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**

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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.

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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

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.

See Online for appendix

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

	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 (CPITN 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).

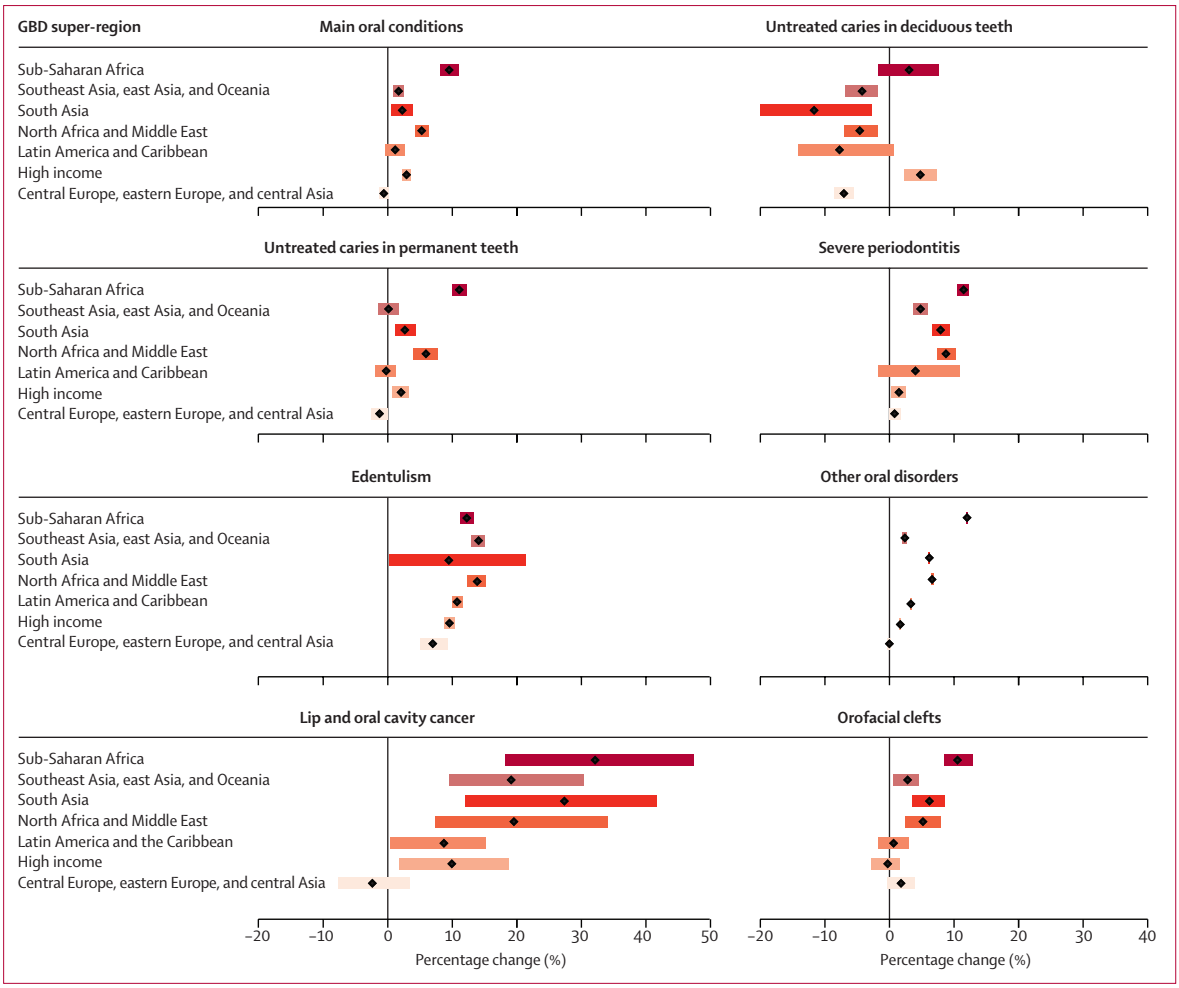


Figure 1: **Percentage changes between 2019 and 2023 in prevalent or incident cases of oral conditions, by GBD super-region**
Bars represent 95% uncertainty intervals. Main oral conditions include untreated caries, severe periodontitis, edentulism, and other oral disorders only. Prevalent cases are shown 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**

