OUKA
The University of Osaka
Institutional Knowledge Archive

Title	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
Author(s)	GBD 2023 Causes of Death Collaborators; Yasufuku, Yuichi
Citation	The Lancet. 2025, 406(10513), p. 1811-1872
Version Type	VoR
URL	https://hdl.handle.net/11094/103532
rights	This article is licensed under a Creative Commons Attribution 4.0 International License.
Note	

The University of Osaka Institutional Knowledge Archive : OUKA

https://ir.library.osaka-u.ac.jp/

The University of Osaka

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

*GBD 2023 Causes of Death Collaborators**

Lancet 2025; 406: 1811–72

Published Online
October 12, 2025
https://doi.org/10.1016/S0140-6736(25)01917-8

See Comment page 1703

*Collaborators listed at the end of the Article

Correspondence to:
Prof Simon I Hay, Institute for Health Metrics and Evaluation, University of Washington, Seattle, WA 98195, USA
sihay@uw.edu

Summary

Background Timely and comprehensive analyses of causes of death stratified by age, sex, and location are essential for shaping effective health policies aimed at reducing global mortality. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2023 provides cause-specific mortality estimates measured in counts, rates, and years of life lost (YLLs). GBD 2023 aimed to enhance our understanding of the relationship between age and cause of death by quantifying the probability of dying before age 70 years (70q0) and the mean age at death by cause and sex. This study enables comparisons of the impact of causes of death over time, offering a deeper understanding of how these causes affect global populations.

Methods GBD 2023 produced estimates for 292 causes of death disaggregated by age-sex-location-year in 204 countries and territories and 660 subnational locations for each year from 1990 until 2023. We used a modelling tool developed for GBD, the Cause of Death Ensemble model (CODEm), to estimate cause-specific death rates for most causes. We computed YLLs as the product of the number of deaths for each cause-age-sex-location-year and the standard life expectancy at each age. Probability of death was calculated as the chance of dying from a given cause in a specific age period, for a specific population. Mean age at death was calculated by first assigning the midpoint age of each age group for every death, followed by computing the mean of all midpoint ages across all deaths attributed to a given cause. We used GBD death estimates to calculate the observed mean age at death and to model the expected mean age across causes, sexes, years, and locations. The expected mean age reflects the expected mean age at death for individuals within a population, based on global mortality rates and the population's age structure. Comparatively, the observed mean age represents the actual mean age at death, influenced by all factors unique to a location-specific population, including its age structure. As part of the modelling process, uncertainty intervals (UIs) were generated using the 2·5th and 97·5th percentiles from a 250-draw distribution for each metric. Findings are reported as counts and age-standardised rates. Methodological improvements for cause-of-death estimates in GBD 2023 include a correction for the misclassification of deaths due to COVID-19, updates to the method used to estimate COVID-19, and updates to the CODEm modelling framework. This analysis used 55 761 data sources, including vital registration and verbal autopsy data as well as data from surveys, censuses, surveillance systems, and cancer registries, among others. For GBD 2023, there were 312 new country-years of vital registration cause-of-death data, 3 country-years of surveillance data, 51 country-years of verbal autopsy data, and 144 country-years of other data types that were added to those used in previous GBD rounds.

Findings The initial years of the COVID-19 pandemic caused shifts in long-standing rankings of the leading causes of global deaths: it ranked as the number one age-standardised cause of death at Level 3 of the GBD cause classification hierarchy in 2021. By 2023, COVID-19 dropped to the 20th place among the leading global causes, returning the rankings of the leading two causes to those typical across the time series (ie, ischaemic heart disease and stroke). While ischaemic heart disease and stroke persist as leading causes of death, there has been progress in reducing their age-standardised mortality rates globally. Four other leading causes have also shown large declines in global age-standardised mortality rates across the study period: diarrhoeal diseases, tuberculosis, stomach cancer, and measles. Other causes of death showed disparate patterns between sexes, notably for deaths from conflict and terrorism in some locations. A large reduction in age-standardised rates of YLLs occurred for neonatal disorders. Despite this, neonatal disorders remained the leading cause of global YLLs over the period studied, except in 2021, when COVID-19 was temporarily the leading cause. Compared to 1990, there has been a considerable reduction in total YLLs in many vaccine-preventable diseases, most notably diphtheria, pertussis, tetanus, and measles. In addition, this study quantified the mean age at death for all-cause mortality and cause-specific mortality and found noticeable variation by sex and location. The global all-cause mean age at death increased from 46·8 years (95% UI 46·6–47·0) in 1990 to 63·4 years (63·1–63·7) in 2023. For males, mean age increased from 45·4 years (45·1–45·7) to 61·2 years (60·7–61·6), and for females it increased from 48·5 years (48·1–48·8) to 65·9 years (65·5–66·3), from 1990 to 2023. The highest all-cause mean age at death in 2023 was found in the high-income super-region, where the mean age for females

reached 80·9 years (80·9–81·0) and for males 74·8 years (74·8–74·9). By comparison, the lowest all-cause mean age at death occurred in sub-Saharan Africa, where it was 38·0 years (37·5–38·4) for females and 35·6 years (35·2–35·9) for males in 2023. Lastly, our study found that all-cause 70q0 decreased across each GBD super-region and region from 2000 to 2023, although with large variability between them. For females, we found that 70q0 notably increased from drug use disorders and conflict and terrorism. Leading causes that increased 70q0 for males also included drug use disorders, as well as diabetes. In sub-Saharan Africa, there was an increase in 70q0 for many non-communicable diseases (NCDs). Additionally, the mean age at death from NCDs was lower than the expected mean age at death for this super-region. By comparison, there was an increase in 70q0 for drug use disorders in the high-income super-region, which also had an observed mean age at death lower than the expected value.

Interpretation We examined global mortality patterns over the past three decades, highlighting—with enhanced estimation methods—the impacts of major events such as the COVID-19 pandemic, in addition to broader trends such as increasing NCDs in low-income regions that reflect ongoing shifts in the global epidemiological transition. This study also delves into premature mortality patterns, exploring the interplay between age and causes of death and deepening our understanding of where targeted resources could be applied to further reduce preventable sources of mortality. We provide essential insights into global and regional health disparities, identifying locations in need of targeted interventions to address both communicable and non-communicable diseases. There is an ever-present need for strengthened health-care systems that are resilient to future pandemics and the shifting burden of disease, particularly among ageing populations in regions with high mortality rates. Robust estimates of causes of death are increasingly essential to inform health priorities and guide efforts toward achieving global health equity. The need for global collaboration to reduce preventable mortality is more important than ever, as shifting burdens of disease are affecting all nations, albeit at different paces and scales.

Funding Gates Foundation.

Copyright © 2025 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

Introduction

Measuring causes of death is a foundational step towards developing effective strategies to improve human health. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) provides comprehensive and systematic analyses of causes of death worldwide and across time. The utility of GBD cause of death estimates has been particularly valuable during the onset of COVID-19.[1–3] However, GBD estimates have uses beyond informing preparation for stochastic events, such as a novel virus or new pandemic; these estimates are used integrally as tools for understanding public health trends, shaping health policy, and monitoring progress toward global health goals.[4] As a global public good, GBD 2023 contributes freely available, updated, and comprehensive estimates of causes of death to the existing body of scientific literature. In addition to presenting the routinely updated estimates of causes of death, the current study expands our analysis to further explore the relationship between age and cause of death.

This study investigates important age patterns in mortality by estimating the probability of dying from any given cause before the age of 70 years (70q0). The probability of death measure is a fundamental indicator in public health because it can effectively capture improvements in survival within all age groups before age 70 years.[5] In recent publications, it has become common practice to classify deaths occurring before 70 years of age as premature.[6] Some studies, including the Global Health 2050 report from the *Lancet* Commission on Investing in Health, have shown that the probability of all-cause mortality before age 70 years has decreased globally and across major regions.[5] The Global Health 2050 report concluded that further reductions, by as much as 50%, are attainable by mid-century with targeted health investments, a goal referred to as 50 by 50.[5] To support progress towards 50 by 50, our study aims to address remaining questions, including which causes of death deviate from the broader improvements in premature mortality, and where disparities might exist in the likelihood of dying before age 70 years within specific populations. These are pressing concerns for policy makers and health-planning teams at both national and international levels.

Another primary objective of GBD 2023 was to calculate the mean age at the time of death across causes and locations. This metric allows for straightforward observations of national and regional disease burdens in relation to global values. Related studies find that the overall mortality rate from all causes has been decreasing over the past 75 years,[7] and the mean age at the time of death has been trending upward for many countries.[8] Estimates of mean age at death are influenced not only by a population's age distribution but also by disease characteristics, health-care access, socioeconomic status, comorbidities, and other risk factors.[8,9] Although some of this general upward trend can be attributed to shifts in age structure and sex distribution by location, in certain

Research in context

Evidence before this study

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) is a worldwide research initiative that provides comprehensive and timely assessments of mortality, morbidity, and risk factors disaggregated to granular levels that are meaningful for policy development. In the last iteration, the GBD 2021 causes-of-death publication marked a major advancement in the evidence base; the study delineated cause-specific mortality to provide insights on the primary causes of death influencing life expectancy across locations. It also identified several causes with shifting mortality trends that had important implications for targeted policy initiatives—causes that were once widespread across the globe but became increasingly localised and in need of tailored reduction strategies. The GBD 2021 causes-of-death analysis was also the first of its kind to publish worldwide estimates of deaths from the initial years of the COVID-19 pandemic, quantifying its effect on life expectancy and offering comparisons to deaths from other causes. While estimates from other studies are published periodically that assess specific causes of death among a subset of populations or across a narrower timeframe, GBD remains the only research effort to offer cause-specific estimates of mortality to this degree of time and location detail and to produce these assessments in peer-reviewed and GATHER-compliant publications.

Added value of this study

This study provides new and more robust evidence of mortality patterns across the globe, updating and extending the analysis from GBD 2021, and reanalysing the entire time series to supersede all previous GBD publications. We provide estimates of cause-specific mortality for 292 causes of death within 204 countries and territories and 660 subnational locations, disaggregated by age and sex, from 1990 to 2023. These estimates include 11 474 new sources compared with GBD 2021. This update advances mortality measurements in several ways. First, we present the probability of death before age 70 years (70q0) by sex and year to enable measurements of premature mortality by individual causes. We describe causes of death that are not following global improvements in 70q0 to highlight locations where disparities are occurring in the likelihood of dying before age 70 years. Second, we calculate the mean age at death by assigning the midpoint age of each age group for every death, followed by computing the overall mean across all deaths attributed to a given cause. Our analysis of mean age of death offers insights into a country's ability to manage different disease burdens relative to global benchmarks, independent of local population structure. Additionally, our study examines the correlation between mean age at death and the Socio-demographic Index (SDI) to evaluate whether countries at the higher end of the SDI exhibit older mean ages at death for a given cause compared with countries with a lower SDI value, while controlling for SDI's effect on population structure. This approach adds a novel dimension to understanding how sociodemographic factors influence both the risk and timing of mortality. This study also builds upon our estimates from GBD 2021 to include 2 additional years of COVID-19 analysis, providing a more comprehensive picture of COVID-19 mortality worldwide. Lastly, we report estimates for several newly disaggregated causes of death, including ulcerative colitis; Crohn's disease; thyroid disease; other endocrine, metabolic, and blood and immune disease; and electrocution.

Implications of all the available evidence

Our study offers a thorough analysis of causes of death over the past 34 years, including new findings into the full duration of the COVID-19 pandemic. We highlight causes of death that have declined in certain locations, which could lend insight for policy change and implementation. We also identify causes that persist as major sources of mortality across populations, signifying priority areas for future intervention. Additionally, our study investigated important age patterns in mortality by estimating the probability of dying from any given cause before age 70 years, thereby advancing our understanding of the relationship between age and cause of death. The Global Health 2050 report set a target to reduce the probability of premature deaths by 50% by 2050. We aim to complement and support this goal by offering an in-depth analysis of 70q0 across time, sex, and geographical locations. Lastly, our mean age of death analysis is a valuable metric for comparing observed mortality levels with expected patterns to help identify locations that are keeping pace with development trends and those that might be falling behind. Evidence from this study can be used to examine epidemiological patterns and trends across time and locations, and to gauge progress in global development goals. These findings can also guide future policy initiatives aimed at furthering reductions in cause-specific mortality and, in particular, achieving better pandemic preparedness within the context of specific locations. In aggregate, cyclical updates to GBD reflect improvements in data availability and enhanced methodology that reduce bias and improve transparency, supporting the development and implementation of new evidence-based health policies worldwide.

areas and for specific causes, the mean age is much higher or lower than expected.[8] Quantifying the difference between the expected mean age at death (based only on population age structure and disease characteristics) and the observed mean age at death provides policy makers with additional population-level understanding beyond simply comparing age-standardised death rates between locations. These quantified differences could be linked to modifiable factors within a community, such as high blood pressure

or the use of alcohol, tobacco, or drugs, which can be targeted through public health interventions.[10]

The timeframe of this analysis allows for important new insights into COVID-19, including two additional years of estimation since GBD 2021, new data collected, and improved methodology. As we mark 5 years since the onset of the COVID-19 pandemic—declared officially by WHO in March, 2020[11]—it is important to reflect on its impact. Substantial declines in deaths from COVID-19 were not noted until 2023, after a period of extraordinary global disruption.[7] Since that time, countries with robust vital registration systems have been able to publish mortality data for the years with the highest number of COVID-19 deaths. In addition, localised studies revealed shifts in mortality patterns occurring for certain causes of death during the height of the pandemic.[12] As additional vital registration data become available, a more comprehensive understanding of the long-term effects of COVID-19 on global mortality will continue to unfold. Key questions remain regarding the total number of deaths attributed to COVID-19, the populations most affected, and which causes of death—and to what extent—were affected by the COVID-19 pandemic.

See Online for appendix 1

This study provides new insights related to trends in 70q0 and the mean age at death, and identifies and delineates causes that most heavily affect mortality across populations. An updated understanding of how the COVID-19 pandemic interrupted or altered previous trajectories in mortality by cause, age, sex, or location is another important contribution of GBD 2023. At the same time, tracking changes in 70q0 and the mean age at death across causes, populations, and over time—alongside metrics such as the number of deaths, age-standardised mortality rates, and years of life lost (YLLs), offers more actionable insights to improve health at the population level. These patterns can be an essential guide for policy makers when shaping health priorities. This manuscript was produced as part of the GBD Collaborator Network and in accordance with the GBD Protocol.[13]

Methods

Overview

GBD 2023 produced estimates for each epidemiological quantity of interest for 292 causes of death by age-sex-location-year for 25 age groups from birth to 95 years and older; for males, females, and all sexes combined; in 204 countries and territories grouped into 21 regions and seven super-regions; and for every year from 1990 to 2023. GBD 2023 also includes subnational analyses for 20 countries and territories. This study drew on the expertise of a network of 14 410 international collaborators from more than 160 countries and territories who provide, review, and analyse the available data to generate these metrics.

GBD 2023 produced updated estimates of health loss around the world using the best available data. For each GBD round, newly available data and updated methods are used to update the full time series of estimates from 1990 to the latest year of analysis. Consequently, GBD 2023 estimates supersede all previous estimates. The methods used to generate estimates for GBD 2023 closely followed those for GBD 2021.[14] These methods have been extensively peer reviewed over previous rounds of GBD[14–19] and concurrently as part of the peer review process for GBD 2023. Here, we provide an overview of the methods with an emphasis on the main methodological changes since GBD 2021; a comprehensive description of the analytical methods for GBD 2023 is provided in appendix 1.

The GBD 2023 cause-of-death estimates described here include cause-specific mortality, observed and expected mean ages at death, cause-specific probabilities of death before age 70 years, and the premature death metric YLLs. YLLs were calculated as the number of deaths for each cause-age-sex-location-year multiplied by the standard life expectancy at each age (appendix 1 section 6.3). Standard life expectancy is calculated from the lowest age-specific mortality rate between countries.[7] In brief, cause-specific death rates for 214 causes were estimated using the Cause of Death Ensemble model (CODEm), while alternative strategies were used to model causes with very limited data, changes in reporting over the study period, or very specific epidemiology. The modelling strategy used for all cause of death estimates can be found in appendix 1 (table S8). CODEm is a modelling tool developed specifically for GBD that evaluates the out-of-sample predictive validity of different statistical models and covariate permutations and then combines the results from those evaluations to produce cause-specific fatal burden estimates.

Methodological improvements for cause-of-death estimates in the current round of estimation focused on several key areas. First, a method for the identification and correction of causes displaying excess mortality spikes due to misclassified COVID-19 deaths was applied to all vital registration data between the years of 2020 and 2023. Second, we added 312 new country-years of vital registration data on cause of death, 3 country-years of surveillance data, 51 country-years of verbal autopsy data, and 144 country-years of other data types. Third, all CODEms were fitted to mortality rates rather than cause fractions. Fourth, we updated the modelling framework for COVID-19 to incorporate pandemic-era vital registration data and preliminary vital registration reporting.

The GBD disease and injury hierarchy

GBD classifies diseases and injuries into a hierarchy with four Levels that include both fatal and non-fatal causes. Level 1 causes include three broad aggregate categories (communicable, maternal, neonatal, and nutritional [CMNN] diseases; non-communicable diseases [NCDs]; and injuries); Level 2 disaggregates those categories into 22 clusters of causes, which are further disaggregated into Level 3 and Level 4 causes. At the most detailed Level, 292 fatal causes are estimated. For a full list of causes of death by Level, see appendix 1 (table S1). For

GBD 2023, five causes of death were estimated for the first time: ulcerative colitis; Crohn's disease; thyroid disease; other endocrine, metabolic, blood, and immune disease; and electrocution.

Data sources, processing, and assessing for completeness

The GBD 2023 cause-of-death database included data sources identified in previous rounds of estimation in addition to 11474 new sources, for a total of 55761 data sources—these sources are detailed in appendix 1 (table S3) and can be accessed through the Global Health Data Exchange (GHDx) website. Multiple data types were included to capture the widest array of information, including vital registration data for all 292 causes, as well as verbal autopsy, survey, census, surveillance, cancer registry, and police record data; open-source databases; and minimally invasive tissue sampling. To standardise these data so that they could be compared by cause, age, sex, location, and time, a set of data processing corrections were applied. First, deaths with insufficient or missing age and sex detail underwent a process of distribution via age and sex splitting (appendix 1 section 3.5). In addition, garbage codes, which are non-specific, implausible, or intermediate rather than underlying cause-of-death codes from the ICD, were redistributed to appropriate targets to assign the underlying cause of death.[20] Data sources with more than 50% of all deaths assigned to major garbage codes (class 1 or class 2 garbage codes) in any location-year were excluded to mitigate the potential for bias from these sources (appendix 1 section 3.11).

Assessing data completeness illustrates the coverage from a data source on overall mortality for the country. Vital registration and verbal autopsy data completeness—a source-specific estimate of the percentage of total cause-specific deaths that are reported in a given location and year—was assessed by location-year, and sources with less than 50% completeness were excluded. We excluded 283 country-years of data due to insufficient completeness or excessive garbage coding. The estimated all-cause mortality for each age-sex-location-year was then multiplied by the cause fraction for the corresponding age-sex-location-year to adjust all included sources to 100% completeness. GBD assesses the quality of all vital registration and verbal autopsy data using a star ranking system of one to five stars, based on the percentage of completeness and percentage of garbage coding. Vital registration and verbal autopsy data availability, completeness, and five-star quality rating for each location-year are available in appendix 1 (figures S4 and S5). Full details on all data processing corrections can be found in appendix 1 (section 3.16).

Presentation of cause-specific mortality estimates

Cause-specific mortality estimates for GBD 2023 are given in death counts and age-standardised rates per 100000 population, calculated using the GBD standard population structure.[7] For changes over time, we present percentage changes over the period 1990–2023, and annualised rates of change as the difference in the natural log of the values at the start and end of the time interval divided by the number of years in the interval. 95% uncertainty intervals (UIs) for all metrics are computed using the 2·5th and 97·5th percentiles from a 250-draw distribution for each metric (appendix 1 section 4.1.3). To reduce computing power and time, the number of computations per process was scaled back from 500 in GBD 2021 to 250 in GBD 2023, as simulation testing revealed that final estimates and their uncertainty were not affected by this reduction. See appendix 1 (section 4.1.3) for further details on this update.

For **GBD data sources at the Global Health Data Exchange** see https://ghdx.healthdata.org/gbd-2023/sources

Measuring probability of premature death

In accordance with the GBD framework, a death that occurs at any age before the standard (expected) life expectancy is classified as premature. To inform discussions and debates in the literature on premature deaths before age 70 years, in alignment with studies from WHO,[6,21] the US National Institutes of Health,[22] and the US Centers for Disease Control and Prevention,[23] we computed the probability of death from birth to age 70 years (70q0).

Calculation of the probability of premature death by cause

The probability-of-death metric represents the chance of dying from a given cause in a specific age period, for a specific population. Methods for calculating all-cause probability of premature death have been described elsewhere.[7] For example, for males aged 0–70 years in Canada in 1990, a probability of death of 0·1 from ischaemic heart disease indicates a 10% chance of dying from this cause before age 70 years. Cause-specific probability of death can be calculated as follows:

$$q^n_{x,c} = \text{deaths}^n_{x,c} \times q^n_x$$

where

$q^n_{x,c}$

represents the probability of death for ages x to $x+n$ in cause c,

$\text{deaths}^n_{x,c}$

represents deaths in cause fraction space for age group x to $x+n$ in cause c; and

q^n_x

represents the all cause probability of death for ages x to $x+n$.

Socio-demographic Index

The Socio-demographic Index (SDI) is a composite measure of two demographic indicators (total fertility rate in people younger than 25 years and mean educational attainment for those aged 15 years and older) and an economic indicator (lag-distributed income per capita).[7] Values are given as a range between 0·0 and 1·0. Additional details describing the calculation of SDI for GBD 2023 are provided in appendix 1 (section 5) of our companion publication.[7]

Calculation of the observed mean age at death and the expected mean age at death based on the global age-specific rates

The calculation of mean age at death uses cause-specific GBD modelled death estimates. GBD produces cause-of-death estimates for every location-year-age-sex group, even when no reported cause-of-death data are available. GBD uses standard 5-year age groups (eg, 15–19, 20–24, and 25–29 years) from age 5 years to 94 years. The remaining non-standard age groups consist of 0–6 days, 7–27 days, 1–5 months, 6–11 months, 12–23 months, 2–4 years, and 95 years and older. For this calculation, each GBD age group is assigned a distinct age at death by taking the mean age of each age group. For example, the age group 15–19 years, which represents people from the day they turn 15 years of age to the day before they turn 20 years of age, was assigned to have a distinct age at death of 17·5 years. The only age group without a discernible mean is the 95 years and older group. For this age group, the distinct age at death was calculated by adding the life expectancy of the 95 years and older age group to 95 years by sex-year-location.

The observed mean age at death uses GBD estimates directly, and each death can be assigned a distinct age at death. Distinct ages are then summed together for a given demographic consisting of a given location-year-sex-cause. This value is then divided by the total number of deaths for the same demographic to quantify the mean age at death.

Expected deaths were calculated using cause-specific GBD global mortality rates by age and sex and applying them to each country's population. By multiplying the mortality rate on the population to calculate deaths, expected death estimates control for population structure. These expected death estimates are comparable to normal GBD estimates, consisting of the same age-sex groups. The same process used to calculate the observed mean age at death is then applied to the expected deaths to calculate the expected mean age at death.

See Online for appendix 3

The relationship between mean age at death and SDI was explored by running linear regressions of SDI against the observed mean age at death as well as running linear regressions of SDI against the difference of observed and expected mean ages at death. Appendix 2 (table S14) reports the resulting r^2, slope, and p values of each regression. An individual regression was run for each cause–sex combination, in which each observation represents a country in 1990, 2010, 2019, 2021, or 2023. By observing the relationship between SDI and the difference between observed and expected values, we are able to measure the correlation of SDI with the mean age at death while accounting for differences in population structure that might also be correlated with SDI.

See Online for appendix 2

Correction for the misclassification of COVID-19 deaths

GBD 2023 received 83 country-years of vital registration data from 2020, 67 from 2021, and 38 from 2022. During these years, there is evidence that deaths due to COVID-19 were misclassified as other causes of death.[24,25] Relative to smooth prepandemic mortality trends, these misclassified COVID-19 deaths contributed to mortality spikes in the other causes of death. To systematically identify these spikes in other causes, we developed a Support Vector Machine, a machine-learning algorithm for identifying deviations from the established time trends in the years 2020–22. After we identified causes with mortality spikes during the COVID-19 pandemic years, we ascertained, for each cause of interest, whether the spike was a result of COVID-19 misclassification or a true increase in mortality. To do this, we evaluated the correlation between the rate of excess mortality in the cause of interest and the observed mortality rate of COVID-19. Mortality spikes identified to contain COVID-19 misclassification were then considered eligible for correction.

When a mortality spike had been identified as being eligible for correction, we calculated the portion of excess mortality attributable to misclassified COVID-19. We first created an estimate of expected deaths absent of any pandemic effects using the mean of two counterfactual estimates: one calculated by a linear regression of the 5 years before the start of the pandemic (2015–19), and another calculated using a global relative rate of non-COVID-19 deaths, adapted from a previously published method used in the correction of misclassified HIV.[26] Total excess mortality could then be estimated by subtracting the expected death count total from the observed death count total. Finally, total excess mortality was then scaled according to the level of correlation between COVID-19 rate and excess mortality rate to calculate the amount of excess attributable to COVID-19. The total excess attributable to COVID-19 was then subtracted from the cause of interest and reassigned to COVID-19. The full details regarding the identification and correction of misclassified COVID-19 can be found in appendix 1 (section 3.8), appendix 2 (table S2), and appendix 3. Detailed results of this process can be found in appendix 2 (table S3).

Estimation of COVID-19 as a cause of death

For modelling COVID-19, we supplemented the corrected vital registration data described above with two other sources of data: 9 country-years of provisional

