

Global and regional progress towards reduced burden of oral conditions between 2019 and 2023: a systematic analysis for the Global Burden of Disease Study 2023



GBD 2023 Oral Disorders Collaborators*



Summary

Background WHO's Global Oral Health Action Plan (GOHAP) targets include a 10% relative reduction in the combined prevalence of main oral conditions by 2030. The first GOHAP evaluation was planned for 2023, with subsequent evaluations scheduled for 2026 and 2030. The aim of this systematic analysis of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2023 was to evaluate global and regional progress (2019–23) towards this target and related complementary indicators.

Methods Using modelled estimates from epidemiological surveys and registries in 204 countries and territories, we estimated the age-standardised prevalence of untreated caries in deciduous and permanent teeth, severe periodontitis, edentulism, other oral disorders and orofacial clefts, and the age-standardised incidence of lip and oral cavity cancer. Progress towards GOHAP targets was measured by comparing the percentage change from 2019 to 2023 in the above indicators against the stated GOHAP target of a 10% relative reduction.

Findings Globally, the age-standardised prevalence of main oral conditions declined (–1·55% [95% uncertainty interval –2·32 to –0·82]) between 2019 and 2023, but global cases increased by 3·07% (2·32 to 3·75), from 3·62 billion (3·35 to 3·95) to 3·73 billion (3·45 to 4·06). Among complementary indicators, reductions in age-standardised prevalence were observed for untreated caries in permanent teeth (–1·99% [–2·49 to –1·40]) whereas the age-standardised incidence of lip and oral cavity cancer increased (8·35% [0·13 to 16·32]), as did the age-standardised prevalence of orofacial clefts (2·25% [0·77 to 3·83]). Progress was heterogeneous across GBD super-regions, with south Asia having the largest reductions in the age-standardised prevalence of main oral conditions (–3·34% [–4·95 to –1·80]) and untreated caries in deciduous teeth (–9·09% [–17·62 to –0·08]). Sub-Saharan Africa showed the largest increase in prevalent cases of main oral conditions (9·51% [8·09–10·94]) and age-standardised incidence of lip and oral cavity cancer (14·86% [1·19–32·45]). The high-income super-region had an increase in the age-standardised prevalence of main oral conditions (1·24% [0·56–1·96]) and untreated caries in deciduous teeth (9·21% [6·60–11·89]).

Interpretation Our modelled estimates of global trends in the prevalence of oral conditions from 2019 to 2023 suggest that early progress is modest and, at the current pace, insufficient to meet the 2030 GOHAP targets. Accelerated, equity-focused prevention and integration of essential oral health-care services within primary care and universal health coverage are needed, alongside strengthened oral cancer control and congenital anomaly care.

Funding The Gates Foundation.

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Introduction

Oral diseases are a foundational yet persistently underprioritised component of global health, with far-reaching implications for quality of life, health equity, and health systems worldwide.^{1–3} Despite being largely preventable, the burden of oral diseases has remained high over the past three decades,⁴ and its economic and social costs underscore the urgent need for robust, equitable global strategies.⁵ Recognition of oral diseases within global public health agendas, including WHO's Global Oral Health Action Plan (GOHAP) and related policy initiatives,^{6,7} reflects an imperative to embed oral disease prevention and health care in broader health systems to achieve sustainable improvements in population health.^{8–10}

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) provides one of the few globally comparable resources for estimating the oral disease burden across locations and over time.^{11,12} Data from GBD 2019 were instrumental in setting evidence-based targets within the WHO GOHAP 2023–2030. GOHAP is a call to action that outlines 11 global targets, six strategic objectives, and 100 recommended actions to be achieved by 2030.⁶ The GOHAP monitoring framework establishes two key overarching global targets: to achieve universal coverage for oral health-care services (target A) and to reduce the oral disease burden (target B). Specifically, target B calls for a relative reduction of 10% by 2030 in the combined global prevalence of the main oral conditions over the life course. Ten complementary indicators accompany overarching

Lancet Public Health 2026;
11: e630–41

*Collaborators listed at the end of the Article

Correspondence to:
Professor Eduardo Bernabe,
Institute of Dentistry, Queen
Mary University of London,
London E1 2AD, UK
e.bernabe@qmul.ac.uk

Research in context

Evidence before this study

Oral conditions are highly prevalent and contribute to substantial disability globally, but international reporting has often been fragmented, focusing on individual diseases or select regions. Previous systematic analyses for the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) have generated comparable global estimates for oral conditions. GBD 2010 showed that increases in prevalence and disease burden were largely driven by population growth and ageing, offsetting improvements in age-standardised rates. GBD 2015 reported little progress towards achieving the joint World Dental Federation/WHO goals of reducing oral disease levels by 2020. GBD 2017 quantified the inequalities in burden by World Bank income groups. GBD 2019 estimates supported the development of evidence-based targets within the WHO Global Oral Health Action Plan (GOHAP) 2023–2030. GBD 2021 estimates reported global, regional, and national trends in the burden of oral conditions through 2021; however, these analyses predated, or were not organised around, the GOHAP monitoring framework.

Added value of this study

Using data from GBD 2023, we provide the first assessment explicitly aligned with the GOHAP monitoring framework and

evaluate early progress during its first evaluation period (ie, 2019–23). We estimated prevalent cases and age-standardised prevalence for untreated caries in deciduous and permanent teeth, severe periodontitis, edentulism, other oral disorders, orofacial clefts, and incident cases and age-standardised incidence for lip and oral cavity cancer. We report the percentage change from 2019 to 2023 with 95% uncertainty intervals at global and GBD super-region levels. Compared with previous GBD analyses, which have emphasised long-term trends, this study reframes GBD outputs into a short-cycle accountability assessment for GOHAP, identifying where progress is occurring, stalling, or reversing.

Implications of all the available evidence

Progress towards achieving one of the two overarching GOHAP targets of a 10% reduction in global prevalence of main oral conditions by 2030 has been uneven across the seven GBD super-regions. Successfully achieving all the WHO GOHAP targets will require accelerated, equity-focused prevention and integration of essential oral health-care services within universal health coverage, alongside targeted action for oral cancer control and cleft care in regions with rising burden.

global target B, six of which relate to reductions in the prevalence of untreated caries of deciduous teeth (indicator B.4), untreated caries of permanent teeth (B.5), severe periodontitis (B.6), edentulism (B.7), and orofacial clefts (B.9), and reductions in the incidence of lip and oral cavity cancer (B.8). WHO used data from GBD 2019 to establish baseline measures for the GOHAP targets. The first evaluation of GOHAP was scheduled for 2023, with follow-up assessments planned for 2026 and 2029–30.⁶

A comprehensive understanding of current trends in oral conditions is essential to drive urgent action and inform long-term policy planning. The aim of this analysis, conducted as part of GBD 2023, was to evaluate global and regional progress towards the GOHAP targets for the prevalence of oral conditions between 2019 and 2023. Country-level progress was not evaluated due to the global scope of the GOHAP targets.

Methods

Study overview

This study was designed as a monitoring and accountability analysis of progress towards the GOHAP targets, rather than as a causal assessment of epidemiological change or policy effectiveness. Accordingly, the GBD estimates should be interpreted as modelled approximations that integrate diverse data sources and rely on explicit statistical assumptions. Additionally, the short observation window (2019–23), chosen to align with the GOHAP initial monitoring period, might limit the ability to detect

structural changes in disease patterns and should be understood as reflecting early progress rather than long-term trends.

This study was developed as part of the GBD Collaborator Network and GBD Protocol,¹³ with support from the GBD Secretariat, the Institute for Health Metrics and Evaluation (IHME), and the GBD Oral Disorders Collaborator Network under IHME ID 6181. Ethical approval was not required for this study. The complete GBD methodology is available in the primary reports of GBD 2023 and their accompanying appendices.^{14,15} Our study complies with the GATHER statement,⁸ and the GATHER checklist is available in the appendix (p 38).

Data sources

Seven oral conditions were evaluated: untreated caries in deciduous teeth; untreated caries in permanent teeth; severe periodontitis; edentulism; other oral disorders; lip and oral cavity cancer; and orofacial clefts. Case definitions and corresponding ICD-10 codes are shown in table 1. The term main oral conditions refers to the combined group of untreated caries, severe periodontitis, edentulism, and other oral disorders.

Data on untreated caries, severe periodontitis, and edentulism were identified through systematic searches of PubMed, Embase, the Latin American and Caribbean Health Sciences Literature, the Scientific Electronic Library Online, and the Global Health Data Exchange. Data on lip and oral cavity cancer were obtained from

See Online for appendix

	Untreated caries in deciduous teeth	Untreated caries in permanent teeth	Severe periodontitis	Edentulism	Other oral disorders	Lip and oral cavity cancer	Orofacial clefts
Reference definition	Coronal cavity at dentin level or root cavity in cementum	Coronal cavity at dentin level or root cavity in cementum	PPD ≥ 6 mm (CPI/TN 4 or CPI 4 or PPD > 5 mm) or CAL ≥ 6 mm	No remaining permanent teeth from clinical oral examination	Dental, tongue, or jaw disorders not included elsewhere	Malignant neoplasms of the lips and oral cavity	Isolated cleft palate and cleft palate with or without cleft lip
ICD-10 code	K02-K02.9	K02-K02.9	K05-K06.9	K08.0-K08.499	K00-K01.1, K03-K04.99, K07-K08, K08.8-K14.9, M26-M27.9	C00-C07, C08-C08.9	Q35-Q37.9
Alternative definitions	Percentage of DMFT > 0 with DT/DMFT ratio	Percentage of DMFT > 0 with DT/DMFT ratio	CAL ≥ 5 mm, CAL ≥ 4 mm, or PPD ≥ 5 mm	No remaining permanent teeth from self-reports	None	None	None
Data harmonisation: cross-walking using MR-BRT	Alternative to reference definition for people aged < 20 years	Alternative to reference definition for people aged < 20 years	Alternative to reference definition	Used before GBD 2021, but not since then	None	Cancer registry data to vital registration data	Sources excluded to sources that included chromosomal diagnosis
Location-level covariates	LN-LDI and high prevalence of SSB intake	LN-LDI and high prevalence of SSB intake	LN-LDI, smoking prevalence, and high plasma glucose prevalence	LN-LDI, smoking prevalence, and high plasma glucose prevalence	None	HAQ index	HAQ index, LN-LDI, folic acid per capita, composite fortification standard, and folic acid inclusion
Correction for edentulism	No	Yes	Yes	No	No	No	No

CAL=clinical attachment loss. CPI=community periodontal index. CPITN=community periodontal index of treatment need. DMFT=decayed, missing, and filled teeth. DT=decayed teeth. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study. HAQ=Healthcare Access and Quality. LN-LDI=natural logarithm of the lag-distributed income per capita. MR-BRT=meta-regression-Bayesian, regularised, trimmed. PPD=probing pocket depth. SSB=sugar-sweetened beverages.