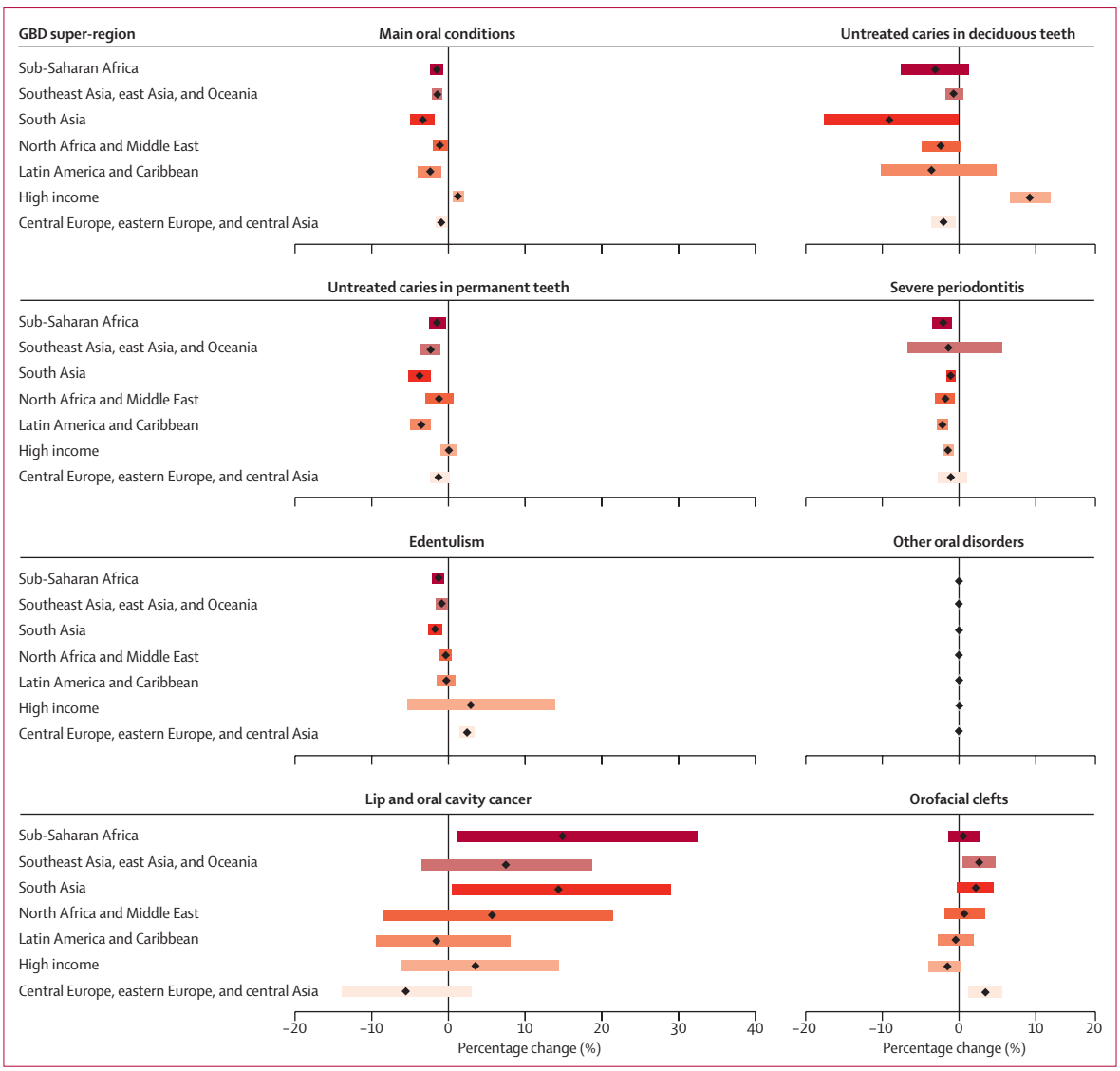


Figure 2: **Percentage changes between 2019 and 2023 in age-standardised prevalence or incidence of oral conditions, by GBD super-region**
Bars represent 95% uncertainty intervals. Main oral conditions include untreated caries, severe periodontitis, edentulism, and other oral disorders only. Age-standardised 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.

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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.

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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).

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