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
All causes	**50 746·1 (50 430·8 to 51 060·8)**	**60 043·1 (59 045·4 to 61 239·8)**	**18·3% (16·1 to 20·8)***	**1009·0 (1002·5 to 1015·2)**	**701·5 (690·2 to 714·9)**	**–30·5% (–31·7 to –29·0)***	**2 058 941·2 (2 046 424·5 to 2 073 121·2)**	**1 808 856·0 (1 784 551·7 to 1 836 374·3)**	**–12·1% (–13·3 to –10·7)***	**36 126·3 (35 903·4 to 36 364·3)**	**22 647·5 (22 371·3 to 22 958·5)**	**–37·3% (–38·1 to –36·3)***
Communicable, maternal, neonatal, and nutritional diseases	**15 054·6 (14 495·6 to 15 946·2)**	**10 326·0 (9761·6 to 11 100·0)**	**–31·1% (–34·7 to –27·2)***	**263·4 (252·2 to 280·2)**	**136·9 (129·9 to 146·0)**	**–47·8% (–50·4 to –45·2)***	**1 005 458·1 (980 016·4 to 1 042 665·5)**	**553 137·9 (526 426·5 to 581 083·9)**	**–44·9% (–47·2 to –42·7)***	**16 568·9 (16 142·1 to 17 230·8)**	**8024·1 (7654·4 to 8382·4)**	**–51·5% (–53·6 to –49·6)***
HIV/AIDS and sexually transmitted infections	**1578·2 (1462·9 to 1719·2)**	**917·2 (799·7 to 1072·2)**	**–41·9% (–49·0 to –34·1)***	**26·1 (24·2 to 28·4)**	**11·2 (9·7 to 13·1)**	**–57·1% (–62·5 to –51·3)***	**90 307·6 (83 037·7 to 100 135·0)**	**47 785·7 (40 824·0 to 56 588·0)**	**–47·1% (–53·4 to –40·5)***	**1466·2 (1347·8 to 1623·3)**	**610·4 (519·2 to 732·2)**	**–58·4% (–63·8 to –53·0)***
HIV/AIDS	1489·3 (1387·8 to 1620·1)	833·4 (727·1 to 959·0)	–44·1% (–50·8 to –36·5)*	24·6 (22·9 to 26·8)	9·9 (8·6 to 11·3)	–59·9% (–64·7 to –54·7)*	82 763·4 (76 737·0 to 90 409·0)	40 794·5 (35 907·8 to 46 637·8)	–50·7% (–56·0 to –44·6)*	1343·9 (1246·5 to 1465·6)	497·8 (439·2 to 568·8)	–63·0% (–66·9 to –58·6)*
HIV/AIDS and drug-susceptible tuberculosis co-infection	477·2 (340·6 to 569·7)	190·5 (125·2 to 252·6)	–60·1% (–68·6 to –49·1)*	7·9 (5·6 to 9·4)	2·3 (1·5 to 3·0)	–71·3% (–77·5 to –63·5)*	26 632·9 (18 980·6 to 31 911·6)	9365·2 (6135·8 to 12 463·7)	–64·8% (–72·6 to –55·4)*	432·4 (307·9 to 517·9)	114·5 (74·9 to 152·5)	–73·5% (–79·4 to –66·5)*
HIV/AIDS and multidrug-resistant tuberculosis without extensive drug resistance co-infection	29·9 (7·8 to 81·5)	18·8 (6·5 to 38·9)	–37·2% (–73·3 to 82·7)	0·5 (0·1 to 1·4)	0·2 (0·1 to 0·5)	–55·0% (–80·8 to 31·4)	1656·9 (434·8 to 4546·7)	927·2 (319·3 to 1921·4)	–44·0% (–75·7 to 61·2)	26·9 (7·1 to 74·0)	11·3 (3·9 to 23·5)	–57·9% (–81·6 to 20·0)
HIV/AIDS and extensively drug-resistant tuberculosis co-infection	0·4 (0·1 to 0·9)	0·8 (0·3 to 1·6)	125·1% (4·4 to 443·7)*	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	61·2% (–24·9 to 286·1)	19·0 (5·2 to 46·4)	39·3 (15·5 to 78·1)	107·0% (–3·4 to 402·6)	0·3 (0·1 to 0·8)	0·5 (0·2 to 0·9)	54·0% (–27·8 to 272·7)
HIV/AIDS resulting in other diseases	981·9 (863·6 to 1174·0)	623·3 (519·2 to 770·0)	–36·5% (–48·1 to –24·5)*	16·2 (14·3 to 19·4)	7·4 (6·2 to 9·1)	–54·5% (–62·8 to –46·0)*	54 454·7 (47 620·4 to 64 665·7)	30 462·9 (25 561·4 to 37 382·8)	–44·1% (–53·5 to –33·4)*	884·3 (772·9 to 1048·7)	371·5 (311·5 to 454·2)	–58·0% (–65·0 to –50·2)*
Sexually transmitted infections excluding HIV	88·9 (39·6 to 164·0)	83·7 (35·7 to 154·3)	–5·8% (–21·2 to 7·1)	1·5 (0·7 to 2·7)	1·3 (0·5 to 2·5)	–9·4% (–25·8 to 2·4)	7544·2 (3116·7 to 14 412·4)	6991·2 (2728·7 to 13 257·7)	–7·3% (–21·0 to 5·3)	122·2 (50·6 to 233·3)	112·6 (43·1 to 214·8)	–7·9% (–22·1 to 4·7)
Syphilis	82·9 (33·2 to 159·9)	77·0 (29·5 to 147·5)	–7·1% (–21·1 to 6·4)	1·3 (0·5 to 2·6)	1·2 (0·5 to 2·4)	–8·0% (–22·1 to 4·5)	7283·1 (2827·8 to 14 218·5)	6725·4 (2488·9 to 12 994·1)	–7·7% (–21·8 to 6·1)	117·9 (45·8 to 230·1)	109·4 (40·2 to 211·6)	–7·2% (–21·9 to 6·7)
Chlamydial infection	1·3 (0·7 to 2·6)	1·5 (0·9 to 2·6)	11·0% (–51·0 to 135·0)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–26·1% (–67·1 to 54·7)	63·0 (32·0 to 126·6)	62·8 (34·9 to 115·3)	–0·3% (–58·5 to 122·2)	1·0 (0·5 to 2·0)	0·8 (0·4 to 1·4)	–25·7% (–69·0 to 64·3)
Gonococcal infection	0·6 (0·3 to 1·0)	0·6 (0·4 to 1·0)	7·8% (–41·6 to 91·3)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–29·0% (–61·0 to 25·3)	26·7 (14·7 to 49·0)	25·9 (15·5 to 45·2)	–3·0% (–51·3 to 80·2)	0·4 (0·2 to 0·8)	0·3 (0·2 to 0·6)	–27·4% (–63·7 to 35·7)
Other sexually transmitted infections	4·0 (2·3 to 7·7)	4·6 (2·8 to 8·0)	15·0% (–46·8 to 127·4)	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·1)	–27·4% (–66·0 to 40·7)	171·3 (91·5 to 335·0)	177·0 (101·3 to 317·3)	3·3% (–55·2 to 116·4)	2·9 (1·6 to 5·6)	2·1 (1·2 to 3·8)	–26·8% (–68·1 to 51·8)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Respiratory infections and tuberculosis	**4446·2 (4000·3 to 4975·1)**	**4337·1 (3947·6 to 4723·1)**	**–1·4% (–13·0 to 13·0)**	**84·0 (75·8 to 93·8)**	**52·9 (48·1 to 57·6)**	**–36·4% (–43·4 to –27·4)***	**233 209·3 (208 675·3 to 263 016·9)**	**156 730·3 (138 940·5 to 173 994·9)**	**–32·5% (–41·5 to –20·9)***	**3962·0 (3548·2 to 4466·5)**	**2106·8 (1864·0 to 2361·4)**	**–46·6% (–54·1 to –37·6)***
Tuberculosis	1760·3 (1397·6 to 2165·4)	1010·5 (806·6 to 1244·7)	–42·6% (–57·8 to –20·2)*	32·7 (26·0 to 40·3)	11·6 (9·2 to 14·4)	–64·4% (–73·7 to –50·8)*	72 482·5 (56 508·1 to 91 015·3)	37 633·5 (29 040·2 to 46 853·0)	–48·1% (–62·7 to –28·3)*	1249·9 (977·5 to 1562·4)	455·2 (349·3 to 570·1)	–63·6% (–73·8 to –49·8)*
Drug-susceptible tuberculosis	1629·6 (1241·5 to 2010·7)	908·3 (670·6 to 1140·9)	–44·3% (–61·0 to –18·8)*	30·3 (23·1 to 37·7)	10·5 (7·7 to 13·2)	–65·4% (–75·8 to –49·9)*	67 228·8 (50 572·5 to 84 499·1)	33 952·7 (24 886·5 to 43 347·3)	–49·5% (–65·7 to –27·8)*	1158·9 (874·0 to 1451·8)	411·2 (300·0 to 528·0)	–64·5% (–75·9 to –49·5)*
Multidrug-resistant tuberculosis without extensive drug resistance	127·1 (35·2 to 305·7)	95·5 (28·9 to 224·1)	–24·9% (–76·0 to 147·9)	2·4 (0·7 to 5·7)	1·1 (0·3 to 2·6)	–53·8% (–85·3 to 51·1)	5112·2 (1376·5 to 12 610·0)	3448·2 (1093·5 to 7932·4)	–32·5% (–76·7 to 118·8)	88·6 (24·0 to 217·4)	41·3 (13·2 to 94·0)	–53·4% (–83·9 to 50·0)
Extensively drug-resistant tuberculosis	3·6 (1·1 to 8·8)	6·8 (2·6 to 14·5)	86·6% (–21·9 to 400·0)	0·1 (0·0 to 0·2)	0·1 (0·0 to 0·2)	13·5% (–52·4 to 199·2)	141·5 (41·2 to 346·0)	232·6 (92·1 to 503·8)	64·5% (–30·6 to 336·4)	2·5 (0·7 to 6·0)	2·7 (1·1 to 5·9)	10·5% (–53·2 to 191·5)
Lower respiratory infections	2646·6 (2369·3 to 2950·0)	2501·3 (2241·0 to 2812·2)	–5·5% (–19·0 to 9·4)	50·5 (45·6 to 55·7)	31·6 (28·3 to 35·3)	–37·5% (–46·0 to –28·1)*	158 286·0 (136 227·6 to 182 886·1)	98 421·5 (87 415·4 to 111 734·7)	–37·8% (–48·2 to –24·7)*	2671·2 (2305·3 to 3075·7)	1391·9 (1215·8 to 1601·7)	–47·9% (–56·6 to –36·7)*
Upper respiratory infections	38·3 (7·1 to 93·9)	27·1 (6·1 to 77·3)	–29·4% (–68·7 to 48·4)	0·7 (0·1 to 1·7)	0·4 (0·1 to 1·1)	–46·9% (–76·8 to 6·8)	2389·4 (387·8 to 6402·0)	1727·4 (277·4 to 5097·2)	–27·7% (–69·3 to 65·7)	40·1 (6·6 to 106·4)	25·9 (3·9 to 76·6)	–35·4% (–72·7 to 47·4)
Otitis media	1·0 (0·3 to 3·7)	0·7 (0·3 to 1·7)	–35·3% (–78·8 to 166·6)	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	–56·0% (–85·2 to 83·5)	51·3 (11·9 to 206·6)	31·9 (10·2 to 94·8)	–37·9% (–81·5 to 219·9)	0·9 (0·2 to 3·5)	0·4 (0·1 to 1·3)	–49·7% (–85·1 to 156·2)
COVID-19	0·0 (0·0 to 0·0)	797·6 (722·9 to 857·0)	0·0% (0·0 to 0·0)	0·0 (0·0 to 0·0)	9·3 (8·4 to 10·0)	0·0% (0·0 to 0·0)	0·0 (0·0 to 0·0)	18 916·1 (17 699·8 to 19 764·2)	0·0% (0·0 to 0·0)	0·0 (0·0 to 0·0)	233·3 (219·0 to 244·0)	0·0% (0·0 to 0·0)
Enteric infections	**2658·5 (2142·0 to 3452·1)**	**1268·6 (962·6 to 1683·3)**	**–52·3% (–61·9 to –40·0)***	**48·4 (39·1 to 64·1)**	**16·4 (12·6 to 21·3)**	**–66·1% (–72·4 to –57·5)***	**165 871·4 (133 972·2 to 201 264·5)**	**61 613·6 (48 551·8 to 78 598·2)**	**–62·9% (–70·1 to –52·3)***	**2769·9 (2241·4 to 3358·4)**	**879·9 (694·4 to 1126·1)**	**–68·2% (–74·7 to –59·0)***
Diarrhoeal diseases	2336·2 (1838·9 to 3112·9)	1107·1 (810·5 to 1535·9)	–52·6% (–63·3 to –38·5)*	43·2 (33·8 to 59·0)	14·2 (10·6 to 19·2)	–67·2% (–74·1 to –57·7)*	140 734·9 (108 979·9 to 177 999·5)	49 534·6 (37 596·6 to 65 658·5)	–64·8% (–73·3 to –52·6)*	2365·9 (1833·8 to 2982·2)	706·0 (531·1 to 931·4)	–70·2% (–77·4 to –59·1)*
Typhoid and paratyphoid	231·3 (122·0 to 378·2)	82·8 (43·4 to 135·4)	–64·2% (–68·2 to –58·6)*	3·7 (2·0 to 6·1)	1·1 (0·6 to 1·9)	–69·2% (–72·5 to –64·7)*	18 217·0 (9546·2 to 30 015·7)	6154·0 (3217·3 to 9994·0)	–66·2% (–70·0 to –61·0)*	291·2 (153·4 to 480·7)	86·9 (45·6 to 141·2)	–70·1% (–73·6 to –65·4)*
Typhoid fever	196·9 (101·7 to 326·2)	72·0 (38·1 to 118·6)	–63·5% (–67·5 to –57·7)*	3·2 (1·6 to 5·2)	1·0 (0·5 to 1·6)	–68·5% (–72·0 to –63·9)*	15 503·9 (7911·3 to 25 488·6)	5352·6 (2773·7 to 8719·9)	–65·5% (–69·5 to –60·1)*	247·9 (125·7 to 407·8)	75·6 (39·0 to 122·4)	–69·5% (–73·1 to –64·8)*
Paratyphoid fever	34·4 (16·0 to 64·7)	10·9 (5·2 to 20·9)	–68·5% (–72·5 to –62·5)*	0·6 (0·3 to 1·0)	0·1 (0·1 to 0·3)	–72·8% (–76·3 to –67·9)*	2713·1 (1252·9 to 5065·2)	801·4 (379·4 to 1567·5)	–70·5% (–74·4 to –64·7)*	43·3 (19·9 to 80·5)	11·3 (5·3 to 22·4)	–73·9% (–77·5 to –69·0)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Invasive non-typhoidal salmonella	89·5 (72·5 to 112·2)	76·7 (60·1 to 100·1)	−14·3% (−23·9 to −4·0)*	1·5 (1·2 to 1·8)	1·1 (0·8 to 1·4)	−25·9% (−35·3 to −16·8)*	6834·5 (5356·2 to 8716·2)	5843·9 (4441·4 to 7770·4)	−14·5% (−25·0 to −3·3)*	111·4 (87·2 to 142·0)	85·9 (64·3 to 115·6)	−22·8% (−32·5 to −12·5)*
Other intestinal infectious diseases	1·5 (1·2 to 1·9)	1·9 (1·4 to 2·4)	27·5% (−13·5 to 82·5)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	−14·9% (−41·8 to 23·6)	85·0 (62·3 to 111·7)	81·0 (59·0 to 105·1)	−4·7% (−41·4 to 46·5)	1·4 (1·0 to 1·8)	1·1 (0·8 to 1·4)	−24·5% (−53·6 to 16·2)
Neglected tropical diseases and malaria	**1050·3 (652·3 to 1601·1)**	**804·9 (394·2 to 1392·4)**	**−23·4% (−40·1 to −11·4)***	**17·5 (10·9 to 26·6)**	**11·3 (5·4 to 19·5)**	**−35·5% (−50·0 to −25·6)***	**79 141·6 (47 827·7 to 122 595·4)**	**56 346·7 (26 007·0 to 98 093·7)**	**−28·8% (−44·8 to −17·9)***	**1295·3 (783·7 to 2006·4)**	**829·8 (378·5 to 1443·5)**	**−35·9% (−51·1 to −26·1)***
Malaria	881·4 (478·4 to 1450·7)	670·0 (261·2 to 1257·9)	−24·0% (−46·2 to −11·3)*	14·6 (8·0 to 24·0)	9·6 (3·7 to 17·9)	−34·5% (−54·1 to −23·8)*	68 625·0 (36 825·2 to 112 650·3)	49 102·3 (18 837·4 to 91 563·7)	−28·4% (−49·6 to −16·1)*	1124·7 (604·9 to 1843·1)	732·1 (280·5 to 1358·1)	−34·9% (−54·2 to −23·9)*
Chagas disease	10·6 (9·8 to 11·6)	8·4 (7·5 to 9·4)	−20·5% (−27·2 to −13·9)*	0·2 (0·2 to 0·2)	0·1 (0·1 to 0·1)	−57·0% (−60·5 to −53·3)*	295·2 (273·9 to 321·8)	190·7 (171·5 to 210·9)	−35·4% (−40·5 to −30·5)*	5·6 (5·2 to 6·1)	2·1 (1·9 to 2·3)	−62·8% (−65·8 to −59·9)*
Leishmaniasis	10·1 (2·5 to 24·2)	4·6 (1·9 to 8·7)	−54·1% (−67·8 to −17·0)*	0·2 (0·0 to 0·4)	0·1 (0·0 to 0·1)	−61·8% (−74·1 to −27·2)*	738·5 (194·5 to 1743·9)	332·1 (141·3 to 610·1)	−55·0% (−69·8 to −17·1)*	11·9 (3·1 to 28·2)	4·6 (2·0 to 8·4)	−61·1% (−74·4 to −26·4)*
Visceral leishmaniasis	10·1 (2·5 to 24·2)	4·6 (1·9 to 8·7)	−54·1% (−67·8 to −17·0)*	0·2 (0·0 to 0·4)	0·1 (0·0 to 0·1)	−61·8% (−74·1 to −27·2)*	738·5 (194·5 to 1743·9)	332·1 (141·3 to 610·1)	−55·0% (−69·8 to −17·1)*	11·9 (3·1 to 28·2)	4·6 (2·0 to 8·4)	−61·1% (−74·4 to −26·4)*
African trypanosomiasis	26·5 (13·4 to 45·8)	1·4 (0·7 to 2·5)	−94·7% (−95·2 to −94·1)*	0·4 (0·2 to 0·7)	0·0 (0·0 to 0·0)	−95·9% (−96·3 to −95·5)*	1620·1 (825·8 to 2806·8)	84·2 (40·1 to 147·4)	−94·8% (−95·3 to −94·3)*	25·2 (12·8 to 43·8)	1·1 (0·5 to 1·9)	−95·8% (−96·2 to −95·4)*
Schistosomiasis	21·6 (19·8 to 23·9)	13·5 (12·3 to 14·8)	−37·7% (−42·8 to −31·9)*	0·4 (0·4 to 0·4)	0·2 (0·1 to 0·2)	−59·4% (−62·7 to −56·0)*	987·8 (898·1 to 1115·3)	564·3 (508·2 to 623·0)	−42·9% (−47·7 to −37·9)*	16·5 (15·0 to 18·5)	6·8 (6·2 to 7·5)	−58·5% (−61·9 to −55·1)*
Cysticercosis	2·4 (1·8 to 3·2)	1·5 (1·1 to 2·1)	−36·4% (−53·9 to −10·1)*	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	−53·4% (−66·4 to −34·2)*	135·9 (99·2 to 194·0)	80·1 (55·6 to 114·4)	−41·1% (−58·3 to −16·5)*	2·2 (1·6 to 3·1)	1·0 (0·7 to 1·4)	−54·0% (−67·8 to −35·4)*
Cystic echinococcosis	3·0 (2·3 to 3·8)	1·4 (1·0 to 1·8)	−53·8% (−67·8 to −34·9)*	0·1 (0·0 to 0·1)	0·0 (0·0 to 0·0)	−68·1% (−77·5 to −55·3)*	179·3 (134·7 to 227·6)	61·8 (41·9 to 82·6)	−65·6% (−77·2 to −51·9)*	3·0 (2·2 to 3·8)	0·8 (0·5 to 1·1)	−73·4% (−83·0 to −62·5)*
Dengue	24·0 (9·0 to 60·2)	52·7 (25·2 to 108·9)	119·6% (−18·1 to 616·4)	0·4 (0·2 to 1·0)	0·7 (0·3 to 1·3)	60·9% (−40·0 to 415·1)	1612·3 (601·4 to 4086·4)	2655·6 (1233·0 to 5361·4)	64·7% (−39·5 to 442·1)	26·2 (9·8 to 66·3)	35·1 (16·2 to 70·8)	34·0% (−50·9 to 335·2)
Yellow fever	12·6 (4·5 to 26·7)	4·4 (1·5 to 9·3)	−65·0% (−71·0 to −58·8)*	0·2 (0·1 to 0·4)	0·1 (0·0 to 0·1)	−70·9% (−75·8 to −65·6)*	901·0 (318·6 to 1930·3)	310·0 (108·7 to 652·8)	−65·6% (−71·5 to −58·9)*	14·0 (5·0 to 30·1)	4·1 (1·4 to 8·7)	−70·5% (−75·7 to −64·7)*
Rabies	26·5 (13·9 to 44·0)	15·8 (6·7 to 27·4)	−40·3% (−74·0 to 15·5)	0·4 (0·2 to 0·7)	0·2 (0·1 to 0·3)	−55·7% (−80·5 to −14·4)*	1681·5 (851·8 to 2850·0)	870·9 (348·4 to 1588·3)	−48·2% (−78·6 to 4·3)	27·0 (13·7 to 45·7)	11·3 (4·4 to 20·8)	−58·1% (−82·6 to −15·3)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Intestinal nematode infections	14·3 (10·9 to 18·9)	5·0 (3·8 to 6·1)	−65·3% (−69·5 to −59·6)*	0·2 (0·2 to 0·3)	0·1 (0·1 to 0·1)	−68·6% (−72·6 to −63·4)*	1224·7 (925·4 to 1619·0)	409·0 (309·6 to 510·2)	−66·6% (−70·9 to −61·0)*	20·2 (15·2 to 26·7)	6·2 (4·7 to 7·7)	−69·3% (−73·2 to −64·1)*
Ascariasis	14·3 (10·9 to 18·9)	5·0 (3·8 to 6·1)	−65·3% (−69·5 to −59·6)*	0·2 (0·2 to 0·3)	0·1 (0·1 to 0·1)	−68·6% (−72·6 to −63·4)*	1224·7 (925·4 to 1619·0)	409·0 (309·6 to 510·2)	−66·6% (−70·9 to −61·0)*	20·2 (15·2 to 26·7)	6·2 (4·7 to 7·7)	−69·3% (−73·2 to −64·1)*
Ebola virus disease	0·3 (0·3 to 0·4)	0·0 (0·0 to 0·0)	−100·0% (−100·0 to −100·0)*	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	−100·0% (−100·0 to −100·0)*	18·1 (14·9 to 21·4)	0·0 (0·0 to 0·0)	−100·0% (−100·0 to −100·0)*	0·3 (0·2 to 0·3)	0·0 (0·0 to 0·0)	−100·0% (−100·0 to −100·0)*
Zika virus disease	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0% (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0% (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0% (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	0·0% (0·0 to 0·0)
Other neglected tropical diseases	16·9 (9·9 to 29·1)	26·3 (13·0 to 48·3)	55·1% (−31·6 to 234·7)	0·3 (0·2 to 0·5)	0·4 (0·2 to 0·7)	22·0% (−46·2 to 168·5)	1121·9 (595·1 to 2077·8)	1685·7 (699·5 to 3352·0)	50·3% (−41·1 to 256·5)	18·5 (9·9 to 34·2)	24·6 (9·9 to 49·6)	32·6% (−48·4 to 216·0)
Other infectious diseases	**1888·8 (1440·7 to 2382·5)**	**841·7 (682·3 to 1009·2)**	**−55·4% (−62·5 to −44·9)***	**31·4 (24·1 to 39·5)**	**11·6 (9·3 to 14·1)**	**−62·9% (−68·6 to −54·7)***	**148 686·9 (110 615·9 to 190 966·4)**	**56 632·6 (44 640·6 to 69 674·9)**	**−61·9% (−68·3 to −52·4)***	**2429·6 (1806·0 to 3120·1)**	**826·9 (639·9 to 1034·9)**	**−66·0% (−71·7 to −57·3)***
Meningitis	428·9 (341·9 to 547·5)	258·8 (202·2 to 334·6)	−39·7% (−56·7 to −17·2)*	7·2 (5·7 to 9·1)	3·5 (2·7 to 4·6)	−51·3% (−65·6 to −32·1)*	31 766·9 (24 209·5 to 41 522·9)	16 918·5 (13 198·7 to 22 556·0)	−46·7% (−63·5 to −23·3)*	516·5 (393·3 to 676·7)	239·5 (185·0 to 326·9)	−53·6% (−68·3 to −34·4)*
Encephalitis	82·0 (52·0 to 119·1)	76·5 (54·7 to 113·4)	−6·7% (−43·1 to 38·0)	1·4 (0·9 to 2·1)	1·0 (0·7 to 1·4)	−33·5% (−59·4 to −1·4)*	4995·7 (3183·0 to 7374·9)	3683·9 (2525·8 to 5765·2)	−26·3% (−56·1 to 14·0)	82·4 (52·5 to 121·5)	50·0 (34·1 to 79·1)	−39·3% (−64·0 to −5·9)*
Diphtheria	23·3 (18·0 to 29·6)	4·0 (3·0 to 5·3)	−82·8% (−86·7 to −78·1)*	0·4 (0·3 to 0·5)	0·1 (0·0 to 0·1)	−84·5% (−88·1 to −80·2)*	1960·7 (1506·4 to 2513·8)	329·7 (242·6 to 440·7)	−83·2% (−87·2 to −78·5)*	32·0 (24·5 to 41·1)	4·9 (3·6 to 6·6)	−84·7% (−88·4 to −80·2)*
Pertussis	205·9 (111·4 to 328·6)	115·2 (66·6 to 189·2)	−44·0% (−68·8 to −4·2)*	3·4 (1·8 to 5·4)	1·8 (1·0 to 2·9)	−46·8% (−70·4 to −9·1)*	17 890·3 (9682·8 to 28 542·9)	10 001·5 (5766·0 to 16 405·3)	−44·1% (−68·9 to −4·3)*	292·3 (158·3 to 466·3)	155·9 (89·8 to 256·0)	−46·7% (−70·3 to −8·9)*
Tetanus	126·4 (91·1 to 179·2)	19·8 (11·7 to 31·0)	−84·4% (−90·8 to −74·3)*	2·1 (1·5 to 3·0)	0·3 (0·2 to 0·4)	−87·3% (−92·5 to −79·8)*	9792·2 (6895·6 to 13 888·7)	1239·8 (745·3 to 1917·7)	−87·3% (−92·8 to −79·6)*	158·6 (111·8 to 225·2)	17·8 (10·8 to 27·3)	−88·8% (−93·6 to −82·0)*
Measles	762·8 (347·4 to 1338·5)	143·6 (58·6 to 255·2)	−81·2% (−84·4 to −78·3)*	12·5 (5·7 to 21·9)	2·2 (0·9 to 3·9)	−82·3% (−85·3 to −79·6)*	66 032·7 (30 137·0 to 115 712·6)	12 431·7 (5068·1 to 22 097·5)	−81·2% (−84·4 to −78·3)*	1081·2 (493·8 to 1893·1)	191·9 (78·2 to 341·2)	−82·2% (−85·3 to −79·5)*
Varicella and herpes zoster	15·3 (14·0 to 16·5)	13·7 (12·2 to 14·8)	−10·4% (−17·9 to −2·5)*	0·3 (0·3 to 0·3)	0·2 (0·2 to 0·2)	−41·0% (−45·3 to −36·3)*	872·2 (789·1 to 966·6)	598·8 (534·3 to 662·1)	−31·4% (−37·6 to −23·8)*	14·7 (13·4 to 16·3)	8·6 (7·6 to 9·6)	−41·7% (−47·1 to −35·0)*
Acute hepatitis	171·7 (124·5 to 227·8)	93·1 (65·4 to 123·4)	−45·8% (−64·5 to −19·6)*	2·9 (2·1 to 3·9)	1·2 (0·8 to 1·6)	−59·7% (−73·8 to −40·0)*	10 991·5 (7719·8 to 14 818·4)	5146·2 (3538·2 to 6952·0)	−53·2% (−71·5 to −28·7)*	179·1 (126·1 to 241·8)	69·0 (46·7 to 94·0)	−61·5% (−76·8 to −41·1)*
Acute hepatitis A	103·8 (75·1 to 147·2)	35·6 (21·8 to 52·0)	−65·7% (−80·3 to −45·6)*	1·7 (1·3 to 2·5)	0·5 (0·3 to 0·7)	−73·2% (−84·7 to −57·2)*	7122·9 (4960·5 to 10 188·7)	2170·2 (1293·2 to 3222·5)	−69·5% (−82·9 to −50·7)*	115·5 (80·5 to 165·6)	30·0 (17·7 to 45·3)	−74·1% (−85·5 to −57·6)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Acute hepatitis B	54·1 (31·1 to 87·3)	45·9 (28·0 to 66·9)	−15·2% (−53·0 to 53·2)	0·9 (0·5 to 1·5)	0·6 (0·3 to 0·8)	−38·8% (−66·5 to 8·1)	3169·3 (1652·8 to 5272·4)	2403·0 (1395·3 to 3610·2)	−24·2% (−60·0 to 43·3)	52·0 (27·5 to 86·2)	31·6 (18·0 to 47·9)	−39·1% (−68·0 to 13·5)
Acute hepatitis C	10·4 (5·0 to 18·1)	7·2 (3·8 to 11·9)	−30·5% (−65·7 to 27·1)	0·2 (0·1 to 0·3)	0·1 (0·0 to 0·1)	−55·0% (−77·6 to −17·2)*	483·3 (210·2 to 873·5)	312·1 (148·6 to 543·9)	−35·4% (−67·6 to 23·6)	8·2 (3·6 to 14·5)	3·8 (1·8 to 6·8)	−53·1% (−76·5 to −12·5)*
Acute hepatitis E	3·5 (1·6 to 6·5)	4·4 (2·1 to 8·1)	26·0% (−45·0 to 173·8)	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·1)	−4·3% (−57·7 to 116·7)	216·0 (93·2 to 443·9)	260·9 (119·4 to 490·9)	20·8% (−50·7 to 180·6)	3·5 (1·5 to 7·2)	3·6 (1·6 to 6·8)	1·7% (−58·5 to 144·7)
Other unspecified infectious diseases	72·5 (41·4 to 115·1)	117·0 (65·3 to 191·9)	61·4% (3·4 to 144·9)*	1·3 (0·7 to 2·0)	1·5 (0·8 to 2·5)	18·2% (−24·2 to 81·2)	4384·6 (2323·4 to 7276·8)	6282·5 (3183·3 to 10 888·1)	43·3% (−15·8 to 131·4)	72·6 (38·8 to 120·2)	89·1 (44·2 to 156·6)	22·7% (−28·3 to 100·6)
Maternal and neonatal disorders	**3007·2 (2877·3 to 3149·7)**	**1867·9 (1739·6 to 1993·0)**	**−37·9% (−42·5 to −33·6)***	**48·2 (46·1 to 50·5)**	**29·7 (27·6 to 31·7)**	**−38·5% (−43·0 to −34·0)***	**259 274·7 (247 935·5 to 271 583·0)**	**160 961·8 (149 602·1 to 171 949·9)**	**−37·9% (−42·5 to −33·3)***	**4162·7 (3979·9 to 4360·5)**	**2581·6 (2402·3 to 2761·6)**	**−38·0% (−42·6 to −33·3)***
Maternal disorders	396·7 (355·3 to 438·6)	239·9 (207·8 to 280·3)	−39·5% (−48·1 to −27·9)*	6·1 (5·4 to 6·7)	3·0 (2·6 to 3·5)	−50·8% (−57·7 to −41·3)*	24 511·9 (21 945·7 to 27 102·5)	14 559·5 (12 630·9 to 16 968·2)	−40·6% (−48·8 to −29·1)*	374·3 (335·1 to 413·9)	182·7 (158·5 to 212·8)	−51·2% (−57·8 to −41·7)*
Maternal haemorrhage	133·9 (102·0 to 165·4)	52·0 (35·8 to 70·0)	−61·2% (−74·3 to −43·7)*	2·1 (1·6 to 2·5)	0·6 (0·4 to 0·9)	−68·5% (−79·2 to −54·4)*	8217·9 (6262·5 to 10 169·5)	3127·0 (2160·9 to 4205·8)	−61·9% (−74·9 to −44·7)*	125·7 (95·8 to 155·5)	39·1 (27·1 to 52·7)	−68·9% (−79·5 to −54·8)*
Maternal sepsis and other pregnancy-related infections	43·6 (30·6 to 61·2)	26·7 (19·0 to 37·1)	−38·7% (−58·2 to −8·0)*	0·7 (0·5 to 0·9)	0·3 (0·2 to 0·5)	−49·9% (−65·7 to −24·8)*	2719·9 (1902·2 to 3807·8)	1627·1 (1156·8 to 2253·8)	−40·2% (−59·2 to −10·2)*	41·4 (29·0 to 58·0)	20·4 (14·5 to 28·3)	−50·6% (−66·2 to −25·9)*
Maternal hypertensive disorders	68·9 (53·9 to 85·1)	48·2 (37·3 to 59·9)	−30·0% (−49·1 to −5·6)*	1·1 (0·8 to 1·3)	0·6 (0·5 to 0·8)	−42·7% (−58·4 to −22·7)*	4299·7 (3367·0 to 5317·2)	2940·4 (2275·4 to 3662·6)	−31·6% (−50·3 to −8·0)*	65·5 (51·3 to 80·9)	37·0 (28·6 to 46·1)	−43·5% (−59·0 to −24·0)*
Maternal obstructed labour and uterine rupture	22·1 (13·4 to 33·4)	12·2 (7·5 to 18·4)	−44·8% (−69·7 to 5·3)	0·3 (0·2 to 0·5)	0·2 (0·1 to 0·2)	−55·4% (−75·4 to −14·9)*	1342·8 (806·8 to 2039·5)	736·3 (452·0 to 1119·2)	−45·2% (−70·0 to 4·9)	20·6 (12·4 to 31·3)	9·2 (5·7 to 14·0)	−55·2% (−75·5 to −14·4)*
Maternal abortive outcome	43·4 (29·1 to 64·0)	19·6 (12·2 to 30·8)	−54·8% (−71·2 to −19·8)*	0·7 (0·4 to 1·0)	0·2 (0·2 to 0·4)	−63·2% (−76·6 to −34·9)*	2675·5 (1786·7 to 3944·6)	1205·0 (748·7 to 1890·4)	−55·0% (−71·4 to −20·1)*	40·9 (27·4 to 60·3)	15·1 (9·4 to 23·7)	−63·0% (−76·5 to −34·3)*
Ectopic pregnancy	9·9 (6·6 to 14·1)	12·7 (8·5 to 17·8)	28·6% (−22·4 to 99·5)	0·2 (0·1 to 0·2)	0·2 (0·1 to 0·2)	4·8% (−36·7 to 62·5)	613·2 (410·2 to 872·7)	776·7 (520·9 to 1079·9)	26·7% (−23·5 to 96·4)	9·4 (6·3 to 13·3)	9·8 (6·5 to 13·5)	4·3% (−37·0 to 61·6)
Indirect maternal deaths	29·7 (19·6 to 42·7)	23·0 (16·3 to 32·7)	−22·5% (−47·7 to 20·4)	0·5 (0·3 to 0·7)	0·3 (0·2 to 0·4)	−36·5% (−57·1 to −1·3)*	1860·5 (1228·0 to 2667·9)	1409·4 (1002·3 to 2002·6)	−24·2% (−48·7 to 18·0)	28·3 (18·7 to 40·7)	17·7 (12·6 to 25·2)	−37·4% (−57·7 to −2·5)*
Late maternal deaths	7·2 (6·1 to 8·9)	8·0 (6·8 to 9·9)	10·8% (−3·3 to 29·3)	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·1)	−10·0% (−21·2 to 5·2)	447·0 (371·7 to 549·3)	484·1 (404·2 to 596·5)	8·3% (−6·1 to 26·5)	6·8 (5·7 to 8·4)	6·1 (5·0 to 7·5)	−11·1% (−22·5 to 3·9)
Maternal deaths aggravated by HIV/AIDS	2·7 (1·7 to 3·6)	1·7 (1·0 to 2·3)	−38·9% (−49·5 to −26·4)*	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	−50·9% (−59·4 to −41·0)*	166·9 (105·8 to 223·3)	96·1 (60·2 to 134·9)	−42·4% (−52·4 to −31·0)*	2·6 (1·6 to 3·4)	1·2 (0·7 to 1·7)	−53·3% (−61·4 to −44·1)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Other direct maternal disorders	35·3 (23·1 to 51·0)	35·7 (25·2 to 51·8)	1·2% (−37·2 to 71·5)	0·5 (0·4 to 0·8)	0·4 (0·3 to 0·6)	−17·8% (−49·1 to 39·2)	2168·5 (1419·8 to 3142·4)	2157·5 (1520·0 to 3142·4)	−0·5% (−38·6 to 68·3)	33·2 (21·7 to 48·1)	27·0 (19·1 to 39·4)	−18·5% (−49·7 to 37·9)
Neonatal disorders	2610·4 (2495·1 to 2736·7)	1628·0 (1506·0 to 1748·0)	−37·6% (−42·6 to −32·6)*	42·1 (40·3 to 44·2)	26·7 (24·7 to 28·6)	−36·7% (−41·7 to −31·5)*	234 762·8 (224 399·3 to 246 110·0)	146 402·3 (135 446·8 to 157 187·9)	−37·6% (−42·6 to −32·6)*	3788·5 (3620·9 to 3971·9)	2398·9 (2219·7 to 2575·4)	−36·7% (−41·7 to −31·5)*
Neonatal preterm birth	1064·4 (922·5 to 1244·7)	623·3 (509·7 to 735·0)	−41·4% (−54·4 to −25·6)*	17·2 (14·9 to 20·1)	10·2 (8·4 to 12·0)	−40·5% (−53·7 to −24·4)*	95 728·4 (82 962·8 to 111 938·1)	56 052·0 (45 839·1 to 66 086·5)	−41·4% (−54·4 to −25·6)*	1544·6 (1338·6 to 1806·0)	918·4 (751·2 to 1082·6)	−40·5% (−53·7 to −24·4)*
Neonatal encephalopathy due to birth asphyxia and trauma	825·2 (676·6 to 995·4)	562·1 (471·4 to 678·7)	−31·9% (−47·1 to −7·1)*	13·3 (10·9 to 16·1)	9·2 (7·7 to 11·1)	−30·8% (−46·2 to −5·6)*	74 223·5 (60 862·4 to 89 528·0)	50 562·7 (42 408·8 to 61 048·3)	−31·9% (−47·1 to −7·1)*	1196·9 (981·4 to 1444·0)	828·9 (695·3 to 1000·7)	−30·7% (−46·2 to −5·6)*
Neonatal sepsis and other neonatal infections	324·7 (213·8 to 466·6)	223·2 (155·6 to 315·2)	−31·3% (−54·8 to 2·5)	5·2 (3·5 to 7·5)	3·7 (2·5 to 5·2)	−30·3% (−54·2 to 3·8)	29 199·1 (19 224·7 to 41 953·3)	20 069·1 (13 989·7 to 28 336·6)	−31·3% (−54·8 to 2·5)	471·9 (310·7 to 678·0)	328·7 (229·1 to 464·0)	−30·3% (−54·2 to 3·8)
Haemolytic disease and other neonatal jaundice	99·2 (54·4 to 180·0)	30·3 (16·7 to 47·8)	−69·4% (−82·9 to −42·2)*	1·6 (0·9 to 2·9)	0·5 (0·3 to 0·8)	−69·0% (−82·7 to −41·4)*	8913·3 (4890·9 to 16 180·1)	2726·9 (1501·2 to 4296·3)	−69·4% (−82·9 to −42·2)*	144·1 (79·1 to 261·5)	44·7 (24·6 to 70·4)	−69·0% (−82·7 to −41·4)*
Other neonatal disorders	296·9 (207·3 to 420·9)	189·0 (124·2 to 267·4)	−36·4% (−59·3 to 1·7)	4·8 (3·3 to 6·8)	3·1 (2·0 to 4·4)	−35·4% (−58·7 to 3·2)	26 698·5 (18 643·0 to 37 846·9)	16 991·7 (11 163·8 to 24 043·6)	−36·4% (−59·3 to 1·7)	431·0 (301·0 to 610·8)	278·3 (182·8 to 393·9)	−35·4% (−58·7 to 3·2)
Nutritional deficiencies	**425·4 (355·6 to 499·8)**	**288·6 (231·1 to 350·3)**	**−32·2% (−47·4 to −12·6)***	**7·7 (6·5 to 9·1)**	**3·8 (3·0 to 4·6)**	**−51·5% (−62·4 to −37·5)***	**28 966·7 (23 792·6 to 34 568·4)**	**13 067·2 (10 013·5 to 16 919·1)**	**−54·9% (−66·7 to −39·4)***	**483·1 (397·1 to 575·5)**	**188·6 (142·9 to 246·9)**	**−61·0% (−71·2 to −47·6)***
Protein-energy malnutrition	378·2 (316·6 to 448·9)	245·8 (195·9 to 300·8)	−35·1% (−50·6 to −15·6)*	6·8 (5·7 to 8·1)	3·3 (2·6 to 4·1)	−52·4% (−63·9 to −38·7)*	26 783·9 (21 969·1 to 32 265·2)	11 799·0 (8808·0 to 15 515·0)	−56·0% (−68·5 to −41·4)*	445·7 (365·8 to 536·0)	172·7 (127·5 to 229·0)	−61·3% (−72·3 to −48·2)*
Other nutritional deficiencies	47·2 (36·0 to 61·1)	42·8 (30·1 to 58·5)	−9·4% (−36·5 to 34·5)	0·9 (0·7 to 1·2)	0·5 (0·4 to 0·7)	−45·2% (−61·9 to −19·1)*	2182·8 (1568·7 to 3015·5)	1268·2 (859·0 to 1769·6)	−41·9% (−62·0 to −7·4)*	37·4 (27·1 to 51·4)	15·9 (10·8 to 22·2)	−57·4% (−72·5 to −31·2)*
Non-communicable diseases	**31 130·5 (30 469·8 to 31 722·1)**	**44 842·6 (43 824·4 to 46 047·5)**	**43·9% (39·5 to 48·6)***	**666·6 (653·0 to 678·2)**	**506·2 (494·7 to 519·3)**	**−24·1% (−26·4 to −21·7)***	**813 992·9 (789 034·7 to 837 268·3)**	**1 035 074·3 (1 009 265·1 to 1 063 890·6)**	**27·1% (22·2 to 32·4)***	**15 672·8 (15 242·2 to 16 077·7)**	**11 866·9 (11 560·1 to 12 221·0)**	**−24·3% (−27·1 to −21·4)***
Neoplasms	**7072·9 (6679·9 to 7356·8)**	**10 567·9 (9726·9 to 11 166·9)**	**49·3% (41·2 to 57·8)***	**143·9 (135·8 to 150·0)**	**117·0 (107·7 to 123·5)**	**−18·8% (−22·6 to −14·4)***	**197 152·6 (187 838·8 to 204 021·0)**	**267 421·9 (252 512·2 to 280 600·0)**	**35·6% (29·5 to 43·6)***	**3734·1 (3556·7 to 3868·0)**	**2984·7 (2819·7 to 3129·3)**	**−20·1% (−23·5 to −15·3)***
Lip and oral cavity cancer	120·6 (108·1 to 131·0)	225·7 (198·6 to 262·3)	87·1% (60·6 to 124·1)*	2·4 (2·2 to 2·6)	2·5 (2·2 to 2·9)	3·0% (−11·5 to 23·0)	3545·0 (3170·0 to 3892·6)	6290·1 (5461·5 to 7446·1)	77·4% (51·0 to 114·4)*	67·0 (60·0 to 73·4)	69·5 (60·3 to 82·4)	3·7% (−11·8 to 25·5)
Nasopharynx cancer	64·2 (56·3 to 71·5)	75·4 (63·3 to 89·1)	17·4% (−4·1 to 43·0)	1·2 (1·1 to 1·3)	0·8 (0·7 to 1·0)	−31·1% (−43·8 to −15·9)*	2273·6 (1967·4 to 2553·2)	2495·5 (2058·5 to 2957·0)	9·7% (−11·4 to 36·3)	40·7 (35·4 to 45·7)	28·0 (23·1 to 33·2)	−31·2% (−44·6 to −14·5)*
Other pharynx cancer	54·2 (46·7 to 65·7)	113·9 (92·5 to 140·6)	110·2% (60·8 to 168·8)*	1·1 (0·9 to 1·3)	1·2 (1·0 to 1·5)	16·5% (−10·7 to 49·2)	1639·7 (1400·5 to 1993·3)	3273·8 (2635·2 to 4090·5)	99·6% (52·0 to 159·1)*	31·1 (26·6 to 37·9)	35·8 (28·8 to 44·7)	14·9% (−12·5 to 48·8)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Oesophageal cancer	443·5 (380·3 to 481·6)	577·8 (505·7 to 643·2)	29·8% (15·0 to 51·9)*	9·0 (7·7 to 9·8)	6·3 (5·5 to 7·0)	−30·0% (−37·9 to −18·1)*	11 478·2 (9812·4 to 12 479·0)	13 899·3 (12 424·2 to 15 658·7)	20·8% (7·0 to 43·2)*	223·7 (191·7 to 243·5)	151·2 (135·0 to 170·7)	−32·6% (−40·3 to −20·4)*
Stomach cancer	943·1 (808·3 to 1042·2)	935·9 (797·9 to 1083·5)	−0·9% (−12·2 to 15·3)	19·2 (16·5 to 21·3)	10·3 (8·8 to 11·9)	−46·6% (−52·7 to −38·1)*	24 561·0 (20 779·6 to 26 982·5)	22 182·4 (19 028·7 to 25 650·1)	−9·8% (−21·1 to 4·9)	474·3 (402·0 to 521·7)	243·2 (208·1 to 281·4)	−48·8% (−55·2 to −40·4)*
Colon and rectum cancer	704·3 (655·8 to 742·9)	1107·1 (997·7 to 1214·9)	57·1% (46·5 to 68·9)*	14·9 (13·8 to 15·8)	12·3 (11·0 to 13·5)	−17·9% (−23·5 to −12·0)*	16 986·2 (15 891·8 to 17 911·6)	25 041·4 (22 808·4 to 27 266·0)	47·4% (35·7 to 59·8)*	333·9 (312·4 to 351·9)	275·5 (250·7 to 300·3)	−17·5% (−24·0 to −10·7)*
Liver cancer	325·8 (297·8 to 357·9)	507·7 (442·4 to 570·0)	55·9% (34·6 to 79·0)*	6·4 (5·9 to 7·0)	5·6 (4·9 to 6·3)	−13·0% (−24·8 to −0·4)*	9798·0 (8817·8 to 10 941·2)	13 782·5 (11 945·8 to 15 939·9)	40·7% (18·6 to 65·0)*	182·9 (165·1 to 203·6)	153·3 (132·4 to 178·3)	−16·2% (−29·4 to −1·7)*
Liver cancer due to hepatitis B	141·4 (123·5 to 162·0)	188·3 (161·3 to 220·6)	33·4% (13·6 to 55·5)*	2·7 (2·3 to 3·1)	2·1 (1·8 to 2·4)	−22·4% (−33·8 to −9·1)*	4851·2 (4219·9 to 5543·1)	5956·2 (5089·8 to 6886·3)	22·9% (3·2 to 44·1)*	87·8 (76·3 to 100·2)	66·3 (56·6 to 76·8)	−24·4% (−36·3 to −11·2)*
Liver cancer due to hepatitis C	93·5 (82·0 to 107·7)	155·5 (131·1 to 186·4)	66·3% (45·9 to 87·6)*	2·0 (1·7 to 2·2)	1·7 (1·5 to 2·1)	−12·5% (−22·8 to −1·6)*	2179·6 (1920·9 to 2566·2)	3355·5 (2790·7 to 4121·1)	53·8% (34·1 to 76·2)*	43·5 (38·2 to 51·0)	36·6 (30·5 to 45·0)	−15·8% (−26·2 to −3·6)*
Liver cancer due to alcohol use	51·1 (42·4 to 63·0)	95·1 (75·9 to 117·6)	86·1% (58·3 to 116·7)*	1·0 (0·8 to 1·3)	1·0 (0·8 to 1·3)	1·3% (−13·8 to 17·7)	1361·2 (1123·7 to 1695·5)	2413·0 (1899·3 to 3046·1)	77·3% (47·2 to 111·3)*	26·2 (21·7 to 32·6)	26·2 (20·5 to 33·1)	0·0% (−16·7 to 19·2)
Liver cancer due to NASH	20·5 (16·3 to 25·4)	41·7 (31·6 to 52·6)	103·9% (69·0 to 138·6)*	0·4 (0·3 to 0·5)	0·5 (0·3 to 0·6)	10·8% (−7·6 to 29·5)	551·6 (439·7 to 686·3)	1045·7 (801·0 to 1337·1)	89·6% (53·9 to 125·3)*	10·5 (8·4 to 13·0)	11·5 (8·8 to 14·7)	9·6% (−10·9 to 30·4)
Hepatoblastoma	3·9 (2·9 to 5·2)	3·5 (2·3 to 5·2)	−10·9% (−44·5 to 45·1)	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·1)	−16·0% (−47·7 to 36·9)	343·5 (250·1 to 455·3)	306·0 (198·7 to 454·9)	−10·9% (−44·6 to 45·2)	5·6 (4·1 to 7·5)	4·7 (3·1 to 7·0)	−15·9% (−47·7 to 37·2)
Liver cancer due to other causes	15·5 (13·0 to 18·5)	23·6 (18·4 to 29·7)	52·4% (27·4 to 76·4)*	0·3 (0·2 to 0·4)	0·3 (0·2 to 0·3)	−12·6% (−25·5 to 1·4)	510·9 (423·9 to 623·8)	706·0 (541·5 to 886·1)	38·2% (14·7 to 67·0)*	9·3 (7·7 to 11·3)	7·9 (6·1 to 9·9)	−14·7% (−29·6 to 2·6)
Gallbladder and biliary tract cancer	118·6 (105·8 to 132·7)	184·1 (159·8 to 220·6)	55·2% (40·4 to 69·6)*	2·5 (2·3 to 2·8)	2·0 (1·8 to 2·4)	−19·5% (−27·0 to −12·0)*	2709·1 (2406·6 to 3056·5)	3948·6 (3411·9 to 4727·4)	45·7% (30·1 to 60·0)*	54·2 (48·3 to 60·8)	43·1 (37·3 to 51·6)	−20·5% (−28·9 to −12·5)*
Pancreatic cancer	280·5 (262·5 to 294·3)	552·7 (501·8 to 588·7)	96·9% (85·9 to 108·2)*	5·9 (5·4 to 6·2)	6·1 (5·5 to 6·5)	3·1% (−2·3 to 8·8)	6706·1 (6336·4 to 7017·3)	12 167·8 (11 281·6 to 12 986·1)	81·3% (70·8 to 92·7)*	132·7 (125·0 to 139·0)	132·4 (122·7 to 141·4)	−0·4% (−5·9 to 5·7)
Larynx cancer	87·9 (77·7 to 98·8)	130·8 (112·1 to 156·4)	48·7% (27·4 to 76·0)*	1·8 (1·6 to 2·0)	1·4 (1·2 to 1·7)	−19·5% (−31·0 to −4·7)*	2408·8 (2122·0 to 2724·1)	3434·1 (2894·3 to 4138·7)	42·5% (20·4 to 70·9)*	46·6 (41·0 to 52·6)	37·3 (31·4 to 45·0)	−19·9% (−32·3 to −4·0)*
Tracheal, bronchus, and lung cancer	1322·0 (1243·4 to 1408·8)	2037·1 (1857·7 to 2212·9)	53·9% (41·9 to 65·1)*	27·0 (25·3 to 28·7)	22·2 (20·2 to 24·1)	−17·8% (−24·0 to −11·9)*	33 085·6 (30 779·3 to 35 405·5)	46 132·3 (41 948·2 to 50 238·8)	39·3% (28·5 to 49·9)*	647·1 (602·6 to 692·3)	499·5 (453·8 to 544·3)	−22·9% (−28·8 to −17·0)*
Malignant skin melanoma	41·9 (38·7 to 45·5)	66·6 (59·9 to 75·2)	58·7% (47·4 to 70·1)*	0·9 (0·8 to 0·9)	0·7 (0·7 to 0·8)	−12·8% (−19·0 to −6·3)*	1212·0 (1107·5 to 1334·2)	1680·0 (1484·3 to 1954·4)	38·6% (26·3 to 50·2)*	22·7 (20·8 to 24·8)	18·8 (16·6 to 21·9)	−17·1% (−24·5 to −10·0)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Non-melanoma skin cancer	30·2 (27·2 to 33·7)	63·9 (54·4 to 71·6)	111·1% (83·2 to 138·5)*	0·7 (0·6 to 0·8)	0·7 (0·6 to 0·8)	6·5% (−7·2 to 20·1)	678·1 (604·1 to 763·1)	1239·4 (1044·5 to 1409·7)	82·5% (55·1 to 111·2)*	13·7 (12·2 to 15·3)	13·8 (11·6 to 15·7)	1·0% (−13·9 to 17·0)
Non-melanoma skin cancer (squamous-cell carcinoma)	30·2 (27·2 to 33·7)	63·9 (54·4 to 71·6)	111·1% (83·2 to 138·5)*	0·7 (0·6 to 0·8)	0·7 (0·6 to 0·8)	6·5% (−7·2 to 20·1)	678·1 (604·1 to 763·1)	1239·4 (1044·5 to 1409·7)	82·5% (55·1 to 111·2)*	13·7 (12·2 to 15·3)	13·8 (11·6 to 15·7)	1·0% (−13·9 to 17·0)
Soft tissue and other extraosseous sarcomas	37·9 (31·1 to 48·9)	60·9 (49·0 to 75·8)	60·8% (19·9 to 101·6)*	0·7 (0·6 to 0·9)	0·7 (0·6 to 0·9)	−1·8% (−26·4 to 22·9)	1535·8 (1215·1 to 2079·6)	2151·0 (1655·4 to 2783·7)	40·1% (−2·5 to 84·4)	26·4 (21·1 to 35·5)	25·9 (19·7 to 33·9)	−1·9% (−31·5 to 29·1)
Malignant neoplasm of bone and articular cartilage	49·0 (40·5 to 61·5)	76·7 (60·8 to 96·4)	56·3% (16·7 to 98·9)*	0·9 (0·7 to 1·1)	0·9 (0·7 to 1·1)	−0·8% (−25·2 to 25·0)	2161·9 (1708·1 to 2857·2)	2942·0 (2216·9 to 3849·4)	36·0% (−4·8 to 81·7)	35·8 (28·6 to 46·8)	35·3 (26·2 to 46·5)	−1·6% (−31·3 to 31·8)
Breast cancer	446·4 (408·7 to 481·8)	780·2 (685·7 to 871·0)	74·7% (55·2 to 95·7)*	9·0 (8·2 to 9·7)	8·7 (7·6 to 9·7)	−3·4% (−13·9 to 8·3)	13 394·8 (12 216·4 to 14 561·3)	23 024·3 (19 985·8 to 25 997·2)	71·9% (49·2 to 97·7)*	250·8 (229·4 to 271·8)	258·0 (223·9 to 291·7)	2·8% (−10·7 to 18·5)
Cervical cancer	235·7 (190·6 to 300·7)	369·5 (291·7 to 474·5)	56·7% (20·6 to 105·5)*	4·5 (3·6 to 5·7)	4·1 (3·3 to 5·3)	−7·7% (−28·8 to 20·6)	8243·4 (6589·2 to 10 746·9)	12 876·8 (9852·7 to 16 768·3)	56·2% (16·4 to 107·0)*	147·9 (118·6 to 191·9)	146·1 (111·5 to 190·7)	−1·2% (−26·4 to 31·2)
Uterine cancer	67·2 (57·6 to 74·9)	108·6 (93·2 to 126·2)	61·6% (37·3 to 85·8)*	1·4 (1·2 to 1·5)	1·2 (1·0 to 1·4)	−14·0% (−26·6 to −1·3)*	1741·3 (1464·8 to 1966·4)	2639·7 (2227·3 to 3105·3)	51·5% (26·0 to 79·4)*	33·7 (28·5 to 38·0)	28·8 (24·3 to 33·9)	−14·6% (−28·9 to 0·5)
Ovarian cancer	129·9 (117·1 to 142·7)	221·0 (191·6 to 255·0)	70·1% (48·1 to 96·3)*	2·6 (2·4 to 2·9)	2·4 (2·1 to 2·8)	−7·1% (−19·3 to 6·9)	3699·3 (3315·2 to 4116·5)	6304·4 (5313·3 to 7450·7)	70·4% (43·9 to 102·3)*	70·0 (62·9 to 77·6)	70·1 (59·0 to 83·1)	0·0% (−15·9 to 18·7)
Prostate cancer	274·4 (243·7 to 301·9)	473·0 (415·9 to 530·2)	72·4% (55·5 to 94·8)*	6·2 (5·5 to 6·9)	5·3 (4·6 to 5·9)	−15·4% (−23·3 to −4·7)*	4863·4 (4357·1 to 5362·3)	8010·1 (6965·5 to 9037·7)	64·7% (46·0 to 88·0)*	104·1 (93·0 to 114·6)	87·7 (76·4 to 99·0)	−15·7% (−25·0 to −3·7)*
Testicular cancer	8·8 (7·2 to 10·9)	11·9 (9·6 to 14·7)	35·5% (2·0 to 76·8)*	0·2 (0·1 to 0·2)	0·1 (0·1 to 0·2)	−6·6% (−29·4 to 21·6)	422·9 (344·0 to 536·9)	540·0 (429·0 to 678·7)	27·7% (−6·6 to 70·5)	6·8 (5·6 to 8·6)	6·5 (5·2 to 8·2)	−4·4% (−29·7 to 27·6)
Kidney cancer	101·1 (93·2 to 108·7)	165·4 (146·7 to 180·0)	63·5% (52·2 to 75·7)*	2·1 (1·9 to 2·2)	1·8 (1·6 to 2·0)	−12·0% (−17·9 to −5·6)*	2704·6 (2467·2 to 2955·4)	3899·7 (3438·2 to 4322·7)	44·1% (31·5 to 57·5)*	52·1 (47·6 to 56·6)	43·7 (38·4 to 48·5)	−16·1% (−23·4 to −8·3)*
Bladder cancer	146·2 (135·1 to 156·8)	233·7 (208·5 to 257·6)	59·9% (48·2 to 75·5)*	3·2 (3·0 to 3·5)	2·6 (2·3 to 2·9)	−18·8% (−24·6 to −11·0)*	3017·5 (2768·9 to 3254·1)	4330·4 (3953·5 to 4822·8)	43·5% (30·9 to 60·7)*	61·9 (57·0 to 66·6)	47·6 (43·3 to 53·0)	−23·2% (−29·8 to −14·1)*
Brain and central nervous system cancer	175·2 (150·9 to 200·1)	264·2 (230·5 to 313·2)	50·6% (37·4 to 63·0)*	3·3 (2·8 to 3·7)	3·0 (2·6 to 3·5)	−8·3% (−16·2 to −0·6)*	7154·4 (6034·0 to 8243·3)	9028·2 (7915·8 to 10 869·8)	26·1% (12·7 to 39·1)*	123·9 (105·1 to 142·8)	106·5 (93·2 to 128·1)	−14·1% (−23·4 to −5·1)*
Eye cancer	9·5 (6·5 to 14·1)	10·1 (7·3 to 14·2)	6·2% (−33·5 to 68·4)	0·2 (0·1 to 0·3)	0·1 (0·1 to 0·2)	−27·7% (−53·6 to 12·4)	520·5 (299·7 to 898·3)	476·9 (279·7 to 796·8)	−8·4% (−51·7 to 77·4)	8·9 (5·2 to 15·1)	6·5 (3·6 to 11·5)	−26·4% (−62·8 to 41·6)
Retinoblastoma	4·0 (1·8 to 8·4)	3·2 (1·3 to 7·0)	−18·9% (−71·3 to 130·7)	0·1 (0·0 to 0·1)	0·0 (0·0 to 0·1)	−24·8% (−73·3 to 114·0)	344·5 (156·1 to 726·0)	279·9 (110·1 to 608·4)	−18·7% (−71·2 to 131·0)	5·7 (2·6 to 12·0)	4·3 (1·7 to 9·3)	−24·6% (−73·3 to 114·5)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Other eye cancers	5·5 (4·3 to 7·1)	6·9 (5·4 to 8·8)	24·2% (1·1 to 52·6)*	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·1)	−29·5% (−42·7 to −13·7)*	175·9 (132·9 to 235·4)	197·0 (146·6 to 271·5)	12·0% (−15·5 to 42·5)	3·2 (2·4 to 4·2)	2·2 (1·7 to 3·1)	−29·6% (−47·0 to −10·3)*
Neuroblastoma and other peripheral nervous cell tumours	4·2 (3·5 to 5·0)	6·0 (5·0 to 7·6)	42·9% (15·7 to 79·2)*	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·1)	4·3% (−16·2 to 31·0)	263·2 (214·8 to 316·7)	324·3 (261·2 to 429·6)	23·2% (−4·9 to 59·2)	4·3 (3·6 to 5·2)	4·4 (3·5 to 5·9)	1·6% (−22·6 to 31·7)
Thyroid cancer	28·8 (25·7 to 33·5)	52·2 (44·7 to 61·5)	81·2% (51·9 to 123·3)*	0·6 (0·5 to 0·7)	0·6 (0·5 to 0·7)	−0·7% (−16·7 to 21·7)	814·1 (710·2 to 975·7)	1415·2 (1192·5 to 1715·1)	73·8% (41·4 to 120·8)*	15·2 (13·3 to 18·1)	16·0 (13·4 to 19·4)	4·8% (−14·5 to 33·5)
Mesothelioma	17·2 (15·6 to 19·2)	28·0 (24·8 to 30·9)	62·2% (43·5 to 82·1)*	0·4 (0·3 to 0·4)	0·3 (0·3 to 0·3)	−13·2% (−23·0 to −2·7)*	427·0 (385·1 to 476·7)	615·3 (544·3 to 685·3)	44·0% (26·5 to 63·2)*	8·3 (7·5 to 9·3)	6·8 (6·0 to 7·5)	−18·9% (−28·5 to −8·1)*
Hodgkin lymphoma	28·8 (22·4 to 35·4)	27·2 (21·0 to 34·9)	−5·7% (−27·9 to 15·4)	0·5 (0·4 to 0·6)	0·3 (0·2 to 0·4)	−38·0% (−52·6 to −24·3)*	1310·0 (1006·9 to 1659·6)	1150·9 (837·0 to 1516·3)	−12·2% (−35·8 to 12·2)	21·7 (16·7 to 27·4)	14·0 (10·1 to 18·5)	−35·4% (−52·8 to −17·5)*
Non-Hodgkin lymphoma	188·5 (173·9 to 209·5)	283·1 (247·5 to 320·5)	50·1% (26·9 to 71·3)*	3·8 (3·5 to 4·2)	3·2 (2·8 to 3·6)	−15·2% (−28·1 to −3·1)*	6038·6 (5446·5 to 6866·0)	8039·7 (6845·8 to 9375·2)	33·1% (8·9 to 58·4)*	109·6 (99·4 to 124·2)	93·5 (79·1 to 109·6)	−14·7% (−30·2 to 2·0)
Burkitt lymphoma	5·0 (3·6 to 6·8)	6·7 (5·1 to 9·6)	34·0% (−8·9 to 94·4)	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·1)	−3·2% (−34·5 to 40·3)	305·6 (212·8 to 434·6)	365·9 (257·0 to 567·1)	19·7% (−25·9 to 88·3)	4·9 (3·4 to 7·0)	4·8 (3·3 to 7·5)	−3·1% (−40·4 to 52·2)
Other non-Hodgkin lymphoma	183·5 (169·0 to 203·9)	276·4 (241·6 to 312·8)	50·6% (27·6 to 72·0)*	3·7 (3·4 to 4·1)	3·1 (2·7 to 3·5)	−15·5% (−27·8 to −3·2)*	5733·1 (5235·3 to 6499·7)	7673·8 (6582·3 to 8895·1)	33·8% (10·3 to 60·3)*	104·6 (95·7 to 118·1)	88·7 (75·8 to 103·6)	−15·3% (−30·0 to 2·2)
Multiple myeloma	68·2 (62·3 to 73·8)	125·1 (112·8 to 137·0)	83·3% (65·4 to 100·6)*	1·4 (1·3 to 1·6)	1·4 (1·2 to 1·5)	−4·9% (−14·1 to 3·8)	1551·0 (1408·1 to 1694·9)	2701·7 (2426·4 to 2995·3)	74·2% (53·6 to 95·2)*	31·0 (28·2 to 33·8)	29·5 (26·5 to 32·7)	−4·9% (−16·1 to 6·5)
Leukaemia	291·9 (260·2 to 320·5)	342·0 (307·2 to 381·8)	17·1% (3·7 to 31·0)*	5·5 (4·9 to 6·0)	4·0 (3·6 to 4·4)	−27·5% (−35·5 to −19·0)*	12 723·9 (11 104·5 to 14 146·2)	11 905·5 (10 517·9 to 13 661·0)	−6·5% (−20·4 to 7·0)	215·3 (188·8 to 238·2)	145·4 (128·0 to 168·1)	−32·5% (−42·5 to −22·8)*
Acute lymphoid leukaemia	87·3 (64·5 to 111·6)	77·5 (54·2 to 98·7)	−11·3% (−27·4 to 8·6)	1·5 (1·1 to 1·9)	1·0 (0·7 to 1·2)	−33·4% (−45·1 to −17·7)*	5511·5 (4114·6 to 6944·4)	4318·8 (3077·5 to 5438·2)	−21·7% (−37·2 to −3·0)*	88·0 (65·9 to 111·0)	56·7 (40·6 to 71·6)	−35·6% (−48·3 to −19·7)*
Chronic lymphoid leukaemia	37·5 (33·5 to 41·6)	44·8 (39·6 to 51·6)	19·5% (6·3 to 33·5)*	0·8 (0·7 to 0·9)	0·5 (0·4 to 0·6)	−38·7% (−45·2 to −31·8)*	855·9 (734·5 to 969·5)	885·1 (779·6 to 1049·9)	3·3% (−10·8 to 22·1)	17·0 (14·8 to 19·1)	9·8 (8·6 to 11·7)	−42·3% (−50·1 to −32·5)*
Acute myeloid leukaemia	91·9 (75·5 to 108·0)	131·6 (112·6 to 152·5)	43·2% (25·3 to 62·8)*	1·7 (1·4 to 2·0)	1·5 (1·3 to 1·7)	−13·3% (−23·6 to −2·1)*	3731·7 (2862·0 to 4654·8)	4161·7 (3387·0 to 5135·5)	11·5% (−7·1 to 33·5)	63·9 (50·0 to 78·5)	49·6 (39·9 to 62·1)	−22·5% (−35·9 to −7·8)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Chronic myeloid leukaemia	34·3 (28·1 to 40·9)	26·3 (21·2 to 32·7)	−23·2% (−39·3 to 1·6)	0·7 (0·6 to 0·8)	0·3 (0·2 to 0·4)	−55·5% (−64·7 to −41·9)*	1187·5 (919·7 to 1486·7)	779·0 (585·9 to 1037·8)	−34·4% (−51·5 to −9·6)*	21·0 (16·6 to 26·0)	9·1 (6·8 to 12·2)	−56·9% (−68·2 to −41·3)*
Other leukaemia	41·1 (33·0 to 53·7)	61·7 (49·3 to 77·0)	50·1% (20·7 to 93·1)*	0·8 (0·6 to 1·0)	0·7 (0·6 to 0·9)	−12·7% (−28·7 to 10·8)	1437·2 (1103·7 to 1975·1)	1760·9 (1338·4 to 2323·2)	22·4% (−5·7 to 61·8)	25·4 (19·8 to 34·5)	20·3 (15·3 to 26·9)	−20·3% (−38·2 to 4·3)
Other malignant neoplasms	157·2 (142·0 to 174·1)	226·0 (196·9 to 251·0)	43·6% (23·7 to 66·1)*	3·1 (2·8 to 3·4)	2·6 (2·2 to 2·8)	−17·5% (−28·9 to −5·2)*	5479·8 (4821·3 to 6210·0)	6520·7 (5597·1 to 7450·5)	18·9% (−1·3 to 40·6)	98·1 (86·8 to 110·8)	76·6 (65·7 to 87·9)	−22·0% (−35·3 to −7·4)*
Other neoplasms	69·9 (61·2 to 79·1)	124·5 (106·4 to 145·3)	78·0% (59·2 to 96·0)*	1·5 (1·3 to 1·7)	1·4 (1·2 to 1·7)	−4·2% (−14·2 to 5·3)	2003·8 (1653·3 to 2380·4)	2957·9 (2467·6 to 3615·1)	47·5% (25·1 to 68·6)*	37·4 (31·3 to 43·8)	34·3 (28·4 to 42·1)	−8·4% (−21·7 to 5·3)
Myelodysplastic, myeloproliferative, and other haemopoietic neoplasms	26·1 (23·0 to 29·0)	62·0 (51·7 to 71·9)	137·2% (111·0 to 163·5)*	0·6 (0·5 to 0·7)	0·7 (0·6 to 0·8)	16·1% (3·1 to 29·2)*	503·0 (433·2 to 564·6)	1058·9 (900·6 to 1244·8)	110·4% (86·3 to 135·2)*	10·5 (9·2 to 11·7)	11·9 (10·1 to 14·0)	13·4% (0·5 to 26·5)*
Other benign and in-situ neoplasms	43·8 (35·8 to 52·8)	62·5 (49·1 to 79·0)	42·6% (18·6 to 70·1)*	0·9 (0·7 to 1·0)	0·7 (0·6 to 0·9)	−18·4% (−31·8 to −3·7)*	1500·8 (1140·1 to 1879·8)	1899·1 (1431·7 to 2501·8)	26·5% (0·3 to 55·0)*	26·9 (20·8 to 33·4)	22·3 (16·7 to 29·6)	−16·9% (−34·2 to 2·2)
Cardiovascular diseases	**14 562·6 (13 675·2 to 15 351·9)**	**19 159·2 (17 364·3 to 20 420·7)**	**31·4% (21·3 to 41·7)***	**322·0 (298·9 to 340·4)**	**215·2 (194·3 to 229·8)**	**−33·2% (−37·9 to −28·3)***	**324 658·5 (305 331·0 to 346 523·1)**	**395 762·2 (364 152·2 to 424 474·4)**	**21·8% (11·3 to 33·6)***	**6527·3 (6126·6 to 6937·0)**	**4411·0 (4053·4 to 4736·6)**	**−32·5% (−38·1 to −26·3)***
Rheumatic heart disease	437·4 (347·4 to 541·2)	388·9 (261·0 to 554·4)	−11·1% (−37·1 to 22·8)	8·5 (6·9 to 10·5)	4·4 (3·0 to 6·3)	−48·4% (−63·9 to −28·9)*	15 177·2 (11 748·8 to 19 150·7)	11 820·6 (7609·9 to 17 181·5)	−22·1% (−46·6 to 10·2)	269·8 (209·7 to 338·4)	136·6 (88·5 to 199·2)	−49·4% (−65·0 to −28·8)*
Ischaemic heart disease	6286·6 (5802·6 to 6713·4)	8905·9 (8043·9 to 9659·6)	41·5% (30·2 to 53·6)*	140·1 (129·0 to 149·5)	99·8 (89·9 to 108·4)	−28·9% (−34·1 to −22·9)*	136 804·5 (126 478·8 to 147 444·0)	182 550·6 (167 559·7 to 199 538·9)	33·3% (20·3 to 46·9)*	2778·4 (2582·7 to 2973·5)	2020·0 (1852·7 to 2212·8)	−27·4% (−34·2 to −19·9)*
Stroke	6059·2 (5579·8 to 6549·6)	6793·2 (6064·9 to 7467·6)	12·0% (0·1 to 24·2)*	133·0 (122·9 to 143·6)	75·9 (67·8 to 83·5)	−43·0% (−49·0 to −36·9)*	131 886·2 (120 831·0 to 143 533·8)	139 860·2 (124 616·6 to 154 296·3)	6·0% (−6·9 to 20·1)	2663·6 (2441·1 to 2894·2)	1552·5 (1381·1 to 1713·2)	−41·8% (−48·9 to −34·1)*
Ischaemic stroke	2853·9 (2602·5 to 3179·8)	3279·0 (2869·9 to 3689·1)	14·7% (1·0 to 29·6)*	66·4 (60·5 to 73·8)	37·0 (32·4 to 41·7)	−44·4% (−50·8 to −37·4)*	50 456·2 (45 793·6 to 56 641·0)	54 733·9 (48 138·2 to 61 730·7)	8·3% (−6·5 to 24·7)	1084·8 (982·9 to 1212·7)	606·9 (532·2 to 685·6)	−44·2% (−51·6 to −35·8)*
Intracerebral haemorrhage	2857·0 (2539·1 to 3198·6)	3156·7 (2752·8 to 3546·9)	10·4% (−4·4 to 30·3)	59·4 (52·7 to 66·2)	34·9 (30·4 to 39·3)	−41·3% (−49·1 to −31·1)*	71 650·8 (62 936·0 to 81 253·0)	75 460·6 (65 335·9 to 85 395·0)	5·3% (−11·6 to 26·3)	1394·1 (1228·3 to 1566·3)	836·2 (723·7 to 946·8)	−40·0% (−49·4 to −28·3)*
Subarachnoid haemorrhage	348·4 (245·3 to 428·2)	357·5 (303·7 to 430·2)	2·5% (−18·1 to 43·5)	7·1 (5·0 to 8·8)	4·0 (3·4 to 4·8)	−44·1% (−55·3 to −21·3)*	9779·2 (7247·7 to 12 102·1)	9665·7 (8021·1 to 12 175·6)	−1·2% (−22·0 to 31·6)	184·6 (135·3 to 228·2)	109·4 (90·3 to 138·2)	−40·7% (−53·1 to −20·5)*
Hypertensive heart disease	797·5 (643·5 to 953·1)	1485·0 (1179·4 to 1825·7)	86·1% (50·7 to 126·4)*	18·1 (14·5 to 21·6)	16·8 (13·4 to 20·7)	−7·2% (−24·6 to 12·6)	16 085·1 (12 843·2 to 19 689·6)	27 326·2 (21 762·9 to 34 181·3)	69·8% (34·7 to 110·8)*	333·9 (267·7 to 403·3)	303·6 (241·5 to 380·2)	−9·1% (−27·5 to 12·1)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Non-rheumatic valvular heart disease	97·5 (85·8 to 107·2)	191·3 (157·0 to 214·6)	96·1% (76·6 to 116·1)*	2·4 (2·1 to 2·6)	2·2 (1·8 to 2·5)	−7·7% (−16·0 to 1·0)	1741·9 (1536·7 to 1934·4)	3035·5 (2581·4 to 3528·7)	74·3% (50·5 to 98·0)*	37·8 (33·0 to 42·0)	34·6 (29·4 to 40·3)	−8·3% (−19·7 to 4·1)
Non-rheumatic calcific aortic valve disease	71·3 (61·2 to 78·4)	149·4 (120·1 to 166·0)	109·6% (89·9 to 129·6)*	1·8 (1·5 to 2·0)	1·7 (1·4 to 1·9)	−3·6% (−12·1 to 5·2)	1158·7 (1020·8 to 1275·0)	2169·7 (1837·7 to 2474·0)	87·3% (65·7 to 112·0)*	26·1 (22·9 to 28·7)	24·8 (20·9 to 28·3)	−5·0% (−15·6 to 7·2)
Non-rheumatic degenerative mitral valve disease	25·3 (21·7 to 29·2)	39·7 (32·4 to 50·7)	57·0% (26·9 to 92·7)*	0·6 (0·5 to 0·7)	0·5 (0·4 to 0·6)	−21·5% (−35·9 to −3·9)*	558·2 (471·0 to 683·5)	815·6 (640·0 to 1100·6)	46·2% (9·3 to 88·8)*	11·2 (9·5 to 13·5)	9·3 (7·3 to 12·5)	−17·2% (−37·2 to 7·6)
Other non-rheumatic valve diseases	0·9 (0·6 to 1·6)	2·1 (1·3 to 3·3)	133·0% (63·5 to 251·5)*	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	24·3% (−11·1 to 89·3)	25·0 (16·4 to 41·2)	50·2 (31·9 to 81·1)	100·9% (31·2 to 213·3)*	0·5 (0·3 to 0·8)	0·6 (0·4 to 0·9)	22·4% (−19·0 to 92·5)
Cardiomyopathy and myocarditis	335·7 (295·6 to 388·6)	399·9 (338·4 to 465·1)	19·1% (−2·0 to 44·7)	7·1 (6·3 to 8·2)	4·6 (3·9 to 5·3)	−35·9% (−47·4 to −21·8)*	10 322·7 (8777·2 to 12 535·3)	11 541·4 (9460·2 to 13 920·1)	11·8% (−12·3 to 40·5)	191·5 (164·2 to 229·9)	136·0 (109·7 to 166·5)	−29·0% (−44·8 to −11·1)*
Myocarditis	21·6 (14·5 to 33·6)	16·9 (11·3 to 24·1)	−21·9% (−46·1 to 20·7)	0·4 (0·3 to 0·6)	0·2 (0·1 to 0·3)	−50·9% (−65·6 to −25·6)*	1015·0 (656·8 to 1588·1)	624·3 (414·2 to 940·0)	−38·5% (−62·2 to −4·0)*	17·2 (11·1 to 26·8)	8·1 (5·3 to 12·2)	−53·0% (−71·2 to −27·5)*
Alcoholic cardiomyopathy	76·5 (68·6 to 86·0)	62·3 (56·0 to 71·6)	−18·6% (−28·8 to −7·4)*	1·4 (1·3 to 1·6)	0·7 (0·6 to 0·8)	−52·3% (−58·3 to −45·7)*	2727·3 (2448·9 to 3040·3)	2108·8 (1889·5 to 2420·0)	−22·7% (−32·4 to −11·9)*	49·0 (44·0 to 54·7)	23·6 (21·2 to 27·2)	−51·8% (−57·8 to −45·1)*
Other cardiomyopathy	237·6 (203·3 to 287·4)	320·7 (260·3 to 380·7)	35·0% (6·2 to 69·4)*	5·3 (4·5 to 6·3)	3·7 (3·0 to 4·4)	−30·2% (−44·5 to −13·6)*	6580·4 (5359·5 to 8558·1)	8808·3 (6840·4 to 10 925·2)	33·9% (−1·0 to 77·5)	125·3 (103·8 to 160·1)	104·3 (80·2 to 130·9)	−16·8% (−38·9 to 9·4)
Pulmonary arterial hypertension	20·0 (15·0 to 27·0)	22·8 (17·5 to 29·8)	13·8% (−17·0 to 60·6)	0·4 (0·3 to 0·5)	0·3 (0·2 to 0·4)	−33·4% (−50·6 to −5·8)*	778·6 (532·5 to 1147·1)	682·9 (494·1 to 978·5)	−12·4% (−43·6 to 31·2)	13·7 (9·5 to 19·7)	8·5 (6·0 to 12·5)	−37·6% (−59·6 to −7·0)*
Atrial fibrillation and flutter	160·4 (144·5 to 174·3)	377·7 (319·0 to 424·2)	135·2% (112·7 to 157·0)*	4·2 (3·8 to 4·6)	4·4 (3·7 to 5·0)	3·9% (−5·7 to 13·2)	2213·1 (2033·2 to 2395·7)	4863·5 (4236·4 to 5380·4)	119·6% (98·6 to 138·7)*	53·7 (49·0 to 58·3)	55·5 (48·2 to 61·5)	3·3% (−6·0 to 12·3)
Aortic aneurysm	109·6 (101·9 to 119·8)	167·4 (147·1 to 187·3)	52·8% (37·7 to 68·0)*	2·4 (2·2 to 2·6)	1·9 (1·6 to 2·1)	−22·5% (−29·6 to −15·3)*	2303·7 (2122·4 to 2557·6)	3416·5 (3025·9 to 3838·3)	48·4% (30·4 to 64·9)*	46·8 (43·0 to 51·7)	37·8 (33·4 to 42·5)	−19·2% (−28·8 to −10·4)*
Lower extremity peripheral arterial disease	52·9 (47·8 to 57·6)	74·9 (66·1 to 83·1)	41·5% (27·5 to 55·5)*	1·3 (1·2 to 1·4)	0·9 (0·7 to 0·9)	−34·4% (−40·7 to −27·9)*	871·1 (800·3 to 943·3)	1189·8 (1063·1 to 1332·8)	36·6% (21·1 to 53·5)*	19·5 (17·7 to 21·2)	13·2 (11·8 to 14·8)	−32·4% (−39·7 to −24·4)*
Endocarditis	52·4 (44·2 to 62·6)	86·2 (74·2 to 100·8)	64·7% (33·7 to 100·9)*	1·1 (0·9 to 1·3)	1·0 (0·9 to 1·2)	−9·7% (−25·4 to 8·3)	1688·4 (1314·4 to 2173·5)	2302·6 (1918·6 to 2840·0)	36·4% (−1·1 to 83·6)	30·6 (24·4 to 38·7)	27·2 (22·5 to 33·8)	−11·0% (−34·6 to 18·2)
Other cardiovascular and circulatory diseases	153·3 (129·8 to 185·3)	265·9 (217·1 to 317·9)	73·4% (37·2 to 116·3)*	3·2 (2·8 to 3·8)	3·0 (2·5 to 3·6)	−6·2% (−24·8 to 15·6)	4786·1 (3817·4 to 6161·9)	7172·3 (5626·5 to 8764·7)	49·9% (8·5 to 97·8)*	88·0 (71·0 to 111·7)	85·3 (66·0 to 105·5)	−3·1% (−29·5 to 27·4)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Chronic respiratory diseases	**2885·3 (2366·5 to 3234·0)**	**4163·7 (3612·7 to 5138·2)**	**44·0% (20·3 to 85·9)***	**63·4 (52·2 to 70·5)**	**46·8 (40·6 to 57·7)**	**–26·4% (–38·1 to –5·5)***	**61 339·5 (50 077·3 to 68 952·7)**	**78 935·2 (69 624·7 to 96 907·6)**	**28·5% (7·7 to 65·7)***	**1243·6 (1021·6 to 1394·8)**	**882·8 (774·9 to 1083·8)**	**–29·1% (–40·9 to –9·1)***
Chronic obstructive pulmonary disease	2404·0 (1975·9 to 2700·6)	3426·1 (2955·2 to 4079·8)	42·1% (19·5 to 84·7)*	53·5 (44·1 to 60·1)	38·4 (33·2 to 45·8)	–28·4% (–39·6 to –7·2)*	46 704·9 (38 738·6 to 52 933·2)	59 918·6 (51 344·7 to 71 728·7)	28·1% (7·8 to 67·1)*	972·5 (808·1 to 1097·6)	659·7 (563·7 to 788·5)	–32·3% (–42·9 to –12·1)*
Pneumoconiosis	15·8 (12·3 to 22·4)	18·7 (14·1 to 24·9)	18·1% (–18·8 to 57·5)	0·3 (0·3 to 0·5)	0·2 (0·2 to 0·3)	–37·6% (–56·2 to –18·0)*	362·9 (268·6 to 542·3)	391·8 (288·8 to 521·1)	7·6% (–29·1 to 48·2)	7·2 (5·4 to 10·6)	4·3 (3·2 to 5·7)	–39·9% (–59·6 to –18·2)*
Silicosis	8·7 (6·4 to 13·1)	11·0 (7·7 to 15·2)	26·1% (–21·0 to 81·5)	0·2 (0·1 to 0·3)	0·1 (0·1 to 0·2)	–32·8% (–57·1 to –5·5)*	205·9 (142·7 to 328·1)	241·5 (166·3 to 336·6)	16·8% (–29·7 to 81·1)	4·0 (2·8 to 6·3)	2·7 (1·8 to 3·7)	–34·3% (–60·0 to –0·4)*
Asbestosis	1·8 (1·5 to 2·4)	3·0 (2·4 to 4·0)	63·1% (22·1 to 110·6)*	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	–16·2% (–36·8 to 7·4)	37·1 (28·9 to 50·5)	51·0 (40·0 to 71·9)	37·4% (0·3 to 88·5)*	0·8 (0·6 to 1·0)	0·6 (0·4 to 0·8)	–25·6% (–45·3 to 1·5)
Coal worker pneumoconiosis	3·3 (2·5 to 5·1)	2·3 (1·7 to 3·1)	–30·5% (–57·8 to 3·8)	0·1 (0·1 to 0·1)	0·0 (0·0 to 0·0)	–63·9% (–77·5 to –47·1)*	71·1 (49·1 to 117·8)	45·6 (31·5 to 61·9)	–36·0% (–64·5 to 4·1)	1·4 (1·0 to 2·3)	0·5 (0·3 to 0·7)	–65·0% (–80·1 to –44·0)*
Other pneumoconiosis	1·9 (1·4 to 2·9)	2·4 (1·6 to 3·6)	22·8% (–27·1 to 87·9)	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	–34·3% (–60·1 to 0·5)	48·9 (33·8 to 77·7)	53·8 (36·1 to 83·0)	10·0% (–35·9 to 72·1)	0·9 (0·7 to 1·5)	0·6 (0·4 to 0·9)	–36·8% (–63·0 to –1·6)*
Asthma	342·7 (221·6 to 503·5)	441·9 (305·8 to 665·1)	29·0% (–16·8 to 97·0)	7·0 (4·6 to 10·4)	5·0 (3·5 to 7·5)	–29·1% (–53·8 to 7·6)	10 076·9 (6600·9 to 14 431·5)	11 758·2 (8323·7 to 16 923·2)	16·7% (–23·3 to 76·3)	187·6 (122·6 to 271·2)	135·7 (96·1 to 194·8)	–27·7% (–51·9 to 9·8)
Interstitial lung disease and pulmonary sarcoidosis	76·3 (62·5 to 111·0)	213·2 (176·1 to 261·2)	179·6% (96·2 to 241·6)*	1·7 (1·4 to 2·4)	2·4 (2·0 to 2·9)	43·2% (2·3 to 73·7)*	1663·0 (1328·0 to 2584·8)	3997·3 (3268·2 to 5136·7)	140·4% (59·0 to 205·6)*	33·5 (27·0 to 51·1)	44·4 (36·3 to 57·1)	32·7% (–11·1 to 67·6)
Other chronic respiratory diseases	46·5 (34·7 to 66·7)	63·6 (46·6 to 90·1)	36·8% (–15·1 to 94·6)	0·9 (0·7 to 1·2)	0·8 (0·6 to 1·1)	–9·4% (–41·9 to 28·4)	2531·7 (1808·6 to 3549·2)	2869·4 (2005·3 to 4285·7)	13·3% (–31·5 to 62·9)	42·9 (30·8 to 60·5)	38·7 (26·5 to 57·4)	–9·9% (–44·7 to 28·6)
Digestive diseases	**2052·3 (1849·8 to 2264·3)**	**2416·3 (2151·6 to 2671·8)**	**17·7% (0·6 to 38·0)***	**40·8 (36·9 to 44·9)**	**27·3 (24·2 to 30·2)**	**–33·1% (–42·9 to –22·0)***	**68 187·2 (60 449·9 to 75 780·1)**	**69 999·8 (61 560·7 to 78 001·8)**	**2·7% (–13·8 to 21·9)**	**1235·1 (1100·2 to 1367·0)**	**805·7 (705·4 to 899·9)**	**–34·8% (–45·2 to –22·4)***
Cirrhosis and other chronic liver diseases	1127·0 (1003·3 to 1275·7)	1282·0 (1141·9 to 1430·1)	13·8% (–3·9 to 35·5)	21·4 (19·1 to 24·2)	14·3 (12·7 to 16·0)	–33·4% (–43·4 to –20·8)*	39 866·9 (35 267·0 to 45 423·6)	41 637·4 (36 506·1 to 47 053·8)	4·4% (–12·9 to 26·8)	713·2 (631·8 to 812·3)	473·2 (413·0 to 535·6)	–33·7% (–44·6 to –19·7)*
Chronic hepatitis B including cirrhosis	391·2 (332·4 to 464·5)	394·2 (324·6 to 464·5)	0·8% (–16·9 to 24·3)	7·4 (6·3 to 8·9)	4·4 (3·6 to 5·2)	–41·1% (–51·8 to –27·6)*	13 496·9 (11 469·0 to 15 799·5)	12 747·5 (10 558·1 to 15 071·6)	–5·6% (–24·1 to 18·3)	242·7 (207·0 to 285·7)	143·8 (118·7 to 170·7)	–40·7% (–52·3 to –26·2)*
Chronic hepatitis C including cirrhosis	283·6 (236·1 to 343·1)	334·5 (276·9 to 403·7)	18·0% (–1·9 to 40·1)	5·4 (4·5 to 6·5)	3·7 (3·1 to 4·5)	–31·6% (–43·1 to –18·8)*	9665·1 (7973·5 to 11 667·2)	10 741·2 (8791·1 to 12 988·0)	11·1% (–8·0 to 35·1)	174·6 (144·6 to 210·6)	121·1 (98·5 to 146·6)	–30·6% (–42·5 to –15·7)*
Cirrhosis due to alcohol use	251·9 (215·4 to 291·7)	308·8 (259·4 to 358·2)	22·6% (6·3 to 41·5)*	4·8 (4·1 to 5·6)	3·4 (2·8 to 3·9)	–29·9% (–39·5 to –19·3)*	8268·1 (7071·2 to 9724·4)	9473·6 (7963·9 to 11 068·1)	14·6% (–1·8 to 33·0)	152·2 (130·0 to 178·2)	104·9 (87·8 to 122·8)	–31·1% (–41·2 to –20·0)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Non-alcoholic fatty liver disease including cirrhosis	52·3 (37·2 to 69·9)	89·8 (64·7 to 120·3)	71·8% (56·2 to 89·9)*	1·1 (0·7 to 1·4)	1·0 (0·7 to 1·3)	−5·7% (−13·6 to 4·5)	1524·5 (1048·0 to 2082·8)	2459·8 (1710·6 to 3299·7)	61·4% (47·5 to 78·1)*	28·7 (19·8 to 38·9)	27·2 (19·0 to 36·3)	−5·2% (−13·8 to 5·3)
Cirrhosis due to other causes	148·1 (120·2 to 186·3)	154·7 (118·8 to 200·3)	4·5% (−15·7 to 28·9)	2·7 (2·1 to 3·4)	1·8 (1·4 to 2·3)	−32·6% (−44·5 to −17·2)*	6912·3 (5638·5 to 8562·7)	6215·3 (4872·2 to 7830·9)	−10·1% (−28·5 to 12·6)	115·1 (93·6 to 141·1)	76·1 (59·5 to 95·8)	−33·9% (−47·1 to −16·8)*
Upper digestive system diseases	316·1 (265·6 to 370·2)	265·4 (220·0 to 328·5)	−16·1% (−34·2 to 7·7)	6·5 (5·5 to 7·6)	3·0 (2·5 to 3·7)	−53·6% (−63·2 to −40·5)*	9368·2 (7717·1 to 11147·1)	6795·7 (5464·0 to 8582·5)	−27·5% (−45·3 to −3·4)*	173·5 (144·1 to 205·7)	77·7 (62·1 to 98·5)	−55·2% (−66·0 to −40·5)*
Peptic ulcer disease	273·7 (230·0 to 325·8)	222·4 (180·2 to 281·7)	−18·8% (−38·0 to 7·4)	5·6 (4·7 to 6·6)	2·5 (2·0 to 3·2)	−55·2% (−65·8 to −40·6)*	8019·7 (6460·1 to 9888·4)	5642·5 (4413·6 to 7489·3)	−29·6% (−48·2 to −4·6)*	149·0 (121·6 to 182·8)	64·2 (49·9 to 85·8)	−56·9% (−68·2 to −41·1)*
Gastritis and duodenitis	42·3 (29·3 to 57·6)	42·9 (27·1 to 58·5)	1·4% (−27·6 to 46·8)	0·9 (0·6 to 1·2)	0·5 (0·3 to 0·7)	−43·2% (−58·6 to −16·9)*	1348·4 (904·5 to 1906·6)	1153·2 (684·6 to 1724·0)	−14·5% (−43·1 to 30·2)	24·6 (16·6 to 34·1)	13·6 (8·0 to 20·4)	−44·7% (−63·2 to −15·3)*
Appendicitis	33·2 (21·4 to 47·8)	31·0 (21·9 to 43·5)	−6·7% (−36·7 to 46·4)	0·6 (0·4 to 0·9)	0·4 (0·3 to 0·5)	−40·6% (−59·2 to −7·9)*	1498·4 (900·8 to 2229·2)	1174·6 (815·5 to 1725·4)	−21·6% (−49·0 to 30·6)	24·9 (15·3 to 36·8)	14·2 (9·9 to 21·0)	−43·0% (−62·6 to −5·9)*
Paralytic ileus and intestinal obstruction	184·9 (152·8 to 221·6)	243·7 (201·6 to 286·2)	31·8% (3·5 to 72·6)*	3·8 (3·2 to 4·4)	2·9 (2·4 to 3·4)	−24·2% (−39·5 to −1·5)*	7095·3 (5679·0 to 8921·9)	7030·5 (5498·7 to 8614·0)	−0·9% (−26·5 to 37·0)	125·4 (101·3 to 156·0)	87·7 (68·4 to 107·3)	−30·1% (−47·6 to −3·7)*
Inguinal, femoral, and abdominal hernia	39·0 (30·0 to 51·9)	51·1 (38·9 to 67·4)	31·2% (−10·1 to 86·1)	0·8 (0·6 to 1·1)	0·6 (0·4 to 0·8)	−28·5% (−50·2 to −0·2)*	1234·4 (906·7 to 1724·3)	1260·5 (923·4 to 1769·8)	2·1% (−34·7 to 57·5)	22·8 (16·9 to 31·3)	15·2 (11·1 to 21·5)	−33·2% (−56·6 to 1·9)
Inflammatory bowel disease	27·5 (22·9 to 32·9)	46·5 (40·4 to 53·1)	69·4% (37·2 to 103·5)*	0·6 (0·5 to 0·7)	0·5 (0·5 to 0·6)	−12·5% (−28·4 to 4·5)	724·9 (569·0 to 893·6)	1031·8 (874·2 to 1235·1)	42·3% (9·1 to 78·3)*	13·9 (11·1 to 16·9)	11·9 (10·0 to 14·3)	−14·4% (−33·7 to 5·9)
Ulcerative colitis	22·7 (18·5 to 27·6)	39·6 (34·1 to 45·8)	74·0% (36·1 to 112·0)*	0·5 (0·4 to 0·6)	0·5 (0·4 to 0·5)	−11·3% (−28·9 to 6·8)	580·6 (447·7 to 740·8)	836·6 (703·4 to 1019·5)	44·1% (7·1 to 84·4)*	11·2 (8·8 to 14·1)	9·6 (8·1 to 11·8)	−14·3% (−35·5 to 8·3)
Crohn's disease	4·7 (3·8 to 5·8)	7·0 (5·9 to 8·5)	47·1% (17·0 to 88·1)*	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·1)	−18·8% (−35·0 to 3·4)	144·2 (115·1 to 184·4)	195·2 (157·7 to 249·4)	35·3% (3·1 to 81·1)*	2·6 (2·1 to 3·3)	2·2 (1·8 to 2·9)	−15·2% (−35·4 to 13·1)
Vascular intestinal disorders	67·8 (61·3 to 73·8)	92·6 (82·4 to 102·5)	36·7% (23·9 to 48·4)*	1·6 (1·4 to 1·7)	1·0 (0·9 to 1·2)	−33·4% (−39·3 to −27·9)*	1291·4 (1150·7 to 1428·0)	1670·7 (1519·1 to 1869·3)	29·4% (13·9 to 43·1)*	27·2 (24·3 to 29·9)	18·6 (16·9 to 20·9)	−31·5% (−39·4 to −23·9)*
Gallbladder and biliary diseases	74·1 (61·1 to 87·8)	146·7 (121·8 to 171·4)	98·1% (62·0 to 132·6)*	1·7 (1·4 to 2·0)	1·7 (1·4 to 2·0)	−1·0% (−18·0 to 15·3)	1581·2 (1272·2 to 1894·0)	2682·4 (2235·9 to 3182·5)	69·7% (33·5 to 103·5)*	32·2 (26·1 to 38·2)	30·3 (25·2 to 35·9)	−6·0% (−25·9 to 12·1)
Pancreatitis	88·7 (75·8 to 110·6)	124·5 (107·8 to 147·3)	40·2% (13·8 to 74·3)*	1·7 (1·5 to 2·1)	1·4 (1·2 to 1·7)	−18·6% (−34·0 to 0·7)	3037·6 (2554·9 to 3840·7)	3817·4 (3236·2 to 4664·5)	25·7% (0·2 to 59·2)*	54·1 (45·6 to 68·2)	43·6 (36·9 to 53·5)	−19·5% (−36·1 to 2·1)
Other digestive diseases	94·1 (77·9 to 117·0)	132·9 (113·6 to 154·5)	41·1% (13·6 to 71·1)*	2·1 (1·7 to 2·5)	1·5 (1·3 to 1·8)	−27·1% (−40·3 to −12·6)*	2489·0 (1949·9 to 3230·7)	2898·9 (2418·3 to 3535·1)	16·5% (−13·8 to 53·1)	47·9 (38·2 to 61·4)	33·4 (27·8 to 40·7)	−30·4% (−47·6 to −8·8)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Neurological disorders	**1316·1 (623·0 to 2702·2)**	**3024·3 (1357·2 to 6102·8)**	**129·3% (116·2 to 142·1)***	**32·8 (14·4 to 70·0)**	**35·2 (15·7 to 71·2)**	**7·0% (0·1 to 17·0)***	**24 683·4 (14 830·2 to 43 397·8)**	**47 512·9 (25 997·7 to 86 959·8)**	**92·2% (65·1 to 109·6)***	**526·2 (293·7 to 980·0)**	**553·8 (307·3 to 1002·1)**	**5·1% (–4·8 to 16·0)**
Alzheimer's disease and other dementias	934·3 (230·7 to 2338·9)	2214·6 (549·4 to 5363·7)	136·4% (124·0 to 153·2)*	24·9 (6·1 to 62·5)	25·9 (6·4 to 62·7)	3·7% (–2·0 to 10·9)	12 473·3 (3072·0 to 31 556·2)	27 638·4 (6912·9 to 67 708·7)	121·0% (107·9 to 135·8)*	307·2 (75·6 to 765·4)	315·8 (78·8 to 771·3)	2·6% (–2·8 to 9·3)
Parkinson's disease	190·7 (173·2 to 206·8)	427·1 (379·1 to 469·9)	123·8% (105·9 to 139·8)*	4·5 (4·1 to 4·9)	4·8 (4·3 to 5·3)	8·1% (–0·4 to 15·6)	3030·0 (2784·8 to 3284·1)	6345·3 (5691·2 to 6953·1)	109·3% (92·5 to 123·6)*	67·0 (61·3 to 72·7)	70·7 (63·4 to 77·3)	5·4% (–2·9 to 12·6)
Idiopathic epilepsy	118·7 (90·3 to 150·2)	159·4 (125·4 to 202·9)	34·3% (–2·7 to 80·8)	2·0 (1·5 to 2·5)	2·0 (1·5 to 2·5)	–1·3% (–28·5 to 32·8)	6929·8 (5144·4 to 8895·3)	8186·6 (6217·1 to 10 738·7)	18·1% (–16·9 to 62·3)	110·6 (82·5 to 141·8)	105·3 (79·4 to 139·4)	–4·8% (–33·1 to 31·0)
Multiple sclerosis	12·2 (11·2 to 13·4)	19·1 (17·4 to 21·7)	56·5% (41·2 to 75·0)*	0·2 (0·2 to 0·3)	0·2 (0·2 to 0·2)	–10·2% (–18·8 to 0·6)	409·2 (373·8 to 456·4)	551·3 (495·4 to 629·0)	34·7% (19·4 to 54·4)*	7·5 (6·8 to 8·3)	6·1 (5·5 to 7·0)	–18·1% (–27·1 to –5·9)*
Motor neuron disease	22·6 (20·2 to 24·7)	44·6 (40·8 to 50·0)	97·4% (78·9 to 116·7)*	0·5 (0·4 to 0·5)	0·5 (0·4 to 0·6)	8·7% (–1·2 to 19·8)	680·0 (583·5 to 765·6)	1158·0 (1046·7 to 1347·7)	70·3% (49·4 to 95·4)*	12·7 (11·0 to 14·2)	13·1 (11·8 to 15·4)	3·3% (–9·2 to 17·6)
Other neurological disorders	37·7 (33·9 to 41·5)	159·5 (137·4 to 180·4)	323·0% (270·6 to 373·9)*	0·8 (0·7 to 0·9)	1·8 (1·6 to 2·1)	128·7% (101·1 to 156·1)*	1161·1 (1036·5 to 1273·0)	3633·3 (3290·0 to 4022·3)	212·7% (173·9 to 258·7)*	21·3 (19·0 to 23·4)	42·7 (38·5 to 47·5)	100·7% (77·1 to 130·6)*
Mental disorders	**0·2 (0·1 to 0·3)**	**0·2 (0·1 to 0·4)**	**8·6% (–20·1 to 42·2)**	**0·0 (0·0 to 0·0)**	**0·0 (0·0 to 0·0)**	**–15·4% (–37·7 to 10·8)**	**12·3 (5·3 to 18·2)**	**13·2 (6·5 to 21·0)**	**7·4% (–20·8 to 40·9)**	**0·2 (0·1 to 0·3)**	**0·2 (0·1 to 0·3)**	**–15·1% (–37·3 to 11·2)**
Eating disorders	0·2 (0·1 to 0·3)	0·2 (0·1 to 0·4)	8·6% (–20·1 to 42·2)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–15·4% (–37·7 to 10·8)	12·3 (5·3 to 18·2)	13·2 (6·5 to 21·0)	7·4% (–20·8 to 40·9)	0·2 (0·1 to 0·3)	0·2 (0·1 to 0·3)	–15·1% (–37·3 to 11·2)
Anorexia nervosa	0·2 (0·1 to 0·3)	0·2 (0·1 to 0·4)	8·6% (–20·1 to 42·2)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–15·4% (–37·7 to 10·8)	12·3 (5·3 to 18·2)	13·2 (6·5 to 21·0)	7·4% (–20·8 to 40·9)	0·2 (0·1 to 0·3)	0·2 (0·1 to 0·3)	–15·1% (–37·3 to 11·2)
Substance use disorders	**254·5 (234·9 to 279·7)**	**344·1 (316·6 to 374·4)**	**35·2% (19·4 to 50·6)***	**4·5 (4·1 to 4·9)**	**3·9 (3·6 to 4·3)**	**–11·5% (–21·7 to –1·5)***	**11 302·6 (10 393·2 to 12 449·2)**	**14 426·8 (13 200·2 to 15 765·4)**	**27·6% (12·1 to 43·2)***	**190·0 (175·0 to 209·1)**	**168·3 (153·9 to 184·1)**	**–11·4% (–22·1 to –0·6)***
Alcohol use disorders	170·2 (155·8 to 190·1)	171·6 (154·5 to 197·0)	0·8% (–14·9 to 19·9)	3·0 (2·8 to 3·4)	1·9 (1·7 to 2·2)	–36·7% (–46·6 to –24·5)*	7088·2 (6447·9 to 7992·7)	6460·2 (5727·4 to 7529·1)	–8·9% (–24·1 to 9·9)	122·0 (111·3 to 137·2)	73·6 (65·1 to 86·1)	–39·7% (–49·8 to –27·1)*
Drug use disorders	84·3 (73·2 to 96·7)	172·5 (149·2 to 198·8)	104·5% (68·6 to 142·7)*	1·4 (1·2 to 1·6)	2·0 (1·7 to 2·3)	42·4% (17·6 to 69·2)*	4214·4 (3647·9 to 4824·1)	7966·6 (6900·5 to 9123·5)	89·0% (55·2 to 124·0)*	68·0 (58·9 to 77·9)	94·7 (82·1 to 108·4)	39·4% (14·5 to 64·9)*
Opioid use disorders	57·0 (49·1 to 65·6)	125·9 (108·2 to 144·8)	120·9% (83·6 to 165·2)*	1·0 (0·8 to 1·1)	1·5 (1·3 to 1·7)	53·4% (27·7 to 83·6)*	2810·3 (2410·7 to 3260·9)	5833·0 (5027·1 to 6697·7)	107·6% (73·0 to 148·1)*	45·5 (39·1 to 52·6)	69·4 (59·9 to 79·7)	52·7% (27·5 to 82·7)*
Cocaine use disorders	6·4 (4·9 to 8·3)	17·6 (13·9 to 21·7)	174·7% (91·8 to 280·3)*	0·1 (0·1 to 0·1)	0·2 (0·2 to 0·3)	90·0% (32·7 to 162·9)*	318·2 (245·3 to 412·1)	795·1 (632·4 to 972·2)	149·9% (75·8 to 245·5)*	5·2 (4·0 to 6·7)	9·4 (7·5 to 11·4)	81·5% (27·6 to 150·9)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Amphetamine use disorders	5·9 (3·9 to 9·6)	12·0 (9·6 to 15·0)	101·8% (21·8 to 221·3)*	0·1 (0·1 to 0·2)	0·1 (0·1 to 0·2)	43·0% (–13·7 to 126·9)	318·2 (207·1 to 514·5)	551·0 (441·8 to 685·2)	73·1% (5·3 to 173·8)*	5·0 (3·3 to 8·2)	6·5 (5·3 to 8·1)	29·6% (–21·3 to 105·4)
Other drug use disorders	15·0 (11·6 to 20·1)	17·0 (14·7 to 20·6)	13·4% (–17·5 to 52·6)	0·3 (0·2 to 0·3)	0·2 (0·2 to 0·2)	–20·2% (–41·7 to 6·6)	767·7 (588·7 to 1029·3)	787·5 (679·6 to 948·9)	2·6% (–26·0 to 38·0)	12·3 (9·4 to 16·5)	9·4 (8·1 to 11·4)	–23·5% (–44·7 to 2·8)
Diabetes and kidney diseases	**1719·5 (1560·3 to 1893·2)**	**3535·6 (3142·0 to 3888·8)**	**105·5% (84·4 to 133·2)***	**36·3 (33·0 to 40·1)**	**39·5 (35·0 to 43·4)**	**8·5% (–2·7 to 22·2)**	**44 977·7 (40 396·5 to 49 071·0)**	**82 210·8 (74 339·9 to 91 232·8)**	**82·7% (63·7 to 108·2)***	**863·5 (779·1 to 943·9)**	**919·4 (831·2 to 1020·6)**	**6·4% (–4·2 to 21·3)**
Diabetes mellitus	911·2 (784·3 to 1036·0)	2004·5 (1693·2 to 2306·4)	119·8% (90·0 to 160·5)*	19·2 (16·5 to 21·9)	22·1 (18·7 to 25·5)	14·9% (–0·5 to 35·9)	22 415·9 (19 298·7 to 25 392·7)	45 981·4 (38 780·6 to 53 228·8)	105·0% (76·7 to 143·0)*	438·9 (377·6 to 497·5)	506·2 (426·9 to 586·5)	15·3% (–0·3 to 36·2)
Type 1 diabetes mellitus	48·4 (40·6 to 60·3)	54·4 (42·3 to 71·6)	12·2% (–9·7 to 44·6)	0·8 (0·7 to 1·1)	0·6 (0·5 to 0·8)	–23·0% (–38·1 to –0·8)*	2430·9 (2003·6 to 2963·8)	2556·8 (1980·0 to 3271·3)	5·2% (–15·3 to 36·3)	39·9 (32·8 to 48·7)	31·7 (24·5 to 40·4)	–20·5% (–35·9 to 3·4)
Type 2 diabetes mellitus	862·8 (740·0 to 985·7)	1950·1 (1646·3 to 2235·9)	125·9% (94·9 to 168·7)*	18·4 (15·8 to 21·0)	21·5 (18·1 to 24·7)	16·7% (0·8 to 38·4)*	19 985·0 (17 051·7 to 22 877·7)	43 424·6 (36 681·1 to 50 101·1)	117·2% (86·9 to 159·7)*	399·1 (341·0 to 456·2)	474·4 (401·0 to 548·0)	18·8% (2·3 to 41·7)*
Chronic kidney disease	796·0 (701·6 to 902·0)	1520·1 (1331·1 to 1696·5)	90·9% (66·1 to 123·2)*	16·9 (14·7 to 19·1)	17·2 (15·1 to 19·2)	1·9% (–10·7 to 18·3)	22 063·1 (19 132·0 to 25 266·9)	35 905·8 (30 906·8 to 40 911·1)	62·7% (37·0 to 97·2)*	416·0 (362·4 to 475·7)	409·4 (351·1 to 466·8)	–1·6% (–16·7 to 18·7)
Chronic kidney disease due to type 1 diabetes mellitus	45·0 (35·2 to 57·9)	76·5 (56·4 to 98·4)	70·1% (42·3 to 106·9)*	0·8 (0·6 to 1·1)	0·9 (0·6 to 1·1)	4·1% (–12·3 to 25·6)	1750·8 (1375·2 to 2246·8)	2871·7 (2147·2 to 3677·5)	64·0% (34·9 to 103·4)*	30·8 (24·1 to 40·0)	32·6 (24·3 to 41·7)	5·7% (–12·0 to 30·1)
Chronic kidney disease due to type 2 diabetes mellitus	159·1 (123·4 to 194·4)	343·2 (271·1 to 414·0)	115·7% (88·8 to 150·2)*	3·4 (2·7 to 4·2)	3·8 (3·0 to 4·6)	10·3% (–3·0 to 28·1)	3440·0 (2713·0 to 4265·4)	6906·2 (5505·2 to 8292·3)	100·8% (72·7 to 135·2)*	70·2 (55·2 to 86·9)	75·2 (60·1 to 90·2)	7·1% (–7·2 to 25·5)
Chronic kidney disease due to hypertension	189·4 (153·9 to 229·6)	442·3 (358·5 to 530·1)	133·5% (100·4 to 175·1)*	4·4 (3·6 to 5·4)	5·0 (4·1 to 6·0)	13·3% (–1·1 to 32·8)	3714·7 (2947·7 to 4580·8)	7829·3 (6387·7 to 9431·1)	110·8% (78·6 to 154·9)*	78·2 (63·1 to 96·4)	87·5 (71·6 to 105·0)	12·0% (–4·8 to 34·6)
Chronic kidney disease due to glomerulonephritis	123·3 (101·2 to 145·5)	193·9 (161·9 to 228·9)	57·2% (34·8 to 84·7)*	2·4 (2·0 to 2·8)	2·2 (1·9 to 2·6)	–6·2% (–18·2 to 9·1)	4606·6 (3752·7 to 5506·5)	6352·6 (5165·6 to 7683·4)	37·9% (14·5 to 68·2)*	80·1 (65·4 to 95·7)	74·8 (60·6 to 89·8)	–6·5% (–22·2 to 14·5)
Chronic kidney disease due to other and unspecified causes	279·2 (237·8 to 321·8)	464·1 (387·6 to 545·1)	66·2% (44·2 to 93·0)*	5·8 (4·9 to 6·7)	5·3 (4·4 to 6·2)	–8·8% (–20·0 to 6·1)	8550·9 (7197·2 to 10 086·6)	11 945·9 (9922·4 to 14 087·8)	39·7% (15·0 to 71·7)*	156·8 (133·8 to 183·6)	139·3 (115·7 to 163·9)	–11·1% (–25·5 to 8·6)
Acute glomerulonephritis	12·3 (7·9 to 18·4)	11·1 (7·5 to 14·7)	–9·7% (–38·7 to 32·5)	0·2 (0·1 to 0·3)	0·1 (0·1 to 0·2)	–45·0% (–62·9 to –18·8)*	498·7 (308·1 to 729·6)	323·6 (190·1 to 466·4)	–35·1% (–55·7 to 2·4)	8·5 (5·3 to 12·6)	3·9 (2·2 to 5·6)	–54·9% (–69·9 to –27·5)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Skin and subcutaneous diseases	**66·0 (52·4 to 83·7)**	**161·1 (130·9 to 196·4)**	**144·2% (86·6 to 231·0)***	**1·4 (1·2 to 1·8)**	**1·9 (1·5 to 2·3)**	**30·2% (1·6 to 75·2)***	**2121·2 (1546·9 to 2956·1)**	**4110·4 (3136·7 to 5381·9)**	**93·8% (35·9 to 193·5)***	**38·9 (29·0 to 53·1)**	**49·2 (37·0 to 65·4)**	**26·4% (–11·1 to 90·6)**
Bacterial skin diseases	40·1 (28·2 to 52·9)	101·7 (82·5 to 128·7)	153·8% (82·3 to 276·5)*	0·8 (0·6 to 1·1)	1·2 (0·9 to 1·5)	43·4% (4·5 to 107·0)*	1508·6 (1004·4 to 2158·2)	2763·4 (2067·2 to 3755·8)	83·2% (21·8 to 204·5)*	26·8 (18·1 to 37·8)	33·6 (24·7 to 46·4)	25·2% (–16·7 to 108·4)
Cellulitis	15·8 (10·4 to 23·6)	39·7 (28·9 to 55·5)	150·7% (60·4 to 311·7)*	0·3 (0·2 to 0·5)	0·5 (0·3 to 0·6)	39·4% (–9·9 to 126·4)	537·4 (323·8 to 878·1)	1083·6 (728·7 to 1661·9)	101·7% (17·8 to 273·4)*	9·7 (6·0 to 15·6)	12·9 (8·5 to 20·0)	32·3% (–22·4 to 145·7)
Pyoderma	24·2 (17·1 to 34·4)	62·0 (49·0 to 79·0)	155·9% (76·4 to 271·7)*	0·5 (0·4 to 0·7)	0·7 (0·6 to 0·9)	46·1% (2·6 to 108·2)*	971·2 (591·4 to 1459·5)	1679·8 (1222·9 to 2353·8)	73·0% (9·3 to 193·7)*	17·1 (10·7 to 25·4)	20·7 (14·7 to 29·7)	21·2% (–22·8 to 107·2)
Decubitus ulcer	21·2 (16·3 to 27·8)	48·1 (36·3 to 62·8)	127·0% (65·8 to 213·6)*	0·5 (0·4 to 0·6)	0·5 (0·4 to 0·7)	8·2% (–17·9 to 44·9)	446·2 (309·0 to 651·9)	1010·4 (702·8 to 1440·1)	126·4% (44·0 to 260·4)*	9·1 (6·6 to 12·9)	11·5 (7·9 to 16·5)	26·1% (–17·0 to 92·3)
Other skin and subcutaneous diseases	4·7 (2·8 to 8·3)	11·3 (6·9 to 17·6)	138·8% (14·2 to 384·7)*	0·1 (0·1 to 0·2)	0·1 (0·1 to 0·2)	32·9% (–35·6 to 164·1)	166·5 (83·7 to 338·4)	336·6 (190·9 to 584·5)	102·2% (–20·3 to 392·7)	3·0 (1·5 to 5·9)	4·1 (2·3 to 7·4)	38·5% (–45·7 to 228·7)
Musculoskeletal disorders	**80·2 (66·5 to 92·9)**	**131·7 (107·9 to 154·1)**	**64·1% (37·0 to 88·7)***	**1·7 (1·4 to 1·9)**	**1·5 (1·2 to 1·7)**	**–11·5% (–26·0 to 1·6)**	**2299·8 (1845·6 to 2683·2)**	**3173·8 (2620·9 to 3764·7)**	**38·0% (11·9 to 62·2)***	**42·5 (34·5 to 49·5)**	**36·4 (30·0 to 43·3)**	**–14·5% (–30·4 to 0·4)**
Rheumatoid arthritis	28·8 (20·7 to 36·4)	45·9 (32·7 to 57·9)	59·2% (27·7 to 99·0)*	0·6 (0·4 to 0·8)	0·5 (0·4 to 0·6)	–17·6% (–33·9 to 3·3)	645·5 (447·7 to 820·4)	916·4 (640·7 to 1183·4)	41·9% (11·4 to 77·5)*	12·9 (9·0 to 16·3)	10·1 (7·1 to 13·1)	–21·2% (–38·0 to –1·8)*
Other musculoskeletal disorders	51·4 (42·1 to 60·6)	85·9 (67·9 to 103·6)	66·8% (37·1 to 97·7)*	1·1 (0·9 to 1·3)	1·0 (0·8 to 1·2)	–8·0% (–23·2 to 8·5)	1654·3 (1330·9 to 1948·5)	2257·4 (1790·5 to 2757·1)	36·4% (11·3 to 63·9)*	29·7 (24·2 to 34·8)	26·2 (20·8 to 31·9)	–11·6% (–27·1 to 5·9)
Other non-communicable diseases	**1121·0 (992·9 to 1256·6)**	**1338·5 (1191·5 to 1551·1)**	**19·4% (0·0 to 38·5)***	**19·8 (17·7 to 22·1)**	**17·9 (15·8 to 21·0)**	**–9·4% (–23·9 to 5·5)**	**77 258·0 (66 414·6 to 88 483·4)**	**71 507·3 (59 687·1 to 85 787·3)**	**–7·4% (–26·5 to 13·9)**	**1271·3 (1094·4 to 1452·8)**	**1055·5 (866·7 to 1280·7)**	**–17·0% (–34·1 to 2·8)**
Congenital birth defects	659·3 (547·7 to 792·5)	562·7 (441·3 to 709·6)	–14·7% (–37·6 to 11·6)	10·7 (8·9 to 12·8)	8·8 (6·9 to 11·1)	–17·8% (–40·1 to 7·7)	56 848·7 (47 133·0 to 68 446·9)	47 701·9 (37 217·6 to 60 416·6)	–16·1% (–39·0 to 10·1)	919·0 (761·9 to 1106·5)	753·7 (586·8 to 956·6)	–18·0% (–40·5 to 7·7)
Neural tube defects	65·3 (39·4 to 107·4)	41·7 (24·6 to 69·1)	–36·2% (–66·1 to 18·1)	1·1 (0·6 to 1·7)	0·7 (0·4 to 1·1)	–36·6% (–66·4 to 17·4)	5791·5 (3488·4 to 9536·6)	3673·3 (2158·6 to 6101·7)	–36·6% (–66·4 to 17·5)	93·6 (56·4 to 154·2)	59·2 (34·7 to 98·4)	–36·7% (–66·5 to 17·3)
Congenital heart anomalies	386·7 (307·5 to 471·0)	301·2 (233·4 to 390·5)	–22·1% (–43·5 to 2·5)	6·2 (5·0 to 7·6)	4·7 (3·6 to 6·1)	–25·3% (–45·9 to –1·6)*	33 161·2 (26 261·7 to 40 446·1)	25 455·6 (19 627·3 to 33 175·6)	–23·2% (–44·6 to 1·3)	535·7 (424·1 to 653·5)	399·5 (307·3 to 522·4)	–25·4% (–46·2 to –1·5)*
Orofacial clefts	11·5 (4·1 to 30·6)	3·3 (0·7 to 10·1)	–71·4% (–89·5 to –29·7)*	0·2 (0·1 to 0·5)	0·1 (0·0 to 0·2)	–71·2% (–89·4 to –29·4)*	1027·7 (367·6 to 2745·2)	293·6 (63·7 to 901·6)	–71·4% (–89·5 to –29·7)*	16·7 (6·0 to 44·6)	4·8 (1·0 to 14·7)	–71·2% (–89·4 to –29·4)*
Down syndrome	23·9 (15·4 to 34·4)	29·3 (17·8 to 43·7)	22·7% (–32·7 to 104·2)	0·4 (0·3 to 0·6)	0·4 (0·3 to 0·7)	10·1% (–39·8 to 84·2)	1951·1 (1233·5 to 2848·7)	2251·1 (1330·7 to 3487·0)	15·4% (–37·7 to 97·3)	31·7 (20·1 to 46·3)	34·3 (20·0 to 53·7)	8·1% (–42·1 to 85·6)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Other chromosomal abnormalities	14·9 (10·1 to 22·1)	22·9 (15·4 to 36·0)	53·6% (−7·1 to 142·1)	0·2 (0·2 to 0·4)	0·4 (0·2 to 0·6)	49·4% (−10·0 to 135·6)	1291·8 (869·2 to 1924·2)	1956·0 (1300·4 to 3117·2)	51·4% (−9·4 to 139·4)	20·9 (14·1 to 31·1)	31·2 (20·6 to 49·8)	49·2% (−10·9 to 135·9)
Congenital musculoskeletal and limb anomalies	10·0 (6·6 to 16·3)	9·7 (6·2 to 15·0)	−3·4% (−43·6 to 73·9)	0·2 (0·1 to 0·3)	0·1 (0·1 to 0·2)	−7·0% (−45·8 to 67·5)	853·2 (560·2 to 1387·9)	813·1 (513·6 to 1266·7)	−4·7% (−44·8 to 72·9)	13·8 (9·0 to 22·4)	12·8 (8·1 to 20·0)	−6·7% (−46·1 to 69·2)
Urogenital congenital anomalies	12·9 (7·9 to 21·7)	16·9 (9·3 to 30·8)	30·7% (−32·1 to 167·1)	0·2 (0·1 to 0·4)	0·3 (0·1 to 0·5)	18·9% (−40·2 to 144·6)	1039·6 (610·4 to 1775·6)	1309·1 (675·8 to 2494·3)	25·9% (−38·8 to 177·0)	16·9 (10·0 to 28·9)	20·5 (10·4 to 39·6)	21·2% (−42·1 to 168·0)
Digestive congenital anomalies	63·1 (40·9 to 97·6)	67·0 (42·0 to 97·1)	6·1% (−34·6 to 73·4)	1·0 (0·7 to 1·6)	1·1 (0·7 to 1·6)	5·6% (−35·0 to 72·6)	5606·3 (3633·0 to 8669·4)	5922·1 (3705·9 to 8592·1)	5·6% (−35·0 to 72·7)	90·9 (58·9 to 140·6)	96·0 (60·0 to 139·3)	5·6% (−35·2 to 72·8)
Other congenital birth defects	71·1 (42·4 to 125·4)	70·9 (37·7 to 132·9)	−0·3% (−32·6 to 41·8)	1·1 (0·7 to 2·0)	1·1 (0·6 to 2·1)	−3·5% (−35·3 to 38·1)	6126·5 (3636·7 to 10 879·7)	6028·0 (3169·5 to 11 394·8)	−1·6% (−34·1 to 40·9)	98·8 (58·7 to 175·6)	95·4 (49·9 to 181·0)	−3·5% (−36·0 to 38·9)
Urinary diseases and male infertility	180·8 (162·1 to 199·0)	396·2 (357·0 to 433·6)	119·2% (95·5 to 146·1)*	3·9 (3·5 to 4·3)	4·5 (4·1 to 5·0)	15·6% (4·0 to 28·8)*	5005·7 (4426·8 to 5604·2)	8495·7 (7768·6 to 9356·0)	69·8% (48·9 to 95·1)*	94·5 (83·5 to 105·4)	98·2 (89·7 to 108·1)	3·9% (−9·0 to 19·0)
Urinary tract infections and interstitial nephritis	122·2 (106·7 to 137·0)	288·5 (258·0 to 318·6)	136·2% (108·0 to 171·5)*	2·7 (2·4 to 3·0)	3·3 (3·0 to 3·7)	21·7% (7·9 to 38·1)*	3223·8 (2739·6 to 3698·5)	5884·9 (5246·1 to 6590·9)	82·6% (54·7 to 118·5)*	61·7 (53·2 to 70·3)	67·9 (60·5 to 76·0)	10·1% (−6·7 to 30·3)
Urolithiasis	14·6 (12·1 to 17·2)	24·9 (21·0 to 30·0)	71·0% (34·9 to 108·7)*	0·3 (0·2 to 0·3)	0·3 (0·2 to 0·3)	−1·4% (−22·2 to 20·4)	500·4 (406·5 to 604·3)	685·2 (565·5 to 833·1)	37·0% (4·8 to 76·4)*	8·9 (7·3 to 10·7)	8·0 (6·6 to 9·7)	−9·9% (−31·4 to 16·1)
Other urinary diseases	44·0 (33·4 to 58·5)	82·8 (65·2 to 102·2)	88·1% (32·5 to 160·1)*	0·9 (0·7 to 1·2)	0·9 (0·7 to 1·2)	2·9% (−27·1 to 41·0)	1281·5 (965·0 to 1715·2)	1925·7 (1463·1 to 2497·9)	50·3% (4·8 to 116·0)*	23·9 (18·0 to 31·8)	22·3 (16·9 to 28·9)	−7·0% (−35·1 to 32·8)
Gynaecological diseases	5·3 (3·4 to 8·7)	14·1 (7·1 to 25·2)	165·6% (61·5 to 478·3)*	0·1 (0·1 to 0·2)	0·2 (0·1 to 0·3)	61·9% (−2·4 to 251·5)	210·4 (130·8 to 352·3)	502·5 (259·0 to 893·5)	138·7% (41·4 to 424·3)*	3·6 (2·3 to 6·0)	5·9 (3·0 to 10·4)	62·6% (−3·5 to 253·5)
Uterine fibroids	1·6 (0·9 to 2·9)	4·0 (2·0 to 7·4)	151·9% (38·4 to 474·7)*	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·1)	61·6% (−11·9 to 266·8)	67·5 (38·8 to 123·6)	159·1 (77·5 to 311·2)	135·4% (24·8 to 439·1)*	1·1 (0·7 to 2·1)	1·9 (0·9 to 3·6)	62·0% (−14·1 to 269·5)
Endometriosis	0·0 (0·0 to 0·1)	0·2 (0·0 to 0·5)	260·1% (25·3 to 1199·7)*	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	160·1% (−10·5 to 826·6)	2·2 (0·8 to 5·5)	7·6 (1·5 to 25·5)	245·5% (19·5 to 1118·1)*	0·0 (0·0 to 0·1)	0·1 (0·0 to 0·3)	154·3% (−11·5 to 787·1)
Genital prolapse	0·6 (0·3 to 1·1)	1·6 (0·8 to 3·5)	181·4% (14·7 to 706·6)*	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	50·8% (−37·5 to 324·1)	17·2 (8·5 to 33·6)	43·4 (19·3 to 91·8)	152·4% (−9·2 to 616·6)	0·3 (0·2 to 0·6)	0·5 (0·2 to 1·1)	63·2% (−40·3 to 353·9)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Other gynaecological diseases	3·1 (1·7 to 5·2)	8·3 (3·9 to 15·2)	168·4% (45·0 to 483·1)*	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·2)	63·2% (−11·4 to 249·0)	123·5 (65·5 to 210·9)	292·5 (134·9 to 525·3)	136·8% (26·7 to 433·0)*	2·1 (1·1 to 3·6)	3·4 (1·6 to 6·1)	61·4% (−13·4 to 260·5)
Haemoglobinopathies and haemolytic anaemias	121·9 (88·9 to 183·0)	132·4 (86·7 to 218·0)	8·5% (−33·1 to 57·4)	2·2 (1·7 to 3·3)	1·6 (1·1 to 2·8)	−26·4% (−54·4 to 6·3)	6345·0 (4403·3 to 9919·8)	6361·5 (3804·8 to 11317·4)	0·2% (−42·3 to 55·8)	105·1 (73·4 to 163·8)	84·8 (49·8 to 153·8)	−19·4% (−53·9 to 25·2)
Thalassaemias	17·9 (13·9 to 24·6)	13·5 (9·1 to 19·6)	−24·6% (−55·4 to 19·7)	0·3 (0·2 to 0·4)	0·2 (0·1 to 0·3)	−35·7% (−62·2 to 2·9)	1330·1 (1021·3 to 1846·9)	956·2 (629·0 to 1407·7)	−28·1% (−58·3 to 15·9)	21·3 (16·3 to 29·6)	13·7 (8·9 to 20·6)	−35·7% (−63·0 to 3·7)
Sickle cell disorders	45·6 (26·5 to 85·7)	54·0 (27·0 to 110·5)	18·4% (−34·4 to 100·9)	0·7 (0·4 to 1·4)	0·7 (0·4 to 1·5)	0·4% (−44·5 to 71·2)	3290·0 (1894·7 to 6160·7)	3768·4 (1866·6 to 7680·2)	14·5% (−37·1 to 98·2)	51·9 (29·9 to 97·8)	51·9 (25·6 to 107·0)	0·0% (−45·3 to 73·7)
G6PD deficiency	12·6 (8·5 to 18·3)	12·9 (7·6 to 21·1)	2·9% (−42·6 to 65·7)	0·2 (0·2 to 0·3)	0·1 (0·1 to 0·2)	−34·3% (−63·1 to 4·3)	553·6 (387·9 to 794·2)	516·6 (310·1 to 816·5)	−6·7% (−48·2 to 55·1)	9·4 (6·6 to 13·5)	6·2 (3·8 to 9·8)	−33·4% (−62·6 to 11·0)
Other haemoglobinopathies and haemolytic anaemias	45·9 (36·7 to 60·3)	51·9 (39·7 to 71·8)	13·1% (−21·8 to 52·5)	1·0 (0·8 to 1·3)	0·6 (0·4 to 0·8)	−41·2% (−59·3 to −21·0)*	1171·3 (969·0 to 1485·7)	1120·4 (875·8 to 1457·0)	−4·4% (−32·6 to 27·7)	22·5 (18·5 to 29·0)	12·8 (10·1 to 16·6)	−42·9% (−59·7 to −25·1)*
Endocrine, metabolic, blood, and immune disorders	96·9 (84·3 to 108·9)	207·6 (179·5 to 233·9)	114·1% (89·0 to 141·4)*	2·0 (1·7 to 2·2)	2·4 (2·1 to 2·7)	23·4% (9·9 to 39·9)*	3757·6 (3032·0 to 4410·9)	6149·5 (5122·8 to 7402·5)	63·6% (35·7 to 93·7)*	66·2 (53·9 to 77·1)	75·6 (62·2 to 92·1)	14·0% (−5·1 to 35·2)
Thyroid diseases	19·6 (14·9 to 25·2)	32·4 (25·6 to 41·1)	65·0% (22·4 to 113·1)*	0·4 (0·3 to 0·5)	0·4 (0·3 to 0·5)	−8·0% (−30·6 to 18·2)	674·5 (479·3 to 924·3)	967·1 (712·2 to 1279·4)	43·4% (−3·4 to 101·0)	12·1 (8·8 to 16·3)	11·7 (8·5 to 15·6)	−3·4% (−34·4 to 35·5)
Other endocrine, metabolic, blood, and immune disorders	77·3 (67·1 to 86·5)	175·2 (153·3 to 197·4)	126·6% (103·1 to 154·9)*	1·5 (1·4 to 1·7)	2·0 (1·8 to 2·3)	31·8% (19·3 to 48·4)*	3083·1 (2538·1 to 3609·7)	5182·4 (4384·7 to 6163·9)	68·0% (43·1 to 96·0)*	54·1 (45·0 to 62·9)	63·9 (53·4 to 77·1)	17·9% (0·2 to 39·7)*
Sudden infant death syndrome	56·7 (36·3 to 91·0)	25·6 (15·8 to 40·1)	−54·9% (−73·0 to −24·0)*	0·9 (0·6 to 1·5)	0·4 (0·3 to 0·7)	−54·7% (−72·9 to −23·7)*	5090·6 (3253·1 to 8163·9)	2296·2 (1414·7 to 3601·8)	−54·9% (−73·0 to −24·0)*	82·9 (53·0 to 132·9)	37·5 (23·1 to 58·8)	−54·7% (−72·9 to −23·7)*
Injuries	**4561·0 (4198·4 to 4847·2)**	**4874·5 (4365·5 to 5278·9)**	**6·9% (−1·4 to 17·0)**	**79·0 (73·0 to 83·8)**	**58·4 (52·3 to 63·4)**	**−26·1% (−31·9 to −19·3)***	**239 490·2 (219 550·6 to 255 837·6)**	**220 643·9 (194 754·8 to 240 020·8)**	**−7·9% (−15·4 to 0·3)**	**3884·7 (3557·3 to 4148·4)**	**2756·6 (2426·8 to 2997·9)**	**−29·0% (−34·8 to −22·7)***
Transport injuries	**1370·0 (1150·1 to 1577·2)**	**1425·8 (1126·9 to 1685·0)**	**4·0% (−15·6 to 30·5)**	**23·0 (19·4 to 26·5)**	**17·1 (13·5 to 20·2)**	**−25·9% (−40·1 to −7·0)***	**73 477·8 (61 024·6 to 85 100·8)**	**70 704·2 (55 582·2 to 83 652·9)**	**−3·8% (−21·5 to 21·2)**	**1180·1 (981·8 to 1364·4)**	**875·7 (687·3 to 1039·1)**	**−25·8% (−39·4 to −6·6)***
Road injuries	1285·3 (1073·5 to 1485·5)	1343·7 (1044·8 to 1583·5)	4·5% (−16·0 to 31·7)	21·6 (18·1 to 25·0)	16·1 (12·5 to 19·0)	−25·5% (−40·1 to −6·3)*	69 027·2 (57 038·4 to 79 536·6)	66 726·5 (51 479·6 to 79 414·8)	−3·4% (−21·7 to 22·6)	1108·4 (917·5 to 1276·3)	826·9 (636·8 to 987·2)	−25·4% (−39·6 to −5·4)*
Pedestrian road injuries	517·6 (403·1 to 627·3)	401·4 (294·8 to 531·9)	−22·5% (−44·5 to 10·0)	8·9 (7·0 to 10·7)	4·8 (3·5 to 6·4)	−46·5% (−61·8 to −24·8)*	26 512·5 (20 298·8 to 32 278·7)	18 879·3 (13 593·8 to 25 843·3)	−28·8% (−49·4 to −0·1)*	432·5 (331·6 to 526·7)	235·1 (168·4 to 321·0)	−45·6% (−61·6 to −24·1)*
Cyclist road injuries	62·3 (47·0 to 82·2)	89·1 (61·6 to 127·5)	42·6% (−15·8 to 118·5)	1·1 (0·8 to 1·4)	1·0 (0·7 to 1·5)	−5·3% (−44·0 to 44·6)	3040·8 (2295·4 to 4061·4)	3647·8 (2434·3 to 5248·3)	19·7% (−28·2 to 83·2)	49·8 (37·6 to 66·3)	43·4 (29·1 to 62·5)	−13·1% (−48·1 to 34·1)