Table 1: Case definitions and key modelling inputs for each oral condition

population-based cancer registries and vital registration systems. Data on orofacial clefts were derived from birth defects registries, hospital records, insurance claims, and published literature. Data sources used to produce GBD 2023 estimates are listed in the GBD 2023 Sources Tool. More details of the data-seeking approach and data coverage for each oral condition are provided in the appendix (p 4).

Data processing and disease modelling

Data processing included age–sex splitting, harmonisation to reference definitions, covariate adjustment, and correction for edentulism and comorbidity correction (table 1). Input data on all oral conditions except for lip and oral cavity cancer were analysed with Disease Modelling Meta-Regression (DisMod-MR 2.1) to estimate prevalence, incidence, and mortality by year, age, and sex across 204 countries and territories. For locations with no data inputs, DisMod-MR 2.1 applied a cascading approach across five hierarchical levels (global, GBD super-region, region, country, and subnational), using data from higher levels and country-specific covariates as priors for lower-level estimates.¹⁴ For lip and oral cavity cancer, mortality was estimated with the Cause of Death Ensemble model (also known as CODEm) to generate cause-specific mortality by age, sex, location, and year. Cancer incidence was derived from these mortality estimates using mortality-to-incidence ratios modelled with spatiotemporal Gaussian process regression.¹⁶ Percentage changes are reported to two decimal places

whereas counts of cases, prevalence, and incidence are reported to three significant figures.

Assessment of progress towards GOHAP targets

To align with the GOHAP overarching global target and complementary indicators, we report the count of prevalent cases and age-standardised prevalence for all oral conditions except for lip and oral cavity cancer, for which the count of incident cases and age-standardised incidence rate were reported. Age standardisation (per 100 000 population) was done with the GBD standard population to account for variations in both population size and age structure.¹⁷ Estimates for main oral conditions were adjusted for comorbidity with a microsimulation of 20 000 individuals per location-age-sex-year group. Each condition was assigned on the basis of its marginal prevalence, assuming independence, and combined prevalence was calculated as the proportion of individuals with at least one condition, approximated by $1 - \prod (1 - p_i)$, where p_i is the prevalence of each individual oral condition.

We assessed global and regional progress towards GOHAP targets by comparing the percentage change from 2019 to 2023 in the number of prevalent or incident cases, as well as in age-standardised prevalence or incidence, against the stated GOHAP target of a 10% relative reduction. Uncertainty was propagated throughout the estimation process. Estimates represent the mean value across 250 draws from the estimate's distribution, with 95% uncertainty intervals (UIs) calculated as the 2.5th and 97.5th percentile values across

For the GBD 2023 Sources Tool see <https://ghdx.healthdata.org/gbd-2023/sources>

	Prevalent or incident cases in 2019, millions (95% UI)	Prevalent or incident cases in 2023, millions (95% UI)	Percentage change in cases (95% UI)
Main oral conditions	3620 (3350 to 3950)	3730 (3450 to 4060)	3.07% (2.32 to 3.75)
Untreated caries in deciduous teeth	533 (444 to 631)	509 (428 to 590)	-4.56% (-8.51 to -0.43)
Untreated caries in permanent teeth	2200 (1920 to 2560)	2260 (1980 to 2630)	2.78% (2.19 to 3.41)
Severe periodontitis	1030 (879 to 1190)	1090 (915 to 1260)	5.73% (4.57 to 6.91)
Edentulism	336 (289 to 397)	373 (324 to 440)	11.09% (9.64 to 12.93)
Other oral disorders	148 (142 to 154)	154 (149 to 160)	4.56% (4.42 to 4.69)
Lip and oral cavity cancer	0.363 (0.315 to 0.422)	0.430 (0.367 to 0.505)	18.4% (9.76 to 26.9)
Orofacial clefts	4.05 (3.30 to 4.94)	4.26 (3.46 to 5.20)	5.14% (3.63 to 6.78)

Main oral conditions include untreated caries, severe periodontitis, edentulism, and other oral disorders only. Prevalent cases of main oral conditions do not match the sum of prevalent cases of individual conditions because some conditions coexist within the same individuals. Data are shown as age-standardised prevalence for all oral conditions, except for lip and oral cavity cancer, which is shown as age-standardised incidence. Cases are presented to three significant figures and percentage changes are reported to two decimal places. UI=uncertainty interval.

Table 2: Global prevalent or incident cases in 2019 and 2023 and percentage changes in global cases over 2019–23 for oral conditions

the draws. To reduce computing power and time across the estimation process, the number of draws was reduced from 500 in previous GBD iterations to 250 for GBD 2023. Simulations confirmed that estimates and uncertainty were not affected by this reduction.¹⁴ A percentage change between 2019 and 2023 was considered negligible if its 95% UI included zero.

Countries were grouped into 21 regions according to geographical proximity and epidemiological similarity and subsequently grouped into seven super-regions based on patterns of causes of death. The GBD super-regions are: central Europe, eastern Europe, and central Asia; high income (including North America, western Europe, and Asia Pacific); Latin America and the Caribbean; north Africa and the Middle East; south Asia; southeast Asia, east Asia, and Oceania; and sub-Saharan Africa (appendix figure S1).

Role of the funding source

The funder of this study had no role in study design, data collection, data analysis, data interpretation, or the writing of the report.

Results

For each condition, we first present global estimates of prevalent or incident cases, along with variations across super-regions. We then report global age-standardised prevalence or incidence, again highlighting differences across super-regions.

Between 2019 and 2023, global cases of main oral conditions increased by 3.07% (95% UI 2.32–3.75), from 3.62 billion (3.35–3.95) to 3.73 billion (3.45–4.06; table 2). Cases increased across almost all super-regions, ranging from 1.68% (0.79–2.42) in southeast Asia, east Asia, and Oceania to 9.51% (8.09–10.94) in sub-Saharan Africa, except for central Europe, eastern Europe, and central Asia and Latin America and the Caribbean, where no meaningful change was observed (figure 1; appendix table S1).

The global age-standardised prevalence of main oral conditions decreased by -1.55% (95% UI -2.32 to -0.82) between 2019 and 2023, from 45 900 (42 400 to 50 200) per 100 000 population to 45 200 (41 800 to 49 100) per 100 000 population (table 3). Reductions were observed in most super-regions, ranging from -0.94% (-1.63 to -0.22) in central Europe, eastern Europe, and central Asia to -3.34% (-4.95 to -1.80) in south Asia, while an increase occurred in the high-income super-region (1.24% [0.56 to 1.96]; figure 2; appendix table S2).

Globally, prevalent cases of untreated caries in deciduous teeth decreased by 4.56% (95% UI -8.51 to -0.43) between 2019 and 2023, from 533 million (444 to 631) to 509 million (428 to 590; table 2). This change was driven by reductions in south Asia (-11.67% [-20.05 to -2.76]), central Europe, eastern Europe, and central Asia (-7.06% [-8.54 to -5.50]), north Africa and the Middle East (-4.6% [-7.00 to -1.84]) and southeast Asia, east Asia, and Oceania (-4.24% [-6.85 to -1.74]; figure 1; appendix table S1). Cases increased by 4.79% (2.24–7.33) in the high-income super-region.

The global age-standardised prevalence of untreated caries in deciduous teeth remained unchanged (-3.68% [95% UI -7.78 to 0.48]), affecting 7310 (6160 to 8450) people per 100 000 population in 2023 (table 3). Reductions in age-standardised prevalence were observed in south Asia (-9.09% [-17.62 to -0.08]) and central Europe, eastern Europe, and central Asia (-2.03% [-3.59 to -0.41]) whereas an increase was observed in the high-income super-region (9.21% [6.60 to 11.89]; figure 2; appendix table S2).

Globally, prevalent cases of untreated caries in permanent teeth increased by 2.78% (95% UI 2.19–3.41) between 2019 and 2023, from 2.20 billion (1.92–2.56) to 2.26 billion (1.98–2.63; table 2). This change was driven by increases in sub-Saharan Africa (11.07% [9.96–12.22]), north Africa and the Middle East (5.92% [4.01–7.79]), south Asia (2.65% [1.13–4.33]) and the high-income super-region (2.06% [0.75–3.32]; figure 1; appendix table S1).

