidence reviewed demonstrates that two to four times higher rates of untreated caries among vulnerable populations compared to socially advantaged counterparts reflect systematic patterns of exclusion from dental care rather than differential individual preferences or personal responsibility. When studies control for access to dental services and insurance coverage, residual disparities persist, indicating that financial barriers alone do not fully account for observed inequalities and that additional structural factors — including systemic racism, language barriers, geographic maldistribution of dental workforce, and social exclusion — independently drive disparities (Northridge et al., 2020; Bastos et al., 2023).

The life course perspective emerging from longitudinal evidence is particularly important for policy formulation. Cousins et al. (2025) and Karam et al. (2022) demonstrate that early childhood exposure to poverty and neighbourhood disadvantage has lasting effects on dental caries trajectories into adolescence and adulthood, suggesting that interventions targeting structural disadvantage in early childhood may yield the greatest returns for oral health equity. This aligns with broader evidence from social epidemiology on the importance of early life conditions in shaping long-term health trajectories.

The intersection of multiple vulnerabilities — immigration status, low education, and neighbourhood disadvantage — documented by Soares et al. (2024) represents a critical conceptual advance, suggesting that oral health inequalities cannot be adequately understood by examining single determinants in isolation. Intersectionality frameworks that account for how multiple systems of disadvantage compound one another are essential for developing targeted interventions for the most marginalized populations. This has practical implications for dental public health practice: interventions that address only one dimension of disadvantage, such as providing free dental care without addressing transportation barriers, childcare constraints, or language access, may fail to reach those most in need.

The evidence on neighborhood-level determinants adds an important spatial dimension to understanding oral health inequalities. Dental workforce maldistribution — whereby dentists concentrate in affluent urban and suburban areas and underserve rural and low-income communities — is a structural barrier that requires regulatory and incentive-based policy responses beyond individual-level interventions (Fisher-Owens et al., 2019; Winkelmann et al., 2023). Universal health coverage that incorporates dental care, as recommended by Winkelmann et al. (2023), is a necessary but not sufficient policy response; such coverage must be complemented by active dental workforce development and distribution policies that ensure meaningful access for underserved populations.

Several limitations of the reviewed evidence merit acknowledgment. The majority of high-quality studies originate from high-income countries — particularly the United States, United Kingdom, Australia, and Brazil — limiting generalizability to low- and middle-income country contexts where the burden of untreated caries is highest and social determinants may operate through distinct mechanisms. Methodological heterogeneity across studies, including variation in caries measurement criteria, socioeconomic indicator operationalization, and population definitions, limits direct comparisons and cumulative quantification of effect sizes. Publication bias may further limit the representation of negative or null findings in the reviewed evidence.

Limitations

Several limitations should be considered when interpreting the findings of this scoping review. First, only studies published in the English language were included, which may have excluded relevant evidence published in other languages and limited the global comprehensiveness of the review. Second, the included studies demonstrated substantial heterogeneity in study design, population characteristics, outcome measures, and definitions of vulnerability, making direct comparison across studies challenging. Third, as a scoping review, this study aimed to map and synthesize existing evidence rather than assess the methodological quality or risk of bias of individual studies. Additionally, publication bias may have influenced the available literature, as studies reporting significant disparities and inequalities are more likely to be published. Finally, although multiple databases were searched, some relevant grey literature and unpublished studies may not have been captured.

POLICY IMPLICATIONS AND RECOMMENDATIONS

The evidence synthesized in this review supports a multilevel, upstream policy framework for addressing social determinants of untreated dental caries in vulnerable populations. Recommendations are organized across three levels of intervention:

At the structural policy level, the integration of dental coverage into universal health coverage schemes is a foundational requirement for reducing inequalities in untreated caries (Winkelmann et al., 2023). Countries that exclude dental care from publicly funded health systems — as is the case in most national health systems globally — systematically disadvantage low-income populations who cannot afford private dental care. Income support programs, housing stability interventions, and food security policies address the upstream structural determinants of dental caries and are likely to yield oral health co-benefits alongside broader health improvements (Stennett et al., 2026).

At the health system level, dental workforce distribution policies that incentivize practice in underserved communities — including loan repayment programs, dental public health infrastructure investment, and community health center expansion — are essential for reducing geographic access barriers. Culturally and linguistically appropriate dental services, particularly for immigrant, refugee, and indigenous populations, require investment in interpreter services, cultural competency training, and community-based dental care models that engage trusted community intermediaries (Paisi et al., 2022; Vaishampayan et al., 2025).

At the community and individual level, school-based dental programs, community water fluoridation, preventive sealant programs targeting high-risk populations, and oral health literacy initiatives represent evidence-informed upstream interventions that can reach vulnerable children and families through non-clinical settings (van Meijeren-van Lunteren et al., 2023; Stennett et al., 2026). Do et al. (2023) identified socioecological determinants of child oral health that can be addressed through comprehensive community-based programs integrating oral health with broader family support services.

Critically, policy responses must be informed by and co-designed with the affected communities rather than imposed as top-down technical solutions. The historical failure of oral health programs targeting indigenous and other marginalized populations — documented by multiple included studies — reflects the inadequacy of interventions that do not engage community perspectives, cultural values, and existing social capital (Elwell et al., 2021; Foláyan et al., 2025).

Particular attention is warranted for oral health policy in low- and middle-income countries (LMICs), where the absolute burden of untreated dental caries is greatest yet evidence-based policy models remain scarce. In sub-Saharan Africa, South Asia, and Southeast Asia, structural barriers are compounded by severely limited dental workforce capacity, near-absent public oral health financing, and healthcare systems that have historically deprioritized oral health relative to communicable disease control (Singh et al., 2022; Yousaf et al., 2022). Feasible policy pathways for LMICs include integrating oral health into existing primary healthcare infrastructure, training community health workers in basic preventive oral health promotion, scaling up community fluoride programs adapted to local water supply conditions, and leveraging digital health platforms to extend oral health education to geographically remote populations. International development frameworks — including the Sustainable Development Goals and Universal Health Coverage commitments — provide an enabling policy environment for LMIC governments and donors to prioritize oral health equity as a component of broader health system strengthening (Foláyan et al., 2025; Winkelmann et al., 2023).

CONCLUSION

This scoping review demonstrates conclusively that untreated dental caries in vulnerable populations is a manifestation of structural inequality rather than individual behavioral failure. Poverty, racial and ethnic discrimination, immigration vulnerability, housing instability, neighborhood deprivation, and systemic barriers to dental care access collectively and cumulatively produce the substantial oral health disparities documented across diverse global contexts. The consistent gradient from social advantage to disadvantage observed in untreated caries rates across virtually all reviewed studies reflects the powerful influence of social structures on biological health outcomes.

Addressing this burden requires a paradigm shift in dental public health policy — from an individual, clinically-oriented model that places the burden of oral health maintenance on patients, toward a structural, equity-focused model that addresses the social conditions that make optimal oral health impossible for marginalized populations. This requires political will to integrate dental care into universal health coverage frameworks, invest in dental workforce development for underserved communities, and address the upstream socioeconomic conditions that are the primary drivers of oral health inequalities.

Future research should prioritize: longitudinal studies examining how social determinants of oral health operate across the life course in low- and middle-income country contexts; intersectionality analyses that examine how multiple overlapping vulnerabilities compound oral health risk; and rigorous evaluation of structural interventions targeting social determinants of oral health in diverse policy environments. The growing evidence base reviewed here provides a strong foundation for the policy action necessary to realize oral health equity for vulnerable populations globally.

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