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Motorcyclist road injuries	216·7 (161·2 to 286·9)	319·3 (216·6 to 416·4)	47·3% (−5·7 to 123·1)	3·5 (2·6 to 4·6)	3·8 (2·6 to 5·0)	9·4% (−30·1 to 65·5)	12 274·6 (8987·1 to 16 339·8)	16 474·0 (11 327·3 to 21 440·9)	34·2% (−15·6 to 102·9)	193·0 (142·0 to 256·8)	202·2 (139·0 to 263·5)	4·7% (−34·3 to 58·1)
Motor vehicle road injuries	475·6 (394·0 to 598·0)	518·6 (416·7 to 648·1)	9·0% (−17·7 to 45·1)	7·9 (6·6 to 9·9)	6·3 (5·0 to 7·9)	−20·3% (−40·1 to 6·2)	26 488·4 (21 757·2 to 33 135·5)	26 954·9 (21 588·6 to 34 098·7)	1·7% (−23·2 to 35·9)	421·6 (346·7 to 527·4)	336·5 (268·3 to 428·6)	−20·2% (−39·9 to 7·0)
Other road injuries	13·1 (8·7 to 18·9)	15·4 (10·0 to 22·6)	17·3% (−41·2 to 108·8)	0·2 (0·1 to 0·3)	0·2 (0·1 to 0·3)	−16·2% (−58·0 to 49·8)	711·0 (467·5 to 1033·5)	770·5 (491·4 to 1136·7)	8·4% (−47·1 to 97·1)	11·5 (7·5 to 16·6)	9·7 (6·1 to 14·4)	−15·4% (−58·9 to 55·1)
Other transport injuries	84·7 (60·9 to 110·7)	82·0 (55·8 to 112·2)	−3·2% (−37·0 to 47·6)	1·4 (1·0 to 1·9)	1·0 (0·7 to 1·3)	−31·6% (−55·3 to 3·4)	4450·6 (3151·6 to 5913·9)	3977·7 (2673·9 to 5532·3)	−10·6% (−43·2 to 36·8)	71·6 (50·9 to 94·8)	48·7 (32·7 to 68·1)	−32·0% (−56·8 to 3·5)
Unintentional injuries	**1791·4 (1590·1 to 1985·5)**	**2078·4 (1786·5 to 2291·5)**	**16·0% (5·5 to 29·4)***	**32·6 (28·9 to 35·9)**	**24·9 (21·4 to 27·5)**	**−23·5% (−30·2 to −14·8)***	**92 652·4 (80 125·4 to 103 949·3)**	**81 163·1 (69 397·1 to 91 146·1)**	**−12·4% (−21·6 to −2·5)***	**1531·5 (1327·0 to 1713·6)**	**1033·8 (881·6 to 1164·1)**	**−32·5% (−39·5 to −24·7)***
Falls	487·5 (426·9 to 562·8)	857·4 (723·5 to 1002·4)	75·8% (51·9 to 105·1)*	10·2 (8·9 to 11·7)	9·9 (8·3 to 11·6)	−3·2% (−16·3 to 12·3)	16 299·1 (14 045·6 to 19 638·5)	21 114·3 (17 999·1 to 24 778·3)	29·5% (7·5 to 54·6)*	293·0 (253·6 to 349·4)	250·4 (213·8 to 296·1)	−14·6% (−29·6 to 2·3)
Drowning	432·5 (372·3 to 512·2)	291·1 (234·0 to 362·8)	−32·7% (−46·0 to −11·9)*	7·1 (6·2 to 8·4)	3·7 (3·0 to 4·6)	−47·9% (−58·7 to −32·2)*	29 119·6 (24 541·5 to 34 727·6)	16 898·5 (13 180·4 to 21 593·5)	−42·0% (−54·9 to −23·5)*	464·9 (392·5 to 554·2)	225·5 (174·9 to 289·3)	−51·5% (−62·6 to −36·0)*
Fire, heat, and hot substances	134·6 (103·6 to 173·8)	150·7 (102·9 to 205·0)	11·9% (−13·8 to 54·5)	2·4 (1·8 to 3·0)	1·9 (1·3 to 2·6)	−21·6% (−39·4 to 9·1)	7268·4 (5293·8 to 9998·4)	7433·1 (4843·5 to 10 612·7)	2·3% (−24·7 to 47·5)	119·7 (87·9 to 163·7)	97·7 (63·0 to 141·3)	−18·4% (−39·5 to 18·6)
Poisonings	79·0 (65·0 to 99·8)	69·9 (54·4 to 91·7)	−11·6% (−37·9 to 24·6)	1·4 (1·1 to 1·7)	0·8 (0·6 to 1·1)	−37·8% (−56·7 to −11·9)*	4281·2 (3412·7 to 5626·8)	3335·6 (2479·5 to 4592·5)	−22·1% (−48·5 to 18·3)	70·0 (55·9 to 91·7)	42·5 (30·9 to 59·8)	−39·3% (−60·0 to −6·7)*
Poisoning by carbon monoxide	44·0 (37·4 to 52·6)	31·0 (24·4 to 39·9)	−29·7% (−43·1 to −12·7)*	0·8 (0·7 to 0·9)	0·4 (0·3 to 0·5)	−52·8% (−61·9 to −40·7)*	2185·4 (1806·8 to 2684·2)	1290·8 (1014·9 to 1743·1)	−41·0% (−54·4 to −21·2)*	36·1 (29·9 to 44·0)	15·8 (12·3 to 21·7)	−56·4% (−66·5 to −40·9)*
Poisoning by other means	35·0 (22·7 to 52·1)	38·9 (24·5 to 55·8)	11·2% (−37·6 to 97·9)	0·6 (0·4 to 0·9)	0·5 (0·3 to 0·7)	−18·5% (−54·5 to 46·8)	2095·8 (1309·4 to 3230·7)	2044·8 (1279·7 to 3095·7)	−2·5% (−47·0 to 80·7)	33·9 (21·2 to 52·2)	26·8 (16·4 to 41·4)	−21·0% (−57·6 to 48·2)
Exposure to mechanical forces	127·9 (98·2 to 170·3)	104·1 (74·0 to 148·7)	−18·7% (−41·8 to 34·5)	2·1 (1·7 to 2·8)	1·3 (0·9 to 1·8)	−41·6% (−58·1 to −2·9)*	7151·8 (5320·4 to 9989·7)	5170·1 (3634·1 to 7802·5)	−27·7% (−51·6 to 24·4)	115·1 (85·9 to 160·4)	64·5 (45·2 to 100·2)	−43·9% (−62·5 to −3·0)*
Unintentional firearm injuries	23·2 (13·8 to 37·9)	16·2 (10·0 to 25·8)	−30·1% (−56·8 to 26·7)	0·4 (0·2 to 0·6)	0·2 (0·1 to 0·3)	−47·3% (−67·6 to −3·4)*	1340·5 (796·7 to 2191·8)	888·1 (539·5 to 1434·2)	−33·7% (−60·1 to 25·4)	21·0 (12·5 to 34·4)	11·1 (6·7 to 18·4)	−47·0% (−68·3 to 1·1)
Other exposure to mechanical forces	104·7 (80·0 to 141·2)	87·9 (60·6 to 127·5)	−16·1% (−39·2 to 35·4)	1·8 (1·4 to 2·4)	1·1 (0·7 to 1·5)	−40·4% (−56·8 to −2·3)*	5811·2 (4271·2 to 8200·8)	4282·0 (2889·5 to 6483·0)	−26·4% (−49·5 to 24·3)	94·1 (69·5 to 132·4)	53·4 (35·7 to 82·7)	−43·3% (−61·0 to −2·9)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Adverse effects of medical treatment	99·3 (77·6 to 127·7)	102·5 (85·3 to 128·6)	3·2% (−23·6 to 39·0)	1·9 (1·5 to 2·4)	1·2 (1·0 to 1·5)	−35·4% (−51·7 to −12·3)*	4425·4 (3389·4 to 5958·3)	3802·5 (2940·0 to 5042·3)	−14·1% (−40·4 to 22·0)	75·8 (58·4 to 101·4)	49·0 (37·1 to 65·9)	−35·4% (−54·7 to −6·9)*
Animal contact	102·2 (61·8 to 150·3)	103·1 (61·8 to 148·7)	0·9% (−35·2 to 67·1)	1·7 (1·1 to 2·6)	1·2 (0·7 to 1·8)	−28·5% (−53·8 to 18·6)	5869·1 (3456·8 to 8754·7)	5034·6 (3000·3 to 7390·9)	−14·2% (−45·0 to 43·4)	95·1 (56·1 to 141·9)	64·1 (38·0 to 94·8)	−32·6% (−56·7 to 12·6)
Venomous animal contact	92·4 (55·5 to 137·8)	93·7 (56·3 to 137·1)	1·4% (−35·7 to 67·2)	1·6 (0·9 to 2·3)	1·1 (0·7 to 1·7)	−28·0% (−54·0 to 18·9)	5338·7 (3104·6 to 8048·5)	4557·1 (2701·9 to 6798·8)	−14·6% (−46·6 to 42·3)	86·3 (50·3 to 130·4)	57·8 (34·0 to 87·1)	−33·0% (−58·3 to 11·6)
Non-venomous animal contact	9·8 (5·9 to 18·1)	9·5 (5·2 to 14·9)	−3·5% (−45·4 to 70·9)	0·2 (0·1 to 0·3)	0·1 (0·1 to 0·2)	−32·8% (−61·6 to 19·6)	530·3 (300·5 to 1064·2)	477·5 (242·7 to 779·7)	−9·9% (−51·6 to 67·8)	8·8 (5·0 to 17·5)	6·2 (3·1 to 10·4)	−29·0% (−61·7 to 33·1)
Foreign body	102·9 (79·8 to 125·1)	119·8 (91·3 to 148·7)	16·5% (−3·4 to 35·3)	1·9 (1·5 to 2·3)	1·5 (1·1 to 1·9)	−19·1% (−32·2 to −4·5)*	6041·1 (4342·0 to 7516·9)	5517·9 (3934·6 to 7185·8)	−8·7% (−28·9 to 12·5)	100·7 (72·9 to 124·7)	77·0 (54·0 to 100·7)	−23·6% (−40·7 to −4·7)*
Pulmonary aspiration and foreign body in airway	99·3 (77·0 to 119·7)	117·6 (90·0 to 144·7)	18·4% (−1·0 to 37·8)	1·8 (1·5 to 2·2)	1·5 (1·1 to 1·9)	−17·8% (−31·1 to −2·8)*	5818·3 (4173·9 to 7253·5)	5414·8 (3882·7 to 6977·6)	−6·9% (−27·9 to 15·4)	97·1 (70·1 to 120·4)	75·6 (53·3 to 98·9)	−22·1% (−39·9 to −1·9)*
Foreign body in other body part	3·6 (1·5 to 5·6)	2·3 (1·3 to 3·8)	−36·6% (−63·1 to 3·7)	0·1 (0·0 to 0·1)	0·0 (0·0 to 0·0)	−55·6% (−74·0 to −29·3)*	222·8 (80·8 to 360·1)	103·0 (49·1 to 181·1)	−53·8% (−76·0 to −22·9)*	3·7 (1·3 to 5·9)	1·4 (0·6 to 2·4)	−62·6% (−80·7 to −39·4)*
Electrocution	56·7 (29·5 to 88·4)	42·4 (22·0 to 57·4)	−25·2% (−45·3 to 12·6)	0·9 (0·5 to 1·4)	0·5 (0·3 to 0·7)	−41·8% (−57·5 to −11·6)*	3443·9 (1765·2 to 5304·9)	2525·8 (1306·1 to 3478·2)	−26·7% (−47·1 to 8·0)	54·1 (27·8 to 83·6)	32·6 (16·7 to 45·4)	−39·8% (−56·8 to −10·4)*
Environmental heat and cold exposure	56·3 (42·6 to 69·6)	83·4 (71·5 to 95·7)	48·1% (20·8 to 80·9)*	1·0 (0·8 to 1·3)	0·9 (0·8 to 1·1)	−9·2% (−25·8 to 10·4)	2292·9 (1710·6 to 2936·1)	2650·0 (2235·1 to 3102·6)	15·6% (−5·8 to 43·1)	39·7 (29·7 to 50·5)	30·6 (25·6 to 36·1)	−22·9% (−37·2 to −5·4)*
Exposure to forces of nature	9·0 (8·2 to 9·9)	88·6 (80·7 to 97·4)	882·0% (882·0 to 882·0)*	0·2 (0·1 to 0·2)	1·1 (1·0 to 1·2)	598·5% (598·5 to 598·5)*	545·5 (496·7 to 599·7)	4274·0 (3891·6 to 4698·5)	683·5% (683·5 to 683·5)*	8·8 (8·0 to 9·7)	56·8 (51·7 to 62·4)	543·4% (543·4 to 543·4)*
Other unintentional injuries	103·4 (59·7 to 176·9)	65·2 (39·7 to 104·3)	−36·9% (−64·3 to 17·1)	1·7 (1·0 to 2·9)	0·8 (0·5 to 1·3)	−53·8% (−73·8 to −14·8)*	5914·5 (3294·4 to 10 442·9)	3406·8 (2026·0 to 5684·8)	−42·4% (−69·2 to 8·5)	94·5 (53·0 to 166·1)	43·1 (25·5 to 72·6)	−54·4% (−75·6 to −14·7)*
Self-harm and interpersonal violence	**1399·6 (1273·1 to 1514·3)**	**1370·4 (1252·7 to 1496·8)**	**−2·0% (−10·9 to 7·7)**	**23·4 (21·3 to 25·3)**	**16·4 (15·0 to 17·9)**	**−29·9% (−36·4 to −22·8)***	**73 359·9 (66 978·1 to 79 476·6)**	**68 776·6 (62 700·9 to 75 042·7)**	**−6·2% (−14·7 to 3·9)**	**1173·1 (1069·1 to 1271·3)**	**847·1 (771·6 to 925·4)**	**−27·8% (−34·5 to −19·8)***
Self-harm	819·5 (707·3 to 905·0)	766·7 (675·7 to 857·9)	−6·3% (−17·0 to 6·2)	14·1 (12·2 to 15·6)	9·0 (7·9 to 10·1)	−36·4% (−43·6 to −27·9)*	39 034·8 (33 419·7 to 43 263·2)	34 358·5 (29 835·6 to 38 613·6)	−11·9% (−23·2 to 0·1)	636·2 (544·4 to 704·3)	413·9 (358·2 to 465·7)	−34·9% (−43·2 to −26·4)*
Self-harm by firearm	67·3 (50·2 to 98·4)	66·6 (51·5 to 86·1)	−1·1% (−24·1 to 35·0)	1·2 (0·9 to 1·7)	0·8 (0·6 to 1·0)	−32·8% (−47·6 to −9·7)*	3262·0 (2317·0 to 4873·2)	2910·7 (2156·2 to 3887·0)	−10·8% (−34·1 to 25·9)	53·0 (38·1 to 78·9)	34·9 (25·8 to 46·8)	−34·1% (−50·6 to −7·8)*
Self-harm by other specified means	752·2 (642·7 to 839·1)	700·2 (609·7 to 787·9)	−6·8% (−18·3 to 6·6)	13·0 (11·1 to 14·5)	8·2 (7·1 to 9·3)	−36·7% (−44·5 to −27·8)*	35 772·8 (30 493·1 to 39 978·1)	31 447·9 (26 807·0 to 35 588·2)	−12·0% (−23·9 to 0·5)	583·2 (498·2 to 651·3)	378·9 (322·4 to 428·9)	−35·0% (−43·9 to −25·8)*