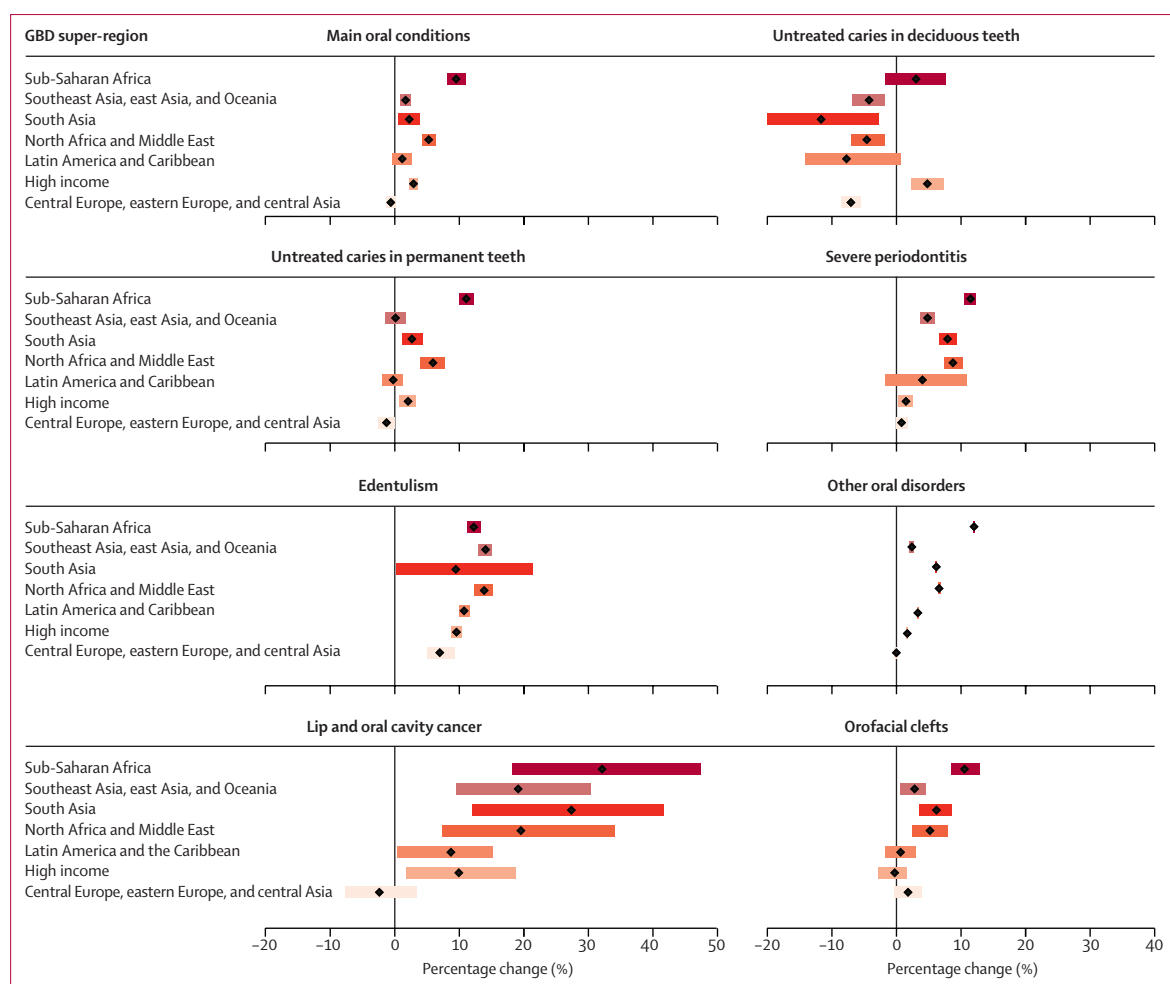


Figure 1: Percentage changes between 2019 and 2023 in prevalent or incident cases of oral conditions, by GBD super-region

Bars represent 95% uncertainty intervals. Main oral conditions include untreated caries, severe periodontitis, edentulism, and other oral disorders only. Prevalent cases are shown for all oral conditions except for lip and oral cavity cancer, for which incident cases are shown. The count of prevalent or incident cases, and their corresponding 95% uncertainty intervals, for each oral condition in 2019 and 2023 are shown in the appendix (table S1). GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

	Age-standardised prevalence or incidence in 2019, per 100 000 (95% UI)	Age-standardised prevalence or incidence in 2023, per 100 000 (95% UI)	Percentage change in age-standardised estimate (95% UI)
Main oral conditions	45 900 (42 400 to 50 200)	45 200 (41 800 to 49 100)	-1.55% (-2.32 to -0.82)
Untreated caries in deciduous teeth	7590 (6330 to 8980)	7310 (6160 to 8450)	-3.68% (-7.78 to 0.48)
Untreated caries in permanent teeth	27 600 (24 100 to 32 200)	27 100 (23 600 to 31 600)	-1.99% (-2.49 to -1.40)
Severe periodontitis	12 500 (10 600 to 14 400)	12 400 (10 400 to 14 300)	-0.69% (-2.07 to 0.98)
Edentulism	4070 (3510 to 4820)	4090 (3550 to 4820)	0.47% (-0.70 to 1.62)
Other oral disorders	1860 (1780 to 1930)	1860 (1780 to 1930)	-0.01% (-0.04 to 0.01)
Lip and oral cavity cancer	4.37 (3.78 to 5.08)	4.73 (4.03 to 5.56)	8.35% (0.13 to 16.32)
Orofacial clefts	53.0 (43.3 to 64.6)	54.2 (44.1 to 66.3)	2.25% (0.77 to 3.83)

Main oral conditions include untreated caries, severe periodontitis, edentulism, and other oral disorders only. Prevalent cases of main oral conditions do not match the sum of prevalent cases of individual conditions because some conditions coexist within the same individuals. Data are shown as age-standardised prevalence for all oral conditions, except for lip and oral cavity cancer, which is shown as age-standardised incidence. Cases are presented to three significant figures and percentage changes are reported to two decimal places. UI=uncertainty interval.

Table 3: Global age-standardised prevalence or age-standardised incidence in 2019 and 2023 and percentage changes in global age-standardised estimates over 2019–23 for oral conditions

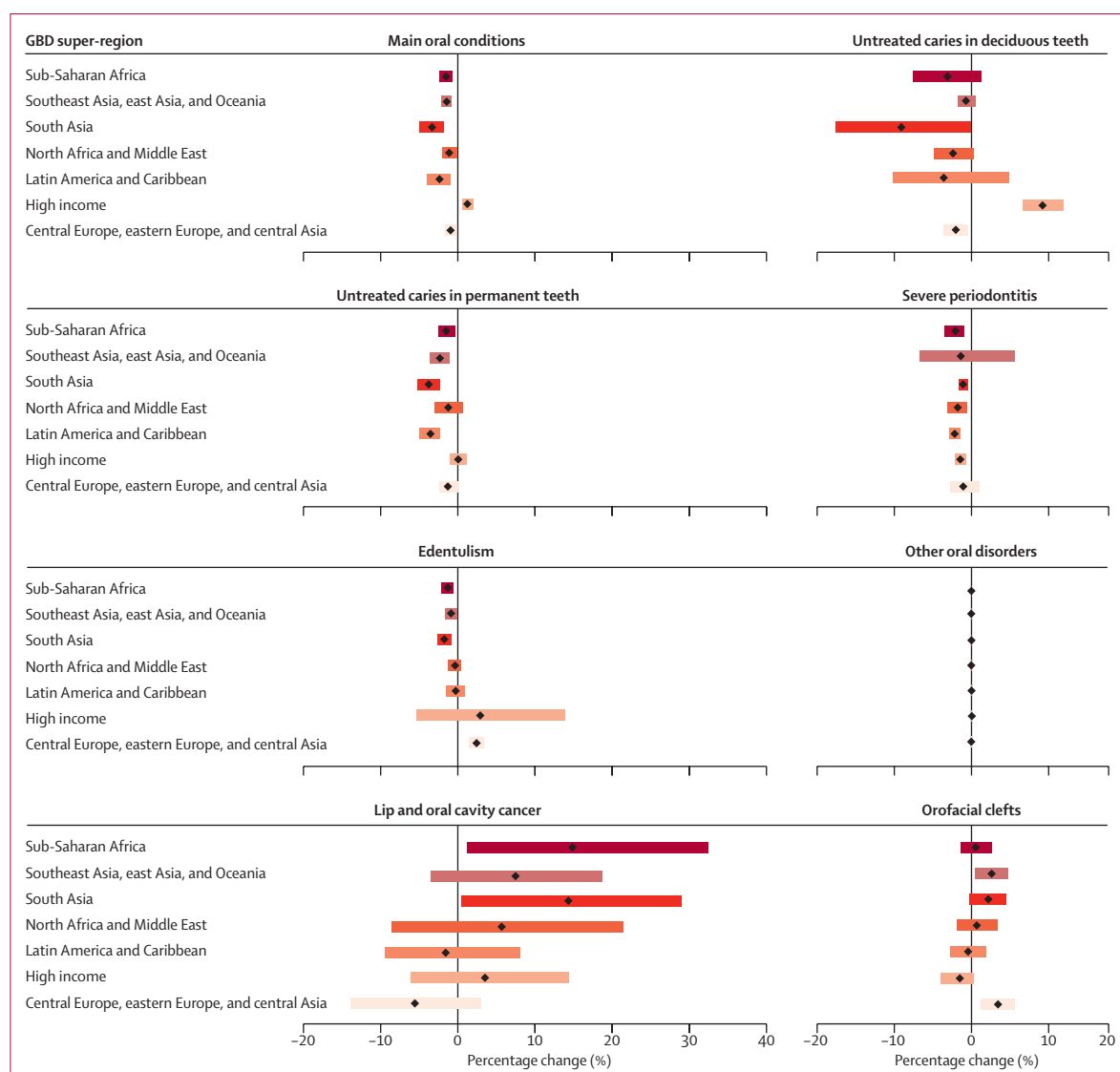


Figure 2: Percentage changes between 2019 and 2023 in age-standardised prevalence or incidence of oral conditions, by GBD super-region
 Bars represent 95% uncertainty intervals. Main oral conditions include untreated caries, severe periodontitis, edentulism, and other oral disorders only. Age-standardised prevalence is shown for all oral conditions except for lip and oral cavity cancer, for which age-standardised incidence is shown. The age-standardised prevalence or age-standardised incidence, and their corresponding 95% uncertainty intervals, for each oral condition in 2019 and 2023 are shown in the appendix (table S2). GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

The global age-standardised prevalence of untreated caries in permanent teeth decreased by -1.99% (95% UI -2.49 to -1.40), from 27 600 (24 100 to 32 200) per 100 000 population in 2019 to 27 100 (23 600 to 31 600) per 100 000 population in 2023 (table 3). Reductions in age-standardised prevalence were observed in south Asia (-3.77% [-5.18 to -2.33]), Latin America and the Caribbean (-3.54% [-5.04 to -2.36]), southeast Asia, east Asia, and Oceania (-2.32% [-3.59 to -1.06]), and sub-Saharan Africa (-1.51% [-2.58 to -0.38]; figure 2; appendix table S2).

Globally, prevalent cases of severe periodontitis increased by 5.73% (95% UI 4.57 – 6.91) between 2019

and 2023, from 1.03 billion (0.879–1.19) to 1.09 billion (0.915–1.26; table 2). Cases increased in sub-Saharan Africa (11.49% [10.55 – 12.34]), north Africa and the Middle East (8.75% [7.48 – 10.33]), South Asia (7.92% [6.55 – 9.30]), southeast Asia, east Asia, and Oceania (4.82% [3.68 – 5.98]), and the high-income super-region (1.47% [0.21 – 2.51]; figure 1; appendix table S1).

The global age-standardised prevalence of severe periodontitis remained unchanged (-0.69% [95% UI -2.07 to 0.98]), at 12 400 (10 400 to 14 300) per 100 000 population in 2023 (table 3). Reductions were observed across all super-regions, ranging from -2.17% (-2.85 to -1.44) in Latin America and the Caribbean to

–1.09% (–1.62 to –0.46) in south Asia, except in central Europe, eastern Europe, and central Asia, and in southeast Asia, east Asia, and Oceania (figure 2; appendix table S2).

Globally, prevalent cases of edentulism increased by 11.09% (95% UI 9.64–12.93) between 2019 and 2023, from 336 million (289–397) to 373 million (324–440; table 2). Cases increased in all super-regions, from 6.97% (5.10–9.32) in central Europe, eastern Europe, and central Asia to 13.85% (12.31–15.11) in north Africa and the Middle East (figure 1; appendix table S1).

The global age-standardised prevalence of edentulism remained unchanged (0.47% [95% UI –0.70 to 1.62]), at 4090 (3550 to 4820) per 100 000 population in 2023 (table 3). Reductions were observed in south Asia (–1.75% [–2.59 to –0.84]), sub-Saharan Africa (–1.29% [–2.07 to –0.54]), and southeast Asia, east Asia, and Oceania (–0.88% [–1.69 to –0.12]) while an increase was observed in central Europe, eastern Europe, and central Asia (2.43% [1.47 to 3.42]; figure 2; appendix table S2).

Globally, prevalent cases of other oral disorders increased by 4.56% (95% UI 4.42–4.69) between 2019 and 2023, from 148 million (142–154) to 154 million (149–160; table 2). Cases increased across all super-regions, ranging from 1.68% (1.59–1.78) in the high-income super-region to 12.02% (11.91–12.14) in sub-Saharan Africa, except for central Europe, eastern Europe, and central Asia, where no meaningful change was observed (figure 1; appendix table S1).

The global age-standardised prevalence of other oral disorders remained unchanged between 2019 and 2023 (–0.01% [95% UI –0.04 to 0.01]), at 1860 (1780 to 1930) per 100 000 population in 2023 (table 3). An increase of 0.05% (0.03–0.07) was observed in the high-income super-region (figure 2; appendix table S2).

Globally, incident cases of lip and oral cavity cancer increased by 18.4% (95% UI 9.76–26.9) between 2019 and 2023, from 0.363 million (0.315–0.422) to 0.430 million (0.367–0.505; table 2). Incident cases increased across all super-regions, ranging from 8.70% (3.41–15.19) in Latin America and the Caribbean to 32.12% (18.25–47.44) in sub-Saharan Africa, except for central Europe, eastern Europe and central Asia, where no meaningful change was observed (figure 1; appendix table S1).

The global age-standardised incidence of lip and oral cavity cancer increased by 8.35% (95% UI 0.13–16.32), from 4.37 (3.78–5.08) per 100 000 population in 2019 to 4.73 (4.03–5.56) per 100 000 population in 2023 (table 3). This change was largely driven by increases in sub-Saharan Africa (14.86% [1.19–32.45]) and south Asia (14.33% [0.47–29.05]; figure 2; appendix table S2).

Globally, prevalent cases of orofacial clefts increased by 5.14% (95% UI 3.63–6.78) between 2019 and 2023, from 4.05 million (3.30–4.94) to 4.26 million (3.46–5.20; table 2). Cases increased in sub-Saharan Africa (10.54% [8.53–12.88]), south Asia (6.19% [3.58–8.59]), north Africa and the Middle East (5.19% [2.43–7.92]), and

southeast Asia, east Asia, and Oceania (2.81% [0.61–4.63]; figure 1; appendix table S1).

The global age-standardised prevalence of orofacial clefts increased by 2.25% (95% UI 0.77–3.83), from 53.0 (43.3–64.6) per 100 000 population in 2019 to 54.2 (44.1–66.3) per 100 000 population in 2023 (table 3). Increases were observed in central Europe, eastern Europe, and central Asia (3.44% [1.20–5.56]) and southeast Asia, east Asia and Oceania (2.61% [0.42–4.75]; figure 2; appendix table S2).

Discussion

Coinciding with the first planned assessment of GOHAP targets, this analysis shows a modest improvement in the combined prevalence of main oral conditions that masks a still-expanding global burden. Against the GOHAP target of a 10% reduction by 2030, the combined age-standardised prevalence of main oral conditions fell by –1.55% between 2019 and 2023, yet cases rose by 3.07% to 3.73 billion, signalling that population growth and ageing are outpacing current prevention efforts and oral health-care service capacity.¹⁸

Although most complementary targets are off track, it is important to recognise that they are not equally responsive to short-term policy change or health-system reorganisation. Thus, expectations for measurable progress should differ accordingly. Only untreated caries in permanent teeth showed a measurable decline (–1.99%), while lip and oral cavity cancers (8.35%) and orofacial clefts (2.25%) showed noticeable increases. This pattern is particularly salient given that, although they are less prevalent than the main oral conditions, lip and oral cavity cancer and orofacial clefts are the only oral conditions in GBD directly associated with mortality. Although these changes might reflect true epidemiological shifts, they could also be the result of improved surveillance, registry coverage, or reporting. This is particularly important for cancers and congenital anomalies, for which ascertainment sensitivity varies across regions.

Progress towards the GOHAP targets was found to be highly uneven across regions, underscoring the need for region-specific policy responses rather than one-size-fits-all approaches. South Asia had the largest decline in the overarching target (–3.34%), a pace that need to be sustained to meet the 2030 targets, alongside reductions in several complementary indicators (ie, untreated caries in deciduous and permanent teeth, severe periodontitis, and edentulism). However, the incidence of lip and oral cavity cancer in south Asia increased markedly (14.33%). The GBD cause list includes heterogeneous oral conditions with distinct aetiologies and management needs, complicating the identification of shared intervention targets or prioritisation based solely on caseload.

Sub-Saharan Africa showed the largest increase in cases of main oral conditions (9.51%), alongside increasing incidence of lip and oral cavity cancer (14.86%), highlighting the need for accelerated prevention,

workforce and service expansion, and equity-focused financing in this super-region. Accelerating and upscaling evidence-based interventions to reduce tobacco use, betel nut consumption, and harmful alcohol use are therefore imperative in both sub-Saharan Africa and south Asia.⁶

The high-income super-region showed an increase in the overarching target (1·24%) and a marked increase in untreated caries in deciduous teeth (9·21%), suggesting that greater resource availability does not necessarily translate into improved outcomes. Persistent structural and behavioural barriers could contribute to limited progress, including the influence of commercial determinants, increasingly cariogenic dietary environments, cessation of community water fluoridation, and gaps in preventive coverage for early childhood caries. These patterns suggest the potential value of strengthening regulatory action on unhealthy products, aligning fiscal and food policies, and improving access to evidence-based preventive services in early life.^{2,9,19}

We emphasise that the modest improvements in the combined age-standardised prevalence are offset by demographic growth, leading to an overall increase in the absolute burden of the main oral conditions. Age-standardised prevalence should not be interpreted in isolation; it needs to be considered alongside changes in case numbers, as reliance on a single metric could create a misleading perception of progress and foster complacency in policy and practice. The growing caseloads indicate that, by 2023, health-care systems were managing a larger population with oral conditions requiring treatment than in 2019. These trends have implications for workforce planning and financing of universal oral health-care coverage.

Our findings reinforce the policy case for integrated oral and non-communicable disease action encompassing prevention, early detection, and timely access to treatment and rehabilitative care.^{2,9,19–21} There is a need to accelerate integrated preventive strategies to shift disease trajectories sufficiently by 2030. Priority areas include strengthening tobacco and alcohol control to reduce lip and oral cavity cancer, severe periodontitis, and orofacial clefts (through reduced consumption during pregnancy), alongside implementing policies to reduce sugar intake and prevent dental caries.^{7,19,22} However, prevention alone is insufficient to address the large proportion of the global population with an unmet need for oral health care. Countries must expand essential oral health-care packages, including pain management, minimally invasive treatment, and affordable rehabilitative care.^{8,9} Worsening indicators in specific conditions demand targeted, context-specific responses. The increasing incidence of lip and oral cavity cancer calls for robust early detection and referral systems in high-growth regions (eg, sub-Saharan Africa), while increasing orofacial clefts underscore the need for strengthened congenital anomaly surveillance and equitable access to reparative and long-term rehabilitative services.²⁰

Caution is warranted when interpreting changes of a small magnitude over short time intervals, as oral conditions take time to develop. Relatively wide uncertainty intervals, often spanning zero, suggest that observed changes might reflect statistical uncertainty rather than true epidemiological shifts. Accordingly, these estimates are better understood as indicative of broad patterns (or signals), with more robust conclusions requiring longer-term trends and consistent directional changes.