(Table 1 continues on next page)

	All-age deaths, thousands			Age-standardised death rate per 100 000 population			All-age YLLs, thousands			Age-standardised YLL rate per 100 000 population		
	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23	2000	2023	Percentage change, 2000–23
(Continued from previous page)												
Interpersonal violence	464·3 (420·2 to 539·4)	435·7 (384·1 to 507·9)	−6·2% (−21·5 to 12·1)	7·5 (6·8 to 8·7)	5·3 (4·7 to 6·2)	−28·9% (−40·6 to −15·0)*	26 564·8 (23 942·0 to 31 034·3)	24 148·6 (21 130·2 to 28 446·6)	−9·1% (−24·0 to 9·0)	418·9 (377·6 to 489·5)	302·4 (264·5 to 358·0)	−27·8% (−39·7 to −13·2)*
Physical violence by firearm	162·0 (145·0 to 185·9)	185·6 (167·5 to 209·2)	14·6% (−3·7 to 34·1)	2·6 (2·3 to 2·9)	2·3 (2·1 to 2·6)	−11·1% (−25·5 to 3·8)	9524·1 (8520·1 to 10 959·9)	10 535·3 (9479·3 to 11 925·5)	10·6% (−7·5 to 29·9)	148·0 (132·4 to 170·4)	131·2 (118·0 to 148·6)	−11·4% (−25·9 to 3·9)
Physical violence by sharp object	116·7 (94·2 to 140·4)	89·9 (67·3 to 125·8)	−23·0% (−42·0 to 7·1)	1·9 (1·5 to 2·3)	1·1 (0·8 to 1·5)	−42·2% (−56·5 to −19·5)*	6511·2 (5234·5 to 7903·5)	4848·9 (3572·3 to 6814·3)	−25·5% (−44·6 to 3·9)	102·7 (82·6 to 124·4)	60·0 (44·0 to 84·5)	−41·6% (−56·6 to −18·3)*
Physical violence by other means	185·6 (155·8 to 236·6)	160·2 (125·3 to 204·7)	−13·7% (−35·1 to 16·4)	3·1 (2·6 to 3·9)	2·0 (1·5 to 2·5)	−35·7% (−51·5 to −13·1)*	10 529·4 (8776·0 to 13 612·8)	8764·4 (6699·7 to 11 310·6)	−16·8% (−37·8 to 14·9)	168·2 (140·5 to 216·7)	111·2 (84·4 to 144·2)	−33·9% (−50·5 to −8·5)*
Conflict and terrorism	108·7 (94·2 to 145·1)	159·1 (125·6 to 208·6)	46·3% (31·7 to 54·5)*	1·7 (1·4 to 2·2)	2·0 (1·6 to 2·6)	19·3% (7·7 to 25·9)*	7348·6 (6362·3 to 9833·7)	9771·2 (7782·4 to 12 730·0)	33·0% (20·6 to 39·9)*	111·5 (96·5 to 149·2)	124·6 (99·5 to 162·0)	11·7% (1·6 to 17·4)*
Police conflict and executions	7·1 (5·5 to 9·1)	8·9 (6·3 to 13·3)	25·8% (−19·5 to 74·9)	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·2)	−3·3% (−38·1 to 36·2)	411·7 (325·1 to 527·2)	498·2 (349·4 to 747·7)	21·0% (−22·3 to 68·8)	6·4 (5·1 to 8·3)	6·2 (4·4 to 9·3)	−3·8% (−38·1 to 35·3)
Total cancers	**7002·9 (6615·8 to 7281·6)**	**10 443·4 (9608·6 to 11 041·7)**	**49·0% (41·0 to 57·5)***	**142·5 (134·4 to 148·4)**	**115·6 (106·3 to 122·1)**	**−18·9% (−22·7 to −14·5)***	**195 148·9 (185 805·2 to 202 090·3)**	**264 464·0 (249 927·7 to 277 556·8)**	**35·4% (29·4 to 43·6)***	**3696·7 (3518·2 to 3830·4)**	**2950·4 (2789·1 to 3094·1)**	**−20·2% (−23·7 to −15·4)***
Total burden related to hepatitis B	**586·6 (522·9 to 656·6)**	**628·4 (537·2 to 707·3)**	**7·1% (−7·8 to 24·1)**	**11·0 (9·9 to 12·4)**	**7·0 (6·0 to 7·9)**	**−36·3% (−45·4 to −25·8)***	**21 517·4 (19 085·4 to 24 352·8)**	**21 106·8 (18 086·9 to 23 933·9)**	**−1·9% (−17·8 to 15·7)**	**382·5 (338·7 to 429·2)**	**241·8 (207·1 to 274·7)**	**−36·8% (−47·0 to −25·3)***
Total burden related to hepatitis C	**387·4 (339·4 to 445·3)**	**497·2 (426·4 to 566·3)**	**28·3% (12·2 to 48·2)***	**7·6 (6·6 to 8·7)**	**5·5 (4·7 to 6·3)**	**−27·2% (−36·3 to −15·8)***	**12 328·0 (10 658·9 to 14 400·8)**	**14 408·7 (12 311·5 to 16 728·9)**	**16·9% (0·1 to 36·2)***	**226·2 (196·2 to 261·9)**	**161·6 (138·3 to 187·6)**	**−28·6% (−38·5 to −16·3)***
Total burden related to non-alcoholic fatty liver disease	**72·7 (57·5 to 91·2)**	**131·5 (103·4 to 164·9)**	**80·8% (62·1 to 98·8)***	**1·5 (1·2 to 1·8)**	**1·4 (1·1 to 1·8)**	**−1·1% (−10·7 to 8·9)**	**2076·1 (1604·1 to 2619·0)**	**3505·5 (2755·4 to 4412·3)**	**68·9% (52·9 to 86·0)***	**39·3 (30·4 to 49·7)**	**38·8 (30·6 to 48·9)**	**−1·2% (−11·1 to 9·6)**
Total cancers excluding non-melanoma skin cancer	**6972·7 (6588·6 to 7250·5)**	**10 379·5 (9553·2 to 10 971·7)**	**48·7% (40·8 to 57·3)***	**141·8 (133·8 to 147·8)**	**114·9 (105·7 to 121·3)**	**−19·0% (−22·9 to −14·6)***	**194 470·7 (185 196·6 to 201 427·7)**	**263 224·6 (248 820·8 to 276 246·5)**	**35·3% (29·2 to 43·4)***	**3683·1 (3505·6 to 3817·3)**	**2936·6 (2777·0 to 3078·5)**	**−20·3% (−23·8 to −15·5)***

Values in parentheses are 95% uncertainty intervals. G6PD=glucose-6-phosphate dehydrogenase. NASH=non-alcoholic steatohepatitis. YLLs=years of life lost. *Statistically significant percentage changes.

Table 1: **Global death and YLL numbers, age-standardised rates per 100 000, and percentage change between 2000 and 2023 for all sexes combined for all GBD causes and Levels 1–4 of the cause hierarchy**

vital registration data and 342 country-years of surveillance data that were reported during the pandemic (to 2022). We developed an analysis method using OneMod, a modelling tool that combines robust feature selection, correlated time-series splines, and covariate effect sizes across age groups, in addition to kernel regression for residual smoothing. It included the following candidate covariates: total COVID-19 infections and variant prevalence; COVID-19 vaccinations;[27] COVID-19 infection detection rate;[27] Healthcare Access and Quality Index;[28] and prevalence of risk factors and comorbidities including obesity, smoking, cancer, cardiovascular disease, chronic kidney disease, chronic obstructive pulmonary disease, and diabetes.[29,30] In the first stage of this model pipeline, we used only the corrected vital registration data to estimate age patterns and sex ratios, which were then used to split the provisional vital registration by age and sex, and split the surveillance data that did not contain detailed age and sex information into the 25 granular GBD age groups. We then ran the models using the entire dataset, setting the infection detection rate to 100% for the corrected vital registration data. After fitting these models, we made predictions assuming that the infection detection rate was 100% in all locations. Details on the estimation of COVID-19 deaths can be found in appendix 1 (section 5).

For the **statistical code used in GBD estimation** see https://ghdx.healthdata.org/gbd-2023/code

For the **GBD Results tool** see https:// vizhub.healthdata.org/gbd-results

For the **GBD Compare tool** see http://vizhub.healthdata.org/gbd-compare

GBD research and reporting practices

This study used de-identified data and was approved by the University of Washington Institutional Review Board (study number 9060). GBD 2023 complies with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) statement (appendix 1 section 2.4).[31] A completed GATHER checklist is provided in appendix 1 (table S13). Software packages used in the cause of death analysis for GBD 2023 were Python version 3.10.4, Stata version 13.1, and R version 4.4.0. Statistical code used for GBD estimation is publicly available online at the GHDx website.

Role of the funding source

The funders of this study had no role in the study design, data collection, data analysis, data interpretation, or the writing of the report. The corresponding author had full access to the data in the study and final responsibility for the decision to submit for publication.

Results

Detailed results for each cause of death in this analysis are available in downloadable form through the GBD Results tool and via visual exploration through the GBD Compare tool.

Global all-cause mortality

Relative to the rate in 1990, the percentage change in annual age-standardised mortality rate from 1991–2019 globally for all causes of death fluctuated between a decrease of 2·9% (95% UI −3·5 to −2·3) and a slight increase of 0·1% (−0·7 to 1·0; appendix 2 figure S1). A notable increase occurred between 2019 and 2020 (6·5% [5·9 to 7·1]) and 2020 and 2021 (7·0% [6·5 to 7·6]), followed by a large decrease between 2021 and 2022 (−9·5% [−10·7 to −8·2]). The total number of global deaths for all sexes and all age groups increased from 47·9 million (47·6–48·3) in 1990 to 55·2 million

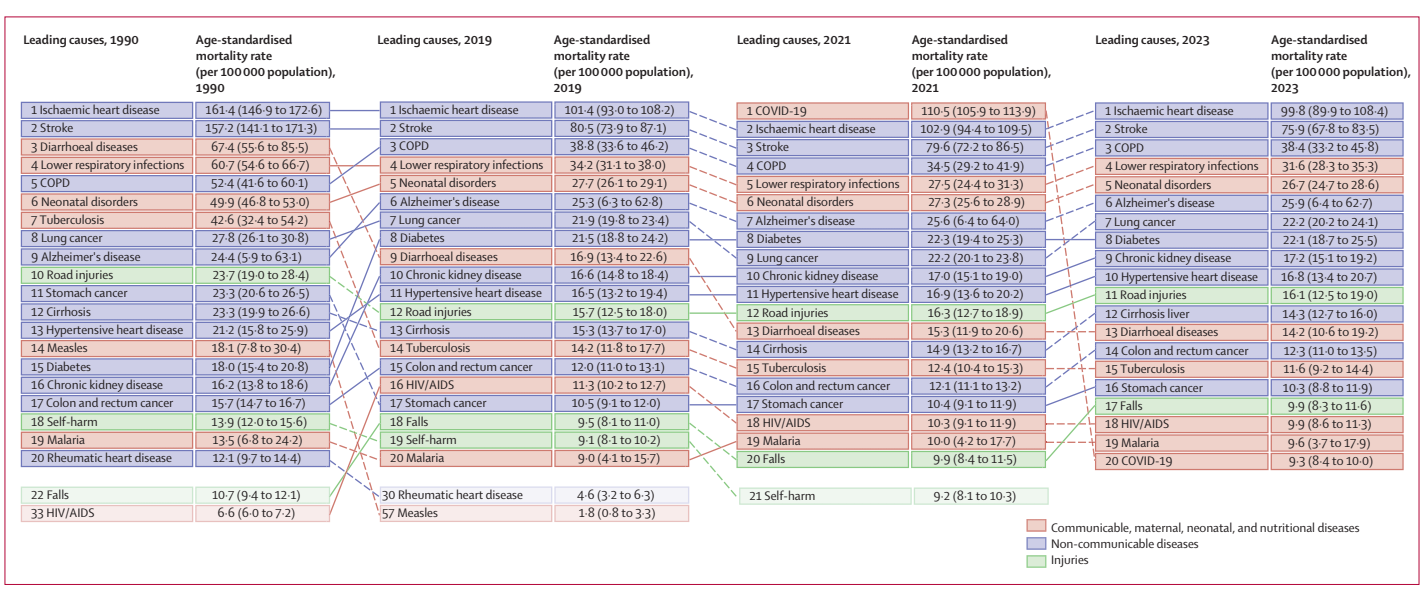


Figure 1: **Leading Level 3 causes of global deaths and age-standardised mortality rate per 100 000 population for all sexes combined, 1990, 2019, 2021, and 2023**
The 20 leading causes of death are shown in descending order. Causes are connected by lines between time periods; solid lines represent an increase or lateral shift in rank and dashed lines represent decreases in rank. Alzheimer's disease=Alzheimer's disease and other dementias. Cirrhosis=cirrhosis and other chronic liver diseases. COPD=chronic obstructive pulmonary disease. Lung cancer=tracheal, bronchus, and lung cancer.

(54·8–55·5) in 2019. An increase occurred during the initial years of the COVID-19 pandemic, with global deaths reaching 65·9 million (65·6–66·2) in 2021. As the pandemic subsided, the annual global death toll decreased to 60·0 million (59·0–61·2) in 2023. From 2000 to 2023, this represents an overall decline of 30·5% (29·0–31·7), in which the global age-standardised mortality rate for all sexes and age groups dropped from 1009·0 (1002·5–1015·2) deaths per 100 000 to 701·5 (690·2–714·9) deaths per 100 000 (table 1, appendix 2 table S7).

Causes of death

Figure 1 shows the global rankings of the leading Level 3 causes of age-standardised mortality rates over the period studied. From 1990 to 2023, ischaemic heart disease and stroke consistently ranked as the first and second leading causes, respectively—except in 2021, when COVID-19 temporarily ranked as the leading cause of age-standardised deaths. In 2021, the rankings of the leading five Level 3 causes, in descending order, were COVID-19, ischaemic heart disease, stroke, chronic obstructive pulmonary disease (COPD), and lower respiratory infections. In 2023, COVID-19 dropped to the 20th leading cause of death, with ischaemic heart disease, stroke, COPD, lower respiratory infections, and neonatal disorders ranking as the leading five causes. Although the rankings of the leading two causes of death in 2023, ischaemic heart disease and stroke, were the same as they were in 1990, the age-standardised mortality rates for each have decreased: ischaemic heart disease decreased from 161·4 deaths (95% UI 146·9–172·6) per 100 000 population in 1990, to 99·8 deaths (89·9–108·4) per 100 000 in 2023; while stroke declined from 157·2 deaths (141·1–171·3) per 100 000 in 1990 to 75·9 deaths (67·8–83·5) per 100 000 in 2023. Other notable shifts in the rankings of leading causes of death have occurred over the past three decades. Four causes showed declines in age-standardised mortality rates between 1990 and 2023: diarrhoeal diseases (67·4 deaths [55·6–85·5] per 100 000 in 1990 to 14·2 deaths [10·6–19·2] per 100 000 in 2023), tuberculosis (42·6 deaths [32·4–54·2] per 100 000 in 1990 to 11·6 deaths [9·2–14·4] per 100 000 in 2023), stomach cancer (23·3 deaths [20·6–26·5] per 100 000 in 1990 to 10·3 deaths [8·8–11·9] per 100 000 in 2023), and measles (18·1 deaths [7·8–30·4] per 100 000 in 1990 to 2·2 deaths [0·9–3·9] per 100 000 in 2023). By contrast, some causes exhibited an increase in age-standardised mortality rates between 1990 and 2023, such as diabetes, chronic kidney disease, Alzheimer's disease and other dementias, and HIV/AIDS.

The percentage change among leading Level 3 causes of death varied over the study period between females and males at the global level (figure 2). The age-standardised mortality rates for HIV/AIDS, urinary diseases, chronic kidney disease, and COPD increased more among females than males. Likewise, those for falls, asthma, and hypertensive heart disease decreased more among males than females. Deaths from conflict and terrorism were particularly disparate by sex and location (appendix 2 table S18). Between 1995 and 2023, 51·3% (95% UI 45·9–53·9) of female deaths due to conflict and terrorism occurred in north Africa and the Middle East, despite only 7·2% of the global female population residing in this region. Eastern Europe contributed 7·5% (6·3–8·3) of female deaths from this cause, despite having only 3·4% of the global female population. Over the same time period, 52·0% (46·3–54·7) of male deaths due to conflict and terrorism occurred in north Africa and the Middle East, which accounts for only 7·7% of the global male population, and 8·0% (6·6–9·1) in eastern Europe, with only 2·9% of the global male population (appendix 2 table S18). In 2023, Palestine had the highest age-standardised mortality rate due to conflict and terrorism of any country in the world (385·8 deaths [351·3–424·1] per 100 000 population), more than five times that of the second-leading country, Ukraine (70·1 deaths [67·2–73·2] per 100 000). Sudan ranks as the third highest country in terms of age-standardised mortality rates for conflict and terrorism, while Russia and Burkina Faso follow as the fourth and fifth leading countries, in 2023 (appendix 2 table S7).

Causes of YLLs

Over the study period, neonatal disorders remained the leading Level 3 cause of global YLLs, despite a decrease in age-standardised YLL rates, from 4487·8 YLLs (95% UI 4212·3–4761·6) per 100 000 population in 1990 to 2398·9 YLLs (2219·7–2575·4) per 100 000 in 2023, representing a decrease of 46·5% (–51·2 to –41·6; appendix 2 table S13). In 2021, however, COVID-19 temporarily surpassed neonatal disorders as the leading cause of global age-standardised YLLs, before dropping to the 25th position in 2023 (appendix figure S2). Since the year 2000, there has been a reduction of 37·6% (32·6–42·6) in total YLLs due to neonatal disorders, from 235 000 in 2000 to 146 000 in 2023 (table 1). In 1990, the total YLLs for vaccine-preventable diseases—including diphtheria, pertussis, tetanus, measles, varicella and herpes zoster, yellow fever, rabies, liver cancer due to hepatitis B, cervical cancer, chronic hepatitis B with cirrhosis, and acute hepatitis B—amounted to a sum of 178 million (95% UI 122–239) years (appendix 2 table S4). By 2023, this number had decreased by 66·5% (57·4–71·9) to 59·8 million (49·6–72·1) years. Similarly, for other preventable diseases that went through major international cooperation and large-scale interventions between 1990 and 2023, total YLLs also showed a decline. In 1990, total YLLs for these diseases were 1·07 billion (1·01–1·12) years; by 2023, they had decreased by 51·6% (48·8–54·4) to 516 million (488–543) years (appendix 2 table S4).

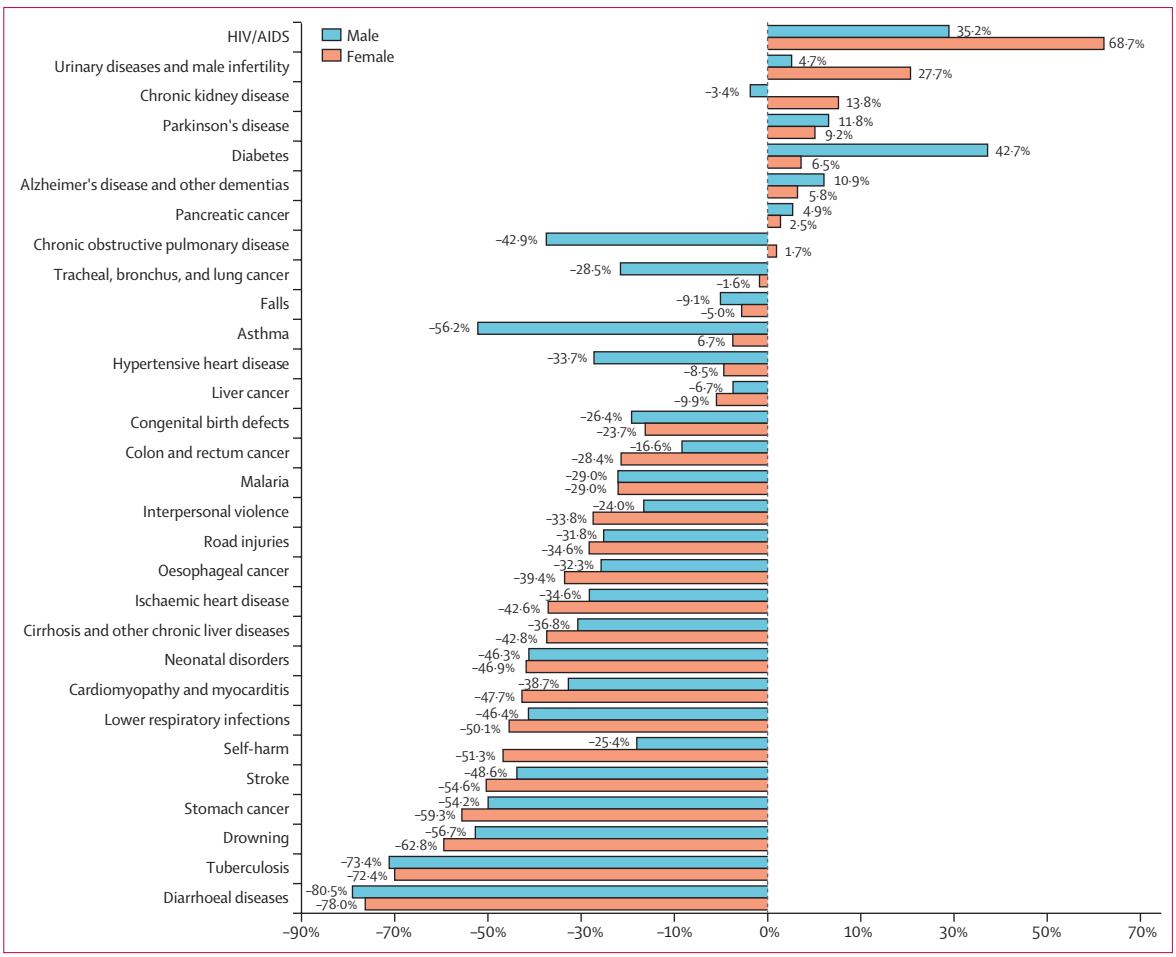


Figure 2: **Percentage change in global age-standardised mortality rate from 1990 to 2023 among the leading 30 Level 3 causes of death, for males and females**

Figure shows the top 30 causes according to their global age-standardised mortality rate, sorted by percentage change from 1990 to 2023 in females, in descending order. COVID-19 and causes affecting only one sex (ie, cervical cancer) were omitted.

COVID-19

Between 2020 and 2023, COVID-19 had an immense global impact, resulting in 18·0 million (95% UI 17·2–18·7) total deaths (appendix 2 table S5). Among these, 10·5 million (10·1–10·9) deaths were in males, and 7·53 million (6·98–7·96) deaths were in females. During 2020, the first year of the pandemic, there were 5·47 million (5·22–5·65) COVID-19 deaths. The highest number of COVID-19 deaths was recorded in 2021 (9·42 million [9·04–9·70] deaths) followed by 2·36 million (2·19–2·47) deaths in 2022, and the lowest number of deaths occurred in 2023 (797 000 deaths [723 000–857 000]). The age group most affected by COVID-19 varied over the years: the highest numbers of deaths occurred in the 70–74 years age group in 2020 and 2021, but in the 80–84 years age group in 2022, and in the 85–89 years age group in 2023 (appendix 2 figure S3). From 2020 to 2023, the five countries with the highest numbers of total COVID-19 deaths (in descending order) were India (3·08 million [2·92–3·28] deaths), the USA (1·21 million [1·10–1·27] deaths), Russia (1·06 million [1·00–1·09] deaths), Indonesia (849 000 deaths [780 000–920 000]), and Brazil (795 000 deaths [748 000–821 000]; appendix 2 table S5). In mortality rates, the countries with the highest burden (in descending order) were Tunisia (245·4 deaths [227·9–256·9] per 100 000), Bolivia (229·0 deaths [215·5–241·4] per 100 000), Peru (220·6 deaths [213·4–228·5] per 100 000), Montenegro (215·2 deaths [197·9–229·3] per 100 000), and Moldova (207·3 deaths [199·4–212·7] per 100 000; appendix 2 table S5).