Limitations in the quality and availability of primary data sources in some super-regions or time periods remain a recurring challenge, underscoring the need to strengthen data collection systems.^{23,24} The COVID-19 pandemic disrupted the implementation of epidemiological surveys worldwide, potentially delaying the availability of data for more recent years. This was particularly true for the main oral conditions. As a result, the observed trends relied largely on historical data inputs, with few primary data sources available for 2020–23. Additionally, heterogeneity in data collection methods and case definitions across input sources requires the use of cross-walking and meta-regression adjustments to improve data harmonisation and expand data coverage. As a result, the observed temporal trends might reflect both true changes in morbidity and detection artefacts.

Beyond this, the quantification of uncertainty around estimates is a key feature of GBD. Fully accounting for the range of uncertainties inherent in burden estimation remains an ongoing challenge, especially since uncertainty and statistical variation cannot be fully eliminated. Uncertainty arising from data inputs, data harmonisation processes, and meta-regression modelling results in broad 95% UIs, which complicates the interpretation of trends over time and comparison across locations.

It is also important to note that the 2019 prevalence estimates reported in the *WHO Global Oral Health Status Report*²⁵ (baseline assessment) were derived from UN population data, whereas GBD relies on internally modelled population estimates. Although methodological differences between these approaches can lead to variation in prevalence estimates, these differences were relatively small for 2019.¹² Although GBD estimates are increasingly being used to inform policy and monitor progress at a global level, they should be interpreted with caution. They are modelled outputs that integrate heterogeneous data sources, and are therefore subject to assumptions, data gaps, and methodological adjustments. As such, they are better understood as tools for benchmarking and broad trend analysis rather than precise measures of programme performance.

Turning to future directions, with each GBD iteration, we aim to include additional oral conditions and expand geographical coverage, while continuously integrating new input sources, refining methods for data harmonisation, and enhancing methods to quantify uncertainty in estimates. These ongoing efforts will improve the accuracy of estimates for the upcoming

assessments of GOHAP targets scheduled for 2026 and 2030. Collaboration with the WHO Oral Health programme is helping to advance methods for the surveillance and monitoring of oral conditions.^{26–28} A key outcome of this work has been the alignment of case definitions for untreated caries and edentulism in the STEPS (WHO STEPwise approach to non-communicable disease risk factor surveillance) survey oral health module with GBD definitions. Over time, this approach will create a valuable source of primary sources for inclusion in the GBD dataset.

Another important area of work is the quantification of the burden of main oral conditions attributable to key behavioural factors for non-communicable diseases, including smoking, sugar intake, and alcohol consumption. This process involves systematically searching for and appraising evidence that quantifies the association between each behavioural factor and oral conditions for inclusion in the GBD database of metabolic, behavioural, and environmental risk–outcome pairs used in modelling. These estimates allow us to evaluate alternative scenarios that can inform policy decisions.

At the estimated 2019–23 rate of change, meeting the 2030 GOHAP target of a 10% reduction in oral disease burden by 2030 appears to be unlikely globally unless rates of improvement accelerate. The growing caseloads indicate that, by 2023, health systems were managing a larger population with oral conditions requiring oral health-care services than in 2019. Some super-regions, such as south Asia, might be able to meet their targets, but this alone is unlikely to substantially influence global estimates. Meeting the 2030 targets will require both faster risk reduction and service expansion to keep pace with population growth and ageing.

GBD 2023 Oral Disorders Collaborators

Eduardo Bernabe*, Wagner Marcenes, Abdullah, Hazim S Ababneh, Belayneh Jejaw Abate, Hedayat Abbastabar, Wael M Abdel-Rahman, Sherief Abd-El salam, Hassan A Abdou, Meriem Abdoun, Rizwan Suliankatchi Abdulkader, Syed Hani Abidi, Richard Gyan Aboagye, Lucas Guimarães Abreu, Sawzan Abuhammad, Anirudh Balakrishna Acharya, Swetha Acharya, Lawan Hassan Adamu, Tajudeen Adesanmi Adebisi, Babatope Oluwadamilare Adebisi, Kamoru Ademola Adedokun, Aanuoluwapo Adeyinka Afolabi, Muhammad Sohail Afzal, Percival Delali Agordoh, Salome Wumpini Agordoh, Trushdeep Agrawal, Piyush Agrawal, Tauseef Ahmad, Sajjad Ahmad, Aqeel Ahmad, Suhaib Ahmad, Khabir Ahmad, Ali Ahmadi, Naveed Ahmed, Shakeel Ahmed, Ali Ahmed, Ayman Ahmed, Kenni Woujoutari Ajele, Kasuni Hm Akalanka, Sara Akeel, Damilare Michael Akintunde, Hammad Akram, Chisom Joyqueenet Akunna, Timothy Olukunle Aladelusi, Yazan Al-Ajlouni, Mohammed Sultan Al-Ak'hali, Mohammad Khurshed Alam, Mostafa Alam, Ruaa A Alamoudi, Amer Hashim Al Ani, Salah Al Awaidey, Mohammed Albashtawy, Mohammed S Aldossary, Abdelazeem M Algammal, Saeed M M Alghamdi, Mohammed Ahmed Alghauli, Amidu Alhassan, Ashraf Alhumaidi, Taha Hussein Hussein Ali, Kamran Ali, Syed Shujait Ali, Montaha Al-Iede, Morteza Alipour, Behrouz Alizadeh Savareh, Sabah Al-Marwani, Sadeq A Al-Maweri, Essam Ahmed Al-Moraissi, Mohmmad Minwer Alnaeem, Khaldoon Aied Alnawafleh, Margret Beaula Alocious Sukumar, Nivaldo Alonso, Mohammad Alqudah, Mohammad R Alqudimat,

Ahmed Yaseen Alqutaibi, Mustafa Haleem Alsaadi, Mohammed Amjed Alsaegh, Anas Alsalhani, Ali Salman Al-Shami, Zaid Altaany, Awais Altaf, Hany Aly, Kareem H Alzoubi, Nada A Alzunaidey, Uchenna Anderson Amaechi, Mcking Izeiza Amedari, Priscilla O Ameh, Junaid Amin, Saeed Amini, Mohammad Hosein Amirzade-Iraniq, Hubert Amu, Abhishek Anil, A H Sruthi Anil Kumar, Kabilan Annadurai, Saied Anvari, Anayochukwu Edward Anyasodor, Jalal Arabloo, Mosab Arafat, Gururaj Arakeri, Aleksandr Y Aravkin, Demelash Arede, Jorge Arias De La Torre, Mohammad Saquib Ashraf, Javed Ashraf, Tahira Ashraf, Esma Asil, Saira Atif, Samuel Babajide Atoyebe, Nyan Min Aung, Manal Awad, Usman Ayub Awan, Sana Javaid Awan, Ashish Awasthi, Aneesa Ayoob, Somayyeh Azimi, Domenico Azzolino, Muhammad Badar, Huma Bader Ul Ain, Ashish D Badiye, Riadh Badraoui, Khlood K Baghlaf, Dania Bahdila, Mohammad Hassan Baig, Atif Amin Baig, Mohamad Amin Bakhshali, Marina Balabekova, Raju Balaji, Wondu Feyisa Balcha, Abdulrahman A A Balhaddad, Yatan Pal Singh Balhara, Maciej Banach, Morteza Banakar, Salam Bani Hani, Palash Chandra Banik, Farhat Bano, Md Abul Barkat, Rocio Barrios-Rodriguez, Amadou Barrow, Shahid Bashir, Azadeh Bashiri, Mohammad-Mahdi Bastan, Hagar Abd El Naby Bastawy, Kavita Batra, Oyundari Batsaikhan, Babak Behnam, Almaz Nibret Belay, Enku Shiferaw Belayneh, Nahom Girma Belete, Uzma Iqbal Belgaumi, Ibrahim Olajide Bello, Ghaith Benhsen, Alemshet Yirga Berhie, Ghalia Y Bhadila, Pooja Bhadoria, Pankaj Bhardwaj, Sonu Bhaskar, Ajay Nagesh Bhat, Ashok Kumar Bhati, Nada Binmadi, Tone Bjørge, Trupti Bodhare, Srinivasa Rao Bolla, Souad Bouaoud, Abdelhakim Bouyahya, Christopher Boxe, Maria Laura Braccini Fagundes, Dejana Braithwaite, Nikolay Ivanovich Briko, Michael Eric Bryan, Lin-Lin Bu, Sayed Muhammad Ata Ullah Shah Bukhari, Yu Cao, Giulia Carreras, Andrea Carugno, Sandra Carvalho, Felix Carvalho, Pamela Roxana Chacón-Uscamaita, Sandip Chakraborty, Vijay Kumar Chattu, Anis Ahmad Chaudhary, Sirshendu Chaudhuri, Akhilanand Chaurasia, Junhao Chen, Meng Xuan Chen, Mirza Farhana Iqbal Chowdhury, Dinh-Toi Chu, Sanjay C J, Natalia Cruz-Martins, Ferran Cuenca-Martínez, Omid Dadrás, Namrata Dagli, Lina Dahabiyeh, Neha Dahiya, Mouni Damineni, Samuel Demissie Darcho, Riya Dave, Mauro Henrique Nogueira Guimarães De Abreu, Emina Dervišević, Premnath Dhanaraj, Amol S Dhane, Antonio Di Guardo, Elangovan Dilipan, Sadia Din, Orlando Luiz Do Amaral Júnior, Sushil Dohare, Cátia Domingues, Francesco Dondi, Lingkan Dong, Ojas Prakashbhai Doshi, Taiwo Omotayo Dosumu, Jiang Du, Mi Du, Vikash Kumar Dubey, Manisha Dubey, Siddhartha Dutta, Arkadiusz Marian Dziedzic, Venkata Ravikanth Eddula, Aziz Eftekhari-mehrabad, Ebrahim Eini, Michael Ekholuenetale, Seraphine Mojoko Eko, Abdelbaset Mohamed Elsalbi, Amine Elbouzidi, Mohamed Elhoumed, Omar Abdelsadek Abdou Elmeligy, Ashraf A El-Metwally, Rami Elmorsi, Abdelfatteh EL Omri, Iman El Sayed, Nadia Bassuoni Elsharkawy, Abdelgawad Salah Eltahawy, Maha El Tantawi, Heba Emad, Purushoth Ethiraj, Devaraj Ezhilarsan, Amanda Ugochi Ezirim, Adeniyi Francis Fagbamigbe, Ayesha Fahim, Nour Fakh, Ebrahim Farashi, Muhammad Amber Fareed, Mohsen A Farghaly, Anees Ahmed Farooq Mohammed, Fatemeh Farshad, Alireza Feizkhah, Guangshou Feng, Maria Pia Ferraz, Nuno Ferreira, Getahun Fetensa, Tommaso Filippini, Florian Fischer, James L Fisher, Carlos Forner Álvarez, Delfin Lovelina Francis, Takeshi Fukumoto, Peter Andras Gaal, Amol Ramchandra Gadbail, Piyada Gaewkhiew, Márió Gajdacs, Silvano Gallus, Fernando Jr Barroga Garcia, Tsion S Gebre, Nsikakabasi Samuel George, Ahmad Ghashghaee, Sama Ghoba, Nasim Gholizadeh, Mahsa Ghorbani, Elena Ghotbi, Thinh Gia Gia Nguyen, Paramjit Singh Gill, Anil Kumar Goel, Marília Goettems, Awais Gohar, Gamze Gökulu, Pouya Goleij, Mohsen Golkar, Shailesh Madhukar Gondivkar, Divya Gopinath, Giuseppe Gorini, Barbara Niegia Garcia Goulart, Changhao Gu, Giovanni Guarducci, Bhuvaneshwari Gunasekar, Sunanda Gupta, Swati Gupta, Bhawna Gupta, Sapna Gupta, Bruno Gutiérrez, Heliasadat Haeriborojoni, Khalid Rehman Hakeem, Esam Halboub, Pritam Halder, Ibrahim Ismael Hamarash, Raz Mohammed Hama Salih, Mohamed Hamed, Samer Hammoudeh,

- Abdelrahman M Hamouda, Mohd Anul Haq, Faizul Hasan, Shamimul Hasan, Towhid Hasan, Hamidreza Hasani, Nada Tawfig Hashim, Ahmad Shueb Hashmi, Md Saquib Hasnain, Simon I Hay, Fei He, Mohammad Heidari, Golnaz Heidari, Narmin Mohammadsaeed Helal, Brenda Yuliana Herrera-Serna, Kamran Heydaryan, Kamal Hezam, Nguyen Quoc Hoan, Matthew Hobbs, Ramesh Holla, Syed Billal Hossain, Mehdi Hosseinzadeh, Sorin Hostiuc, Weijun Huang, Fernando N Hugo, Bing-Fang Hwang, Liliya Ibragimova, Khalid S Ibrahim, Jibran Ikram, Olayinka Stephen Ilesanmi, Irena M Ilic, Milena D Ilic, Danish Iqbal, Bilal Irfan, Md Rabiul Islam, Gaetano Isola, Hiroshi Ito, Chidozie Declan Iwu, Haitham Jahrami, Ayushi Jain, Ammar Abdulrahman Jairoun, Mihajlo Jakovljevic, Sahbanathul Missiriya Jalal, Reza Jalilzadeh Yengejeh, Rajiv Janardhanan, Sathish Kumar Jayapal, Ruwan Duminda Jayasinghe, Wonjeong Jeong, Nathan T Jibat, Nitin Joseph, Krupal Joshi, Farahnaz Joukar, Easter Joury, Jacek Jerzy Jozwiak, Hema Shree K, Thenmozhi K, Zubair Kabir, Vidya Kadaschetti, Adel Kadri, Pradnya Vishal Kakodkar, Eswar Kandaswamy, Kehinde Kazeem Kanmodi, Kamala Kannan, Rami S Kantar, Neila Karagezova, Indira Karibayeva, Mohamed Isaqali Karobari, Tomasz M Karpiński, Gebrehiwot G Kassa, Birhanu Kassie Abeje, Joonas H Kauppila, Stella Adejoke Kayode, Awoke Amare Kebede, Yousef Saleh Khader, Himanshu Khajuria, Raees Khan, Zahid Khan, Hafiz Nadeem Khan, Muhammad Umer Khan, Muhammad Khan, Sameer Uttamaro Khasbage, Khalid A Kheirallah, Feriha Fatima Khidri, Yihyun Kim, Min Seo Kim, Sung Min Kim, Ruth W Kimokoti, Sanjay Kini B, Adnan Kisa, Tobias Kleinjung, Shivakumar K M, Prakash Babu Kodali, Farzad Kompani, Archana Koul, Kewal Krishan, Bindu Krishnan, Nitya Krishnasamy, Omar Kujan, Anit Kujur, Mukhtar Kulimbet, Emmanuel Kumah, Manoj Kumar, Jogender Kumar, Pradeep Kumar, Jeevan Kumar, Pawan Kumar, Sumeet Kumar, Ashok Kumar, Kamal Kumar, Neeraj Kumar, Dewesh Kumar, Sandeep Kumar, Jibin Kunjavara, Om P Kurmi, Pramod Kumar Kushawaha, Dian Kusuma, Timo Lajunen, Dharmesh Kumar Lal, Ratilal Laloo, Tamás Lantos, Giusy Rita Maria La Rosa, Savita Lasrado, Seung Won Lee, Kakithakara Vajravelu Leela, Elvynna Leong, Mengyi LI, Zhengrui Li, Ming-Chieh Li, Ambreen Liaquat, Liu Liu, Erand Llanaj, Madeeha Shahzad Lodhi, Mariia Lopatkina, Anna Lövgren, Shanjie Luan, Alessandra Lugo, Ellina Lytyak, Hawraz Ibrahim M Amin, Siyao Ma, Kevin Sheng-Kai Ma, Monika Machoy-Rakoczy, Máté Mackei, Inamul Hasan Madar, Ahmed A Madfa, Mohammed Magdy Abd El Razek, Mari Kannan Maharajan, Nozad Hussein Mahmood, Trisha Mallick, Iqra Manzoor, Tahir Maqbool, Vijaya Marakala, Priyadarshini Markasagayam, Stefano Masi, Manu Raj Mathur, Medha Mathur, Khurshid A Mattoo, Jacek Matys, Jitendra Kumar Meena, Riffat Mehboob, Vinu Mehta, Dalia E Meisha, Satish Melwani, Ritesh G Menezes, Tomislav Mestrovic, Andrea Michelerio, Giuseppe Minervini, Tridip Mitra, Kanisha Mittal, Hashem Mohamadian, Nough Saad Mohamed, Fatima Awad Elkarim Elfaki Mohamed, Yahaya Mohammed, Yugal Kishore Mohanta, Ali H Mokdad, Himel Mondal, Paula Moraga, Rafael Silveira Moreira, Mahdis Morovvati, Rohith Motappa, Amin Mousavi Khaneghah, Ahmed Msheghhi, Rabia Mubarak, Sumaira Mubarik, Christopher J L Murray, Satta Muthu Murugan, David Musoke, Sherzad Ibrahim Mustafa, Saravanan Muthupandian, Kiran P P Nagdeo, Ganesh R Naik, Lekshmi M Nair, Prasad Nalabothu, Rizwan Naqvi, Shumaila Nargus, Gustavo G Nascimento, Mohammad Zakaria Nassani, Zuhair S Natto, Zakira Naureen, Kinjal Nayak, Biswa Prakash Nayak, Javad Nazari, Sudan Prasad Neupane, Sumaiya Nezam, Long Hoang Nguyen, Tham Thi Nguyen, Cuong Tat Nguyen, Duy Cao Nguyen, Vikram Niranjana, Lawrence Achilles Nnyanzi, Mohammed Noushad, Nazik Nurelhuda, Bogdan Oancea, Musa Kolapo Oladejo, Yinka Doris Oluwafemi, Esteban Ortiz-Prado, Mahesh P A, Alicia Padron-Monedero, Jagadish Rao Padubidri, Sujogya Kumar Panda, Keerthi Panneer Selvam, Georgios D Panos, Shahina Pardhan, Romil R Parikh, Sun Jae Park, Pragnesh Parmar, Sameena Parveen, Eleonora Pascucci, Mitesh Patel, Shivani Patel, Mehali Lalitbhai Patel, Jay Patel, Vipin Patidar, Shankargouda Patil, Shrikant Pawar, Olumuyiwa James Peter, Pawel Piotr Pietkiewicz, Thantrira Pornatavetus, Amit Porwal, Priyanka Porwal, Sergio I Prada, Harsh Priya, Luis Proença, Pooja Puri, Bharathi M Purohit, Nameer Hashim Qasim, Asma Saleem Qazi, Xiang Qi, Cheng Quan, Nuzul Qur'aniati, Venkatraman Radhakrishnan, Raghu Anekal Radhakrishnan, Fakher Rahim, Mosiur Rahman, Hakim Rahmoune, Amina Suleiman Rajah, Rafał Rakoczy, Venkitachalam Ramanarayanan, Shakthi Kumaran Ramasamy, Ramasubburayan Ramasamy, Lokesh Rana, Shailendra Singh Rana, Kumuda Rao, Sowmya J Rao, Mithun Rao, Prateek Rastogi, Shree Rath, Devarajan Rathish, Tapash Ranjan Rautray, Sujith Sri Surya Ravi, Salman Rawaf, Muhammad Liaquat Raza, Elrashdy M Redwan, Abdul Rehman, Bhagwan Narayan Rekadwad, Nazila Rezaei, Abanoub Riad, Maria Jesus Rios-Blancas, Hermano Alexandre Lima Rocha, Chanapong Rojanaworarit, Mario Romandini, Rohini Ruhil, Khaled Saad, Korosh Saber, Fatemeh Sadeghi-Ghyassi, Mohammad Reza Saeb, Umar Saeed, Amirhossein Sahebkar, Fatemeh Saheb Sharif-Askari, Vaibhav Sahni, Durgesh Prasad Sahoo, Ambika Sahoo, Alaka Sahoo, Ankita Saikia, Joseph W Sakshaug, Luciane B Salaroli, Samreen Saleem, Firdaus Samad, Fasineh Shekuba Samura, Abdallah M Samy, Sathish Sankar, Andari Sarasati, Shilpa Sarawagi, Sachin C Sarode, Gargi Sachin Sarode, Michele Sassano, Aanchal Satija, Maheswar Satpathy, Jennifer Saulam, Amar Saurabh, Benedikt Michael Schaarschmidt, Falk Schwendicke, Amin Sedigh, Siddharthan Selvaraj, Subramanian Senthilkumaran, Mostafa Shaban, Arsalan Shahri, Hamid R Shahsavari, Muhammad Shahzad, Masood Ali Shaikh, Muhammad Aaqib Shamim, Alfiya Shamsutdinova, Mohammed Shannawaz, Nadim Sharif, Amin Sharifan, Kamlesh Sharma, Bereket Beyene Shashamo, Mahabalesh Shetty, Premalatha K Shetty, Nzooma Munkwangu Shimaoponda-Mataa, Shirindokht Shirazi, Km Shivangi, Zahra Shokati Eshkiki, Deborah Oluwaseun Shomuyiwa, Sinegugu Nosipho Shongwe, Seyed Afshin Shorofi, Sunil Shrestha, Suleiman Adeiza Shuaibu, Gustavo Correia Basto Da Silva, Luis Manuel Lopes Rodrigues Silva, Jasvinder A Singh, Harpreet Singh, Surjit Singh, Samer Singh, Prince Kumar Singh, Siddharth Singh, Ragini D Singh, Amit Singh, Abhinav Singh, Richa Singhania, Gisha Sivan, Gowri Sivaramakrishnan, Chandan S N, Farrukh Sobia, Ranjan Solanki, Monica Charlotte Solomon, Saraswathy Sreeram, Kannan Sridharan, Quirin D Strotzer, Mahwish Suhaib, Marija Sultana, Jing Sun, Seyyed Mohammad Tabatabaei, Biniyam Beyene Tabor, Santosh Kumar Tadakamadla, Jyothi Tadakamadla, Amir Tahavvori, Jabeen Taiba, Iman M Talaat, Mircea Tampa, Benjamin Kye Jyn Tan, Shynar Tanabayeva, Abdelghani Tbakhi, Reem Tamsah, Abdulkarim Tamsah, Dufera Rikitu Terefa, Tigist Derebe Tesfahun, Azimeraw Arega Tesfu, Ismael Tharwat, Manuel Sebastian Thomas, Amir Tiyuri, Madi Tleshev, Razie Toghrli, Arole Darwin Touko, Marcos Roberto Tovani-Palone, Thang Huu Tran, Indang Trihandini, Mike Tuffour Amirikah, Biruk Shalmeno Tusa, Saeed Ullah, Srikanth Umakanthan, Bhaskaran Unnikrishnan, Amedin Aliyi Ussu, Olivier Uwishema, Hande Uzunçubuk, Orsolya Varga, Siddhartha Alluri Varma, Vishnu Priya Veeraraghavan, Prabhakar Veginadu, U Venkatesh, Nguyen-Kieu Viet-Nhi, Vignesh Vikram, Victor E Villalobos-Daniel, Ave Voit, Simona Ruxandra Volovat, Rashim Wadhwa, Liang Wang, Wanzhou Wang, Zhikang Wang, Tati Suryati Warouw, Chenxuan Wei, Desalegn Desalegn Weldebrhan, Nuwan Darshana Wickramasinghe, Andrew Awuah Wireko, Dawit Habte Woldeyes, Shulan Wu, Patlolla Sriram Yadav, Saba Yahoo, Natsuhiko Yamada, Kivanc Yangi, Thomas Kidanemariam Yewodias, Siyan Yi, Dong Keon Yon, Monal Yuwanati, Vesna Zadnik, Mubashir Zafar, Muhammad Sohail Zafar, Iman Zare, Mohammed G M Zeariya, Zhi-Jiang Zhang, Jianhui Zhao, Lei Zheng, Hafsa Zia, Zahraa Zibara, Magdalena Zielińska, Shafer H Zyoud, Kanyin Liane Ong†.
- *First author
†Senior author
- Affiliations**
Please see the appendix (pp 50–66) for the affiliations for individual authors.