Changes in age-specific mortality rate from 2000 to 2023

Globally, between 2000 and 2023, all 5-year age groups from 10 years to 70 years showed decreases in age-specific mortality rates, ranging from –27·1% to –35·0% (table 2; appendix 2 table S19). However, this trend varied by country, region, sex, and cause of death. Among the 21 GBD regions, only four—high-income Asia Pacific,

	Age 10–14 years	Age 15–19 years	Age 20–24 years	Age 25–29 years	Age 30–34 years	Age 35–39 years	Age 40–44 years	Age 45–49 years	Age 50–54 years	Age 55–59 years	Age 60–64 years	Age 65–69 years
Communicable, maternal, neonatal, and nutritional diseases												
Caribbean												
Male	−32·0%	−22·6%	−33·9%	−46·5%	−50·7%	−53·6%	−53·5%	−49·7%	−39·8%	−32·1%	−29·3%	−26·5%
Female	−23·6%	−16·3%	−24·6%	−38·1%	−36·2%	−35·2%	−38·5%	−36·6%	−37·9%	−35·7%	−33·2%	−26·8%
High-income North America												
Male	−11·1%	−22·5%	−20·9%	−38·1%	−54·0%	−62·6%	−56·2%	−46·4%	−16·2%	13·8%	33·1%	37·1%
Female	−23·7%	−21·6%	−18·5%	−20·0%	−24·4%	−26·6%	−23·8%	−12·4%	23·1%	34·1%	44·1%	47·7%
Central sub-Saharan Africa												
Male	−59·9%	−66·8%	−67·2%	−65·6%	−64·5%	−61·5%	−61·0%	−57·0%	−53·6%	−52·5%	−50·0%	−49·2%
Female	−56·6%	−52·3%	−56·3%	−60·4%	−61·1%	−59·9%	−56·3%	−53·0%	−52·2%	−52·3%	−49·8%	−47·5%
Oceania												
Male	−34·2%	−30·9%	−18·5%	−18·6%	−20·0%	−16·9%	−16·4%	−15·9%	−19·1%	−19·2%	−26·2%	−26·1%
Female	−32·1%	−27·4%	−13·1%	−5·1%	−0·7%	−4·8%	−7·9%	−10·8%	−11·7%	−10·2%	−15·2%	−12·9%
Western sub-Saharan Africa												
Male	−48·0%	−43·3%	−46·4%	−53·9%	−59·6%	−59·0%	−57·3%	−54·2%	−50·6%	−48·9%	−46·6%	−46·8%
Female	−44·8%	−48·6%	−56·7%	−58·2%	−56·6%	−53·7%	−51·6%	−48·6%	−48·9%	−48·4%	−49·7%	−48·1%
Southern sub-Saharan Africa												
Male	−9·0%	37·4%	−42·0%	−72·8%	−75·8%	−73·9%	−63·8%	−58·0%	−50·0%	−42·7%	−41·7%	−40·5%
Female	−16·9%	−37·9%	−71·6%	−81·3%	−75·6%	−68·3%	−55·9%	−52·4%	−51·9%	−51·2%	−46·5%	−39·2%
Southern Latin America												
Male	−19·0%	−6·0%	−17·0%	−42·1%	−49·4%	−26·0%	−5·2%	16·8%	46·7%	49·7%	53·9%	59·5%
Female	−20·8%	−13·5%	−17·5%	−25·0%	−21·5%	−1·6%	28·6%	47·0%	67·2%	83·6%	96·7%	110·6%
Tropical Latin America												
Male	−20·8%	−8·7%	−10·6%	−27·0%	−42·0%	−40·7%	−33·5%	−26·7%	−17·7%	−10·4%	−4·7%	6·8%
Female	−28·0%	−21·0%	−24·1%	−32·7%	−37·1%	−28·2%	−20·8%	−15·3%	−10·9%	−11·6%	−7·6%	6·1%
Eastern sub-Saharan Africa												
Male	−63·2%	−61·4%	−61·9%	−71·3%	−76·1%	−78·4%	−76·1%	−71·7%	−63·4%	−59·5%	−57·1%	−57·9%
Female	−64·5%	−64·6%	−72·2%	−78·8%	−79·0%	−78·6%	−73·3%	−68·3%	−62·8%	−60·7%	−59·2%	−57·8%
North Africa and Middle East												
Male	−52·1%	−30·7%	−27·9%	−35·2%	−37·5%	−41·1%	−43·0%	−46·0%	−44·5%	−39·1%	−39·7%	−27·7%
Female	−55·9%	−41·5%	−44·4%	−45·0%	−44·3%	−46·1%	−43·8%	−38·3%	−39·4%	−36·3%	−36·9%	−22·8%
Eastern Europe												
Male	−40·5%	−57·4%	−78·1%	−62·0%	−35·7%	−30·7%	−36·1%	−50·2%	−59·0%	−56·0%	−47·0%	−21·4%
Female	−33·3%	−41·3%	−44·9%	−2·3%	35·7%	45·0%	44·2%	14·7%	−3·6%	−6·1%	20·0%	53·1%
Central Latin America												
Male	−33·7%	−22·7%	−30·0%	−31·5%	−30·5%	−28·8%	−20·9%	−15·9%	−11·2%	−8·7%	−11·6%	−13·2%
Female	−35·2%	−26·8%	−28·7%	−27·7%	−22·1%	−23·0%	−18·1%	−11·6%	−15·4%	−10·7%	−13·6%	−15·8%
Central Europe												
Male	−67·2%	−17·0%	−6·0%	−13·4%	−19·1%	−18·1%	−27·3%	−18·5%	4·4%	14·0%	36·9%	63·4%
Female	−63·5%	−26·0%	−24·9%	−22·4%	−25·8%	−19·1%	−16·2%	−7·4%	19·7%	28·8%	51·8%	64·7%
Western Europe												
Male	−46·9%	−51·5%	−56·4%	−68·3%	−73·7%	−74·3%	−63·3%	−46·0%	−30·3%	−21·1%	−10·7%	−11·7%
Female	−43·6%	−49·9%	−42·2%	−52·3%	−57·0%	−55·5%	−44·9%	−34·5%	−23·7%	−18·3%	−9·8%	−9·7%
Southeast Asia												
Male	−50·6%	−47·0%	−43·6%	−54·7%	−58·0%	−51·3%	−42·9%	−36·0%	−38·5%	−37·7%	−40·2%	−36·3%
Female	−49·9%	−52·5%	−50·6%	−53·1%	−51·4%	−44·0%	−45·7%	−41·5%	−43·1%	−42·4%	−45·9%	−41·1%
Andean Latin America												
Male	−39·1%	−39·2%	−39·2%	−40·5%	−40·0%	−35·9%	−29·6%	−25·3%	−18·9%	−3·7%	−3·7%	−1·3%
Female	−36·7%	−47·2%	−46·4%	−46·7%	−45·6%	−42·1%	−36·7%	−30·9%	−28·6%	−18·4%	−19·9%	−14·4%

(Table 2 continues on next page)

	Age 10–14 years	Age 15–19 years	Age 20–24 years	Age 25–29 years	Age 30–34 years	Age 35–39 years	Age 40–44 years	Age 45–49 years	Age 50–54 years	Age 55–59 years	Age 60–64 years	Age 65–69 years
(Continued from previous page)												
Australasia												
Male	−29·1%	−50·8%	−44·1%	−66·6%	−62·6%	−66·8%	−57·2%	−46·0%	−35·1%	−30·4%	−29·9%	−29·7%
Female	−42·0%	−50·7%	−38·6%	−45·4%	−49·7%	−40·4%	−21·0%	−17·5%	−17·0%	−15·1%	−21·3%	−27·1%
South Asia												
Male	−74·2%	−71·2%	−71·8%	−73·1%	−70·3%	−70·2%	−65·8%	−68·1%	−68·4%	−65·7%	−68·1%	−69·1%
Female	−70·6%	−75·6%	−76·2%	−74·3%	−71·0%	−70·6%	−67·7%	−65·3%	−67·5%	−59·9%	−67·3%	−67·6%
High-income Asia Pacific												
Male	−54·1%	−59·7%	−50·2%	−49·5%	−58·8%	−64·0%	−64·0%	−57·1%	−46·3%	−45·3%	−38·0%	−39·2%
Female	−57·1%	−52·2%	−45·3%	−51·3%	−58·3%	−49·4%	−49·3%	−47·2%	−44·0%	−47·1%	−46·4%	−49·9%
East Asia												
Male	−60·6%	−56·6%	−38·2%	−22·9%	−24·3%	−24·0%	−24·2%	−24·4%	−30·2%	−40·6%	−45·2%	−42·4%
Female	−69·8%	−71·9%	−72·5%	−69·7%	−67·5%	−56·1%	−46·4%	−38·3%	−43·4%	−51·8%	−52·8%	−46·9%
Central Asia												
Male	−48·9%	−57·3%	−75·4%	−79·2%	−75·0%	−66·7%	−61·7%	−60·5%	−60·1%	−50·1%	−39·9%	−19·0%
Female	−48·5%	−53·6%	−65·4%	−68·0%	−62·3%	−53·8%	−50·6%	−47·2%	−47·2%	−39·8%	−23·1%	−7·5%
Non-communicable diseases												
Caribbean												
Male	−4·4%	2·1%	3·1%	14·9%	17·8%	19·3%	17·8%	9·8%	2·7%	5·1%	3·5%	3·7%
Female	13·0%	8·0%	17·4%	48·9%	52·6%	44·6%	27·5%	13·1%	2·5%	4·1%	−0·9%	−1·9%
High-income North America												
Male	−9·7%	29·5%	79·3%	130·5%	122·5%	70·4%	24·1%	−3·6%	−9·2%	−14·0%	−18·7%	−26·4%
Female	−9·5%	16·3%	50·5%	67·0%	63·3%	30·4%	10·9%	−2·7%	−8·8%	−15·1%	−18·9%	−26·0%
Central sub-Saharan Africa												
Male	−13·9%	−30·2%	−31·7%	−28·2%	−15·7%	14·5%	9·4%	1·5%	0·2%	−1·7%	5·6%	8·8%
Female	−4·7%	−6·6%	−9·5%	30·0%	56·5%	81·1%	71·3%	68·9%	49·2%	26·2%	10·2%	7·3%
Oceania												
Male	−12·8%	−18·5%	−1·1%	16·1%	10·0%	3·3%	−4·3%	−11·1%	−8·6%	−8·5%	−10·9%	−12·2%
Female	−13·4%	−17·7%	0·9%	28·0%	46·9%	31·2%	14·8%	5·9%	4·1%	3·0%	−1·8%	−1·2%
Western sub-Saharan Africa												
Male	−18·3%	−19·6%	−22·3%	−19·7%	−11·2%	11·4%	5·3%	−6·2%	−8·0%	−10·5%	−4·2%	−1·3%
Female	−23·0%	−24·9%	−30·5%	1·2%	16·3%	38·2%	24·3%	28·2%	18·8%	4·1%	−5·0%	−7·3%
Southern sub-Saharan Africa												
Male	−15·6%	−27·8%	−26·1%	−21·2%	−16·4%	−2·7%	0·0%	−19·1%	−32·2%	−24·0%	−19·3%	−9·7%
Female	−21·8%	−13·5%	−5·1%	8·9%	23·9%	44·8%	54·1%	56·5%	27·4%	9·5%	−8·3%	−7·5%
Southern Latin America												
Male	−23·9%	−14·4%	−6·9%	−10·1%	−20·6%	−22·1%	−30·1%	−36·3%	−37·3%	−35·7%	−31·5%	−29·7%
Female	−23·5%	−12·4%	−9·6%	−8·8%	−13·8%	−11·7%	−19·8%	−26·1%	−28·9%	−26·0%	−21·9%	−21·3%
Tropical Latin America												
Male	1·3%	12·9%	14·0%	−0·3%	−15·8%	−24·2%	−30·4%	−30·1%	−27·5%	−26·7%	−25·6%	−23·2%
Female	0·4%	2·9%	7·0%	3·2%	−6·9%	−16·0%	−23·3%	−26·5%	−27·7%	−28·2%	−28·5%	−25·8%
Eastern sub-Saharan Africa												
Male	−20·1%	−26·8%	−30·6%	−24·9%	−17·1%	2·4%	−2·3%	−5·3%	−8·7%	−6·7%	−0·3%	0·7%
Female	−27·9%	−32·0%	−30·5%	−0·4%	12·6%	22·5%	18·3%	35·1%	23·6%	12·2%	1·1%	0·2%
North Africa and Middle East												
Male	−28·3%	−16·5%	−7·0%	−5·6%	−12·2%	−26·4%	−34·5%	−37·9%	−35·7%	−25·4%	−25·4%	−21·5%
Female	−33·7%	−25·8%	−11·9%	−6·2%	−2·7%	−12·0%	−19·4%	−22·6%	−29·6%	−21·1%	−27·4%	−23·9%
Eastern Europe												
Male	−28·8%	−39·7%	−62·2%	−49·1%	−30·6%	−28·6%	−35·6%	−40·2%	−39·1%	−38·0%	−38·8%	−35·5%
Female	−32·2%	−37·8%	−39·7%	−26·8%	−16·5%	−18·7%	−25·8%	−36·0%	−39·1%	−40·8%	−42·0%	−43·0%

(Table 2 continues on next page)

	Age 10–14 years	Age 15–19 years	Age 20–24 years	Age 25–29 years	Age 30–34 years	Age 35–39 years	Age 40–44 years	Age 45–49 years	Age 50–54 years	Age 55–59 years	Age 60–64 years	Age 65–69 years
(Continued from previous page)												
Central Latin America												
Male	0·0%	7·6%	5·4%	5·5%	3·7%	−2·6%	−3·6%	−3·3%	−3·2%	−6·6%	−8·1%	−11·2%
Female	2·9%	1·5%	−0·5%	−1·4%	3·5%	−1·6%	−4·9%	−9·0%	−13·2%	−16·1%	−18·8%	−20·5%
Central Europe												
Male	−45·4%	−31·8%	−23·1%	−19·1%	−20·2%	−29·2%	−43·0%	−45·8%	−39·8%	−34·2%	−30·0%	−28·2%
Female	−30·7%	−25·4%	−22·4%	−22·0%	−22·4%	−31·0%	−41·1%	−43·4%	−38·9%	−34·0%	−29·5%	−33·6%
Western Europe												
Male	−30·0%	−33·7%	−31·5%	−29·4%	−24·1%	−24·4%	−34·3%	−40·1%	−34·4%	−32·9%	−31·2%	−32·3%
Female	−20·4%	−22·0%	−19·0%	−21·8%	−18·6%	−24·4%	−31·2%	−32·8%	−26·9%	−23·8%	−19·2%	−21·3%
Southeast Asia												
Male	−23·7%	−22·7%	−13·8%	−6·8%	−10·5%	−9·3%	−3·6%	3·4%	−0·8%	−5·8%	−13·1%	−16·7%
Female	−14·3%	−10·2%	−5·1%	0·1%	7·4%	9·3%	8·1%	4·9%	1·4%	−0·9%	−8·2%	−13·3%
Andean Latin America												
Male	−6·5%	−5·1%	−11·0%	−5·8%	−10·2%	−13·1%	−14·2%	−18·4%	−16·9%	−12·8%	−14·6%	−13·9%
Female	14·0%	−5·6%	−7·0%	−5·2%	−3·2%	−5·8%	−11·2%	−15·3%	−16·9%	−14·5%	−19·7%	−16·0%
Australasia												
Male	−35·5%	−43·8%	−42·7%	−46·5%	−32·2%	−23·6%	−20·9%	−19·1%	−22·7%	−28·7%	−34·7%	−42·5%
Female	−33·4%	−40·1%	−32·6%	−35·6%	−33·2%	−25·2%	−24·1%	−20·8%	−22·3%	−27·5%	−31·6%	−36·0%
South Asia												
Male	−39·5%	−47·3%	−44·6%	−41·5%	−33·4%	−27·3%	−17·6%	−17·8%	−17·9%	−9·5%	−15·4%	−16·2%
Female	−39·7%	−44·6%	−35·1%	−26·9%	−11·7%	−10·6%	−10·0%	−13·1%	−7·1%	−0·2%	−9·4%	−7·5%
High-income Asia Pacific												
Male	−32·9%	−35·2%	−33·1%	−37·3%	−45·0%	−50·2%	−52·1%	−44·7%	−41·9%	−41·9%	−38·0%	−33·7%
Female	−28·0%	−25·4%	−23·4%	−30·9%	−37·0%	−30·6%	−31·2%	−26·8%	−32·8%	−35·9%	−35·8%	−36·4%
East Asia												
Male	−47·6%	−49·4%	−57·8%	−54·2%	−52·2%	−46·1%	−43·1%	−38·0%	−37·9%	−45·0%	−44·1%	−47·8%
Female	−49·5%	−58·1%	−65·5%	−66·7%	−64·4%	−61·2%	−59·1%	−55·9%	−55·6%	−60·5%	−59·4%	−57·8%
Central Asia												
Male	−19·6%	−32·9%	−46·0%	−50·4%	−44·6%	−37·5%	−36·3%	−38·7%	−42·5%	−33·6%	−33·4%	−30·8%
Female	−16·0%	−24·9%	−38·2%	−41·4%	−36·0%	−31·8%	−34·5%	−39·1%	−44·0%	−40·3%	−39·4%	−35·8%
Injuries												
Caribbean												
Male	−5·2%	31·0%	26·4%	35·3%	36·8%	38·1%	34·5%	27·0%	13·1%	14·9%	10·9%	9·1%
Female	10·1%	11·6%	24·2%	45·7%	42·4%	33·4%	20·0%	9·3%	−3·6%	−0·9%	−3·4%	−6·9%
High-income North America												
Male	−23·3%	−21·9%	−19·2%	1·6%	20·0%	12·8%	8·9%	2·1%	13·1%	18·9%	26·4%	19·8%
Female	−18·9%	−31·0%	−7·5%	6·3%	14·6%	0·6%	1·7%	1·6%	11·4%	11·5%	13·1%	10·5%
Central sub-Saharan Africa												
Male	−4·9%	−23·1%	−23·2%	−15·9%	2·8%	39·5%	32·2%	18·1%	13·1%	7·7%	13·8%	15·1%
Female	2·3%	5·1%	4·3%	51·8%	66·9%	83·8%	75·3%	73·4%	57·2%	36·2%	21·3%	23·8%
Oceania												
Male	−19·8%	−24·8%	−6·3%	8·5%	1·0%	−3·9%	−9·3%	−13·1%	−9·1%	−8·4%	−10·4%	−11·7%
Female	−12·6%	−15·9%	9·4%	30·6%	45·8%	29·9%	18·9%	10·1%	13·4%	11·0%	9·5%	10·7%
Western sub-Saharan Africa												
Male	−19·2%	−19·4%	−23·4%	−21·6%	−12·9%	17·6%	8·6%	−4·9%	−8·0%	−11·8%	−1·4%	−1·5%
Female	−27·6%	−33·0%	−30·2%	−1·7%	7·1%	22·6%	10·8%	14·6%	6·3%	−5·0%	−15·1%	−11·6%
Southern sub-Saharan Africa												
Male	−38·2%	−37·0%	−26·2%	−20·4%	−16·5%	−5·2%	−6·7%	−25·6%	−38·5%	−32·9%	−30·1%	−23·6%
Female	−42·4%	−16·7%	−11·0%	−2·2%	0·4%	10·5%	15·8%	17·3%	1·8%	−14·0%	−27·1%	−25·7%

(Table 2 continues on next page)

	Age 10–14 years	Age 15–19 years	Age 20–24 years	Age 25–29 years	Age 30–34 years	Age 35–39 years	Age 40–44 years	Age 45–49 years	Age 50–54 years	Age 55–59 years	Age 60–64 years	Age 65–69 years
(Continued from previous page)												
Southern Latin America												
Male	−53·0%	−31·2%	−22·0%	−21·1%	−24·3%	−25·9%	−30·6%	−36·1%	−38·0%	−38·9%	−37·6%	−35·3%
Female	−45·7%	−26·3%	−15·1%	−15·0%	−22·8%	−24·4%	−28·8%	−30·9%	−35·7%	−33·5%	−32·8%	−31·4%
Tropical Latin America												
Male	−47·2%	−14·1%	−6·2%	−6·5%	−11·5%	−14·8%	−17·7%	−17·1%	−13·3%	−12·5%	−11·7%	−5·6%
Female	−38·7%	−14·9%	2·8%	5·2%	−1·9%	−8·4%	−10·3%	−11·8%	−12·6%	−15·3%	−14·2%	−7·5%
Eastern sub-Saharan Africa												
Male	−27·8%	−63·3%	−55·1%	−35·1%	−24·8%	−4·8%	−7·1%	−14·7%	−17·3%	−22·4%	−11·0%	−2·3%
Female	−47·2%	−49·0%	−50·0%	−20·7%	−17·5%	−10·8%	−8·2%	1·4%	−2·5%	−4·2%	−12·1%	−8·1%
North Africa and Middle East												
Male	−9·1%	−0·1%	15·1%	−5·7%	−14·0%	−25·6%	−32·7%	−33·6%	−30·9%	−20·7%	−30·3%	−14·6%
Female	30·4%	24·2%	55·2%	45·4%	50·3%	13·2%	−2·4%	−8·4%	−5·7%	26·5%	−3·1%	64·6%
Eastern Europe												
Male	−48·7%	9·2%	−2·3%	−11·4%	−21·6%	−38·0%	−44·4%	−50·7%	−55·5%	−53·9%	−49·7%	−44·0%
Female	1·1%	−30·6%	−37·0%	−45·1%	−47·6%	−50·4%	−49·8%	−52·0%	−54·8%	−56·0%	−51·3%	−46·6%
Central Latin America												
Male	−35·2%	−24·5%	−21·5%	−13·7%	−7·8%	−12·1%	−15·1%	−21·0%	−24·7%	−29·3%	−31·7%	−32·6%
Female	−19·9%	−12·2%	−4·6%	−0·5%	3·4%	−6·7%	−12·4%	−20·5%	−27·6%	−30·2%	−33·2%	−35·3%
Central Europe												
Male	−64·9%	−51·2%	−45·5%	−41·2%	−38·6%	−40·4%	−43·9%	−41·6%	−30·1%	−23·7%	−15·3%	−15·8%
Female	−52·9%	−43·3%	−43·0%	−40·2%	−38·1%	−42·7%	−46·5%	−43·0%	−32·6%	−29·9%	−28·4%	−30·7%
Western Europe												
Male	−57·2%	−51·2%	−47·6%	−41·5%	−31·8%	−23·0%	−16·7%	−8·0%	8·4%	13·5%	13·9%	5·7%
Female	−51·4%	−49·7%	−38·7%	−34·5%	−29·0%	−28·3%	−24·0%	−16·0%	−4·1%	1·1%	3·4%	0·4%
Southeast Asia												
Male	−43·0%	−36·2%	−35·1%	−34·7%	−32·6%	−27·6%	−20·1%	−14·0%	−11·1%	−11·9%	−17·2%	−19·4%
Female	−39·2%	−27·6%	−22·5%	−21·9%	−15·2%	−14·3%	−12·8%	−17·6%	−9·7%	−9·3%	−15·3%	−21·1%
Andean Latin America												
Male	−30·6%	−12·1%	1·6%	11·2%	1·4%	−6·2%	−11·7%	−19·4%	−20·2%	−17·0%	−20·6%	−20·9%
Female	−2·4%	−4·2%	0·5%	4·8%	0·5%	−6·7%	−12·7%	−20·8%	−26·0%	−23·1%	−26·5%	−22·8%
Australasia												
Male	−51·4%	−53·3%	−46·9%	−48·2%	−40·4%	−36·8%	−26·1%	−8·8%	−3·8%	2·2%	−1·4%	−8·3%
Female	−47·0%	−45·1%	−29·2%	−34·3%	−35·7%	−30·4%	−24·2%	−9·5%	−6·9%	−13·0%	−21·8%	−25·2%
South Asia												
Male	−46·2%	−42·2%	−33·0%	−24·3%	−15·7%	−12·0%	−4·2%	−13·4%	−17·4%	−16·2%	−23·3%	−28·4%
Female	−47·3%	−48·5%	−46·3%	−36·4%	−28·3%	−24·4%	−19·4%	−22·7%	−23·8%	−16·9%	−26·8%	−25·7%
High-income Asia Pacific												
Male	−51·6%	−48·3%	−35·5%	−32·5%	−38·9%	−40·3%	−41·2%	−39·8%	−41·1%	−44·7%	−37·9%	−33·9%
Female	−35·5%	−13·8%	−1·8%	−6·1%	−17·1%	−14·4%	−16·0%	−14·5%	−26·3%	−37·6%	−43·3%	−44·3%
East Asia												
Male	−67·3%	−68·8%	−73·6%	−70·7%	−70·5%	−67·4%	−63·0%	−54·2%	−50·1%	−54·0%	−51·2%	−51·3%
Female	−66·1%	−71·2%	−78·3%	−79·7%	−78·6%	−75·6%	−71·5%	−66·3%	−63·8%	−64·9%	−61·4%	−60·6%
Central Asia												
Male	−36·8%	−39·4%	−50·7%	−54·3%	−52·2%	−49·8%	−46·8%	−45·2%	−52·5%	−44·3%	−43·1%	−33·3%
Female	−34·1%	−19·6%	−40·4%	−49·3%	−48·6%	−47·7%	−47·4%	−51·6%	−57·6%	−53·0%	−52·8%	−44·8%

Regions are ordered by the total number of cause-age combinations that showed an increase across all three Level 1 causes.

Table 2: **Percentage change in age-specific mortality rate between 2000 and 2023 for Level 1 causes**

central Asia, east Asia, and south Asia—consistently showed decreases in death rates across all 5-year age groups by sex and Level 1 causes from 2000 to 2023. By contrast, the Caribbean region showed increases in death rates for 40 distinct Level 1 cause-sex-age groups; the largest of these increases was observed in females aged

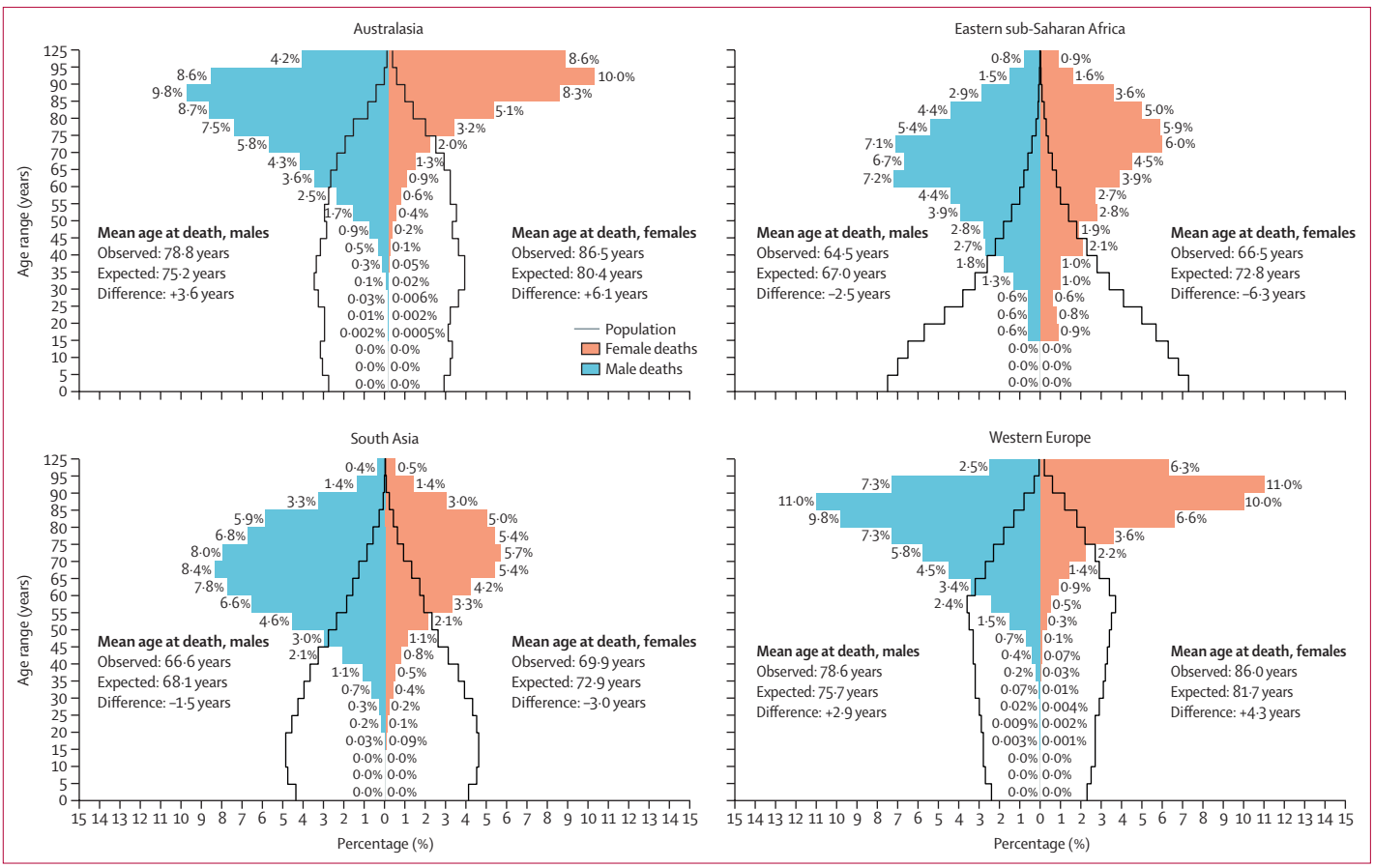


Figure 3: **Comparison of age at death for ischaemic heart disease between four regions for males and females**

Graphs show the distribution of ischaemic heart disease deaths by age and sex within each region. Percentages represent the number of ischaemic heart disease deaths for a given age-sex group out of the total ischaemic heart disease deaths within a region (all ages and sexes combined), or the total number of individuals in a given age-sex group out of the total population in the region. The expected mean age at death is the result of calculating the mean age at death after applying the global mortality rate to a country's population by age and sex for a given cause; a positive difference indicates that the observed mean age at death is higher than expected.

30–34 years, in whom deaths from NCDs increased by 52·6%, and in females aged 25–29 years, in whom NCD deaths rose by 48·9%. Similarly, in high-income North America, there was an increase in death rates across 37 distinct Level 1 cause-sex-age groups. The most notable rise was in males aged 25–29 years, where NCD-related deaths rose by 130·5%, while injury-related deaths increased by 26·4% in males aged 60–64 years. Globally, we found the increase in NCD deaths was primarily due to drug use disorders, while the rise in injury-related deaths was linked to intentional injuries. Other notable injury-related increases around the globe include the conflicts in Palestine and Ukraine, as well as specific natural disasters such as the 2023 earthquake in Türkiye and the 2022–23 heatwaves in Europe (appendix 2 table S19).

Mean age at death

The mean age at death for all causes varied by sex and location (appendix 2 tables S15, S16, S17). The global mean age at death increased from 46·8 years (95% UI 46·6–47·0) in 1990 to 63·4 years (63·1–63·7) in 2023, for all sexes combined. For males, the mean age at death in 1990 was 45·4 years (45·1–45·7) and increased to 61·2 years (60·7–61·6) in 2023. For females, it was 48·5 years (48·1–48·8) in 1990 and 65·9 years (65·5–66·3) in 2023. The highest mean age at death observed in 2023 was found in the high-income super-region. Within this super-region, mean age at death for females reached 80·9 years (80·9–81·0), and was even higher in the high-income Asia Pacific region (85·1 years [85·1–85·2]), with Japan having the highest mean among all countries globally (86·0 years [86·0–86·1]). For males in the high-income super-region, the mean age at death was 74·8 years (74·8–74·9). In high-income Asia-Pacific, it was 78·6 years (78·5–78·6), and Japan also recorded the highest male mean age at death at 79·8 years (79·8–79·8).

At the other end of the spectrum, the lowest mean age at death in 2023 occurred in sub-Saharan Africa, where females had a mean age at death of 38·0 years (95% UI 37·5–38·4; appendix 2 table S16). For males, it was 35·6 years (35·2–35·9; appendix 2 table S17). Within this super-region, western sub-Saharan Africa had a mean

age at death of 33·2 years (32·5–34·0) for females and 31·9 years (31·2–32·6) for males. Niger recorded the lowest mean age at death, with 21·5 years (20·3–22·8) for females and 21·8 years (20·6–23·2) for males.

Mean age at death by cause

In 2023, the gap between the observed and the expected mean age at death varied across causes, locations, and sexes (figure 3; appendix 2 figure S4, appendix 2 table S6). For the global leading cause of death, ischaemic heart disease, females in Switzerland died at the highest mean age of 88·4 years (95% UI 87·8–88·8), which is 6·8 years (6·1–7·5) higher than the expected age of 81·6 (80·7–82·4). By contrast, females in South Sudan died from the same cause at the lowest mean age of 61·2 years (58·9–63·5), which is 7·3 years (4·8–10·1) below the expected age of 68·5 years (67·1–70·2). For tracheal, bronchus, and lung cancer—the sixth-leading cause of death—females in Japan died at the highest mean age of 82·8 years (81·3–83·5), which is 4·2 years (3·6–4·6) later than the expected age of 78·6 (77·4–79·4). However, in Malawi, females died from this cause at the lowest mean age of 55·6 years (53·9–57·9), which is 12·8 years (10·4–14·6) earlier than the expected age of 68·4 (67·2–69·3). For the ninth-leading cause of death, chronic kidney disease, females in Spain died at the second highest mean age of 89·4 years (89·0–89·7), 9·8 years (8·8–11·1) later than the expected age of 79·6 (78·0–80·8). Meanwhile, in Angola, the same cause resulted in a mean age at death of just 46·1 years (42·9–50·3), which is 12·5 years (9·2–15·6) earlier than the expected age of 58·6 (56·1–61·2).

The observed mean age at death in 2023 shows a moderate relationship ($r^2 \geq 0·50$) with SDI across 96 of 141 Level 3 causes of death (appendix 2 table S14). Where SDI explains greater than 50% of the variance seen in the mean age at death, the relationship is positive: as SDI improves, the observed mean age at death increases. After controlling for any relationship SDI has with population structure by comparing observed and expected mean ages and examining their correlation with SDI, the results remain varied by sex.

When comparing observed and expected mean ages for females, a total of 118 causes show a positive correlation with SDI (appendix 2 table S14). Some causes, such as self-harm, exhibit a negative correlation—meaning that females in higher SDI countries died at younger ages than expected from self-harm compared to those in lower SDI countries. All of the causes that had a negative correlation with SDI were considered weak relationships ($r^2 < 0·50$). For females, the difference between the observed and expected mean age at death in the following nine Level 3 causes showed a moderate positive correlation with SDI: ischaemic heart disease, stroke, breast cancer, pancreatic cancer, leukaemia, brain and central nervous system cancer, ovarian cancer, kidney cancer, and invasive non-typhoidal *Salmonella*.

When comparing observed and expected mean ages for males, a total of 110 causes show a positive correlation with SDI (appendix 2 table S14). Similar causes, such as drug use disorders, self-harm, and conflict and terrorism exhibited a negative correlation—indicating that males in higher SDI countries died at younger ages than expected from these causes compared to those in lower SDI countries. All negatively correlated causes were found to have weak relationships with SDI just as females did. For males, the difference between the observed and expected mean age at death in only six Level 3 causes showed a moderate correlation with SDI. These were leukaemia, brain and central nervous system cancer, other malignant neoplasms, other intestinal infectious diseases, kidney cancer, and invasive non-typhoidal *Salmonella*.

All-cause 70q0

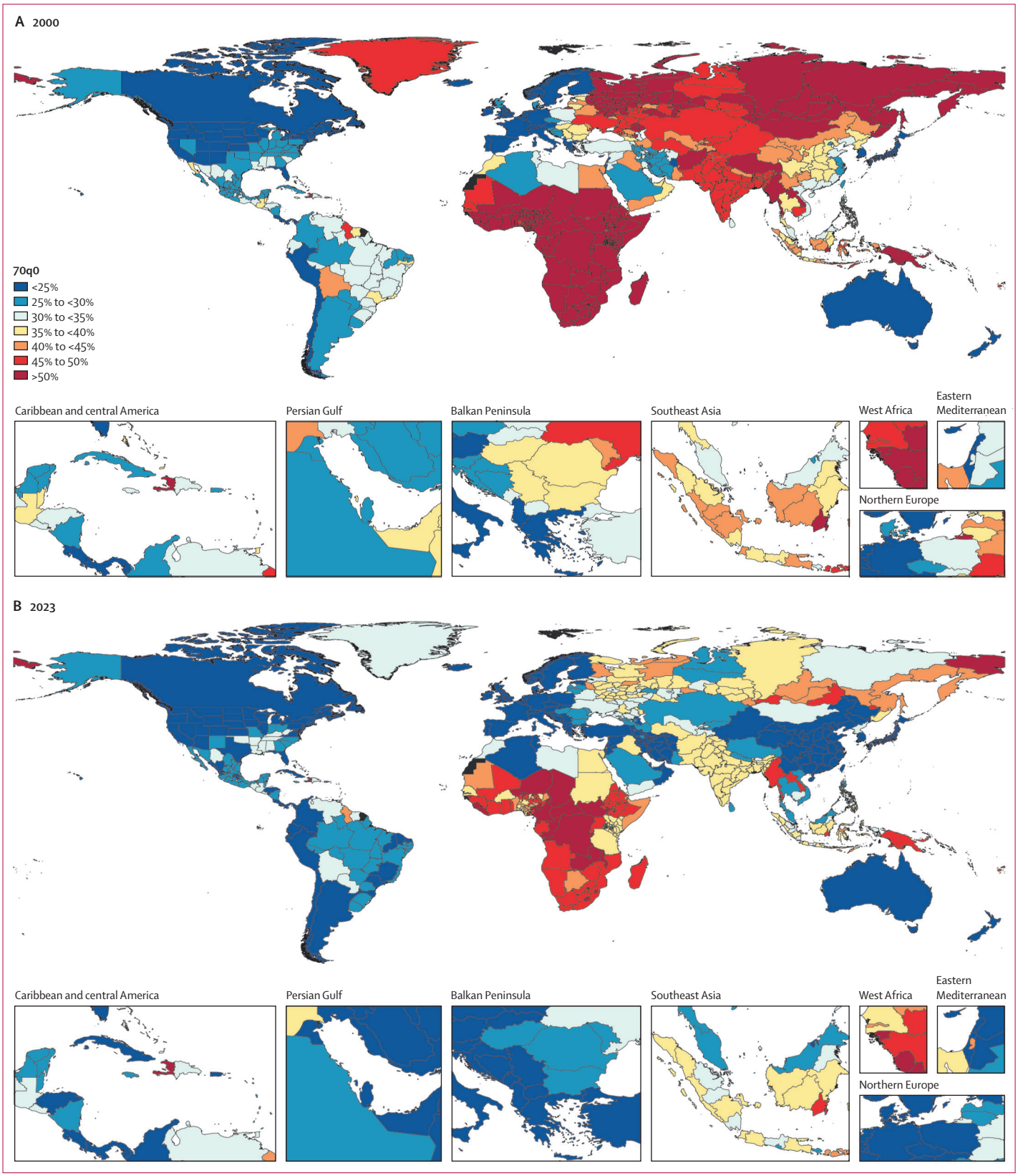
Across every GBD super-region and region, 70q0 from all causes combined decreased for both males and females between 2000 and 2023 (appendix 2 table S11). However, there was variation in these percentage changes between regions. For males, 70q0 in the Caribbean decreased 2·2%, and in high-income North America it decreased 9·6%. Conversely, in high-income Asia Pacific, this decrease was 36·0%, and in east Asia it was 43·8%. For females, 70q0 in Oceania decreased 2·6% and in the Caribbean 6·0%, while in eastern Europe the decrease was 35·6% and in east Asia it was 58·2%.

National-level trends in 70q0 also varied (figure 4, appendix 2 table S11). For males, between 2000 and 2023, an increase in 70q0 occurred in six countries: Palestine (40·6%), Lebanon (19·4%), Guam (14·9%), Paraguay (14·6%), Dominican Republic (9·2%), and Venezuela (3·5%). For females, for the same period, 12 countries had an increase in 70q0: Libya (19·6%), Palestine (14·2%), Lebanon (13·7%), Venezuela (12·8%), Tonga (12·0%), Solomon Islands (7·8%), Samoa (6·6%), Guam (4·9%), Marshall Islands (4·7%), Paraguay (4·6%), Dominican Republic (1·2%), and Fiji (0·8%). For males, the primary cause of death driving these increases for Palestine and Lebanon was conflict and terrorism, while in Paraguay and Guam the primary driver was drug use disorders. Among females, the primary cause responsible for the increases remained conflict and terrorism for Palestine and Lebanon. Additionally, chronic kidney diseases contributed the most to the increases in Libya, and malaria the most to the increases in Venezuela (appendix 2 table S6)

70q0 by cause and location

Among the top 50 global causes of death for females, the 15 causes with the largest amount of increase in 70q0

Figure 4: **70q0 in males and females**
(A) 2000. (B) 2023. 70q0=probability of death before age 70 years.


A 2000
70q0
<25%
25% to <30%
30% to <35%
35% to <40%
40% to <45%
45% to 50%
>50%
Caribbean and central America
Persian Gulf
Balkan Peninsula
Southeast Asia
West Africa
Eastern Mediterranean
Northern Europe
B 2023
Caribbean and central America
Persian Gulf
Balkan Peninsula
Southeast Asia
West Africa
Eastern Mediterranean
Northern Europe

	Global	Central Europe, eastern Europe, and central Asia	High income	Latin America and Caribbean	North Africa and Middle East	South Asia	Southeast Asia, east Asia, and Oceania	Sub-Saharan Africa
All causes	−29·1% (33·8% to 23·9%); 65·9 vs 65·9	−33·4% (29·3% to 19·5%); 75·4 vs 71·3	−17·1% (15·6% to 12·9%); 80·9 vs 76·4	−19·1% (25·5% to 20·6%); 68·7 vs 65·4	−23·4% (31·6% to 24·3%); 62·8 vs 54·3	−26·9% (44·0% to 32·2%); 60·7 vs 56·6	−43·1% (29·7% to 16·9%); 72·8 vs 68·4	−27·8% (59·2% to 42·7%); 38·0 vs 42·5
Ischaemic heart disease	−0·5% (2·1% to 2·1%); 77·4 vs 77·4	−42·7% (5·9% to 3·4%); 80·9 vs 78·0	−40·9% (1·5% to 0·9%); 84·5 vs 81·5	−1·8% (1·8% to 1·8%); 77·8 vs 76·9	−0·8% (3·9% to 3·8%); 73·5 vs 72·3	38·9% (2·4% to 3·4%); 69·9 vs 72·9	−8·2% (2·1% to 1·9%); 78·7 vs 76·6	81·1% (0·6% to 1·0%); 69·2 vs 72·6
Stroke	−20·7% (2·4% to 1·9%); 75·8 vs 75·8	−60·7% (4·7% to 1·8%); 80·5 vs 76·7	−45·8% (1·0% to 0·5%); 85·1 vs 80·0	−27·7% (1·8% to 1·3%); 74·8 vs 75·2	−26·4% (3·0% to 2·2%); 72·6 vs 70·7	48·2% (1·9% to 2·9%); 71·0 vs 71·4	−46·0% (4·5% to 2·5%); 76·1 vs 75·1	51·7% (1·1% to 1·7%); 67·4 vs 70·1
Neonatal disorders	−51·5% (2·8% to 1·4%); 0·1 vs 0·1	−32·0% (0·5% to 0·3%); 0·1 vs 0·1	−55·8% (0·3% to 0·1%); 0·1 vs 0·1	−68·1% (2·4% to 0·8%); 0·1 vs 0·1	−66·8% (3·8% to 1·3%); 0·1 vs 0·1	−57·1% (5·6% to 2·4%); 0·0 vs 0·1	−79·8% (1·5% to 0·3%); 0·1 vs 0·1	−22·0% (5·2% to 4·1%); 0·1 vs 0·1
Lower respiratory infections	−51·2% (2·3% to 1·1%); 55·7 vs 55·7	−38·8% (1·0% to 0·6%); 61·3 vs 66·5	−11·7% (0·3% to 0·2%); 85·2 vs 74·5	−38·8% (1·6% to 1·0%); 71·2 vs 55·7	−62·3% (2·5% to 0·9%); 52·7 vs 37·7	−60·4% (3·8% to 1·5%); 45·2 vs 41·6	−71·6% (1·5% to 0·4%); 70·1 vs 62·7	−32·9% (4·6% to 3·1%); 31·8 vs 23·0
Breast cancer	33·6% (0·7% to 1·0%); 63·0 vs 63·0	−26·2% (1·5% to 1·1%); 68·0 vs 65·5	−28·9% (1·5% to 1·1%); 73·2 vs 69·1	35·6% (0·8% to 1·1%); 63·2 vs 62·0	99·0% (0·5% to 1·1%); 58·1 vs 57·7	139·3% (0·4% to 1·1%); 58·6 vs 58·6	6·3% (0·8% to 0·9%); 60·1 vs 63·0	227·9% (0·4% to 1·2%); 52·4 vs 56·2
HIV/AIDS	−58·2% (1·9% to 0·8%); 40·8 vs 40·8	132·3% (0·1% to 0·3%); 40·9 vs 44·2	−66·7% (0·1% to 0·0%); 48·8 vs 45·0	−48·6% (0·8% to 0·4%); 40·8 vs 40·9	−0·9% (0·2% to 0·2%); 38·8 vs 38·5	−23·6% (0·4% to 0·3%); 41·8 vs 38·5	−29·8% (0·2% to 0·2%); 43·8 vs 43·4	−61·7% (10·6% to 4·1%); 40·5 vs 33·7
Diabetes	42·7% (0·6% to 0·8%); 72·0 vs 72·0	33·1% (0·4% to 0·6%); 75·3 vs 73·3	−34·6% (0·4% to 0·3%); 81·0 vs 76·3	18·9% (1·2% to 1·4%); 72·0 vs 71·4	27·8% (0·7% to 0·9%); 71·6 vs 67·6	119·4% (0·7% to 1·5%); 70·2 vs 68·3	2·4% (0·6% to 0·7%); 71·4 vs 71·5	52·6% (0·4% to 0·5%); 66·9 vs 66·4
Chronic obstructive pulmonary disease	12·3% (0·6% to 0·7%); 78·5 vs 78·5	−31·0% (0·3% to 0·2%); 78·6 vs 78·8	18·5% (0·4% to 0·5%); 81·3 vs 81·6	−10·9% (0·4% to 0·4%); 79·6 vs 78·1	22·1% (0·3% to 0·3%); 76·6 vs 74·9	56·8% (1·1% to 1·8%); 75·3 vs 75·2	−38·3% (0·9% to 0·5%); 81·2 vs 77·7	85·5% (0·1% to 0·2%); 73·1 vs 75·4
Diarrhoeal diseases	−72·0% (2·2% to 0·6%); 52·6 vs 52·6	−74·7% (0·1% to 0·0%); 62·9 vs 63·8	33·8% (0·0% to 0·0%); 84·2 vs 70·6	−79·2% (0·8% to 0·2%); 57·3 vs 52·5	−84·6% (1·1% to 0·2%); 24·0 vs 37·0	−75·4% (4·8% to 1·2%); 65·6 vs 40·6	−77·4% (0·6% to 0·1%); 63·2 vs 59·7	−64·4% (5·8% to 2·1%); 26·8 vs 22·6
Road injuries	−20·3% (0·8% to 0·6%); 42·3 vs 42·3	−64·4% (0·6% to 0·2%); 47·0 vs 49·4	−56·2% (0·5% to 0·2%); 53·5 vs 52·1	−32·3% (0·8% to 0·5%); 42·2 vs 42·3	−28·5% (1·0% to 0·7%); 38·8 vs 36·6	11·4% (0·5% to 0·6%); 47·6 vs 37·2	−58·0% (1·2% to 0·5%); 50·3 vs 46·2	57·6% (0·9% to 1·5%); 32·0 vs 29·5
Cervical cancer	23·6% (0·5% to 0·6%); 56·8 vs 56·8	−28·7% (0·6% to 0·4%); 61·7 vs 59·6	−20·6% (0·3% to 0·2%); 66·9 vs 62·0	−14·1% (0·8% to 0·7%); 59·6 vs 56·0	29·7% (0·2% to 0·2%); 57·8 vs 52·7	41·3% (0·6% to 0·8%); 56·4 vs 53·2	−13·1% (0·5% to 0·4%); 60·6 vs 57·5	103·5% (0·6% to 1·2%); 49·1 vs 50·3
Tracheal, bronchus, and lung cancer	15·2% (0·5% to 0·6%); 71·6 vs 71·6	5·8% (0·6% to 0·6%); 70·5 vs 72·8	−9·5% (1·2% to 1·0%); 75·1 vs 75·4	33·7% (0·4% to 0·5%); 69·9 vs 71·1	94·0% (0·2% to 0·4%); 66·1 vs 68·0	192·6% (0·1% to 0·3%); 64·4 vs 68·7	−4·5% (1·0% to 0·9%); 71·0 vs 71·0	143·9% (0·0% to 0·1%); 62·4 vs 67·7
Chronic kidney disease	27·7% (0·5% to 0·6%); 72·1 vs 72·1	−15·3% (0·3% to 0·3%); 74·5 vs 74·3	33·9% (0·2% to 0·3%); 84·6 vs 78·9	12·8% (1·0% to 1·1%); 71·2 vs 71·4	49·4% (0·8% to 1·1%); 70·4 vs 64·4	38·1% (0·4% to 0·5%); 63·0 vs 65·3	−15·3% (0·6% to 0·5%); 69·3 vs 72·0	90·1% (0·4% to 0·7%); 58·7 vs 61·2
Congenital birth defects	−31·3% (0·8% to 0·5%); 5·4 vs 5·4	−32·1% (0·4% to 0·2%); 9·6 vs 7·8	−38·8% (0·3% to 0·2%); 18·7 vs 8·5	−45·1% (1·0% to 0·6%); 7·2 vs 5·8	−49·4% (2·4% to 1·2%); 3·7 vs 4·5	−18·0% (0·8% to 0·7%); 4·0 vs 5·1	−70·4% (0·8% to 0·2%); 8·0 vs 8·3	16·8% (1·0% to 1·2%); 3·8 vs 2·8
Tuberculosis	−60·0% (1·3% to 0·5%); 53·8 vs 53·8	−71·8% (0·3% to 0·1%); 53·6 vs 60·4	−66·9% (0·0% to 0·0%); 81·9 vs 64·0	−51·8% (0·4% to 0·2%); 51·2 vs 53·2	−57·7% (0·4% to 0·2%); 53·5 vs 45·9	−64·8% (2·9% to 1·0%); 58·9 vs 47·1	−72·5% (1·1% to 0·3%); 58·4 vs 57·0	−42·3% (2·5% to 1·4%); 45·5 vs 36·7
Cirrhosis and other chronic liver diseases	−19·3% (0·7% to 0·5%); 62·3 vs 62·3	4·4% (1·1% to 1·2%); 60·5 vs 65·8	−6·1% (0·5% to 0·5%); 69·6 vs 68·9	−13·7% (0·6% to 0·5%); 65·7 vs 61·5	−21·6% (0·8% to 0·6%); 68·5 vs 56·5	−31·3% (0·8% to 0·5%); 57·2 vs 57·3	−44·3% (0·7% to 0·4%); 63·9 vs 63·1	17·5% (0·5% to 0·6%); 53·3 vs 52·0
Maternal disorders	−52·8% (1·0% to 0·5%); 29·5 vs 29·5	−60·7% (0·1% to 0·0%); 31·8 vs 31·2	−7·1% (0·0% to 0·0%); 33·3 vs 30·5	−36·6% (0·5% to 0·3%); 30·6 vs 29·8	−54·7% (0·7% to 0·3%); 31·6 vs 29·4	−74·9% (1·7% to 0·4%); 28·8 vs 28·9	−71·6% (0·5% to 0·1%); 30·9 vs 30·7	−30·8% (2·9% to 2·0%); 29·3 vs 27·6
Colon and rectum cancer	9·4% (0·4% to 0·4%); 72·5 vs 72·5	−19·9% (0·8% to 0·7%); 73·2 vs 73·9	−21·1% (0·7% to 0·5%); 79·0 vs 77·4	57·6% (0·3% to 0·5%); 70·3 vs 71·8	69·9% (0·2% to 0·4%); 66·6 vs 67·3	89·9% (0·1% to 0·3%); 63·6 vs 68·1	−12·1% (0·5% to 0·5%); 70·3 vs 71·9	155·6% (0·1% to 0·2%); 60·3 vs 66·8
Self-harm	−41·6% (0·7% to 0·4%); 45·8 vs 45·8	−51·2% (0·7% to 0·3%); 54·0 vs 52·4	−12·6% (0·5% to 0·4%); 53·0 vs 55·2	15·5% (0·2% to 0·3%); 39·6 vs 45·1	−22·1% (0·2% to 0·2%); 35·5 vs 40·2	−21·4% (1·1% to 0·8%); 36·9 vs 40·2	−77·2% (1·0% to 0·2%); 58·1 vs 48·9	33·2% (0·2% to 0·2%); 40·7 vs 34·8
Hypertensive heart disease	40·9% (0·3% to 0·4%); 79·1 vs 79·1	−32·1% (0·4% to 0·3%); 82·0 vs 79·5	32·4% (0·1% to 0·2%); 86·9 vs 83·0	−13·7% (0·3% to 0·2%); 79·9 vs 78·7	54·0% (0·5% to 0·8%); 75·6 vs 74·1	126·5% (0·2% to 0·5%); 76·2 vs 74·7	−15·2% (0·4% to 0·3%); 79·8 vs 78·2	127·1% (0·2% to 0·5%); 72·1 vs 75·0

Increasing 70q0, mean age at death lower than expected
Increasing 70q0, mean age at death higher than expected
Decreasing 70q0, mean age at death lower than expected
Decreasing 70q0, mean age at death higher than expected

Figure 5: **Change in 70q0 between 2000 and 2023 and the observed versus expected mean age at death in 2023 for females**
The contents of each cell are as follows: percentage change in 70q0 from 2000 to 2023 (70q0 in 2000 to 70q0 in 2023); observed *vs* expected mean age at death in years. 70q0=probability of death before age 70 years.

between 2000 and 2023 were interstitial lung disease and pulmonary sarcoidosis (+74·8% change; 70q0 in 2023 0·1%); drug use disorders (+68·0%; 0·1%); lip and oral cavity cancer (+54·7%; 0·1%); atrial fibrillation and flutter (+52·2%; <0·1%); Alzheimer's disease and other dementias (+46·2%; 0·2%); diabetes (+42·7%; 0·8%); hypertensive heart disease (+40·9%; 0·4%); pancreatic cancer (+37·7%; 0·2%); Parkinson's disease (+36·7%; <0·1%); ovarian cancer (+36·5%; 0·3%); other cardiovascular and circulatory diseases (+35·9%; 0·1%); breast cancer (+33·6%; 1·0%); endocrine, metabolic, blood, and immune disorders (+29·9%; 0·1%); chronic kidney disease (+27·7%; 0·6%); and non-rheumatic valvular heart disease (+26·2%; <0·1%; appendix 2 table S6).