Contributors

Please see the appendix (pp 66–74) for more detailed information about individual author contributions to the research, divided into the following categories: providing data or critical feedback on data sources; developing methods or computational machinery; providing critical feedback on methods or results; drafting the manuscript or revising it critically for important intellectual content; and managing the estimation or publications process. Members of the core research team for this topic area had full access to the underlying data used to generate estimates presented in this Article, and had final responsibility for the decision to submit the manuscript for publication. All other authors had access to and reviewed estimates as part of the research evaluation process, which includes additional stages of formal review.

Declaration of interests

S Bhaskar reports grants or contracts from the Japan Society for the Promotion of Science (JSPS), Grant-in-Aid for Scientific Research (KAKENHI), Grant ID 23KF0126; and JSPS and the Australian Academy of Science, JSPS International Fellowship, Grant ID P23712; payment or honoraria from the Japan Stroke Society, Japan, for an invited keynote presentation at the 50th Annual Meeting of the Japan Stroke Society, Osaka; and Semey Medical University, Kazakhstan, for an invited professorship and teaching course in neurocardiovascular therapy; support for attending meetings or travel, or both, from the Japan Stroke Society, Japan; travel award for invited keynote presentation at the 50th Annual Meeting of the Japan Stroke Society, Osaka, and Asialink, The University of Melbourne; travel support for opening invited keynote at the 31st Asialink Leaders Foundation Week Program 2026, Melbourne; leadership or fiduciary role in Rotary District 9675, Sydney, Australia (District Chair, Diversity, Equity, Inclusion & Belonging); Global Health & Migration Hub Community, Global Health Hub Germany, Berlin, Germany (Chair, Founding Member and Manager); *PLOS One*, *BMC Neurology*, *Frontiers in Neurology*, *Frontiers in Stroke*, *Frontiers in Public Health*, *Journal of Aging Research*, *Neurology International*, *Diagnostics*, and *BMC Medical Research Methodology* (Editorial Board Member); College of Reviewers, Canadian Institutes of Health Research (CIHR), Government of Canada (Member); World Headache Society, Bengaluru, India (Director of Research); Cariplo Foundation, Milan, Italy (Expert Adviser/Reviewer); National Cerebral and Cardiovascular Center, Department of Neurology, Division of Cerebrovascular Medicine and Neurology, Suita, Osaka, Japan (Visiting Director); Cardiff University Biobank, Cardiff, UK (Member, Scientific Review Committee); Rotary Reconciliation Action Plan (Chair); and Japan Connect, Osaka, Japan (Healthcare and Medical Adviser) outside the submitted work. B Goulart reports stock or stock options in Badger Meter Inc, British American Tobacco, and Altria Group (payments made to B Goulart) outside the submitted work. I Ilic reports support for the present manuscript from the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (grant number 451-03-137/2025-03/200110). K Krishan acknowledges non-financial support from the UGC Centre of Advanced Study, CAS II, awarded to the Department of Anthropology, and RUSA 2.0 grant awarded by the Indian Ministry of Education to Panjab University, Chandigarh, India, outside the submitted work. G La Rosa reports grants or contracts from the Knowledge•Action•Change Tobacco Harm Reduction Programme, an independent public health organisation based in the UK and funded by Global Action to End Smoking, a US-based independent non-profit 501(c)(3) grant-making organization (G La Rosa was awarded a 2026 scholarship for a project focused on oral health; G La Rosa previously received funding through the same programme in 2024–25 for an additional oral health-related project; the content of the present paper is unrelated to those projects), outside the submitted work. M-C Li reports grants or contracts from the National Science and Technology Council, Taiwan (NSTC 113-2314-B-003-002) and the Higher Education Sprout Project of National Taiwan Normal University (M-C Li was supported by these grants); and leadership or fiduciary role as Technical Editor, *Journal of the American Heart Association*, outside the submitted work. K S-K Ma reports support for the present manuscript and grants or contracts from the International Team for Implantology. S Masi reports grants or contracts from Italian Ministry of University, Italian National Research Council, and Italian Ministry of Health (institutional grants for the conduction of research projects); consulting fees from Servier