Among the top 50 global causes for males, the 15 causes with the largest amount of increase in 70q0 between 2000 and 2023 were diabetes (+75·6% change; 70q0 in 2023 1·0%); drug use disorders (+56·8%; 0·2%); atrial fibrillation and flutter (+51·1%; <0·1%); interstitial lung disease and pulmonary sarcoidosis (+48·2%; 0·1%); Alzheimer's disease and other dementias (+45·9%; 0·1%); Parkinson's disease (+44·4%; 0·1%); endocrine, metabolic, blood, and immune disorders (+41·3%; 0·1%); pancreatic cancer (+34·9%; 0·3%); lip and oral cavity cancer (+29·2%; 0·2%); prostate cancer (+24·7%; 0·2%); non-rheumatic valvular heart disease (+23·9%; <0·1%); chronic kidney disease (+18·6%; 0·7%); colon and rectum cancer (+18·0%; 0·6%); urinary diseases and male infertility (+18·0%; 0·1%); and other cardiovascular and circulatory diseases (+15·1%; 0·1%; appendix 2 table S6).

Among the top 50 causes for which a global increase in 70q0 occurred, we observed several notable declines at the super-region level between 2000 and 2023 (appendix 2 table S6). For example, 70q0 due to drug use disorders increased by 56·8% in males and 68·0% in females globally, yet decreased in southeast Asia, east Asia, and Oceania by 73·9% for males and 81·5% for females. For diabetes, 70q0 increased by 75·6% for males and 42·7% for females globally, but decreased by 9·0% for males and 34·6% for females in the high-income super-region. For ovarian cancer, there was a 36·5% increase in 70q0 in females globally, but a 25·5% decrease in the high-income super-region. For chronic kidney disease, 70q0 increased by 18·6% for males and 27·7% for females globally, but in central Europe, eastern Europe, and central Asia, it decreased by 10·4% for males and 15·3% for females.

Alternatively, some causes of death showed increased national 70q0 where there has otherwise been global progress to reduce 70q0. For example, a 47·4% decrease in 70q0 due to lower respiratory infections occurred among males globally, yet there were substantial increases in countries such as Poland (98·8%), Thailand (82·7%), and Argentina (66·0%). Similarly, for females, there was a 51·2% decrease in 70q0 due to lower respiratory infections globally, but notable increases in a number of countries, including Argentina (101·5%), Poland (48·2%), and Thailand (17·1%). Road injuries are another example: a 21·1% decline in 70q0 among males occurred globally, despite increases in many countries, most notably in Sierra Leone (259·8%), Uganda (180·5%), and Malawi (155·0%). For road injuries among females, there was a 20·3% decrease in 70q0 globally, with notable increases in the Democratic Republic of the Congo (158·5%), Sierra Leone (122·1%), and Pakistan (121·7%). Additionally, stroke showed global decreases in 70q0 of 15·6% among males and 20·7% among females, but increases in many countries for males (eg, Rwanda [97·0%], Burundi [85·7%], and Ethiopia [75·6%]) and females (eg, Ethiopia [128·4%], Zimbabwe [106·7%], and South Sudan [106·7%]).

Joint examination of 70q0 and mean age at death in super-regions

From 2000 to 2023, notable variation was observed between sexes when investigating the 70q0 and mean age at death metrics for the top 20 causes of death by super-region (figures 5, 6). For females in sub-Saharan Africa, several of the leading causes showed an increase in 70q0 and a mean age that was lower than expected: ischaemic heart disease (70q0 increased 81·1%, with mean age at death 3·4 years lower than expected); stroke (70q0 increased 51·7%, with mean age at death 2·7 years lower than expected); and breast cancer (70q0 increased 227·9%, with mean age at death 3·8 years lower than expected). There were six additional causes that showed this same pattern. For females in south Asia, 70q0 due to tracheal, bronchus, and lung cancer increased by 192·6%, with a mean age at death 4·3 years lower than expected (figure 5). In addition, ischaemic heart disease, stroke, breast cancer, chronic kidney disease, and colon and rectum cancer also had increasing 70q0 and lower mean age at death compared with expected age in south Asia. In this super-region, there were also five causes that had an increase in 70q0 only (with mean age at death not lower than expected), and five causes had a mean age at death lower than expected without an increased 70q0. In females in the high-income super-region, only COPD showed both increasing 70q0 and lower mean age at death than expected. Chronic kidney disease, diarrhoeal diseases, and hypertensive heart disease had increasing 70q0, but the mean age at death was not lower than expected. In females in southeast Asia, east Asia, and Oceania, there were only two causes among the leading 20 that had an increased 70q0, breast cancer and diabetes, but both of those causes had mean ages at death below the expected values (figure 5).

In males in sub-Saharan Africa, 11 of the top 20 causes of death showed an increase in 70q0 and a mean age that was lower than expected: ischaemic heart disease; stroke; tracheal, bronchus, and lung cancer; cirrhosis and other chronic liver diseases; diabetes; COPD; chronic kidney

	Global	Central Europe, eastern Europe, and central Asia	High income	Latin America and Caribbean	North Africa and Middle East	South Asia	Southeast Asia, east Asia, and Oceania	Sub-Saharan Africa
All causes	−26·4% (46·4% to 34·2%); 61·2 *vs* 61·2	−27·6% (57·4% to 41·5%); 65·5 *vs* 63·9	−21·3% (27·8% to 21·9%); 74·8 *vs* 70·7	−14·7% (38·3% to 32·6%); 62·0 *vs* 61·3	−22·9% (41·4% to 31·9%); 58·6 *vs* 52·8	−25·8% (51·7% to 38·4%); 58·2 *vs* 55·0	−33·2% (42·9% to 28·6%); 67·7 *vs* 64·3	−23·6% (68·3% to 52·2%); 35·6 *vs* 40·4
Ischaemic heart disease	4·7% (4·1% to 4·3%); 71·1 *vs* 71·1	−31·4% (12·9% to 8·8%); 72·2 *vs* 70·7	−36·1% (4·4% to 2·8%); 77·1 *vs* 75·3	15·6% (3·1% to 3·6%); 71·4 *vs* 71·2	10·4% (6·2% to 6·8%); 68·3 *vs* 66·6	40·3% (4·4% to 6·1%); 66·6 *vs* 68·1	22·7% (3·2% to 3·9%); 72·3 *vs* 70·8	73·6% (0·8% to 1·5%); 66·2 *vs* 66·6
Stroke	−15·6% (3·3% to 2·8%); 71·5 *vs* 71·5	−40·4% (5·9% to 3·5%); 72·6 *vs* 71·3	−39·7% (1·5% to 0·9%); 79·3 *vs* 75·5	−15·1% (1·9% to 1·6%); 71·3 *vs* 71·6	−30·0% (3·1% to 2·2%); 70·0 *vs* 67·3	30·9% (2·3% to 3·0%); 68·1 *vs* 68·7	−28·0% (6·1% to 4·4%); 72·0 *vs* 71·4	36·3% (1·3% to 1·8%); 65·6 *vs* 66·2
Neonatal disorders	−51·5% (3·8% to 1·9%); 0·1 *vs* 0·1	−24·1% (0·6% to 0·5%); 0·1 *vs* 0·1	−55·6% (0·4% to 0·2%); 0·1 *vs* 0·1	−67·0% (3·0% to 1·0%); 0·1 *vs* 0·1	−67·0% (4·9% to 1·6%); 0·1 *vs* 0·1	−60·6% (7·3% to 2·9%); 0·0 *vs* 0·1	−78·8% (1·9% to 0·4%); 0·1 *vs* 0·1	−16·5% (7·5% to 6·3%); 0·1 *vs* 0·1
Road injuries	−21·1% (2·2% to 1·8%); 40·9 *vs* 40·9	−56·5% (1·9% to 0·8%); 43·6 *vs* 44·4	−51·2% (1·4% to 0·7%); 49·0 *vs* 48·3	−19·2% (2·7% to 2·1%); 41·5 *vs* 40·6	−28·9% (3·0% to 2·1%); 37·6 *vs* 37·5	27·8% (1·6% to 2·0%); 42·1 *vs* 37·3	−60·3% (3·2% to 1·3%); 47·3 *vs* 44·1	66·6% (2·1% to 3·5%); 33·3 *vs* 31·3
Lower respiratory infections	−47·4% (2·6% to 1·4%); 53·0 *vs* 53·0	−37·8% (2·0% to 1·2%); 55·6 *vs* 58·9	−19·5% (0·5% to 0·4%); 81·5 *vs* 70·0	−28·9% (1·9% to 1·4%); 65·9 *vs* 53·9	−57·9% (2·6% to 1·1%); 51·1 *vs* 39·8	−59·0% (3·4% to 1·4%); 44·3 *vs* 43·3	−64·9% (1·9% to 0·7%); 66·1 *vs* 60·5	−29·1% (5·7% to 4·0%); 30·0 *vs* 23·1
Tracheal, bronchus, and lung cancer	−1·1% (1·3% to 1·3%); 69·8 *vs* 69·8	−31·3% (3·3% to 2·2%); 67·7 *vs* 69·5	−40·4% (2·8% to 1·7%); 74·1 *vs* 72·6	−8·5% (0·7% to 0·6%); 69·7 *vs* 69·7	51·6% (0·8% to 1·2%); 66·4 *vs* 67·0	105·5% (0·3% to 0·6%); 63·6 *vs* 68·1	17·0% (1·9% to 2·2%); 69·1 *vs* 69·4	73·6% (0·2% to 0·3%); 63·5 *vs* 66·9
Cirrhosis and other chronic liver diseases	−15·7% (1·5% to 1·3%); 58·0 *vs* 58·0	13·6% (2·0% to 2·3%); 57·2 *vs* 59·1	−20·4% (1·4% to 1·1%); 65·1 *vs* 63·1	−10·5% (1·9% to 1·7%); 59·4 *vs* 57·7	−20·4% (1·3% to 1·0%); 64·9 *vs* 54·0	−25·3% (1·6% to 1·2%); 55·0 *vs* 55·1	−30·9% (1·7% to 1·2%); 58·1 *vs* 59·0	23·8% (1·1% to 1·3%); 50·5 *vs* 50·9
Diabetes	75·6% (0·6% to 1·0%); 69·0 *vs* 69·0	83·3% (0·4% to 0·6%); 69·7 *vs* 69·0	−9·0% (0·6% to 0·5%); 74·8 *vs* 72·9	72·3% (1·0% to 1·7%); 68·2 *vs* 68·9	75·6% (0·5% to 0·9%); 68·7 *vs* 65·1	180·7% (0·6% to 1·7%); 69·2 *vs* 66·4	35·1% (0·6% to 0·8%); 68·3 *vs* 68·9	63·3% (0·5% to 0·8%); 63·7 *vs* 63·8
Chronic obstructive pulmonary disease	−24·9% (1·3% to 0·9%); 76·3 *vs* 76·3	−43·7% (1·3% to 0·7%); 73·5 *vs* 75·6	−8·8% (0·7% to 0·6%); 79·7 *vs* 78·9	−21·4% (0·6% to 0·5%); 77·3 *vs* 76·5	−13·6% (0·6% to 0·5%); 74·0 *vs* 73·3	1·7% (2·0% to 2·0%); 74·1 *vs* 74·1	−51·0% (1·9% to 1·0%); 77·8 *vs* 75·8	20·1% (0·3% to 0·3%); 71·3 *vs* 73·9
Self-harm	−24·3% (1·2% to 0·9%); 46·6 *vs* 46·6	−51·0% (3·3% to 1·6%); 48·7 *vs* 49·4	−18·5% (1·5% to 1·3%); 52·4 *vs* 54·0	19·6% (0·8% to 0·9%); 42·8 *vs* 46·1	6·5% (0·4% to 0·4%); 38·2 *vs* 42·5	3·5% (1·2% to 1·2%); 40·2 *vs* 42·5	−56·3% (1·0% to 0·4%); 53·8 *vs* 49·1	39·4% (0·6% to 0·9%); 42·2 *vs* 37·7
Tuberculosis	−58·0% (2·1% to 0·9%); 55·2 *vs* 55·2	−78·5% (1·3% to 0·3%); 53·4 *vs* 57·6	−69·4% (0·1% to 0·0%); 76·3 *vs* 62·9	−39·8% (0·6% to 0·4%); 53·9 *vs* 54·9	−62·8% (0·4% to 0·2%); 55·8 *vs* 49·6	−62·0% (4·5% to 1·7%); 59·2 *vs* 50·8	−64·6% (1·5% to 0·5%); 59·4 *vs* 57·6	−39·4% (3·6% to 2·2%); 47·2 *vs* 41·8
HIV/AIDS	−55·6% (1·8% to 0·8%); 42·5 *vs* 42·5	27·1% (0·4% to 0·5%); 41·6 *vs* 44·7	−71·5% (0·3% to 0·1%); 51·7 *vs* 46·6	−42·3% (1·2% to 0·7%); 42·5 *vs* 42·4	−11·1% (0·2% to 0·1%); 40·3 *vs* 40·5	−51·6% (0·6% to 0·3%); 42·9 *vs* 40·4	−24·6% (0·4% to 0·3%); 46·0 *vs* 44·9	−58·8% (9·1% to 3·7%); 41·6 *vs* 34·9
Chronic kidney disease	18·6% (0·6% to 0·7%); 69·0 *vs* 69·0	−10·4% (0·4% to 0·3%); 69·5 *vs* 69·3	44·1% (0·3% to 0·5%); 80·3 *vs* 74·9	34·1% (1·0% to 1·3%); 69·2 *vs* 69·1	23·9% (0·9% to 1·1%); 69·3 *vs* 62·8	4·0% (0·5% to 0·5%); 62·7 *vs* 64·4	−8·4% (0·7% to 0·6%); 66·7 *vs* 69·5	51·6% (0·6% to 0·9%); 57·6 *vs* 59·4
Interpersonal violence	−26·7% (0·9% to 0·7%); 35·1 *vs* 35·1	−68·7% (1·8% to 0·6%); 46·3 *vs* 38·0	−10·5% (0·4% to 0·3%); 36·0 *vs* 39·4	−22·3% (4·6% to 3·5%); 34·8 *vs* 35·0	14·5% (0·4% to 0·4%); 32·5 *vs* 33·7	−22·5% (0·5% to 0·4%); 39·9 *vs* 33·0	−66·5% (0·4% to 0·1%); 38·5 *vs* 37·6	5·1% (1·2% to 1·3%); 30·7 *vs* 29·3
Diarrhoeal diseases	−72·4% (2·3% to 0·6%); 42·7 *vs* 42·7	−76·7% (0·2% to 0·0%); 50·5 *vs* 50·1	10·4% (0·0% to 0·0%); 79·9 *vs* 62·7	−79·6% (0·9% to 0·2%); 47·6 *vs* 43·5	−83·4% (1·1% to 0·2%); 20·6 *vs* 30·6	−78·7% (4·0% to 0·8%); 62·9 *vs* 33·7	−78·5% (0·7% to 0·1%); 53·3 *vs* 51·8	−63·7% (7·3% to 2·6%); 20·0 *vs* 16·3
Stomach cancer	−31·9% (0·9% to 0·6%); 68·6 *vs* 68·6	−41·0% (1·3% to 0·8%); 67·6 *vs* 68·5	−51·1% (0·8% to 0·4%); 7 5·7 *vs* 72·1	−8·1% (0·7% to 0·6%); 68·1 *vs* 68·5	0·9% (0·4% to 0·4%); 67·0 *vs* 65·2	23·8% (0·3% to 0·4%); 64·1 *vs* 66·5	−44·4% (2·0% to 1·1%); 68·2 *vs* 68·4	56·6% (0·1% to 0·2%); 61·6 *vs* 64·9
Colon and rectum cancer	18·0% (0·5% to 0·6%); 69·7 *vs* 69·7	7·6% (0·9% to 1·0%); 70·2 *vs* 69·5	−19·2% (1·0% to 0·8%); 74·9 *vs* 73·5	84·8% (0·3% to 0·5%); 68·0 *vs* 69·6	76·8% (0·2% to 0·4%); 66·1 *vs* 65·8	80·3% (0·1% to 0·3%); 64·6 *vs* 67·1	15·4% (0·7% to 0·8%); 67·4 *vs* 69·5	127·2% (0·1% to 0·2%); 63·3 *vs* 65·4
Congenital birth defects	−35·5% (0·9% to 0·6%); 5·2 *vs* 5·2	−32·2% (0·4% to 0·3%); 8·4 *vs* 7·1	−41·8% (0·3% to 0·2%); 20·9 *vs* 8·3	−46·3% (1·1% to 0·6%); 6·8 *vs* 5·5	−48·5% (2·2% to 1·1%); 3·3 *vs* 4·6	−26·8% (1·0% to 0·8%); 3·8 *vs* 4·9	−70·5% (0·9% to 0·3%); 7·3 *vs* 8·1	26·4% (1·0% to 1·2%); 3·4 *vs* 2·5
Falls	−5·2% (0·5% to 0·5%); 64·6 *vs* 64·6	−34·7% (0·8% to 0·5%); 60·4 *vs* 66·0	−5·6% (0·3% to 0·3%); 79·1 *vs* 73·3	−6·0% (0·4% to 0·4%); 64·9 *vs* 64·8	−5·5% (0·4% to 0·4%); 50·8 *vs* 56·3	5·2% (0·6% to 0·6%); 62·2 *vs* 58·1	−15·5% (0·6% to 0·5%); 63·1 *vs* 66·2	32·6% (0·3% to 0·4%); 48·7 *vs* 49·4
Hypertensive heart disease	13·1% (0·4% to 0·5%); 73·5 *vs* 73·5	−2·7% (0·5% to 0·4%); 74·6 *vs* 72·9	70·5% (0·2% to 0·3%); 77·8 *vs* 77·4	10·5% (0·3% to 0·3%); 75·2 *vs* 73·7	−0·4% (0·7% to 0·7%); 72·6 *vs* 69·1	34·7% (0·4% to 0·5%); 71·8 *vs* 70·5	−19·4% (0·6% to 0·5%); 74·4 *vs* 73·2	58·7% (0·3% to 0·4%); 67·5 *vs* 69·6

Increasing 70q0, mean age at death lower than expected
Increasing 70q0, mean age at death higher than expected
Decreasing 70q0, mean age at death lower than expected
Decreasing 70q0, mean age at death higher than expected

Figure 6: **Change in 70q0 between 2000 and 2023 and the observed versus expected mean age at death in 2023 for males**
The contents of each cell are as follows: percentage change in 70q0 from 2000 to 2023 (70q0 in 2000 to 70q0 in 2023); observed *vs* expected mean age at death in years. 70q0=probability of death before age 70 years.

disease; stomach cancer; colon and rectum cancer; falls; and hypertensive heart disease (figure 6). Additionally, road injuries, self-harm, interpersonal violence, and congenital birth defects had an increase in 70q0, but the mean age at death was not lower than expected. In males in south Asia, eight of the top 20 causes of death showed an increase in 70q0 and a mean age at death that was lower than expected: ischaemic heart disease, stroke, tracheal, bronchus, and lung cancer, COPD, self-harm, chronic kidney disease, stomach cancer, and colon and rectum cancer. Additionally, road injuries, diabetes, falls, and hypertensive heart disease had an increase in 70q0 only. In males in the high-income super-region, 70q0 due to interpersonal violence decreased slightly but had a mean age at death that was more than 3 years lower than expected. Additionally, 70q0 for chronic kidney disease, diarrhoeal diseases, and hypertensive heart disease also increased.

Discussion

High-level overview on causes of death

This study offers valuable new insights into global causes of human mortality over the past several decades, building upon and expanding previous iterations of GBD research. In a post-COVID-19-pandemic world, our study highlights several encouraging patterns in global health. Across many leading causes of death, there were declines in overall mortality within the period studied, despite disrupted rankings during the height of the COVID-19 pandemic. The rate of total YLLs have also reduced considerably relative to 1990, and particularly for many of the vaccine-preventable diseases, illustrating successes in reductions to preventable causes of death. Patterns in 70q0 show improvements across the globe, with overall declines observed in every GBD super-region, region, and in most countries. Additionally, the all-cause global mean age at death has been rising, indicating that people are generally dying later in life. While these broad-level improvements show considerable promise—particularly in the aftermath of a pandemic—they sometimes conceal disparities occurring at local levels. Differences by sex, age, and location underscore the complexity of global health progress and the persistent challenges in addressing causes of death. We highlight some of these inequalities below.

The role of international cooperation in reducing deaths and YLLs

Over the past three decades, we found large reductions in age-standardised rates of YLLs for four causes—respiratory infections and tuberculosis, nutritional deficiencies, other infectious diseases, and enteric infections—which had individual declines ranging from 58·9% to 79·0%. This achievement was facilitated by many years of sustained international cooperation with local governments. If we expand this scope to include maternal and neonatal disorders, neglected tropical diseases, malaria, HIV/AIDS, and sexually transmitted infections, and categorise them into two groups—vaccine-preventable diseases and other diseases under international intervention plans—we see that the first group had a 66·5% reduction in YLLs, while the second had a 51·6% decline. These findings highlight the profound impact of sustained funding, vaccination, international collaboration, and targeted support programmes with local governments in addressing public health challenges. Previous studies, including GBD 2021, have highlighted the importance of controlling infectious diseases as a key factor in improving life expectancy.[14] Many of these diseases are concentrated in specific populations and locations, making their control an achievable goal.[14] During a time of uncertainty regarding the future of global health funding, it is essential to maintain these efforts, as discontinuing them could jeopardise the gains made in public health.

COVID-19: challenges to recording and lessons for preparedness

The COVID-19 pandemic produced a challenge to global health that has not been seen in recent history, including the difficulties associated with accurately recording and analysing deaths from a novel pandemic. GBD 2021 estimated COVID-19 mortality using confirmed COVID-19 death estimates and excess mortality, an approach which measured the total toll of the pandemic but had limitations for understanding how many deaths were directly attributable to COVID-19.[14] GBD 2023 addresses the issues related to COVID-19 reporting by applying a method for identifying and correcting misclassified COVID-19 deaths in vital registration data in the years 2020–23. This has allowed us to more accurately quantify the COVID-19 pandemic, as well as to correct for inaccurate spikes in mortality from other causes that were instead misclassified COVID-19 deaths. The applied correction occurs after garbage code redistribution to ensure that any deaths from COVID-19 are correctly identified and that other changes in garbage code practices do not result in cause-specific excess deaths.

The additional 2 years of analysis since GBD 2021 allows for a more complete picture of COVID-19 mortality. We estimated a total of 18·0 million people died from COVID-19 globally between 2019 and 2023. This profound loss of life underscores shortcomings in global health systems and a need to fill critical gaps in preparedness for epidemic diseases. Necessary steps to better prepare for the next pandemic should include strengthening health-care infrastructure, enhancing global surveillance, improving vaccine development and delivery, ensuring equitable access to essential and preventive health services, and improving global collaboration to include data sharing and advanced disease monitoring.[32,33]

In 2020 and 2021, the global mortality rate from COVID-19 for people younger than 70 years was several

times higher than the rates for lower respiratory infections before the pandemic, in 2019. In 2023, the rate of COVID-19 deaths decreased to be lower than the sum of all other lower respiratory infections for those younger than 70 years. A similar pattern holds true for those aged 70 years and older. This suggests that COVID-19's impact on mortality could be comparable to other individual lower respiratory infections in future years, and that health-care systems should prepare for and expect future COVID-19 seasons to be endemic.[34]

Measuring the impact of a pandemic is inherently challenging; we recognise that future estimates might be subject to continued improvements as more data become available. The last pandemic of this nature to occur was the 1918 H1N1 influenza pandemic that killed between 21 million and 100 million people within 2 years.[35,36] The true death toll of the 1918 influenza pandemic still remains uncertain, and even with improved records, there will likely always be some ambiguity surrounding the COVID-19 estimates as well.

Changes in age-specific mortality rate from 2000 to 2023

With all other factors held constant, the age-specific death rate for teenagers, young adults, and older adults (aged 10–69 years) should decline over time, reflecting improvements in health care, socioeconomic conditions, and public health measures.[7] However, this trend has not been universal across all 21 GBD regions. Only four regions—high-income Asia Pacific, central Asia, east Asia, and south Asia—have had a declining age-specific death rate for both males and females across all 5-year age groups for the three Level 1 GBD causes: CMNN diseases, NCDs, and injuries.

In regions displaying an increase in NCDs, primary drivers vary by region; however, we commonly observed high rates of diabetes and kidney disease, cardiovascular disease, substance use disorders, and neoplasms. There were two regions where the increase in NCDs was primarily driven by an increase in drug use disorders: high-income North America and central Europe. The regions facing large increases in neoplasms were north Africa and the Middle East, southeast Asia, tropical Latin America, the Caribbean, and all four regions of sub-Saharan Africa. Diabetes and kidney disease largely contributed to the increase in central Europe, the Caribbean, central Latin America, and southern sub-Saharan Africa. Addressing these trends requires targeted public health interventions, improved health-care access, and socioeconomic policies to mitigate the underlying risk factors.

Among regions displaying an increase in injuries, there was similar variation by region, although common drivers included increases in self-harm, interpersonal violence, conflict and terrorism, environmental heat and cold exposure, and falls. In north Africa and the Middle East and eastern Europe, the rise in injury-related deaths was primarily due to collective and interpersonal violence, in addition to the earthquake in Türkiye. In central and eastern Europe, heatwaves have been occurring more frequently over the past decade. At the same time, increases in high-income North America, central Latin America, and tropical Latin America were all driven by increasing rates of self-harm.

Deaths from violent causes

Our study shows several noteworthy patterns in deaths from violent causes occurring throughout the world. Trends of interpersonal violence showed global-level improvements with regional heterogeneity. Although global mortality from interpersonal violence has generally declined, the regions most heavily affected have seen worsening trends. The primary drivers associated with deaths from interpersonal violence are highly variable across locations.[37] In some parts of the world, the drug trade fuels deaths from this form of violence by driving territorial conflicts, organised crime, and competition over illicit markets.[37] Deaths from interpersonal violence can also be linked to several important social determinants of health, including adverse childhood experiences, alcohol and drug use disorders, and lack of social support, among others.[38,39]

Deaths from conflict and terrorism are stochastic in nature and have fluctuated over the past three decades, displaying periods of declines and increases influenced by complex regional dynamics. In recent years, the area of conflict has begun to shift from north Africa and the Middle East to central Europe, eastern Europe, and central Asia, due to the war between Russia and Ukraine. Although the regional mortality rates of north Africa and the Middle East are no longer the highest, we found that Palestine had the highest mortality rate and 70q0 due to conflict and terrorism of any country in the world. These findings align with the recently reported number of fatalities in the Gaza Strip,[40] and an estimated 30-year loss in life expectancy within the first 12 months of the war—a conservative estimate that nearly halves the pre-war life expectancy in Palestine.[41]

Global self-harm rates have been trending downwards since the early 1990s, but this progress conceals spikes in self-harm occurring in some locations.[42] We observed an increase in self-harm in central Latin America, and more moderate increases occurring in Andean Latin America, high-income North America, high-income Asia Pacific, and tropical Latin America. There were, however, declines in self-harm in east Asia, particularly in China, where improved economic and social conditions, along with tailored and specified campaigns to reduce self-harm, have been useful in supporting population wellbeing.[43,44] We also observed that the mean age at death from self-harm has been increasing globally over the past three decades, a finding that potentially reflects both successes and failures with regard to self-harm prevention.[42] While an increase in mean age at death due

to self-harm could signal that intervention strategies tailored to younger groups have yielded improvements, increased deaths in older ages might indicate missed opportunities in addressing risk factors that are more relevant in older age groups, such as social isolation, economic insecurity, and increased chronic illness.[45] Taken together, the findings that self-harm persists as a leading cause of death in young people in several regions while the global mean age at death due to self-harm increases suggest pivotal opportunities for further prevention strategies that must be carefully tailored to the intended demographic.

Interpretation of mean age at death

The mean age at death measure provides a clear, easily interpretable metric for summarising the population affected by a given disease or injury. Interventions at both the individual and population levels vary depending on the age of those affected. For example, strategies to improve health outcomes for ischaemic heart disease in South Sudan, where the mean age at death due to this cause is 61·2 years for females, would be likely to focus on prevention strategies and early detection, whereas strategies to improve health outcomes for the same disease in Switzerland, where the mean age at death is 88·4 for females, might focus more on palliative care and limit treatment options. Identifying who is being affected by a disease using a single, interpretable measure could help policy makers to make informed decisions in complex situations.

There are some challenges when drawing comparisons in the observed mean age at death between populations with different age structures. An older population is likely to have an older mean age at death for a given cause than a population with a younger age structure. For this reason, comparing mean ages at death between locations with different population structures is not a good measure for how well a disease is being treated. To account for this, an evaluation of the expected mean age at death reflecting the given demographic's population structure is needed for comparison between locations.

The difference between the expected and observed mean age at death can reflect important factors and risks, beyond just the age distribution, that vary between and within different locations. When the observed mean age at death is lower than expected, it shows that people are dying younger than global rates would suggest. These differences across countries underscore notable inequalities. Causes of death that strongly correlate with SDI and differences between expected and observed mean ages at death are indicative of areas in which the global community has the capacity to improve health outcomes—yet resources and interventions remain unevenly distributed across locations. A lower mean age at death compared with the expected indicates weakness in public health, particularly in preventive measures, early diagnosis, and timely treatment that could delay or prevent deaths. Many examples of lower mean age at death are seen in cardiovascular diseases, cancers, and chronic respiratory diseases in low-income regions, suggesting challenges in both prevention and treatment.

Probability of death

We included the probability of death between the ages of 0 and 70 years (70q0) in this study to assess the likelihood that an individual born today will die from a specific cause before reaching 70 years of age, assuming that current age-specific mortality rates remain unchanged. The 70q0 measure incorporates competing risks, acknowledging that individuals might die from other causes before reaching the high-risk ages for a particular cause. In other words, our goal was to provide a more comprehensive assessment of the 70q0 from a specific cause over the entire lifespan, assuming survival from other causes.

In 2024, the Global Health 2050 report set a target to cut global premature mortality in half by the year 2050, a goal referred to as 50 by 50.[5] In support of this target, we aimed to better position GBD to provide the current state of national premature mortality estimates across causes and locations, which could be useful to track progress on future developments. We used an analysis of 70q0 to detail substantial sources of health loss that most contribute to premature death before age 70 years, providing a roadmap to help countries address their primary contributors to premature mortality.

Several studies suggest that probability of death is a valuable indicator, and providing 70q0 by cause of death highlights areas in which countries can improve the observed age at death for specific causes, drawing attention to locations and causes that have not kept pace with global progress in cause-specific mortality.[5,46] The probability of death measure also illustrates global and regional success stories in which, as a global health community, we have successfully reduced mortality rates for specific causes in people younger than 70 years. For instance, lower respiratory infections declined 51·2% among females and 47·4% among males between 2000 and 2023 due to reductions in the case-fatality rate and various risk factors,[47] including reductions in household air pollution, a decrease in the prevalence of childhood wasting, and improved vaccine coverage, all of which were effective in reducing the burden of lower respiratory infections.[48] Vaccines against *Haemophilus influenzae* type b and *Streptococcus pneumoniae* are particularly crucial in the reduction of lower respiratory infections in 70q0.[49] Global improvements were also observed in diarrhoeal diseases, with declines of over 70% in 70q0 for males and females. There have been many multisectoral approaches that have contributed to a reduction in diarrhoeal deaths globally in 70q0, many of which have focused on diarrhoeal deaths in children younger than 5 years. These interventions include oral rehydration therapy, enhanced water, sanitation, and hygiene

infrastructure, and the rollout of the rotavirus vaccination.[50]

The global reduction of 70q0 due to tuberculosis from 2000 to 2023 is another success story. There was an overall decline of 60·0% in females and 58·0% in males, and notable improvements in some super-regions, particularly central Europe, eastern Europe, and central Asia, where a 78·5% decrease among males and a 71·8% decrease among females occurred in that period. The analysis of 70q0 is more optimistic than other literature on tuberculosis, because the slowest progress in tuberculosis mortality has been in older adults.[47] While we have seen success in reducing 70q0 from tuberculosis, with improvements in mortality for those aged 15 years and younger, more work is needed to reduce tuberculosis mortality in individuals aged 50 years and older,[47,51] and to reach WHO's End TB Strategy.[52] Further reductions to tuberculosis-related risk factors, such as smoking, alongside early diagnosis and treatment, and the development of less toxic and shorter-duration tuberculosis treatments, are crucial for continued improvements to reach WHO targets by 2035.[47] Lastly, improvements in 70q0 for neonatal disorders globally, decreasing by 51·5% for males and females, reflect the success of efforts to reduce mortality in those younger than 5 years across health sectors and multilaterally. This is generally cited as one of public health's biggest achievements of the 20th century.[53] There are many lessons to be learned from this progress, including the importance of public health standards and measures adopted globally, such as the rollout of the *S pneumoniae* vaccine to prevent lower respiratory infections and the rotavirus vaccine for diarrhoea prevention. Sustainable Development Goal Target 3.2, which aims to end preventable deaths of newborns and children younger than 5 years by 2030, will build on the progress already made in reducing neonatal mortality and support ongoing efforts toward an 80% reduction in tuberculosis cases by 2030, as measured by WHO.[54]

Unfortunately, not all causes of death show an optimistic picture in terms of 70q0. There remain large disparities by cause and location. First, as the epidemiological transition continues, we see rising probabilities of deaths from NCDs in sub-Saharan Africa, Latin America and the Caribbean, south Asia, and southeast Asia, east Asia, and Oceania. With global progress in 70q0, there are outliers where increased mortality rates have occurred during this period. Ten countries saw an increase in 70q0 across all causes between 2000 and 2023; the largest increase was in Palestine at 33·1%, more than double that of the next-largest increase in Lebanon with 15·3%. The staggering increase in Palestine is driven almost entirely by the conflict between Israel and Palestine, with an increase in 70q0 of 8980% due to conflict and terrorism. Despite a substantial rise in 70q0 due to conflict and terrorism in many countries, including the remainder of the top ten countries (Sudan, Ukraine, Russia, Burkina Faso, Myanmar, Israel, Somalia, Syria, and Yemen), none of these countries had an overall increase in their all-cause 70q0 due to their increased risk of conflict deaths.

Patterns in NCD mortality

Rising NCDs worldwide, especially in low-income areas, will represent a significant global health challenge moving forward.[55,56] Historically, low-income countries have been disproportionately affected by the burden of infectious diseases, but shifts towards more chronic conditions are a reflection of the ongoing global epidemiological transition.[57] In 1990, the three regions with the highest overall mortality rates from all causes were western, eastern, and central sub-Saharan Africa, where 73·4% of deaths came from CMNN diseases. By 2023, CMNN diseases in these regions dropped to 51·4% of all deaths, representing a 30·0% decrease from 1990. Our findings also show that age-standardised mortality rates and 70q0 for both cardiovascular diseases and neoplasms are increasing in sub-Saharan Africa and in south Asia (appendix 2 figure S5). As further reductions in communicable diseases continue, it is likely that deaths from these NCDs could become the dominant sources of mortality in future years.

Findings from our study are in agreement with many studies drawing attention to the surge in NCDs occurring in low-income settings.[57,58] Although the concept of the epidemiological transition is not new, the speed and scale of the rise in NCDs in low-income regions is increasingly concerning.[57] There are several important implications for health systems when disease burdens transition from communicable diseases to those from non-communicable sources.[10,57] Health-care infrastructure might face a range of growing challenges associated with increased care needs for chronic disease management requiring long-term care and ongoing treatment. Low-resourced locations remain poorly equipped to address the rising burden of NCDs, with health-care systems often underfunded and unable to provide adequate preventive care or treatment options.[57] Collaborative and focused efforts—including coordinated policy initiatives and prevention programmes targeting key risk factors—are needed to alleviate immediate health challenges related to the rising burden of NCDs in low-income regions and to achieve long-term improvements in global health outcomes.

Limitations

As with any study of this scope, there are several important limitations to consider. We provide cause-specific limitations for every GBD cause of death in detail in appendix 1 (section 3). Here, we highlight limitations with applicability across many causes. First, accuracy of cause-of-death estimates can be affected by data sparsity or unreliability from some regions, time periods, or age groups. In locations for which we have scarce or

unreliable data, estimates are interpolated from neighbouring regional patterns by relying on predictive covariates. Second, the cause-of-death estimates rely on medically verifiable sources of cause-of-death data, for which quality can vary. Some datasets do not cover all deaths in a given age, sex, location, and year, and some have high levels of garbage-coded underlying causes of death, which require redistribution algorithms to correct. For transparency about data quality, we publish a star rating of the quality of all vital registration and verbal autopsy data (a 1–5 score compiled based on percentage completeness and percentage garbage). These scores are available in appendix 1 and in a publicly available visualisation tool. Third, for causes with limited data, it is preferable to provide estimates with appropriate uncertainty, rather than providing no information. Fourth, reporting lags in medically verifiable cause-of-death data are a factor in data availability for recent years, particularly 2023; therefore, estimates for these years rely more heavily on the modelling process. Fifth, there are several limitations that pertain to our COVID-19 estimates. While GBD 2023 reflects the most comprehensive set of COVID-19 estimates published by GBD to date, we still have a limited availability of time series for some locations from 2020 to 2023, particularly for 2023. Some location-cause-age-sex groups have a small enough sample size that their time series are stochastic by default, making the development of a counterfactual model difficult. To our knowledge, estimates from GBD 2023 reflect the best account of COVID-19 and miscoded COVID-19 to date. However, as we learn more about the virus and its presentation, it is possible our corrections will be updated to reflect new knowledge in the field. Sixth, mean age at death calculations also have limitations, as they are not standardised for different population age structures. Aggregate estimates are therefore influenced by the most populated areas. As a result, it can be unclear whether the increase in the mean age at death is attributed to a reduction of deaths in younger ages, or if it is simply a result of an ageing population. Our calculation of mean age at death is also limited by the granularity of GBD results. Here, each death is assigned an age group, whereas in reality, each death occurred at a specific age. This strategy does not capture effects within age groups, and it does not show how cohorts age from year to year. Seventh, 70q0 is a broad age group that does not capture improvements made in younger ages if the death occurs before age 70 years. For example, if the mean age at death improved from 30 years to 50 years in a period of time, but the overall mortality rate remained the same, 70q0 would not show this improvement. Lastly, data for stochastic events such as natural disasters and conflicts are generally reported without age and sex detail and instead leverage age-sex splitting using the available detailed data to split the deaths into the granular GBD age groups. These types of events are particularly subject to a lag in reporting, and these estimates will continue to be improved in the future.

Conclusion

GBD cause of death studies are fundamental for understanding mortality trends and aligning them with public health decision making. While progress has been made in reducing deaths from infectious diseases on a global scale, the rising burden of NCDs presents new challenges, particularly for low-income nations. Patterns in premature mortality across the globe have been changing, signifying priority areas for public health intervention. Findings from GBD 2023 show a crucial need for continued investment in health care, improved data collection, and targeted interventions to address both emerging and persistent health issues. Tackling the global health challenges of the future will require sustained international collaboration in the prevention and treatment of both communicable and non-communicable diseases. Strengthening access and quality of health care in low-income and middle-income countries is needed for improving the prevention and treatment of NCDs in particular, which continue to rise as major health threats. A unified global effort will also be necessary to combat the growing number of deaths from drug use and violence, both of which require comprehensive strategies for prevention, treatment, and support. By fostering greater international cooperation and focusing on these key areas, we can make significant progress towards reducing global mortality rates and improving health outcomes for populations worldwide.