(personal payments for consultancy activities); payment or honoraria from Servier (personal honoraria for lectures, presentations, speakers bureaus, manuscript writing, and educational events); support for attending meetings or travel, or both, from Servier (personal support for attending congresses); participation on a data safety monitoring board or advisory board from Servier (personal payments for participation on advisory boards); and leadership or fiduciary role in European Society of Hypertension, Working Group of Hypertension and the Heart (Vice-President, unpaid), and Italian Society of Internal Medicine (President of the Tuscany-Umbria section, unpaid) outside the submitted work. R Moreira reports grants or contracts from CNPq (National Council for Scientific and Technological Development), Research Productivity Scholarship, registration number 308986/2025-3 (R Moreira is a research productivity fellow; R Moreira would like to mention the acknowledgment of this grant and its number in the Article, as it is also related to research using GBD), outside the submitted work. B Oancea reports support for the present manuscript from the Romanian National Research, Development, and Innovation Plan 2022–27, project PNRR/2022/C9/MCID/18 number 1672173292, contract number 760231; and PNRR/2022/C9/MCID/18 project 842027778, contract number 760096. S Panda reports support for the present manuscript from Siksha 'O' Anusandhan (Deemed to be University; payment of salary); grants or contracts from Central Council for Research in Homoeopathy (CCRH), Government of India (file number 17-59/2023-24, as Co-Investigator); and Indian National Science Academy (INSA), Government of India (file number HS/RC/393, as Principal Investigator) outside the submitted work. G D Panos reports payment or honoraria from Thea, Roche, and Bayer (payments made to their institution); and support for attending meetings or travel, or both, from Thea, Roche, and Bayer (payments made to the organising agency of the event) outside the submitted work. P Pietkiewicz reports payment or honoraria from Heine Optotechnik, Dermatological Society of South Africa, Fotofinder Systems, Akademia Dermatoskopii, Polpharma, Galderma, Melanoma Society South Africa, and Primary Care Dermatological Society (UK); leadership or fiduciary role in Polish Dermatoscopy Group (President) and EADV Honors and Award Committee (Member); receipt of equipment, materials, drugs, medical writing, gifts, or other services from Heine Optotechnik; and other financial or non-financial interests in SkinSkan (shareholder), outside the submitted work. A Riad reports support for the present manuscript from the Czech Health Research Council (project number: NW26J-09-00120). S Saleem reports support for the present manuscript from Health Services Academy, Islamabad, Pakistan; and payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing, or educational events from Health Services Academy, Islamabad, Pakistan, outside the submitted work. B Schaarschmidt reports grants or contracts from Else Kröner-Fresenius Foundation (research grant), Deutsche Forschungsgemeinschaft (research grant), and PharmaCept (research grant); payment or honoraria from AstraZeneca (speaker), Boston Scientific (speaker/proctor), and MedMile (speaker); and support for attending meetings or travel, or both, from Bayer (travel grant), outside the submitted work. L Silva reports grants or contracts from SPRINT – Sport Physical Activity and Health Research & Innovation Center, Portugal, FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology), grant numbers UID/06185/2025, UID/PRR/06185/2025, and UID/PRR2/06185/2025; and RISE-Health, Department of Medical Sciences, Faculty of Health Sciences, University of Beira Interior, Covilhã, Portugal, outside the submitted work. J A Singh reports consulting fees from ROMTech, Atheneum, Clearview Healthcare Partners, Yale, Hulo, Horizon Pharmaceuticals/DINORA, ANI/Exeltis USA, SOBI Pharmaceuticals, Frictionless Solutions, Schipher, Crealta/Horizon, Medisys, Fidia, PK Med, Two Labs, Adept Field Solutions, Clinical Care Options, Putnam Associates, Focus Forward, Navigant Consulting, Spherix, MediQ, Jupiter Life Science, UBM, Trio Health, Medscape, WebMD, and Practice Point Communications; the US National Institutes of Health; and the American College of Rheumatology (consultant fees paid to J A Singh for each entity); payment or honoraria from Simply Speaking (speakers bureau); J A Singh previously served as a consultant and consultant fees were paid to J A Singh); support for attending meetings or travel, or both, as

past steering committee member of OMERACT (J A Singh previously received support from the organisation to attend their meeting every 2 years); participation on a data safety monitoring board or advisory board with the US Food & Drug Administration Arthritis Advisory Committee (J A Singh served previously as a member; no financial support); leadership or fiduciary role as past steering committee member of OMERACT, an international organisation that develops measures for clinical trials and receives arm's length funding from 12 pharmaceutical companies (J A Singh previously received support from the organisation to attend their meeting every 2 years); and stock or stock options in aTyr Pharmaceuticals, Atai Life Sciences, Kintara Therapeutics, Intelligent Biosolutions, Acumen Pharmaceutical, TPT Global Tech, Vaxart Pharmaceuticals, Aytu BioPharma, Adaptimmune Therapeutics, GeoVax Labs, Pieris Pharmaceuticals, EnzoLytics, Seres Therapeutics, Tonix Pharmaceuticals Holding Corp, Aebona Pharmaceuticals, and Charlotte's Web Holdings (J A Singh owns stock options; J A Singh previously owned stock options in Amarin, Viking, and Moderna Pharmaceuticals), outside the submitted work. S Singh reports grants or contracts from the DTRA Biological Threat Reduction Program (HDTRA1-21-1-0036), Indian Council of Medical Research (VIR/12/2022/ECD-1), and Institute of Eminence (IoE), Banaras Hindu University (seed grant and transdisciplinary research grant); the laboratory of S Singh was partially supported by these grants), outside the submitted work. J Zhao reports support for the present manuscript from Fundamental Research Funds for the Central Universities (2024BSSXM20); Zhejiang University Qiushi Flying Eagle Program; Key Laboratory of Integrated Care for Geriatric Chronic Diseases, Kunming Medical University, School of Nursing, and the Yunnan Provincial Education Department (grant number 2024HTHLYB05); and Doctoral Student Special Program of the China Association for Science and Technology (CAST) Young Talent Support Project. M Zielińska reports financial or non-financial interests as an Alexion AstraZeneca Rare Disease employee, outside the submitted work. All other authors declare no competing interests.

Data sharing

To download citations and metadata for the input data sources used in the GBD 2023 analyses presented in this study, please visit the GBD 2023 Sources Tool (<https://ghdx.healthdata.org/gbd-2023/sources>).

Acknowledgments

This study was funded by the Gates Foundation.

References

- Peres MA, Macpherson LMD, Weyant RJ, et al. Oral diseases: a global public health challenge. *Lancet* 2019; **394**: 249–60.
- Watt RG, Daly B, Allison P, et al. Ending the neglect of global oral health: time for radical action. *Lancet* 2019; **394**: 261–72.
- Benzian H, Watt R, Makino Y, Stauff N, Varenne B. WHO calls to end the global crisis of oral health. *Lancet* 2022; **400**: 1909–10.
- Bernabe E, Marcenes W, Hernandez CR, et al, and the GBD 2017 Oral Disorders Collaborators. Global, regional, and national levels and trends in burden of oral conditions from 1990 to 2017: a systematic analysis for the Global Burden of Disease 2017 Study. *J Dent Res* 2020; **99**: 362–73.
- Jevdjevic M, Listl S. Global, regional, and country-level economic impacts of oral conditions in 2019. *J Dent Res* 2025; **104**: 17–21.
- WHO. Global strategy and action plan on oral health 2023–2030. Geneva: World Health Organization, 2024.
- UN. Equity and integration: transforming lives and livelihoods through leadership and action on noncommunicable diseases and the promotion of mental health and well-being (A/80/L.34). Dec 8, 2025. <https://docs.un.org/en/A/80/L.34> (accessed July 8, 2026).
- Winkelmann J, Listl S, van Ginneken E, Vassallo P, Benzian H. Universal health coverage cannot be universal without oral health. *Lancet Public Health* 2023; **8**: e8–10.
- Fisher J, Matanhire-Zihanzu C, Buse K. A new approach to oral health can lead to healthier societies. *BMJ* 2024; **385**: q925.
- Benzian H, Kavanaugh D, Naidoo S, Mathur MR. Oral disease must be central in policies to improve global health. *BMJ* 2025; **389**: r1070.
- Murray CJL. The Global Burden of Disease Study at 30 years. *Nat Med* 2022; **28**: 2019–26.
- GBD 2021 Oral Disorders Collaborators. Trends in the global, regional, and national burden of oral conditions from 1990 to 2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet* 2025; **405**: 897–910.
- IHME. Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) Protocol. June 4, 2024. <https://www.healthdata.org/sites/default/files/2024-06/GBD%20Protocol%20060424.pdf> (accessed Nov 25, 2024).
- GBD 2023 Disease and Injury and Risk Factor Collaborators. Burden of 375 diseases and injuries, risk-attributable burden of 88 risk factors, and healthy life expectancy in 204 countries and territories, including 660 subnational locations, 1990–2023: a systematic analysis for the Global Burden of Disease Study 2023. *Lancet* 2025; **406**: 1873–922.
- GBD 2023 Causes of Death Collaborators. Global burden of 292 causes of death in 204 countries and territories and 660 subnational locations, 1990–2023: a systematic analysis for the Global Burden of Disease Study 2023. *Lancet* 2025; **406**: 1811–72.
- GBD 2023 Cancer Collaborators. The global, regional, and national burden of cancer, 1990–2023, with forecasts to 2050: a systematic analysis for the Global Burden of Disease Study 2023. *Lancet* 2025; **406**: 1565–86.
- GBD 2023 Demographics Collaborators. Global age-sex-specific all-cause mortality and life expectancy estimates for 204 countries and territories and 660 subnational locations, 1950–2023: a demographic analysis for the Global Burden of Disease Study 2023. *Lancet* 2025; **406**: 1731–810.
- Marcenes W, Kassebaum NJ, Bernabé E, et al. Global burden of oral conditions in 1990–2010: a systematic analysis. *J Dent Res* 2013; **92**: 592–97.
- Benzian H, Daar A, Naidoo S. Redefining the non-communicable disease framework to a 6x6 approach: incorporating oral diseases and sugars. *Lancet Public Health* 2023; **8**: e899–904.
- Mustakim KR, Eo MY, Mustakim IG, Kim SM. Sustainable Development Goals for cleft care. *J Craniofac Surg* 2025; **36**: e258–64.
- Benzian H, Naidoo S. Constituting global oral health: toward a policy-relevant and action-oriented science. *Community Dent Oral Epidemiol* 2026; published online Feb 28. <https://doi.org/10.1111/cdoe.70054>.
- Bouvard V, Nethan ST, Singh D, et al. IARC perspective on oral cancer prevention. *N Engl J Med* 2022; **387**: 1999–2005.
- Bhutta ZA. Global Burden of Disease 2023: challenges and opportunities for a growing collaboration. *PLoS Med* 2025; **22**: e1004838.
- Ward ZJ, Goldie SJ. Global Burden of Disease Study 2021 estimates: implications for health policy and research. *Lancet* 2024; **403**: 1958–59.
- WHO. Global oral health status report: towards universal health coverage for oral health by 2030. Nov 18, 2022. <https://www.who.int/publications/i/item/9789240061484> (accessed July 8, 2026).
- WHO. Meeting report of the expert workshop on monitoring and surveillance of oral diseases, London, United Kingdom, 23–24 November 2023. June 27, 2024. <https://www.who.int/publications/i/item/B09048> (accessed July 8, 2026).
- WHO. Report of the WHO global oral health meeting, Bangkok, Thailand, 26–29 November 2024. June 25, 2025. <https://www.who.int/publications/i/item/B09422> (accessed July 8, 2026).
- Bernabé E, Salomon-Ibarra CC, Marcenes W. Guidelines for Reporting Oral Epidemiologic Studies to Inform Burden Estimation (GROESBE). *J Dent Res* 2025; **104**: 140–46.