For the **data quality visualisation tool** see https://ihmeuw.shinyapps.io/gbd_starviz_shiny/

GBD 2023 Causes of Death Collaborators

Mohsen Naghavi,* Hmwe Hmwe Kyu,* Bhoomadevi A, Mohammad Amin Aalipour, Hasan Aalruz, Hazim S Ababneh, Bedru J Abafita, Ukachukwu O Abaraogu, Cristiana Abbafati, Madineh Abbasi, Faezeh Abbaspour, Hedayat Abbastabar, Abdallah H A Abd Al Magied, Samar Abd ElHafeez, Ashraf Nabiel Abdalla, Mohammed Altigani Abdalla, Emad M Abdallah, Barkhad Aden Abdeeq, Nadin M I Abdel Razeq, Ahmed Abdelrahman Abdelgalil, Reda Abdel-Hameed, Michael Abdelmasseh, Mahmoud Abdelnabi, Wael M Abdel-Rahman, Arman Abdous, Mostafa M Abdrabou, Jeza Muhamad Abdul Aziz, Deldar Morad Abdulah, Auwal Abdullahi, Toufik Abdul-Rahman, Habtamu Abebe Getahun, Aidin Abedi, Armita Abedi, Parisa Abedi, Asrat Agalu Abejew, Roberto Ariel Abeldaño Zuñiga, Shehab Uddin Al Abid, Syed Hani Abidi, Alemwork Abie, Olugbenga Olusola Abiodun, Richard Gyan Aboagye, Shady Abohashem, Hassan Abolhassani, Ulric Sena Abonie, Nagah M Abourashed, Mohamed Abouzid, Dmitry Abramov, Lucas Guimarães Abreu, Dariush Abtahi, Rana Kamal Abu Farha, Fuad Hamdi A Abuadas, Aminu Kende Abubakar, Nermeen Abu-Elala, Eman Abu-Gharbieh, Sawsan Abuhammad, Ahmad Y Abuhelwa, Hana J Abukhadijah, Niveen ME Abu-Rmeileh, Salahdein Aburuz, Dina Abushanab, Manfred Mario Kokou Accrombessi, Anirudh Balakrishna Acharya, Apurba Acharya, Ousman Adal, Lisa C Adams, Abdu A Adamu, Isaac Yeboah Addo, Oluwafemi Atanda Adeagbo, Tajudeen Adesanmi Adebisi, Isaac Akinkunmi Adedeji, Kamoru Ademola Adedokun, Oluwatobi E Adegbile, Nurudeen A Adegoke, Olumide Thomas Adeleke, Bulcha Guye Adema, Bashir Aden, Isaac Ayodeji Adesina, Miracle Ayomikun Adesina, Juliana Bunmi Adetunji, Habeeb Omoponle Adewuyi, Temitayo Esther Adeyeoluwa, Mache Tsadik Adhana, Ripon Kumar Adhikary, Usha Adiga, Tanin Adl Parvar, Mohd Adnan,

Qorinah Estiningtyas Sakilah Adnani, Prince Owusu Adoma, Leticia Akua Adzigbli, David Adzrago, Giuseppina Affinito, Ahmed M Afifi, Clifford Afoakwah, Aanuoluwapo Adeyimika Afolabi, Rotimi Felix Afolabi, Vlad-Adrian Afrăsânie, Saira Afzal, Gizachew Beykaso Agafari, Suneth Buddhika Agampodi, Thilini Chanchala Agampodi, Navidha Aggarwal, Mahdi Aghaalikhani, Sepehr Aghajanian, Seyed Mohammad Kazem Aghamir, Feleke Doyore Agide, César Agostinis Sobrinho, Anurag Agrawal, Williams Agyemang-Duah, Mahsa Ahadi, Bright Opoku Ahinkorah, Aqeel Ahmad, Danish Ahmad, Faisal Ahmad, Ijaz Ahmad, Khabir Ahmad, Khurshid Ahmad, Sajjad Ahmad, Tauseef Ahmad, Waqas Ahmad, Negar Sadat Ahmadi, Ali Ahmed, Ayman Ahmed, Gasha Salih Ahmed, Haroon Ahmed, Junaid Ahmed, Luai A Ahmed, MD Faisal Ahmed, Mehrunnisha Sharif Ahmed, Meqdad Saleh Ahmed, Muktar Beshir Ahmed, Mushood Ahmed, Shabbir Ahmed, Sindew Mahmud Ahmed, Syed Anees Ahmed, Gulzhanat Aimagambetova, Marjan Ajami, Budi Aji, Hossein Akbarialiabad, Saeid Akbarifard, Oluwasefunmi Akeju, Roland Eghoghosoa Akhigbe, Ruslan Akhmedullin, Olufemi Ambrose Akinkuotu, Mohammed Ahmed Akkaif, Wole Akosile, Ashley E Akrami, Ralph Kwame Akyea, Alaa Al Amiry, Salah Al Awaidy, Syed Mahfuz Al Hasan, Ammar Al Homsi, Mohammad Khaled Al Nawayseh, Omar Al Omari, Zain Al Ta'ani, Yazan Al Thaher, Omar Ali Mohammed Al Zaabi, Mohammad Ahmmad Mahmoud Al Zoubi, Mousa Ali Al-Abbadi, Tariq A Alalwan, Ziyad Al-Aly, Khurshid Alam, Manjurul Alam, Mohammad Khursheed Alam, Mostafa Alam, Rasmieh Mustafa Al-Amer, Abebaw Alamrew, Amani Alansari, Turki M Alanzi, Fahmi Y Al-Ashwal, Mohammed Albashtawy, Wafa A Aldhaleei, Mohammed S Aldossary, Robert W Aldridge, Shereen M Aleidi, Bezawit Abeje Alemayehu, Fentahun Alemnew, Melaku Birhanu Alemu, Kefyalew Addis Alene, Ayman Al-Eyadhy, Ali M Alfalki, Fahad D Algahtani, Abdelazeem M Algammal, Khairat Al-Habbal, Nma Bida Alhaji, Samar Al-Hajj, Fadwa Naji Alhalaiqa, Mohammed Khaled Al-Hanawi, Khalid A Alhasan, Ashraf Alhumaidi, Fahad A Alhumaydhi, Amjad Ali, Haroon Muhammad Ali, Irfan Ali, Liaqat Ali, Maratab Ali, Mohammad Daud Ali, Mohammed Usman Ali, Rafat Ali, Shahid Ali, Syed Shujait Ali, Waad Ali, Gianfranco Alicandro, Montaha Al-Iede, Sheikh Mohammad Alif, Hamid Alinejad Rokny, Morteza Alipour, Samah W Al-Jabi, Mohamad Aljofan, Moath Saleh Aljohani, Syed Mohamed Aljunid, Ahmad Alkhatib, Mustafa Alkhawam, Peter Allebeck, Khaled S Allemailem, Mohammed Z Allouh, Wesam Taher Almagharbeh, Sabah Al-Marwani, Nihad A Almasri, Joseph Uy Almazan, Hesham M Al-Mekhlafi, Omar Almidani, Amr Almobayed, Khaldoon Aied Alnawafleh, Hasan Yaser Alniss, Margret Beaula Alocious Sukumar, Mahmoud A Alomari, Mohammad R Alosta, Jaber S Alqahtani, Saleh A Alqahtani, Mohammad R Alqudimat, Ahmad Rajeh Al-Qudimat, Intima Alrimawi, Sahel Majed Alrousan, Salman Khalifah Al-Sabah, Mohammed A Alsabri, Zaid Altaany, Awais Altaf, Alaa B Al-Tammemi, Jaffar A Al-Tawfiq, Malik A Althobiani, Khalid A Altirkawi, Javier Alvarez-Galvez, Nelson Alvis-Guzman, Nelson J Alvis-Zakzuk, Hassan Alwafi, Mohammad Al-Wardat, Yaser Mohammed Al-Worafi, Hany Aly, Mohammad Sharif Ibrahim Alyahya, Hosam Alzahrani, Karem H Alzoubi, Adel Sharaf Al-Zubairi, Ekiyor Joseph Amafah, Joy Amafah, Reza Amani-Beni, Faten Amer, Bardia Amidi, Amr Amin, Tarek Tawfik Amin, Alireza Amindarolzarbi, Saeed Amini, Ehsan Amini-Salehi, Majid Aminzare, Sohrab Amiri, Joanne O Amlag, Dickson A Amugsi, Ganiyu Adeniyi Amusa, Filippos Anagnostakis, Roshan A Ananda, Nazanin Anaraki, Robert Ancuceanu, Deanna Anderlini, David B Anderson, Nguyen Hoang Anh, Abdul-Azeez Adeyemi Anjorin, Samuel Egyakwa Ankomah, Kabilan Annadurai, Sumbul Ansari, Alireza Ansari-Moghaddam, Catherine M Antony, Ernoiz Antriyandarti, Boluwatife Stephen Anuoluwa, Iyadunni Adesola Anuoluwa, Saeid Anvari, Saleha Anwar, Sumadi Lukman Anwar, Razique Anwer, Shahnawaz Anwer, Anayochukwu Edward Anyasodor, Francis Appiah, Juan Pablo Arab, Hossein Arabi, Jalal Arabloo, Mosab Arafat, Daniel T Araki, Aleksandr Y Aravkin, Demelash Areda, Getnet Mesfin Aregu, Jorge Arias de la Torre, Ghazal Arjmand, Benedetta Armocida, Johan Ärnlöv, Jesu Arockiaraj, Mahwish Arooj, Anton A Artamonov, Ashokan Arumugam, Deepavalli Arumuganainar, Umesh Raj Aryal, Nurila Aryntayeva, Mahsa Asadi Anar, Muhammad Asaduzzaman, Syed Mohammed Basheeruddin Asdaq, Mulusew Andualem A Asemahagn, Mulu Tiruneh Asemu, Saeed Asgary, Mohammad Asghari-Jafarabadi, Syed Amir Ashraf, Tahira Ashraf, Mitra Ashrafi, Milad Ashrafizadeh, Bernard Kwadwo Yeboah Asiamah-Asare, Saeed Aslani, Yuni Asri, Batyrbek Assembekov, Seyyed Shamsadin Athari, Alok Atreya, Julie Alaere Atta, Zeenah A Atwan, Khursheed Aurangzeb, Marcel Ausloos, Abolfazl Avan, Núbia Carelli Pereira Avelar, Sana Javaid Awan, Adedapo Wasiu Awotidebe, Lemessa Assefa A Ayana, Haleh Ayatollahi, Yusuf Oloruntoyin Ayipo, Seyed Mohammad Ayyoubzadeh, Sina Azadnajafabad, Arian Azadnia, James Mba Azam, Alireza Azarboo, Zelalem Nigussie Azene, Gulrez Shah Azhar, Amirali Azimi, Farya Azimi, Mohd Yusmaidie Aziz, Sadat Abdulla Aziz, Amin Azizan, Ahmed Y Azzam, Giridhara Rathnaiah Babu, Youngoh Bae, Arvind Bagga, Nasser Bagheri, Sara Bagheri, Elahe Baghizadeh, Fereshteh Baghizadeh, Sana Baghizadeh, Khlood K Baghlaf, Najmeh Bahmanziari, Ruhai Bai, Mohamed Ibrahem Baklola, Abdulaziz T Bako, Wondu Feyisa Balcha, Maher Balkis, Jose Balmori-de-la-Miyar, Mohammadreza Balooch Hasankhani, Ovidiu Constantin Baltatu, Soham Bandyopadhyay, Palash Chandra Banik, Noel C Barengo, Suzanne Lyn Barker-Collo, Hiba Jawdat Barqawi, Amadou Barrow, Sandra Barteit, Lingkan Barua, MD Abu Bashar, Shahid Bashir, Guido Basile, Rehana Basri, Quique Bassat, Mohammad-Mahdi Bastan, Abdul-Monim Batiha, Kavita Batra, Matteo Bauckneht, Mahdis Bayat, Mohammad Amin Bayat Tork, Thomas Beaney, Neeraj Bedi, Narasimha M Beeraka, Massimiliano Beghi, Jina Behjati, Bezawit K Bekele, Almaz Nibret Belay, Demeke Mesfin Belay, Asnake Gashaw Belayneh, Melesse Belayneh, Abel Cherkos Belete, Gokce Belge Bilgin, Muhammad Bashir Bello, Olorunjuwon Omolaja Bello, Umar Muhammad Bello, Luis Belo, Apostolos Beloukas, Riyad Bendardaf, Isabela M Bensenor, Samiun Nazrin Bente Kamal Tune, Maria Bergami, Alemshet Yirga Berhie, Abiye Assefa Berihun, Amiel Nazer C Bermudez, Robert S Bernstein, Gregory J Bertolacci, Paola Bertuccio, Paulo J G Bettencourt, Ajeet Singh Bhadoria, Akshaya Srikanth Bhagavathula, Neeraj Bhala, Buna Bhandari, Kayleigh Bhangdia, Charmi Bhanushali, Nikha Bhardwaj, Pankaj Bhardwaj, Ashish Bhargava, Sonu Bhaskar, Anup Bhat, Priyadarshini Bhattacharjee, Shuvarthi Bhattacharjee, Gurjit Kaur Bhatti, Jasvinder Singh Bhatti, Mohiuddin Ahmed Bhuiyan, Zulfiqar A Bhutta, Soumitra S Bhuyan, Haoran Bi, Sibhatu Kassa Biadgilign, Raluca Bievel-Radulescu, Naif Kandash Binsaleh, Catherine Bisignano, Atanu Biswas, Bijit Biswas, Mohammad Shahangir Biswas, Ahmad Naoras Bitar, Molalegne Bitew, Bruno Bizzozero-Peroni, Tone Bjørge, Virginia Bodolica, Eyob Ketema Bogale, Lucimere Bohn, Obasanjo Afolabi Bolarinwa, Paria Bolourinejad, Aime Bonny, Sri Harsha Boppana, Hamed Borhany, Mina Borran, Sudipta Bose, Samuel Adolf Bosoka, Alejandro Botero Carvajal, Soufiane Boufous, Christopher Boxe, Dejana Braithwaite, Luisa C Brant, Michael Brauer, Nicholas J K Breitborde, Susanne Breitner, Hermann Brenner, Edmond D Brewer, Maria L Bringas Vega, Julie Brown, Annie J Browne, Traolach Brugha, Raffaele Bugiardini, Norma B Bulamu, Tsion Samuel Bunare, Danilo Buonsenso, Richard A Burns, Akeem Olayinka Busari, Felix Busch, Yasser Bustanji, Nadeem Shafique Butt, Zahid A Butt, Sanjay C J, Tianji Cai, Rose Cairns, Mehtap Çakmak Barsbay, Daniela Calina, Luis Alberto Cámera, Luciana Aparecida Campos, Ismael Campos-Nonato, Fan Cao, Si Cao, Angelo Capodici, Rosario Cárdenas, Giulia Carreras, Juan Jesus Carrero, Andrea Carugno, Andre F Carvalho, Felix Carvalho, Márcia Carvalho, Ana Paula Carvalho-e-Silva, Joao Mauricio Castaldelli-Maia, Carlos A Castañeda-Orjuela, Giulio Castelpietra, Ferrán Catalá-López, Alberico L Catapano, Maria Sofia Cattaruzza, Luca Cegolon, Francieli Cembranel, Muthia Cenderadewi, Kelly M Cercy, Ester Cerin, Pamela Roxana Chacón-Uscamaita, Chiranjib Chakraborty, Sandip Chakraborty, Joht Singh Chandan, Rama Mohan Chandika, Miyuru Chandradasa, Baskaran Chandrasekaran, Vijay Kumar Chattu, Victoria Chatzimavridou-Grigoriadou, Anis Ahmad Chaudhary,

Sirshendu Chaudhuri, Akhilanand Chaurasia, An-Tian Chen, Catherine S Chen, Guangjin Chen, Haiyan Chen, Hana Chen, Haowei Chen, Hui Chen, Rucheng Chen, Shanquan Chen, Simiao Chen, Xiang Chen, Haojin Cheng, Ka Ching Cheung, Nicholas WS Chew, Gerald Chi, Fatemeh Chichagi, Izumi Chihara, Odgerel Chimed-Ochir, Patrick R Ching, Jesus Lorenzo Chirinos-Caceres, Daniel Youngwhan Cho, William C S Cho, Bryan Chong, Yuen Yu Chong, Hou In Chou, Enayet Karim Chowdhury, Sreshtha Chowdhury, Hanne Christensen, Ting-Wu Chuang, Isaac Sunday Chukwu, Erin Chung, Sheng-Chia Chung, Sunghyun Chung, Muhammad Chutiyami, Arrigo Francesco Giuseppe Cicero, Cain C T Clark, Fred Cohen, Alyssa Columbus, Joao Conde, Stephen E Congly, Nathalie Conrad, Leslie Trumbull Cooper, Alexandru Corlateanu, Samuele Cortese, Paolo Angelo Cortesi, Claudia Cosma, Ewerton Cousin, Emma Johnson Cowart, Michael H Criqui, Andrew Crist, Jessica A Cruz, Natalia Cruz-Martins, Xiaolin Cui, Garland T Culbreth, Patricia Cullen, Matthew Cunningham, Nour Dababo, Ali Dabbagh, Omid Dadras, Tukur Dahiru, Xiaochen Dai, Zhaoli Dai, Mayank Dalakoti, Koustuv Dalal, Gloria Dalla Costa, Emanuele D'Amico, Roy Arokiam Daniel, Lucio D'Anna, Pojsakorn Danpanichkul, Samuel E Danso, Samuel Demissie Darcho, Latefa Ali Dardas, Chengetai Dare, Bahar Darouei, Reza Darvishi Cheshmeh Soltani, Sayan Kumar Das, Claudio Alberto Dávila-Cervantes, Nicole Davis Weaver, Dimash Davletov, Kairat Davletov, Fernando Pio De la Hoz, Alejandro de la Torre-Luque, Edward Christopher Dee, Sindhura Deekonda, Amanda Deen, Louisa Degenhardt, Paria Dehesh, Pouria Delbari, Laura Delgado-Ortiz, Mohammad Delsoz, Andreas K Demetriades, Edgar Denova-Gutiérrez, Tadios Niguss Derese, Ismail Dergaa, Kebede Deribe, Hunegnaw Almaw Derseh, Nikolaos Dervenis, Emina Dervišević, Hardik Dineshbhai Desai, Abraham Aregay Desta, Vinoth Gnana Chellaiyan Devanbu, Pradeep Kumar Devarakonda, Syed Masudur Rahman Dewan, Arkadeep Dhali, Kuldeep Dhama, Sreedhar Dharmagadda, Mandira Lamichhane Dhimal, Meghnath Dhimal, Bibha Dhungel, Marcello Di Pumpo, Diana Dias da Silva, Daniel Diaz, Luis Antonio Diaz, Kimia Didehvar, Elangovan Dilipan, Lauren K Dillard, Xueting Ding, Saeid Doaei, Sushil Dohare, Klara Georgieva Dokova, Mario D'Oria, Fariba Dorostkar, E Ray Dorsey, Ojas Prakashbhai Doshi, Leila Doshmangir, Robert Kokou Dowou, Menayit Tamrat Dresse, Tim Robert Driscoll, Ashel Chelsea Dsouza, Jiang Du, John Dube, Judy R Dubno, Emeka W Dumbili, Samuel C Dumith, Bruce B Duncan, Andre Rodrigues Duraes, Oyewole Christopher Durojaiye, Ashit Kumar Dutta, Siddhartha Dutta, Sulagna Dutta, Osamudiamen Ebohon, Ejemai Eboreime, Lamiaa Labieb Mahmoud Ebraheim, Alireza Ebrahimi, Mohammad Hossein Ebrahimi, Abdelaziz Ed-Dra, David Edvardsson, Ferry Efendi, Behrad Eftekhari, Foolad Eghbali, Ashkan Eighaei Sedeh, Terje Andreas Eikemo, Ebrahim Eini, Michael Ekholuenetale, Temitope Cyrus Ekundayo, Rabie Adel El Arab, Abdelfatteh EL Omri, Maysaa El Sayed Zaki, Mohamed Ahmed Eladl, Reza Elahi, Said El-Ashker, Rana Elbeshbeishy, Noha Mousaad Elemam, Ghada Metwally Tawfik ElGohary, Muhammed Elhadi, Mohamed Elhoumed, Waseem El-Huneidi, Omar Abdelsadek Abdou Elmeligy, Mohamed A Elmonem, Rami Elmorsi, Mohamed Hassan Elnaem, Gihan ELNahas, Mohammed Elshaer, Ibrahim Elsohaby, Abdelgawad Salah Eltahawy, Tadele Emagneneh, Misganu Endriyas, Ryenchindorj Erkhembayar, Christopher Imokhuede Esezobor, Derese Eshetu, Majid Eslami, Narges Eslami, Rafaela Cavalheiro do Espírito Santo, Kara Estep, Oghenowede Eyawo, Ugochukwu Anthony Eze, Elochukwu Ezenwankwo, Heidar Fadavian, Adeniyi Francis Fagbamigbe, Omotayo Francis Fagbule, Ayesha Fahim, Saman Fahimi, Aamir Fahira, Ildar Ravisovich Fakhradiyev, Aliasghar Fakhri-Demeshghieh, Luca Falzone, Qiping Fan, Mohammad Farahmand, Ali Faramarzi, Mohammad Fareed, Zaki Farhana, Liliana Faria, Carla Sofia e Sá Farinha, MoezAlIslam Ezzat Mahmoud Faris, Andre Faro, Syed Muhammad Yousaf Farooq, Hossein Farrokhpour, Fatemeh Farshad, Farima Farsi, Folorunso Oludayo Fasina, Modupe Margaret Fasina, Ali Fatehizadeh, Davood Fathi, Zareen Fatima, Mohammad Fayaz, Pooria Fazeli, Valery L Feigin, Alireza Feizkhah, Gelana Fekadu, Ginenus Fekadu, Ulrich Membe Femoe, Talukdar Raian Ferdous, Seyed-Mohammad Fereshtehnejad, Rodrigo Fernandez-Jimenez, Pietro Ferrara, Alize J Ferrari, Nuno Ferreira, Getahun Fetensa, Bikila Regassa Feyisa, Alexander Finnemore, Claudio Fiorilla, Florian Fischer, Ida Fitriana, Federica Fogacci, Morenike Oluwatoyin Folayan, Artem Alekseevich Fomenkov, Marco Fonzo, Lisa M Force, Daniela Fortuna, Matteo Foschi, Maryam Fotouhi, Kayode Raphael Fowobaje, Richard Charles Franklin, Alberto Freitas, Jinming Fu, Takeshi Fukumoto, Ami Fukunaga, John E Fuller, Sridevi G, Peter Andras Gaal, Muktar A Gadanya, Dominic Dormenyo Gadeka, Lebo Francina Gafane-Matemane, Mário Gajdács, Yaseen Galali, Dinara Galiyeva, Silvano Gallus, Dhanraj Ganapathy, Balasankar Ganesan, Shivaprakash Gangachannaiah, Xiang Gao, Yijie Gao, Bashiru Garba, Miguel Garcia-Argibay, David Garcia-Azorin, William M Gardner, Wendy Paola Gastélum Espinoza, Zisis Gatzioufas, Prem Gautam, Rupesh K Gautam, Bamba Gaye, Hong-Han Ge, Feven Sahle Gebre, Miglas Welay Gebregergis, Mesfin Gebrehiwot, Miesa Gelchu, Stefano Gelibter, Nsikakabasi Samuel George, Lemma Getacher, Genanew K Getahun, Kalab Yigermal Gete, Peter W Gething, Keyghobad Ghadiri, Fataneh Ghadirian, Amir Ghaffari Jolfayi, Arin Ghamkhar, Shakiba Ghasemi Assl, Fariba Ghassemi, Ramy Mohamed Ghazy, Sama Ghoba, Maryam Gholamalizadeh, Zainab Gholami, Nasim Gholizadeh, Zeinab Ghorbani, Elena Ghotbi, Arun Ghuge, Alessandro Gialluisi, Konstantinos Giannakis, Syed Abdullah Gilani, Tiffany K Gill, Bikash Ranjan Giri, Alem Abera Girmay, Alessandro Girombelli, Laszlo Göbölös, Anil Kumar Goel, Archit Goel, Rajesh Kumar Goel, Lay Hoon Goh, Kimiya Gohari, Mahaveer Golechha, Ali Golestani, Davide Golinelli, Melika Golmohammadi, Wenping Gong, Alessandra C Goulart, Ayman Grada, Simon Matthew Graham, Michal Grivna, Shi-Yang Guan, Giovanni Guarducci, Mohammed Ibrahim Mohialdeen Gubari, Mesay Dechasa Gudeta, Avirup Guha, Stefano Guicciardi, Sheffali Gulati, Sasidhar Gunturu, Cui Guo, Xingzhi Guo, Zhaoyu Guo, Zhifeng Guo, Bhawna Gupta, Gaurav Gupta, Lalit Gupta, Rajeev Gupta, Reyna Alma Gutiérrez, Roberth Steven Gutiérrez-Murillo, Jose Guzman-Esquivel, Abrham Tesfaye Habteyes, Awoke Derbie Habteyohannes, Tesfahun Simon Hadaro, Najah R Hadi, Zahra Hadian, Abdul Hafiz, Sarah Hafsia, Faraidoon Haghdoost, Arian Haghtalab, Nguyen Hai Nam, Addisalem Haile, Demewoz Haile, Pritam Halder, Sebastian Haller, Rabih Halwani, Kosar Hikmat Hama Aziz, Islam M Hamad, Randah R Hamadeh, Samer Hamidi, Erin B Hamilton, Ahmad Hammoud, Chieh Han, Hannah Han, Asif Hanif, Nasrin Hanifi, Graeme J Hankey, Fahad Hanna, Ashanul Haque, Md Nuruzzaman Haque, Obaid I Haque, Arief Hargono, Andy Martahan Andreas Hariandja, Josep Maria Haro, Ashley Ann Harris, Ahmed I Hasaballah, Faizul Hasan, Md Kamrul Hasan, Towhid Hasan, Hamidreza Hasani, Ali Hasanpour- Dehkordi, Mohammad Hashem Hashempur, Nada Tawfig Hashim, Ammarah Hasnain, Abbas M Hassan, Amr Hassan, Ibrahim Nagmeldin Hassan, Ikrama Hassan, Nageeb Hassan, Omed Hassan Ahmed, Yusuf Hassan Wada, Mahgol Sadat Hassan Zadeh Tabatabaei, Soheil Hassanipour, Lasanthi Wathsala Hathagoda, Johannes Haubold, Rasmus J Havmoeller, Simon I Hay, Youssef Hbid, Jiawei He, Jeffrey J Hebert, Golnaz Heidari, Mohammad Heidari, Mojtaba Heydari, Kamal Hezam, Yuta Hiraike, Nobuyuki Horita, Alamgir Hossain, Lubna Hossain, Md Belal Hossain, Md Mahbub Hossain, Md Sabbir Hossain, Mohammad Bellal Hossain, Fatemeh Sadat Hosseini, Mehdi Hosseinzadeh, Mihaela Hostiuc, Sorin Hostiuc, Peter J Hotez, Priya Hotwani, Hanno Hoven, Chengxi Hu, Yifei Hu, Junjie Huang, Weijun Huang, Yefei Huang, Yuting Huang, Zhenyao Huang, Mega Hasanul Huda, Ayesha Humayun, Waqar Husain, Kiavash Hushmandi, Javid Hussain, Nawfal R Hussein, Mohamed Ibrahim Husseiny, Luigi Francesco Iannone, Segun Emmanuel Ibitoye, Khalid S Ibrahim, Ramzi Ibrahim, Reem Ibrahim, Umar Idris Ibrahim, Anel Ibrayeva, Fidelia Ida, Kevin S Ikuta, Olayinka Stephen Ilesanmi, Irena M Ilic, Milena D Ilic, Muhammad Hamza Ilyas, Mohammad Tarique Imam,

Masoud Imani, Lucius Chidiebere Imoh, Arit Inok, Meesha Iqbal, Mujahid Iqbal, Lalu Muhammad Irham, Mustafa Alhaji Isa, Benni Iskandar, Teresa R Iskander, Md Rabiul Islam, Md Shahinul Islam, Md Shariful Islam, Sheikh Mohammed Shariful Islam, Farhad Islami, Faisal Ismail, Nahlah Elkudssiah Ismail, Yerlan Ismoldayev, Gaetano Isola, Masao Iwagami, Ihoghosa Osamuyi Iyamu, Vinothini J, Jalil Jaafari, Louis Jacob, Kathryn H Jacobsen, Ali Jadidi, Farhad Jadidi-Niaragh, Mohammadsadegh Jafari, Morteza Jafarinia, Abdollah Jafarzadeh, Shabbar Jaffar, Haitham Jahrami, Ammar Abdulrahman Jairoun, Vikash Jaiswal, Sanobar Jaka, Mihajlo Jakovljevic, Reza Jalilzadeh Yengejeh, Mohamed Jalloh, Armaan Jamal, Qazi Mohammad Sajid Jamal, Jazlan Jamaluddin, Jerin James, Hasan Jamil, Safayet Jamil, Roland Dominic G Jamora, Masoud Jamshidi, Shaghayegh JamshidiRastabi, Rajiv Janardhanan, Chinmay T Jani, Esmaeil Jarrahi, Tahereh Javaheri, Syed Sarmad Javaid, Anita Javanmardi, Javad Javidnia, Talha Jawaid, Qassim Jawell Odah Abed, Sathish Kumar Jayapal, Shubha Jayaram, Ruwan Duminda Jayasinghe, Yovanthi Anurangi Jayasinghe, Sun Ha Jee, Jayakumar Jeganathan, Diptismita Jena, Seogsong Jeong, Bijay Mukesh Jeswani, Vivekanand Jha, John S Ji, Min Jiang, Wenyi Jin, Nabi Jomehzadeh, Jost B Jonas, Tamas Joo, Abu Jor, Abel Joseph, Nitin Joseph, Meha Joshi, George Joy, Jacek Jerzy Jozwiak, Mikk Jürisson, Vaishali K, Billingsley Kaambwa, Ali Kabir, Zubair Kabir, Rajendra Kadel, Dler H Hussein Kadir, Ashish Kumar Kakkar, Pradnya Vishal Kakodkar, Rizwan Kalani, Khalil Kalavani, Feroze Kaliyadan, Sanjay Kalra, Md Moustafa Kamal, Mehnaz Kamal, Sivesh Kathir Kamarajah, Rajesh Kamath, Saltanat Kamenova, Arun Kamireddy, Ramat T Kamorudeen, Devanish Narasimhasanth Kamtam, Naser Kamyari, Oleksandr Kamyshnyi, Mona Kanaan, Saddam Fuad Kanaan, Jiseung Kang, Kehinde Kazeem Kanmodi, Suthanthira Kannan S, Rami S Kantar, Debasish Kar, Sujita Kumar Kar, Paschalis Karakasis, Jafar Karami, Reema A Karasneh, Mohammad Amin Karimi, Salah Eddin Karimi, Arman Karimi Behnagh, Mohmed Isaqali Karobari, Tomasz M Karpiński, Adarsh Katamreddy, Joonas H Kauppila, Kanica Kaushal, Foad Kazemi, Nastaran Kazemi Rad, Sina Kazemian, Hafte Kahsay Kebede, Yabets Tesfaye Kebede, Tibebeselassie S Keflie, Swetha N Kempegowda, Salima Kerai, Jessica A Kerr, Vikash Ranjan Keshri, Kamyab Keshtkar, Emmanuelle Kesse-Guyot, Reza Khademi, Yousef Saleh Khader, Sidra Khalid, Hazim O Khalifa, Anas Husam Khalifeh, Anees Ahmed Khalil, Anita Khalili, Pantea Khalili, Alireza Khalilian, Ghazaleh Khalili-Tanha, Mohamed Khalis, Faham Khamesipour, Ajmal Khan, Fayaz Khan, Gulfaraz Khan, Iman Waheed Khan, Maseer Khan, Md Abdullah Saeed Khan, Mohammad Jobair Khan, Muhammad Hamza Khan, Muhammad Mueed Khan, Muhammad Umair Khan, Muhammad Umer Khan, Salman Ali Khan, Serab Khan, Sumaiya Khan, Ubaid Khan, Yusuf Saleem Khan, Zahid Khan, Vishnu Khanal, Shaghayegh Khanmohammadi, Sameer Uttamaro Khasbage, Zenith Khashim, Khaled Khatab, Haitham Khatatbeh, Moawiah Mohammad Khatatbeh, Mahalaqua Nazli Khatib, Kavin Khatri, Hamid Reza Khayat Kashani, Khalid A Kheirallah, Sunil Kumar Khokhar, Najmaddin Salih Husen Khoshnaw, Atulya Aman Khosla, Ardeshir Khosravi, Farbod Khosravi, Sepehr Khosravi, Mahmood Khosrowjerdi, P Ratan Khuman, Zemene Demelash Kifle, Hye Jun Kim, Jinho Kim, Kwanghyun Kim, Min Seo Kim, Yun Jin Kim, Ruth W Kimokoti, Tadele Kinati, Yohannes Kinfu, Sanjay Kini B, Mary Kirk, Adnan Kisa, Sezer Kisa, Katarzyna Kissimova-Skarbek, Tegene Atamenta Kitaw, Mika Kivimäki, Abdul Basith KM, Shivakumar KM, Ann Kristin Skrindo Knudsen, Nazarii Kobyliak, Jonathan M Kocarnik, Sonali Kochhar, Prakash Babu Kodali, Michail Kokkorakis, Ali-Asghar Kolahi, Diana Gladys Kolieghu Tcheumeni, Kairi Kolves, Joyce Komesuor, Farzad Kompani, Aida Kondybayeva, Isaac Koomson, Gerbrand Koren, Tapos Kormoker, Vladimir Andreevich Korshunov, Oleksii Korzh, Soewarta Kosen, Karel Kostev, Parvaiz A Koul, Irene Akwo Kretchy, James-Paul Kretchy, Kewal Krishan, Chong-Han Kua, Ananya Kuanar, Barthelemy Kuate Defo, Mohammed Kuddus, Ilari Kuitunen, Mukhtar Kulimbet, Shweta Kulshreshtha, Dewesh Kumar, Dhasarathi Kumar, Jogender Kumar, Kamal Kumar, Mukesh Kumar, Nitesh Kumar, Nithin Kumar, Tarun Kumar, Tushar Kumar, Vijay Kumar, Vikash Kumar, Subramanian Kumaran, Jibin Kunjavara, Setor K Kunutsor, Almagul Kurmanova, Om P Kurmi, Maria Dyah Kurniasari, Krishna Prasad Kurpad, Asep Kusnali, Christina Yeni Kustanti, Dian Kusuma, Tezer Kutluk, Assylkhan Kuttybayev, Evans F Kyei, Grace Kwakyewaa Kyei, Frank Kyei-Arthur, Ville Kytö, Pallavi L C, Adriano La Vecchia, Carlo La Vecchia, Alessio Lachi, Muhammad Awwal Ladan, Abraham K Lagat, Chandrakant Lahariya, Daphne Teck Ching Lai, Balzhan Lakanova, Anita Lakhani, Tea Lallukka, Judit Lám, Iván Landires, Berthold Langguth, Ariane Laplante-Lévesque, Laura Lara-Castor, Savita Lasrado, Kamaluddin Latief, Areeba Latif, Mahrukh Latif, Jerrald Lau, Paolo Lauriola, Aliyu Lawan, Teniola Lawanson, Harriet L S Lawford, Eilean Rathinasamy Lazarus, Dai Quang Le, Duc Tin Le, Thao Thi Thu Le, Caterina Ledda, Ivan Lee, Paul H Lee, Seung Won Lee, Yo Han Lee, James Leigh, Vasileios Leivaditis, Matthew J Lennon, Matilde Leonardi, Elvynna Leong, Negin Letafatkar, Chengfeng Li, Hui Li, Jiaying Li, Jie Li, Ming-Chieh Li, Si Li, Wei Li, Weilong Li, Zhaolong Adrian Li, Zhengrui Li, Yanxue Lian, Chen Liao, Stephen S Lim, Jialing Lin, Queran Lin, Shuzhi Lin, Daniel Lindholm, Christine Linehan, Yuewei Ling, Shai Linn, Haipeng Liu, Jue Liu, Xianliang Liu, Xiaofeng Liu, Xuefeng Liu, Zhe Liu, Zhenyu Liu, Erand Llanaj, Michael J Loftus, Valerie Lohner, José Francisco López-Gil, Platon D Lopukhov, Stefan Lorkowski, Rafael Lozano, Shanjie Luan, Jailos Lubinda, Taraneh Lucas, Giancarlo Lucchetti, Alessandra Lugo, Raimundas Lunevicius, Huaxia Luo, Lisha Luo, Susu Luo, Lei Lv, Miltiadis D Lytras, Ellina Lytvyak, Kevin Sheng-Kai Ma, Zheng Feei Ma, Raymond Saa-Eru Maalman, Kelsey Lynn Maass, Mahmoud Mabrok, Nikolaos Machairas, Monika Machoy, Seyed Ataollah Madinezad, Aurea Marilia Madureira-Carvalho, Pasquale Maffia, Sasikumar Mahalingam, Samatar Abshir Mahamed, Nozad Hussein Mahmood, Shakeel Ahmed Ibne Mahmood, Alireza Mahmoudi, My Tra Mai, Hao Mai Xuan, Rituparna Maiti, Marek Majdan, Abdelrahman M Makram, Omar M Makram, Mohammad-Reza Malekpour, Reza Malekzadeh, Hardeep Singh Malhotra, Ahmad Azam Malik, Farihah Malik, Deborah Carvalho Malta, Mustapha Mangdow, Jyothsna Manikkath, Yosef Manla, Fahmida Mannan, Farheen Mansoor, Marjan Mansourian, Mohammad Ali Mansournia, Lorenzo Giovanni Mantovani, Changkun Mao, Tahir Maqbool, Bishnu P Marasini, Hamid Reza Marateb, Joemer C Maravilla, Adilson Marques, Bernardo Alfonso Martinez-Guerra, Ramon Martinez-Piedra, Daniela Martini, Santi Martini, Francisco Rogerlândio Martins-Melo, Miquel Martorell, Winfried März, Roy Rillera Marzo, Sammer Marzouk, Sugeng Mashudi, Stefano Masi, Yasith Mathangasinghe, Stephanie Mathieson, Alexander G Mathioudakis, Medha Mathur, Neeta Mathur, Rita Mattiello, Richard James Maude, Pallab K Maulik, Miranda L May, Mahsa Mayeli, Mohsen Mazidi, Antonio Mazzotti, Ikechukwu Innocent Mbachu, Martin McKee, Michael A McPhail, Steven M McPhail, Rishi P Mediratta, Jitendra Meena, Medhin Mehari, Riffat Mehboob, Ravi Mehrotra, Vini Mehta, Tesfahun Mekene Meto, Hadush Negash Meles, Addisu Melese, Satish Melwani, Aishe Memetova, Walter Mendoza, Godfred Antony Menezes, Ritesh G Menezes, Emiru Ayalew Mengistie, George A Mensah, Sultan Ayoub Meo, Michelangelo Mercogliano, Atte Meretoja, Tuomo J Meretoja, Tomislav Mestrovic, Chamila Dinushi Kukulege Mettananda, Sachith Mettananda, Mohamed M M Metwally, Adquate Mhlanga, Tomasz Miazgowski, Irmina Maria Michalek, Andrea Michelerio, Hiwot Soboksa Mideksa, Kebadnew Mulatu Mihretie, Ted R Miller, Giuseppe Minervini, Wai-kit Ming, GK Mini, Mojgan Mirghafourvand, Andreea Mirica, Alireza Mirkheshti, Seyed Ali Mirshahvalad, Mizan Kiros Mirutse, Maryam Mirzaei, Archana Mishra, Ashim Mishra, Vinaytosh Mishra, Philip B Mitchell, Sayan Mitra, Chaitanya Mittal, Mohammadreza Mobayen, Madeline E Moberg, Shivani Modi, Ahmed Ismail Mohamed, Heba M Mohamed, Jama Mohamed, Mona Gamal Mohamed, Nouh Saad Mohamed, Khabab Abbasher Hussien Mohamed Ahmed, Taj Mohammad, Abdolreza Mohammadi, Mohammad Reza Mohammadi,

Abdollah Mohammadian-Hafshejani, Ibrahim Mohammadzadeh, Abdulwase Mohammed, Ammas Siraj Mohammed, Hussen Mohammed, Omer Mohammed, Shafiu Mohammed, Suleiman Mohammed, Yahaya Mohammed, Mohammad Mohseni, Tsz-ngai Mok, Amin Mokari-Yamchi, Ali H Mokdad, Sabrina Molinaro, Amirabbas Mollaei, Shaher Momani, Lorenzo Monasta, Amirabbas Monazzami, Himel Mondal, Marco Montalti, Yousef Moradi, Mohammad Moradi-Joo, Maziar Moradi-Lakeh, Paula Moraga, Lidia Morawska, Rafael Silveira Moreira, Mahmoud M Morsy, Reza Mosaddeghi Heris, Jonathan F Mosser, Elias Mossialos, Maha Motavvef, Vincent Mougin, Asma Mousavi, Seyede Zohre Mousavi, Amin Mousavi Khaneghah, Seyed Mohamad Sadegh Mousavi Kiasary, Amanda Movo, Hagar Lotfy Mowafy, Kimia Mozahheb Yousefi, Matías Mrejen, Rabia Mubarak, Sumaira Mubarik, Steward Mudenda, Faraz Mughal, Syed Aun Muhammad, Muhammad Solihuddin Muhtar, Oscar J Mujica, Sukhes Mukherjee, Sumoni Mukherjee, Amartya Mukhopadhyay, M A Muktadir, Sileshi Mulatu, Francesk Mulita, Chalie Mulugeta, Damaris Felistus Mulwa, Javier Muñoz Laguna, Anjana Munshi, Efren Murillo-Zamora, Ali Mushtaq, Mubarak Taiwo Mustapha, Sathish Muthu, Saravanan Muthupandian, Claude Mambo Muvunyi, Woojae Myung, Amin Nabavi, Fatemehzahra Naddafi, Ayoub Nafei, Ahamarshan Jayaraman Nagarajan, Ganesh R Naik, Gurudatta Naik, Firzan Nainu, Sanjeev Nair, Hastyar Hama Rashid Najmuldeen, Noureddin Nakhostin Ansari, Gopal Nambi, Ni Gusti Ayu Nanditha, Vinay Nangia, Jobert Richie Nansseu, Ibrahim A Naqid, Aparna Ichalangod Narayana, Shumaila Nargus, Delaram Narimani Davani, Yvonne Nartey, Bruno Ramos Nascimento, Gustavo G Nascimento, Abdallah Y Naser, Abdulqadir J Nashwan, Hamide Nasiri, Mahmoud Nassar, Zuhair S Natto, Javaid Nauman, Samidi Nirasha Kumari Navaratna, Biswa Prakash Nayak, Shalini Ganesh Nayak, Vinod C Nayak, Shumaila Naz, Athare Nazri-Panjaki, G Takop Nchanji, Sabina Onyinye Nduaguba, Amanuel Tebabal Nega, Meti T Negassa, Chernet Tafere Negesse, Ionut Negoi, Ruxandra Irina Negoi, Alina Gabriela Negru, Chakib Nejjari, Samata Nepal, Olivia D Nesbit, Henok Biresaw Netsere, Marie Ng, Georges Nguefack-Tsague, Josephine W Ngunjiri, Cuong Tat Nguyen, Dang Nguyen, Huong-Dung Thi Nguyen, Nghia Phu Nguyen, The Phuong Nguyen, Van Thanh Nguyen, Ambe Marius Ngwa, Robina Khan Niazi, Luciano Nieddu, Yeshambel T Nigatu, Ali Nikoobar, Vikram Niranjan, Abebe Melis Nisro, Chukwudi A Nnaji, Shuhei Nomura, Syed Toukir Ahmed Noor, Mohammadamin Noorafrooz, Mamoona Noreen, Masoud Noroozi, Jean Jacques Noubiap, Mehran Nouri, Taylor Noyes, Valentine C Nriagu, Chisom Adaobi Nri-Ezedi, Jean Claude Nshimiyimana, Fred Nugen, Mengistu H Nunemo, Nurfatimah Nurfatimah, Dieta Nurrika, Sylvester Dodzi Nyadanu, Felix Kwasi Nyande, Bogdan Oancea, Ramez M Odat, Fabio Massimo Oddi, Ismail A Odetokun, Oluwakemi Ololade Odukoya, Joseph Kojo Oduro, Michael Safo Oduro, Oluwafunmilayo Tosin Ogundeko-Olugbami, Abiola Ogunkoya, Oluwafunmbi Ebenezer Ogunmiluyi, In-Hwan Oh, Sarah Oh, Hassan Okati-Aliabad, Sylvester Reuben Okeke, Deborah Oluwatosin Okeke-Obayemi, Akinkunmi Paul Okekunle, Olalekan John Okesanya, Osaretin Christabel Okonji, Bolanle Adeyemi Ola, Oluwaseyi Isaiah Olabisi, Oladotun Victor Olalusi, Matthew Idowu Olatubi, Arão Belitardo Oliveira, Gláucia Maria Moraes Oliveira, Abdulhakeem Abayomi Olorukooba, Oluseye Olalekan Oludoye, Ronald Olum, Bolajoko Olubukunola Olusanya, Jacob Olusegun Olusanya, Oluwafemi G Oluwole, Folorunsho Bright Omage, Goran Latif Omer, Abidemi E Omonisi, Kanyin Liane Ong, Sandersan Onie, Obinna E Onwujekwe, Oluwaseyi Aina Gbolade Opesemowo, John Nelson Opio, Marcel Opitz, Aksoltan Shyhdurdyevna Oradova, Michal Ordak, Verner N Orish, Raffaele Ornello, Atakan Orscelik, Alberto Ortiz, Esteban Ortiz-Prado, Augustus Osborne, Samuel M Ostroff, John W Ostrominski, Uchechukwu Levi Osuagwu, Olayinka Osuolale, Elham H Othman, Adrian Otoiu, Abdu Oumer, Jerry John Ouner, Amel Ouyahia, Mayowa O Owolabi, Irene Amoakoh Owusu, Oladayo Ayobami Oyebanji, Kolapo Oyebola, Tope Oyelade, Kehinde Adewole Oyeniran, Oyetunde T Oyeyemi, Ilker Ozsahin, Mahesh P A, Kevin Pacheco-Barrios, Alicia Padron-Monedero, Jagadish Rao Padubidri, Dimpal Manilal Paija, Anton Pak, Yeganeh Pakbaz, Pramod Kumar Pal, Tamás Palicz, Raffaele Palladino, Tejasri Paluvai, Feng Pan, Sujogya Kumar Panda, Songhomitra Panda-Jonas, Deepshikha Pande Katare, Seithikurippu R Pandi-Perumal, Victoria Pando-Robles, Apurvakumar Pandya, Helena Ullyartha Pangaribuan, Georgios D Panos, Leonidas D Panos, Ioannis Pantazopoulos, Anca Pantea Stoian, Giovanni Paolino, Mario Virgilio Papa, Ilias Papadimopoulos, Paraskevi Papadopoulou, Peyvand Parhizkar Roudsari, Romil R Parikh, Chulwoo Park, Seoyeon Park, Arpit Parmar, Roberto Passera, Jay Patel, Mitesh Patel, Neel Navinkumar Patel, Sangram Kishor Patel, Satyananda Patel, Bharat Smita Umakant Patil, Shankargouda Patil, Dimitrios Patoulias, Apurba Patra, Venkata Suresh Patthipati, Shrikant Pawar, Shubhadarshini Pawar, Hamidreza Pazoki Toroudi, Neil Pearce, Amy E Peden, Paolo Pedersini, Jarmila Pekarcikova, Louise Penberthy, Veincent Christian Filipino Pepito, Emmanuel K Peprah, Prince Peprah, João Perdigão, Gavin Pereira, Gladymar Perez Chacon, Arokiasamy Perianayagam, Norberto Perico, Simone Perna, Konrad Pesudovs, Pavlo Petakh, Ionela-Roxana Petcu, Olumuyiwa James Peter, Fanny Emily Petermann-Rocha, William A Petri, Hoang Nhat Pham, Hoang Tran Pham, Tung Thanh Pham, Anil K Philip, Michael R Phillips, Zahra Zahid Piracha, Edoardo Pirera, Moein Piroozkhkah, Saeed Pirouzpanah, Enrico Pisoni, Evgenii Plotnikov, Indrashis Podder, Dimitri Poddighe, Roman V Polibin, Ramesh Poluru, Arjun Pon Avudaiappan, Ville T Ponkilainen, Ion Popa, Djordje S Popovic, Thantrira Porntaveetus, Sajjad Pourasghary, Reza Pourbabaki, Farzad Pourghazi, Naeimeh Pourtaheri, Sergio I Prada, Jalandhar Pradhan, Rifky Octavia Pradipta, Akila Prashant, Elton Junio Sady Prates, Natalie Pritchett, Harsh Priya, Nicola Riccardo Pugliese, Jagadeesh Puvvula, Nameer Hashim Qasim, Ibrahim Qattea, Xiang Qi, Zhipeng Qi, Yanan Qiao, Zahiruddin Syed Quazi, Navid Rabiee, Reza Rabiei, Basuki Rachmat, Raghu Anekal Radhakrishnan, Venkatraman Radhakrishnan, Maja R Radojčić, Negar Radpour, Hadi Raeisi Shahraki, Lida Rafati, Ibrar Rafique, Pracheth Raghuveer, Fakher Rahim, Hawbash Mohammed-Amin Rahim, Sajjad Rahimi, Vafa Rahimi-Movaghar, Fryad Majeed Rahman, Mahbubur Rahman, Md Mosfequr Rahman, Mohammad Hifz Ur Rahman, Mohammad Meshbahur Rahman, Mosiur Rahman, Amir Masoud Rahmani, Saeed Rahmani, Masoud Rahmati, Ghasem Rahmatpour Rokni, Hakim Rahmoune, Diego Raimondo, Ivano Raimondo, Sunil Kumar Raina, Jeffrey Pradeep Raj, Adarsh Raja, Sathish Rajaa, Erta Rajabi, Gunaseelan Rajendran, Judah Rajendran, Vinoth Rajendran, Shaman Rajindrajith, Pushp Lata Rajpoot, Prashant Rajput, Mahmoud Mohammed Ramadan, Majed Ramadan, Kadar Ramadhan, Chitra Ramasamy, Shakthi Kumaran Ramasamy, Zahra Ramezani, Marzieh Ramezani Farani, Robinson Ramírez-Vélez, Juwel Rana, Kirtan Rana, Shailendra Singh Rana, Chhabi Lal Ranabhat, Nemanja Rancic, Smitha Rani, Fatemeh - Ranjbar Noei, Chythra R Rao, Kumuda Rao, Mithun Rao, Davide Rasella, Sina Rashedi, Vahid Rashedi, Mamunur Rashid, Mohammad-Mahdi Rashidi, Mohammad Aziz Rasouli, Ashkan Rasouli-Saravani, Azad Rasul, Devarajan Rathish, Abdur Rauf, Santosh Kumar Rauniyar, Ilari Rautalin, Ramin Ravangard, David Laith Rawaf, Lal Rawal, Reza Rawassizadeh, Bahman Razi, C Mahony Reategui-Rivera, Elrashdy Redwan, Aqeeb Ur Rehman, Faizan Ur Rehman, Wajiha Rehman, Lennart Reifels, Rainer Reile, Giuseppe Remuzzi, Bhageerathy Reshmi, Stefano Restaino, Luis Felipe Reyes, Mina Rezaei, Nazila Rezaei, Nima Rezaei, Mohsen Rezaeian, Donya Rezazadeh Eidgahi, Taeho Gregory Rhee, Yohanes Andy Rias, Antonio Luiz P Ribeiro, Tércia Moreira Ribeiro da Silva, Jennifer Rickard, Moattar Raza Rizvi, Hannah Elizabeth Robinson-Oden, Hermano Alexandre Lima Rocha, João Rocha Rocha-Gomes, Mónica Rodrigues, Thales Philipe Rodrigues da Silva, Jefferson Antonio Buendia Rodriguez, Leonardo Roever, Peter Rohloff, Iftitakhur Rohmah, Susanne Röhr, David Rojas-Rueda, Megan L Rolfzen, Debby Syahru Romadlon, Michele Romoli, Luca Ronfani, Kevin T Root, Emily Rosenblad, Amirhossein Roshanshad, Morteza Rostamian, Gregory A Roth, Kunle Rotimi, Himanshu Sekhar Rout, Hanieh Rouzbahani,

Reza Rouzbahani, Jemma V Rowlands, Adrija Roy, Bedanta Roy, Priyanka Roy, Sharmistha Roy, Shubhanjali Roy, Simanta Roy, Parameswari Royapuram Parthasarathy, Enrico Rubagotti, Susan Fred Rumisha, Michele Russo, Godfrey Mutashambara Rwegerera, Aly M A Saad, Michela Sabbatucci, Maha Mohamed Saber-Ayad, Siamak Sabour, Perminder S Sachdev, Seyed Kiarash Sadat Rafiei, Basema Ahmad Saddik, Bashdar Abuzed Sadee, Tarannom Sadegh, Ehsan Sadeghi, Erfan Sadeghi, Fatemeh Sadeghi-Ghyassi, Mohd Saeed, Umar Saeed, Maryam Saeedi, Mahdi Safdarian, Sare Safi, Sher Zaman Safi, Rajesh Sagar, Mastooreh Sagharichi, Amene Saghazadeh, Dominic Sagoe, Indranil Saha, Nondo Saha, Fatemeh Saheb Sharif-Askari, Narjes Saheb Sharif-Askari, Amirhossein Sahebkar, Kirti Sundar Sahu, Zahra Saif, S Mohammad Sajadi, Md Refat Uz Zaman Sajib, Mirza Rizwan Sajid, Dorsa Salabat, Payman Salamati, Luciane B Salaroli, Mohamed A Saleh, Leili Salehi, Mahdi Salehi, Marwa Rashad Salem, Mohammed Z Y Salem, Aanuoluwa James Salemcity, Dauda Salihu, Sohrab Salimi, Malik Sallam, Hossein Samadi Kafil, Jayami Eshana Samaranayake, Saad Samargandy, Waqas Sami, Yoseph Leonardo Samodra, Abdallah M Samy, Sandeep G Sangle, Elaheh Sanjari, Sathish Sankar, Francesco Sanmarchi, Francesca Sanna, Damian F Santomauro, Itamar S Santos, Lucas H C C Santos, Milena M Santric-Milicevic, Adekunle Sanyaolu, Bruno Piassi Sao Jose, Krishna Prasad Sapkota, Sivan Yegnanarayana Iyer Saraswathy, Yaser Sarikhani, Hemen Sarma, Mohammad Sarmadi, Gargi Sachin Sarode, Sachin C Sarode, Benn Sartorius, Arash Sarveazad, Michele Sassano, Mukesh Kumar Sathya Narayanan, Maheswar Satpathy, Reza Sattarpour, Davide Sattin, Mehrdad Savabi Far, Monika Sawhney, Sangeeta Gopal Saxena, Ganesh Kumar Saya, Abu Sayeed, Christophe Schinckus, Jurgen Carlo Schmidt, Maria Inês Schmidt, Rachel D Schneider, Art Schuermans, Austin E Schumacher, Aletta Elisabeth Schutte, Ghil Schwarz, David C Schwebel, Falk Schwendicke, Sneha Annie Sebastian, Amin Sedigh, Soraya Seedat, Mario Šekerija, Muthamizh Selvamani, Vimalraj Selvaraj, Yuliya Semenova, Mohammad H Semreen, Fikadu Waltengus Sendeku, Pallav Sengupta, Yigit Can Senol, Subramanian Senthilkumaran, Sadaf G Sepanlou, Edson Serván-Mori, Yashendra Sethi, Seyed Mohammad Seyed Alshohadaei, Allen Seylani, Abubakar Sha'aban, Mahan Shafie, Arezoo Shafieioun, Shazlin Shaharudin, Muhammad Shahbaz, Samiah Shahid, Syed Ahsan Shahid, Endrit Shahini, Fatemeh Shahrahmani, Hamid R Shahsavari, Moyad Jamal Shahwan, Masood Ali Shaikh, Alireza Shakeri, Ali Shakerimoghaddam, Ali S Shalash, Muhammad Aaqib Shamim, Farzane Shams, Mehran Shams-Beyranvand, Anas Shamsi, Alfiya Shamsutdinova, Dan Shan, Shan Shan, Mohd Shanawaz, Amin Sharifan, Javad Sharifi Rad, Avimanu Sharma, Bhoopesh Kumar Sharma, Bunty Sharma, Gaurav Sharma, Kamal Sharma, Kamlesh Sharma, Manoj Sharma, Ravi Kumar Sharma, Ujjawal Sharma, Vishal Sharma, Shamee Shastry, Maryam Shayan, Babangida Shehu Bappah, Fateme Sheida, Ali Sheidaei, Ali Sheikhy, Rekha Raghuveer Shenoy, Samendra P Sherchan, B Suresh Kumar Shetty, Shiran Shetty, Fanchao Shi, Fang Shi, Amir Shiani, Belayneh Fentahun Shibesh, Kenji Shibuya, Desalegn Shiferaw, Tariku Shimels, Md Monir Hossain Shimul, Min-Jeong Shin, Rahman Shiri, Reza Shirkoohi, Aminu Shittu, Abdul-karim Olayinka Shitu, Ivy Shiue, Velizar Shivarov, Nathan A Shlobin, Ambreen Shoaib, Shayan Shojaei, Sina Shool, Seyed Afshin Shorofi, Sunil Shrestha, Suleiman Adeiza Shuaibu, Kerem Shuval, Zahra Siavashpour, Nicole Remaliah Samantha Sibuyi, Emmanuel Edwar Siddig, Ahmed Kamal Siddiqi, Diego Augusto Santos Silva, João Pedro Silva, Luís Manuel Lopes Rodrigues Silva, Padam Prasad Simkhada, Biagio Simonetti, Abhinav Singh, Amit Singh, Balbir Bagicha Singh, Baljinder Singh, Bhim Pratap Singh, Harmanjit Singh, Harpreet Singh, Jasvinder A Singh, Jawahar Singh, Kalpana Singh, Mayank Singh, Narinder Pal Singh, Paramdeep Singh, Poornima Suryanath Singh, Puneetpal Singh, Rakesh K Singh, Samer Singh, Satwinder Singh, Surendra Singh, Surjit Singh, Mukesh Kumar Sinha, Robert Sinto, Sarah Brooke Sirota, Dagne Feleke Siyoum, Natia Skhvitaridze, Anna Aleksandrovna Skryabina, David A Sleet, Mahdieh SobhZahedi, Marzieh Soheili, MdSalman Sohel, Somaye Sohrabi, Shipra Solanki, Lencho Kajela Solbana, Solikhah Solikhah, Sameh S M Soliman, Weiyi Song, Aayushi Sood, Prashant Sood, Soroush Soraneh, Reed J D Sorensen, Joan B Soriano, Fernando Sousa, Marco Aurelio Sousa, Ireneous N Soyiri, Ceren Soylu, Michael Spartalis, Chandrashekhar T Sreeramareddy, Suresh Kumar Srinivasamurthy, Shyamkumar Sriram, Prateek Srivastav, Devin Bailey Srivastava, Lauryn K Stafford, Jeffrey D Stanaway, Muhammad Haroon Stanikzai, Nadine Steckling-Muschack, Dan J Stein, Caitlyn Steiner, Jaimie D Steinmetz, Paschalis Steiropoulos, Blossom Christa Maree Stephan, Aleksandar Stevanović, Leo Stockfelt, Sebastian Straube, Jacob L Stubbs, Peter Stubbs, Omer Subasi, Narayan Subedi, Alisha Suhag, Hasnat Sujon, Thitiporn Sukaew, Surajo Kamilu Sulaiman, Auwal Garba Suleiman, Muritala Suleiman Odidi, Muhammad Suleman, Mark J M Sullman, Anusha Sultan Meo, Haitong Zhe Sun, Jing Sun, Mao-ling Sun, Xiaodong Sun, Xiaohui Sun, Zhong Sun, Zhuanlan Sun, Suraj Sundaragiri, Thanigaivel Sundaram, Johan Sundström, David Sunkersing, Sumam Sunny, Vinay Suresh, Hani Susianti, Chandan Kumar Swain, Vivianne M Swart, Dayinta Annisa Syaiful, Tasmin L Symons, Lukasz Szarpak, Mindy D Szeto, Sree Sudha T Y, Payam Tabaee Damavandi, Rafael Tabarés-Seisdedos, Fatemeh Sadat Tabatabaei, Seyed Shahaboddin Tabatabaei, Seyyed Mohammad Tabatabaei, Seyed-Amir Tabatabaeizadeh, Shima Tabatabai, Celine Tabche, Mohammad Tabish, Takahiro Tabuchi, Getu Ferenji Tadesse, Farzad Taghizadeh-Hesary, Zanan Mohammed-Ameen Taha, Jabeen Taiba, Shima Tajabadi, Iman M Talaat, Mircea Tampa, Jacques Lukenze Tamuzi, Ker-Kan Tan, Mohammad Tanashat, Haosu Tang, Mohsan Tanveer, Abiyu Abadi Tareke, Sarvenaz Taridashti, Ingan Ukur Tarigan, Mengistie Kassahun Tariku, Saba Tariq, Aigul Yelgondiyevna Tazhiyeva, Tarilate Temedie-Asogwa, Mohamad-Hani Temsah, Masayuki Teramoto, Azimeraw Arega Tesfu, Nahom Worku Teshager, Gizachew A Tessema, Jay Tewari, Alireza Teymouri, Chandan Kumar Thakur, Kavumpurathu Raman Thankappan, Rekha Thapar, Ismaeel Tharwat, Samar Tharwat, Rasiah Thayakaran, Muthu Thiruvengadam, Manuel Sebastian Thomas, Wei Tian, Jansje Henny Vera Ticoalu, Madi Tleshev, Sojit Tomo, Marcello Tonelli, Roman Topor-Madry, Mathilde Touvier, Marcos Roberto Tovani-Palone, Khaled Trabelsi, Quynh Thuy Huong Tran, Tam Quoc Minh Tran, Thang Huu Tran, Nguyen Tran Minh Duc, Domenico Trico, Indang Trihandini, Manjari Tripathi, Tulika Tripathi, Samuel Joseph Tromans, Quynh Xuan Nguyen Truong, Thien Tan Tri Tai Truyen, Gary Tse, Vasilis-Spyridon Tseriotis, Evangelia Eirini Tsermpini, Lorainne Tudor Car, Munkhtuya Tumurkhuu, Zhouting Tuo, Biruk Shalmeno Tusa, Sok Cin Tye, Stefanos Tyrovolas, Aniefiok John Udoakang, Atta Ullah, Himayat Ullah, Saeed Ullah, Muhammad Umair, Hauwa Onozasi Umar, Lawan Umar, Muhammad Umar, Muhammad Umar, Shehu Salihu Umar, Eduardo A Undurraga, Bhaskaran Unnikrishnan, Dinesh Upadhya, Era Upadhyay, Dipan Uppal, Daniele Urso, Jibrin Sammani Usman, Kelechi Julian Uzor, Hande Uzunçıbuk, Pratyusha Vadagam, Asokan Govindaraj Vaithinathan, Pascual R Valdez, Mario Valenti, Zahir Vally, Jef Van den Eynde, Javad Varasteh, Joe Varghese, Pavani Varma, Tommi Juhani Vasankari, Sampara Vasishta, Srivatsa Surya Vasudevan, Alireza Vaysi, Siavash Vaziri, Narayanaswamy Venketasubramanian, Madhur Verma, Megan Verma, Poonam Verma, Massimiliano Veroux, Georgios-Ioannis Verras, Simone Vidale, Mathavaswami Vijayageetha, Simone Villa, Jorge Hugo Villafañe, Leonardo Villani, David Villarreal-Zegarra, Francesco S Violante, Senthil Visaga Ambi, Luciano Magalhães Vitorino, Vasily Vlassov, Stein Emil Vollset, Avina Vongpradith, Theo Vos, Mehdi Vosoughi, Elpida Vounzoulaki, Linh Vu, Isidora S Vujcic, Krishna Dhavan Vyas, Henok Toga Wada, Yasir Waheed, Mohd Wahid, Mugi Wahidin, Mandaras Tariku Walde, Megha Walia, Jin-Yi Wan, Arvinder Wander, Fang Wang, Fulin Wang, Junshi Wang, Liang Wang, Qingzhi Wang, Ruixuan Wang, Shu Wang, Wanzhou Wang, Xing Wang, Xuequan Wang, Yan Wang, Yanzhong Wang, Yichen Wang, Youxin Wang, Yuan-Pang Wang, Zhihua Wang, Tanveer A Wani, Mary Njeri Wanjau, Ahmed Bilal Waqar, Muhammad Waqas, John W Ward, Paul Ward, Toyiba Hiyaru Wassie, Stefanie Watson,

Ishanka Weerasekara, Fei-Long Wei, Xueying Wei, Robert G Weintraub, Daniel J Weiss, Eli J Weiss, Katherine M Wells, Andrea Werdecker, Ronny Westerman, Taweewat Wiangkham, Yohanes Cakrapradipta Wibowo, Dakshitha Praneeth Wickramasinghe, Nuwan Darshana Wickramasinghe, Samuel Wiebe, Angga Wilandika, Peter Willeit, Shadrach Wilson, Andrew Awuah Wireko, Charles Shey Wiysonge, Abay Tadesse Woday, Bogdan Wojtyniak, Nathnael Abera Woldehana, Dawit Habte Woldeyes, Axel Walter Wolf, Tewodros Eshete Wonde, Yen Jun Wong, Daniel Tarekegn Worede, Abdulhalik Workicho, Minichil Chanie Worku, Ai-Min Wu, Chenkai Wu, Felicia Wu, James Fan Wu, Jinyi Wu, Peng Wu, Zenghong Wu, Yihun Miskir Wubie, Ratna Dwi Wulandari, Zhijia Xia, Guangqin Xiao, Lishun Xiao, Na Xiao, Wanqing Xie, Site Xu, Suowen Xu, Xiaoyue Xu, Yvonne Yiru Xu, Mukesh Kumar Yadav, Vikas Yadav, Mahnaz Yadollahi, Saba Yahoo (Syed), Galal Yahya, Kazumasa Yamagishi, Guangcan Yan, Haibo Yang, Yuichiro Yano, Haiqiang Yao, Laiang Yao, Amir Yarahmadi, Habib Yaribeygi, Haya Yasin, Mohamed A Yassin, Yuichi Yasufuku, Sanni Yaya, Pengpeng Ye, Meghdad Yeganeh, Ali Cem Yekdeş, Mohammad Hossein YektaKooshali, Kuanysh A Yergaliyev, Subah Abderehim Yesuf, Saber Yezli, Siyan Yi, Dehui Yin, Paul Yip, Malede Berihun Yismaw, Yazachew Engida Yismaw, Dong Keon Yon, Naohiro Yonemoto, Seok-Jun Yoon, Mustafa Z Younis, Saideh Yousefi, Abdilahi Yousuf, Chuanhua Yu, Yong Yu, Hui Yuan, Faith H Yuh, Ghazala Yunus, Umar Yunusa, Siddhesh Zadey, Vesna Zadnik, Mubashir Zafar, Manijeh Zaghampour, Emilia Zainal Abidin, Fathiah Zakham, Nazar Zaki, Giulia Zamagni, Nelson Zamora, Hussaini Zandam, Aurora Zanghì, Heather J Zar, Kourosh Zarea, Mohammed Zawiah, Mohammed G M Zeariya, Abay Mulu Zenebe, Sebastian Zensen, Nejimu Biza Zepro, Eyael M Zeru, Tiansong Zhan, Yongle Zhan, Beijian Zhang, Casper J P Zhang, Haijun Zhang, Julio Min Fei Zhang, Kexin Zhang, Liqun Zhang, Meixin Zhang, Xiaoyi Zhang, Xiu-Hang Zhang, Yunquan Zhang, Zhiqiang Zhang, Sholpan Bolatovna Zhangelova, Hanqing Zhao, Jianhui Zhao, Jiefeng Zhao, Yang Zhao, Zhongyi Zhao, Anthony Zhong, Claire Chenwen Zhong, Jiayan Zhou, Juexiao Zhou, Bin Zhu, Abzal Zhumagaliuly, Magdalena Zielińska, Ghazal Zoghi, Mohamed Ali Zoromba, Zhiyong Zou, Rafat Mohammad Zrieq, Liesl J Zuhlke, Lilik Zuhriyah, Alimuddin Zumla, Ahed H Zyoud, Sa'ed H Zyoud, Shaher H Zyoud, Eve E Wool†, and Christopher J L Murray†. *Joint first authors †Joint senior authors

Affiliations
Please see appendix 4 (pp 13–67) for the affiliations for individual authors.

Contributors
Please see appendix 4 (pp 67–90) for more detailed information about individual author contributions to the research, divided into the following categories: managing the overall research enterprise; writing the first draft of the manuscript; primary responsibility for applying analytical methods to produce estimates; primary responsibility for seeking, cataloguing, extracting, or cleaning data; designing or coding figures and tables; 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. The corresponding author and first author had access to and verified the data. The corresponding author confirms all authors have seen and approved the final text.

Declaration of interests
J Ärnlöv reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from AstraZeneca, Boehringer Ingelheim, and Novartis; participation on a Data Safety Monitoring Board or Advisory Board with AstraZeneca, Boehringer Ingelheim, and Astella; all outside the submitted work. D Abramov reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from AstraZeneca and Bayer; participation on a Data Safety Monitoring Board or Advisory Board with BridgeBio; all outside the submitted work. S Afzal reports support for the present manuscript from Institute of Public Health Lahore for study material, manuscripts, medical writings and library resources; grants or contracts from the Dean Institute of Public Health Lahore; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from the Dean Institute of Public Health Lahore; support for attending meetings and/or travel from the Dean Institute of Public Health Lahore; participation on a Data Safety Monitoring Board or Advisory Board with Pakistan National Bioethics Committee as a Member, Institutional Review Board of Fatima Jinnah Medical University as a Member, Ethical Review Board and Data Monitoring Board Institute of Public Health Lahore Pakistan as a Member, Clinical Research Organization King Edward Medical University, Annals of King Edward Medical University Advisory Board as a Member; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Pakistan Higher Education Commission Research Committee as a Member, Pakistan Medical and Dental Commission Research and Journals Committee as a Member, Pakistan National Bioethics Committee as a Member, Pakistan Society of Internal Medicine as a Member, Pakistan Association of Medical Editors as a Member, Medical Microbiology and Infectious Diseases Society as a Member, Leads International as a Fellow, Faculty of Public Health UK as a Fellow, College of Physicians and Surgeons Pakistan as a Fellow; receipt of equipment, materials, drugs, medical writing, gifts or other services from Bergen University Norway; other financial or non-financial interests with Dean Institute of Public Health Birdwood Lahore; all outside the submitted work. C A Sobrinho reports grants or contracts from Fundação para a Ciência e Tecnologia (FCT) via grant CEECINST/00093/2021/CP2815/CT0001, outside the submitted work. R Ancuceanu reports consulting fees from Abbvie and Merck Romania; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Abbvie, Laropharm, Reckitt, Merck Romania, and MagnaPharm; support for attending meetings and/or travel from Merck Romania and Reckitt; all outside the submitted work. O C Baltatu reports support for the present manuscript from the National Council for Scientific and Technological Development Fellowship (CNPq, 304224/2022–7), the Anima Institute (AI) Research Professor Fellowship, and Alfaisal University; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with VividiWise Analytics as Managing Partner and São José dos Campos Tech Park—CITE as Biotech Advisory Board Member; all outside the submitted work. S Barteit reports support for attending meetings and/or travel from Wellcome Trust, September 2023+January 2025; stock or stock options in Climate Change and Health Evaluation and Response System (€4,200 in shares); all outside the submitted work. A Beloukas reports grants or contracts from Gilead for a research grant and sponsorship to the University of West Attica, and from GSK/ViiV for a Research Sponsorship to the University of West Attica; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Gilead and GSK paid to the University of West Attica; support for attending meetings and/or travel from Gilead and GSK paid to the University of West Attica; receipt of equipment, materials, drugs, medical writing, gifts or other services from Cepheid in the form of FOC reagents for a research project; all outside the submitted work. P J G Bettencourt reports the following patents issued or pending: WO2020229805A1, BR112021022592A2, EP3965809A1, OA1202100511, US2023173050A1, EP4265271A2, EP4275700A2, EP4265271A3, EP4275700A3; all outside the submitted work. S Bhaskar reports grants or contracts from Japan Society for the Promotion of Science (JSPS), Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT), Grant-in-Aid for Scientific Research (KAKENHI; grant ID: 23KF0126), JSPS and the Australian Academy of Science, JSPS International Fellowship (grant ID P23712); leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Rotary District 9675, Sydney, Australia as District Chair, Diversity, Equity, Inclusion & Belonging, with Global Health & Migration Hub Community, Global Health Hub Germany, Berlin, Germany as Chair, Founding Member and Manager, with PLOS One, BMC Neurology, Frontiers in Neurology, Frontiers in Stroke, Frontiers in Public Health, Journal of Aging Research, Neurology International, Diagnostics, & BMC Medical Research Methodology as an Editorial Board Member, with College of Reviewers, Canadian Institutes of Health Research (CIHR), Government of Canada as a Member, with World Headache Society, Bengaluru, India as Director of Research, with

See Online for appendix 4

Cariplo Foundation, Milan, Italy as an Expert Adviser/Reviewer, with National Cerebral and Cardiovascular Center, Department of Neurology, Division of Cerebrovascular Medicine and Neurology, Suita, Osaka, Japan as Visiting Director, with Cardiff University Biobank, Cardiff, UK as a Member, Scientific Review Committee, with Rotary Reconciliation Action Plan as Chair, and with Japan Connect, Osaka, Japan as a Healthcare and Medical Adviser; all outside the submitted work. A Biswas reports consulting fees from LUPIN Pharmaceuticals Ltd, INTAS Pharmaceuticals Ltd, Alkem Laboratories Ltd, and Torrent Pharmaceuticals Ltd; all outside the submitted work. R Cairns reports grants or contracts from Reckitt for an untied educational grant to study poisoning; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from The Pharmacy Guild of Australia and Reckitt; all outside the submitted work. M C D de Carvalho reports other financial or non-financial interests with LAQV/REQUIMTE, University of Porto, Porto, Portugal, and from FCT/MCTES under the scope of the project UIDP/50006/2020 (DOI 10.54499/UIDP/50006/2020); all outside the submitted work. A L Catapano reports grants or contracts from Chiesi, Amarin, and Ultragenyx; consulting fees from Amarin, Amgen, AstraZeneca, Chiesi, Daiichi Sankyo, Eli Lilly, Esperion, Ionis Pharmaceutical, Medscape, Menarini, MSD, Novartis, NovoNordisk, Regeneron, Sanofi, Ultragenyx, and Viatris; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Amarin, Amgen, AstraZeneca, Chiesi, Daiichi Sankyo, Eli Lilly, Esperion, Ionis Pharmaceutical, Medscape, Menarini, MSD, Novartis, NovoNordisk, Regeneron, Sanofi, Ultragenyx, and Viatris; participation on a Data Safety Monitoring Board or Advisory Board with Amarin, Amgen, AstraZeneca, Chiesi, Daiichi Sankyo, Eli Lilly, Esperion, Ionis Pharmaceutical, Medscape, Menarini, MSD, Novartis, NovoNordisk, Regeneron, Sanofi, Ultragenyx, and Viatris; all outside the submitted work. H Christensen reports grants or contracts from Velux Foundation, Novo Foundation, Br Hartman Fonden, Tværsfonden, and Lundbeck Foundation; participation on a Data Safety Monitoring Board or Advisory Board with Atricure: LEEAPS trial—DSMB; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Action Plan for Stroke in Europe as Past Chair; all outside the submitted work. F Cohen reports consulting fees from Abbvie and Pfizer; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Abbvie and Axsome; all outside the submitted work. J Conde reports grants or contracts from OncoNanoAI: Artificial intelligence to discover the next generation of personalised nanoparticles for triple-negative breast cancer therapy (2025–2027) (FCT grant LISBOA2030-FEDER-00862500-149983); patents issued or pending: "TRPV2 Antagonists" US Application (number US11273152B2), "Surfactant-based cellulose hydrogel methods and uses thereof" (PCT/IB2025/051694, 17/02/2025), "Self-immolative micelle, methods and uses thereof" (EP25165757, 24/03/2025); all outside the submitted work. S E Congly reports grants or contracts paid to their institution from AstraZeneca, Merck, Ipsen, Bausch Health, Oncoustics, Boehringer Ingelheim, and Gilead Sciences Canada; consulting fees paid to them from GSK and Boehringer Ingelheim; participation on a Data Safety Monitoring Board or Advisory Board with Boehringer Ingelheim, Gilead Sciences Canada, and AstraZeneca; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Canadian Association for the Study of the Liver as a Member of the Board of Directors and Alberta Society of Gastroenterology as Vice President; all outside the submitted work. N Conrad reports grants or contracts paid to their institution from Wellcome Trust Career Development Award (grant number 318034/Z/24/Z), Research Foundation Flanders (grant number 12ZU922N), and KU Leuven (internal funding); all outside the submitted work. S Cortese reports grants or contracts from the National Institute for Health and Care Research (NIHR) and the European Research Agency; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from the Association for Child and Adolescent Mental Health (ACAMH), the British Association of Psychopharmacology (BAP), Medice; support for attending meetings and/or travel from the Association for Child and Adolescent Mental Health (ACAMH), the British Association of Psychopharmacology (BAP), Medice; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with the European ADHD Guideline Group (EAGG); all outside the submitted work. E C Dee reports support for the present manuscript from Prostate Cancer Foundation Young Investigator Award and through the Cancer Center Support grant from the US National Cancer Institute (P30 CA008748). A K Demetriades reports non-fiduciary leadership roles in other board, society, committee or advocacy group with EANS (European Association of Neurosurgical Societies) as a Board member, AO SPINE as a Steering Committee Member for Knowledge Forum Degenerative, Global Neuro Foundation as a Board Member, AO SPINE as a Steering Committee Member for Knowledge Forum Degenerative; all outside the submitted work. X Ding reports grants or contracts from American Heart Association for a 2-year predoctoral fellowship (DOI: 10.58275/AHA.25PRE1373497.pc.gr.227106); quarterly payments made to their institution; all outside the submitted work. L L M Ebraheim reports support for the present manuscript from the Gates Foundation, and royalties or licenses from the Institute for Health Metrics and Evaluation outside the submitted work. A Faro reports support for the present manuscript from National Council for Scientific and Technological Development (CNPq, Brazil) for a personal grant "Researcher at CNPq—Level 1B". A A Fomenkov reports support for the present manuscript from the Ministry of Science and Higher Education of the Russian Federation (theme number 122042600086–7). L M Force reports support for the present manuscript from Gates Foundation, St. Jude Children's Research Hospital; grants or contracts from St. Baldrick's Foundation, Conquer Cancer Foundation, NIH Loan Repayment Program; leadership or fiduciary roles in other board, society, committee or advocacy group, unpaid, with the *Lancet Oncology* International Advisory Board; all outside the submitted work. R C Franklin reports support for attending meetings and/or travel from ACTM—Annual Conference 2022–2024; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Australasian College of Tropical Medicine as President, Kidsafe Australia as President, Royal Life Saving Society Australia as a Board Member, and Auschem Training as a Board Member; all outside the submitted work. A Guha reports grants or contracts from American Heart Association and US Department of Defense; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with ZERO Cancer health disparities working group; all outside the submitted work. A A Harris reports grants or contracts from the Gates Foundation and Gavi; all outside the submitted work. A Hassan reports consulting fees from Novartis, Sanofi Genzyme, Biologix, Astra Zeneca, Pfizer, Merz, Roche, Merck, Hikma Pharma, Janssen, Inspire Pharma, Future Pharma, and Elixir Pharma; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Novartis, Allergan, Abbvie, Merck, Biologix, Viatris, Pfizer, Eli Lilly, Janssen, Roche, Sanofi Genzyme, Bayer, AstraZeneca, Hikma Pharma, Al Andalus, Chemipharm, Lundbeck, Elixir, EvaPharma, Inspire Pharma, Future Pharma and Habib Scientific Office, and Everpharma; support for attending meetings and/or travel from Novartis, Allergan, Merz, Pfizer, Merck, Biologix, Roche, Sanofi Genzyme, Bayer, Hikma Pharma, Chemipharm, Al Andalus and Clavita Pharm; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with MENA Headache Society as Vice President, Multiple Sclerosis Chapter of the Egyptian Society of Neurology as a Board Member, Headache Chapter of the Egyptian Society of Neurology as a Board Member, The International Headache Society (IHS) as a Member of the committee of education, the membership committee, and regional committee; all outside the submitted work. P J Hotez is a co-inventor on non-revenue generating patents for neglected tropical diseases owned by Baylor College of Medicine (BCM). He is also a co-inventor of a COVID-19 recombinant protein vaccine technology owned by BCM that was licensed by Baylor Ventures non-exclusively and with no patent restrictions to several companies committed to advance vaccines for low- and middle-income countries. The co-inventors have no involvement in license negotiations conducted by BCM. Similar to other research universities, a long-standing BCM policy provides its faculty and staff, who make discoveries and that result in a commercial license, a share of any royalty income. Any such distribution will be undertaken in accordance with BCM policy. P J Hotez is also the author of several

books published by academic presses (ASM-Wiley) and Johns Hopkins University Press, and he receives modest royalty income from this activity. I M Ilic reports support for the present manuscript from Ministry of Science, Technological Development and Innovation of the Republic of Serbia; number 451–03–137/2025–03/200110. M D Ilic reports support for the present manuscript from Ministry of Science, Technological Development and Innovation of the Republic of Serbia number 451–03–47/2023–01/200111. N E Ismail reports leadership or fiduciary roles in other board, society, committee or advocacy group, unpaid, with Malaysian Academy of Pharmacy, Malaysia as the Bursar and Council Member and Malaysian Pharmacists Society Education Chapter Committee as a Committee Member; all outside the submitted work. I O Iyamu reports grants or contracts from Canadian Institutes for Health Research (CIHR) Health Systems Impact Fellowship (Funding Reference number IF8–196153), Michael Smith Health Research BC Trainee Award (award number HSIF-2024–04465), and CIHR Canadian HIV Trials Network (CTN+) post-doctoral fellowship; consulting fees from Excellence Community Education Welfare Scheme; support for attending meetings and/or travel from Pacific Public Health Foundation; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Public Health Association of British Columbia as Vice President; all outside the submitted work. V Jha reports consulting fees from Bayer, AstraZeneca, Boehringer Ingelheim, Baxter, Vera, Visterra, Otsuka, Novartis, Timberlyne, Biogen, Chinook, and Alpine; All payments to the George Institute; all outside the submitted work. T Joo reports support for the present manuscript from EU4Health Programme 2021–2027 under grant agreement 101126953 (The Joint Action on CARdiovascular diseases and DIabetes—JACARDI). The views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Health and Digital Executive Agency (HaDEA). Neither the European Union nor the granting authority can be held responsible for them; and National Research, Development and Innovation Office in Hungary (RRF-2.3.1-21-2022-00006, Data-Driven Health Division of National Laboratory for Health Security for funding of participation in the research project. J J Jozwiak reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Novartis, Adamed, Amgen, Boehringer Ingelheim, Servier, Novo Nordisk; all outside the submitted work. R Kalani reports grants or contracts from the National Institutes of Health (NIH) (USA) 1R01NS138297; all outside the submitted work. M Kivimäki reports grants or contracts paid to their university from the Wellcome Trust (221854/Z/20/Z), Medical Research Council (MR/Y014154/1), National Institute on Aging (R01AG056477, R01AG062553) and Research Council of Finland (350426); all outside the submitted work. J M Kocarnik reports support for the present manuscript from Institute for Health Metrics and Evaluation as an employee, the Gates Foundation for funding to his institution, and American Lebanese Syrian Associated Charities for funding to his institution. K Krishan reports other financial or non-financial interests with non-financial support from the UGC Centre of Advanced Study, CAS II, awarded to the Department of Anthropology, Panjab University, Chandigarh, India, outside the submitted work. T Lallukka reports support for the present manuscript from the Research Council of Finland (330527), payments made to their institution. 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; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with *Journal of the American Heart Association* as Technical Editor; all outside the submitted work. D Lindholm reports stock or stock options in AstraZeneca during time of employment (>2.5 years ago); other financial or non-financial interests with AstraZeneca as a former employee (>2.5 years ago); all outside the submitted work. H Liu reports other financial or non-financial interests as a mentor of National Medical Research Association (NMRA, U.K.), a member of British Society for Cardiovascular Research (BSCR, U.K.), and a member of and Cardiovascular Analytics Group (CVAG, HKSAR of China), all are not-for-profit organisations; all outside the submitted work. J Liu reports support for the present manuscript from the National Natural Science Foundation (72474005) and Beijing Natural Science Foundation (L222027, Z240004); grants of contracts the National Natural Science Foundation (72474005) and Beijing Natural Science Foundation (L222027, Z240004), outside the submitted work. V Lohner reports support for the present manuscript from Marga and Walter Boll Foundation, Kerpen, Germany. S Lorkowski reports grants or contracts paid to their institution from dsm-firmenich (formerly DSM Nutritional Products); consulting fees from Danone, Novartis Pharma, and Swedish Orphan Biovitrum (SOBI); payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from AMARIN Germany, Amedes Holding, AMGEN, Berlin-Chemie, Boehringer Ingelheim Pharma, Daiichi Sankyo Deutschland, Danone, Hubert Burda Media Holding, Janssen-Cilag, Lilly Deutschland, Novartis Pharma, Novo Nordisk Pharma, Roche Pharma, Sanofi-Aventis, Swedish Orphan Biovitrum (SOBI), SYNLAB Holding Deutschland; support for attending meetings and/or travel from AMGEN; participation on a Data Safety Monitoring Board or Advisory Board with AMGEN, Daiichi Sankyo Deutschland, Novartis Pharma, Sanofi-Aventis; all outside the submitted work. K S-K Ma reports grants or contracts from the International Team for Implantology outside the submitted work. P Maffia reports grants or contracts from British Heart Foundation, NextGenerationEU PNRR, Heart Research UK, Italian Ministry of University, BBSRC International Partnerships Funding, and Scottish Founding Council; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Translational Section for the International Union of Basic and Clinical Pharmacology (IUPHAR) as Vice-Chair, the Translational Research Medical Review Panel for Heart Research UK (HRUK) as Chair, the European Society of Cardiology (ESC) Working Group on Atherosclerosis & Vascular Biology and Cell Biology of the Heart as a Nucleus Member, the British Atherosclerosis Society (BAS) as an Executive Committee Member, Immunotherapy Committee of the International Union of Immunological Societies (IUIS) as a Member, and the Translational Clinical Studies (TCS) Grant Panel for the Chief Scientist Office (CSO) as a Member; all outside the submitted work. H R Marateb reports grants or contracts from Universitat Politècnica de Catalunya . Barcelona Tech—UPC; all outside the submitted work. S Masi reports grants or contracts from Servier for personal contracts for consulting activities, lectures, presentations, manuscript writing and educational events, Tuscany Region for grants for research projects in the field of arterial hypertension and management of SARS-CoV2 infection, and Italian Ministry of University and Research for grants for research projects in the field of heart failure; consulting fees from Servier (2022-Present); payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Servier (2018-Present); support for attending meetings and/or travel from Servier (2018-Present); participation on a Data Safety Monitoring Board or Advisory Board with Servier on advisory board for the lunch of new drugs (2024-Present); all outside the submitted work. R J Maude reports support for the present manuscript from Wellcome Trust. This research was supported in part by Wellcome Trust (grant number 220211) as it provides core funding for Mahidol Oxford Tropical Medicine Research and contributes to their salary. They are required by Wellcome to acknowledge this grant in all publications. S A Meo reports grants or contracts from the Ongoing Research Funding Program (ORF-2025–47), King Saud University, Riyadh, Saudi Arabia; all outside the submitted work. T R Miller reports grants or contracts from National Institute for Mental Health (USA), AB InBev Foundation, Santa Clara County Public Health Department (California); payment for expert testimony from lawyers representing state & local plaintiffs in opioid litigation; all outside the submitted work. H M Mohamed reports support for the present manuscript from Higher Colleges of Technology; participation on a Data Safety Monitoring Board or Advisory Board with FIP Technology Advisory Group as a Member; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with ISPOR UAE chapter as Education Committee Member; all outside the submitted work. L Monasta reports support for the present manuscript from the Italian Ministry of Health (Ricerca Corrente 34/2017), payments made to the Institute for Maternal and Child Health IRCCS Burlo Garofolo. R da Silveira Moreira reports grants or contracts from CNPq (National Council for Scientific and Technological Development) for a CNPq Research Productivity Scholarship (scholarship registration

number is 316607/2021–5); all outside the submitted work. J F Mosser reports support for the present manuscript from the Gates Foundation; grants or contracts from Gavi; honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Providence Medical Center for CME presentation; support for attending meetings and/or travel from the Gates Foundation; all outside the submitted work. F Mughal reports support for the present manuscript paid to their institution from the National Institute for Health and Care Research (NIHR) (USA) (300957). Views expressed in this manuscript are those of the authors and not of the NHS, NIHR, or DHSC. S Nomura reports support for the present manuscript from Ministry of Education, Culture, Sports, Science and Technology of Japan (24H00663) and the Japan Science and Technology Agency for Precursory Research for Embryonic Science and Technology (JPMJPR22R8). B OANCEA reports support for the present manuscript from Ministry of Research, Innovation and Digitalization through the Core Program of the National Research, Development and Innovation Plan 2022–2027, project number PN 23-02-0101, contract number 7N/2023; PNRR/2022/C9/MCID/I8 project 760096. R Olum reports grants or contracts from Gilead Sciences Inc. through the Gilead Research Scholars Program for Public Health; all outside the submitted work. S Onie reports support for the present manuscript from National Health and Medical Research Council, Australia for an Investigator Grant; consulting fees from WHO for the amount of USD$9000 from November 2023 to date; support for attending meetings and/or travel from Suicide Prevention Australia for travel and attendance fees for annual conference and International Association for Suicide Prevention for conference attendance fees; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with International Association for Suicide Prevention as Vice President and Indonesian Association for Suicide Prevention as President; stock or stock options in Wellspring Indonesia, a local mental health clinic in Indonesia (not majority shareholder); all outside the submitted work. R Ornello reports consulting fees from Teva; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Novartis, Eli Lilly, Teva, AbbVie, Bayer, Pfizer, Lundbeck, Organon; support for attending meetings and/or travel from Teva and Novartis; participation on an Advisory Board with Eli Lilly and AbbVie; receipt of equipment, materials, drugs, medical writing, gifts or other services from Novartis; all outside the submitted work. A Ortiz reports grants or contracts from Sanofi paid to their institution The Fundación Jiménez Díaz Health Research Institute (IIS-FJD UAM) and as Director of the Catedra AstraZeneca-UAM of chronic kidney disease and electrolytes paid to their institution Universidad Autonoma de Madrid (UAM); consulting fees from Astellas, AstraZeneca, Bioporto, Boehringer Ingelheim, Fresenius Medical Care, GSK, Bayer, Sanofi-Genzyme, Lilly, Chiesi, Otsuka, Novo-Nordisk, and Sysmex; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Astellas, AstraZeneca, Bioporto, Boehringer Ingelheim, Fresenius Medical Care, GSK, Bayer, Sanofi-Genzyme, Sobi, Menarini, Lilly, Chiesi, Otsuka, Novo-Nordisk, Sysmex and Vifor Fresenius Medical Care Renal Pharma and Spafarma; support for attending meetings and/or travel from Astellas, AstraZeneca, Fresenius Medical Care, Boehringer-Ingelheim, Bayer, Sanofi-Genzyme, Chiesi, Sobi, and Bayer; participation on a Data Safety Monitoring Board or Advisory Board with Astellas, AstraZeneca, Boehringer-Ingelheim, Fresenius Medical Care, Bayer, Sanofi-Genzyme, Chiesi, Otsuka, Novo Nordisk, and Sysmex; leadership or fiduciary roles in other board, society, committee or advocacy group, unpaid, with Council ERA. SOMANE; all outside the submitted work. P K Pal reports grants or contracts paid to their institution from Indian Council of Medical Research (ICMR), Department of Science & Technology(DST)-Science and Engineering Research Board, Department of Biotechnology (DBT), DST-Cognitive Science Research Initiative, Wellcome Trust UK-India Alliance DBT, PACE scheme of BIRAC, Michael J. Fox Foundation, SKAN (Scientific Knowledge for Ageing and Neurological ailments)-Research Trust; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from the International Parkinson and Movement Disorder Society, and Movement Disorder Societies of Korea, Taiwan and Bangladesh, Japanese Society of Neurology, Teva Pharmaceutical Industries and Elsevier Inc (payment of one-thirds of the honorarium to their institute); support for attending meetings and/or travel from the National Institute of Mental Health and Neurosciences (NIMHANS), International Parkinson and Movement Disorder Society, and Movement Disorder Societies of Korea, Taiwan and Bangladesh, Japanese Society of Neurology and Asian Oceanian Congress of Neurology.; leadership or fiduciary roles in other board, society, committee or advocacy group with Indian Academy of Neurology as Past President, Asian and Oceanian subsection of International Parkinson and Movement Disorder Society (MDS-AOS) as Past Secretary, *Annals of Movement Disorders* as Past Editor-in-Chief, the Parkinson Society of Karnataka as President, Infection Related Movement Disorders Study Group of MDS as Chair, Rare Movement Disorders Study Group of International Parkinson and Movement Disorder Society (IPMDS) as a Member, Education Committee of IAPRD as a Member, Rating Scales Education and Training Program Committee of IPMDS as a Member, Neurophysiology Study Group of IPMDS as a Member, Movement Disorders in Asia Study Group as a Member, Post-Stroke Movement Disorders as a Member, Ataxia Study Group of IPMDS as a Member, Ataxia Global Initiative as a Member, Movement Disorders Society of India as President, and the Education Committee of International Parkinson and Movement Disorder Society (IPMDS) as Chair—all unpaid posts except Annual Leadership stipend for 2023–2025, of which one-thirds to be paid to their institute; all outside the submitted work. S K Panda reports support for the present manuscript from Siksha 'O' Anusandhan (deemed to be university) in the form of a salary; grants or contracts from file number 17-59/2023-24/CCRH/Tech./Coll./ICMR-Diabetes/960 as co-investigator; all outside the submitted work. G D Panos reports support for attending meetings and/or travel (expenses covered without receiving direct payment) from Roche and Bayer AG; all outside the submitted work. R Passera reports participation on a Data Safety Monitoring Board or Advisory Board with the Data Safety Monitoring Board dello studio "Consolidation with ADCT-402 (loncastuximab tesirine) after immunochemotherapy: a phase II study in BTKi-treated/ineligible Relapse/Refractory Mantle Cell Lymphoma (MCL) patients"—FIL, Fondazione Italiana Linfomi, Alessandria (Italy), unpaid; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with the EBMT Statistical Committee, European Society for Blood and Marrow Transplantation, Paris (France) as a member, and the IRB/IEC Comitato Etico AO SS. Antonio e Biagio Alessandria-ASL AL-VC (Italy) as a past Member (2020–2023); all outside the submitted work. A E Peden reports support for the present manuscript from the (Australian] National Health and Medical Research Council (grant number APP2009306). V C F Pepito reports grants or contracts from Sanofi Consumer Healthcare for study self-care in the Philippines, and Zuellig Family Foundation for health systems strengthening; all outside the submitted work. P Ionela-Roxana reports grants or contracts from the project 'Societal and Economic Resilience within multi-hazards environment in Romania' funded by European Union—NextgenerationEU and Romanian Government, under National Recovery and Resilience Plan for Romania, contract number 760050/ 23.05.2023, cod PNRR-C9-I8-CF 267/ 29.11.2022, through the Romanian Ministry of Research, Innovation and Digitalization, within Component 9, Investment I8; all outside the submitted work. L Ronfani reports support for the present manuscript from the Italian Ministry of Health (Ricerca Corrente 34/2017), payments made to the Institute for Maternal and Child Health IRCCS Burlo Garofolo. P S Sachdev reports grants or contracts from National Health and Medical Research Council of Australia, APP1169489 and National Institutes of Health, USA; grants 1RF1AG057531–01 and 2R01AG057531–02A1; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Alkem Labs for a lecture as part of the Frontiers of Psychiatry 2023 seminar, Mumbai, India, June 2023; participation on a Data Safety Monitoring Board or Advisory Board with Biogen Australia Medical Advisory committee in 2020 and 2021 Roche Australia Medical Advisory Committee in 2022, Eli Lilly, Expert Advisory Panel, 2025; leadership or fiduciary roles in other board, society, committee or advocacy group, unpaid, with International Neuropsychiatric Association as Executive Board Member and World Psychiatric Association as Planning Committee Member; all outside the submitted work. Y L Samodra reports grants or contracts from NSTC—

NTU Institute of Epidemiology and Preventive Medicine, Taiwan for a post-doctoral fellow contract; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Benang Merah Research Center, Indonesia as Co-Founder; other financial or non-financial interests with Jago Beasiswa (idebeasiswa.com) as a scholarship mentor; all outside the submitted work. A E Schutte reports consulting fees from AstraZeneca, Medtronic, Sky Labs, Servier, and Roche; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from AstraZeneca, Medtronic, Sky Labs, Servier, Omron, and Aktiia; support for attending meetings and/or travel from Medtronic, Servier; all outside the submitted work. M Šekerija reports consulting fees from Roche; payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Astellas; all outside the submitted work. V Sharma reports other financial or non-financial interests with DFSS (MHA)'s research project (DFSS28(1)2019/EMR/6) at Institute of Forensic Science & Criminology, Panjab University, Chandigarh, India, outside the submitted work. V Shivarov reports one patent issued or pending with the Bulgarian Patent Office; other financial or non-financial interests with ICON plc. in the form of a salary; all outside the submitted work. J P Silva reports support for the present manuscript from Portuguese Foundation for Science and Technology for payment of a salary (contract with reference 2021.01789.CEECIND/CP1662/CT0014). L M L R Da Silva reports grants or contracts from SPRINT, Sport Physical Activity and Health Research e Innovation Center, Polytechnic of Guarda, 6300–559 6 Guarda, Portugal; and collaborate with RISE—UBI, Health Sciences Research Centre, University of Beira Interior, 6201–506 Covilhã, Portugal; all outside the submitted work. J A Singh reports consulting fees from ROMTech, Atheneum, Clearview healthcare partners, American College of Rheumatology, Yale, Hulio, Horizon Pharmaceuticals, DINORA, ANI/Exeltis, USA Inc., Frictionless Solutions, Schipher, Crealta/Horizon, Medisys, Fidia, PK Med, Two labs Inc., Adept Field Solutions, Clinical Care options, Putnam associates, Focus forward, Navigant consulting, Spherix, MedIQ, Jupiter Life Science, UBM LLC, Trio Health, Medscape, WebMD, and Practice Point communications; and the National Institutes of Health; Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Simply Speaking; Support for attending meetings and/or travel from Simply Speaking; Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid as a past steering committee member of the OMERACT, an international organisation that develops measures for clinical trials and receives arm's length funding from 12 pharmaceutical companies, and as a Chair of the Veterans Affairs Rheumatology Field Advisory Committee, and as editor and the Director of the UAB Cochrane Musculoskeletal Group Satellite Center on Network Meta-analysis; Stock or stock options in Atai life sciences, Kintara therapeutics, Intelligent Biosolutions, Acumen pharmaceutical, TPT Global Tech, Vaxart pharmaceuticals, Atyu biopharma, Adaptimmune Therapeutics, GeoVax Labs, Pieris Pharmaceuticals, Enzolytics Inc., Seres Therapeutics, Tonix Pharmaceuticals Holding Corp., Aebona Pharmaceuticals, and Charlotte's Web Holdings, Inc. and previously owned stock options in Amarin, Viking, and Moderna Pharmaceuticals; outside the submitted work. I N Soyiri reports leadership or fiduciary roles in board, society, committee or advocacy groups, unpaid as Trustee of the Citizens Advice Bureau for Hull & East Riding, United Kingdom; outside the submitted work. D J Stein reports consultancy honoraria from Discovery Vitality, Kanna, L'Oreal, Lundbeck, Orion, Servier, Seaport Therapeutics, Takeda, and Wellcome; all outside the submitted work. J Sundström reports direct or indirect stock ownership in companies (Anagram kommunikation AB, Sence Research AB, Symptoms Europe AB, MinForskning AB) providing services to companies and authorities in the health sector including Amgen, AstraZeneca, Bayer, Boehringer, Eli Lilly, Gilead, GSK, Göteborg University, Itrim, Ipsen, Janssen, Karolinska Institutet, LIF, Linköping University, Novo Nordisk, Parexel, Pfizer, Region Stockholm, Region Uppsala, Sanofi, STRAMA, Takeda, TLV, Uppsala University, Vifor Pharma, WeMind; all outside the submitted work.
R Tabarés-Seisdedos reports grants or contracts from Valencian Regional Government's Ministry of Education (PROMETEO/CIPROM/2022/58) and the Spanish Ministry of Science, Innovation and Universities (PID2021–129099OB-I00). The funders were not involved in the design of the manuscript or decision to submit the manuscript for publication, nor will they be involved in any aspect of the study's conduct; all outside the submitted work. J H V Ticoalu reports leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Benang Merah Research Center, Indonesia as Co-Founder; all outside the submitted work. D Trico reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from AstraZeneca, Eli Lilly, and Novo Nordisk; support for attending meetings and/or travel from AstraZeneca; participation on a Data Safety Monitoring Board or Advisory Board with Amarin, Boehringer Ingelheim, Novo Nordisk; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with EASD Early Career Academy and EASD Committee on Clinical Affairs; receipt of equipment, materials, drugs, medical writing, gifts or other services from Abbott and PharmaNutra; all outside the submitted work. S J Tromans reports grants or contracts paid to University of Leicester, their institution, as part of the 2023/4 Adult Psychiatric Morbidity Survey team, collecting epidemiological data on community-based adults living in England (a contracted study from NHS Digital, via the Department of Health and Social Care. Contributions on chapters of the 2023/4 Adult Psychiatric Morbidity Survey report), as lead on a study funded by the National Institute for Health and Care Research Clinical Research Network, on optimising the survey design for people with learning disability and autism, as lead on a study from the National Institute for Health and Care Research related to reviewing a national training programme for health and social care professionals relating to learning disability and autism, and as Co-applicant on study funded by the National Institute for Health and Care Research related to Identification, recording, and reasonable adjustments for people with a learning disability and autistic people in NHS electronic clinical record systems; support for attending meetings and/or travel from the Royal College of Psychiatrists; leadership or fiduciary roles in board, society, committee or advocacy groups, paid or unpaid as Academic Secretary for the Neurodevelopmental Psychiatry Special Interest Group and Psychiatry of Intellectual Disability Faculty at the Royal College of Psychiatrists, as Editorial Board Member for *Progress in Neurology and Psychiatry, Advances in Mental Health and Intellectual Disability*, *Advances in Autism*, *BMC Psychiatry*, and *BJPsych Open*, and as Editor of *Psychiatry of Intellectual Disability Across Cultures* (Oxford University Press); outside the submitted work. V-S Tseriotis reports grants or contracts from the European Academy of Neurology, European Committee for Treatment and Research in Multiple Sclerosis; support for attending meetings and/or travel from Inovis, Genesis Pharma, and Novartis; all outside the submitted work. E Upadhyay reports patents issued or pending for "A system and method of reusable filters for anti-pollution mask" (Published); "A system and method for electricity generation through crop stubble by using microbial fuel cells" (Published); "A system for disposed personal protection equipment (PPE) into biofuel through pyrolysis and method" (Published); "A novel herbal pharmaceutical aid for formulation of gel and method thereof" (Published); "Herbal drug formulation for treating lung tissue degenerated by particulate matter exposure" (Published); "A method to transform cow dung into the wall paint by using natural materials and composition thereof" (Filed); "Biodegradable packaging composition and method of preparation thereof" (Filed); "Eco-friendly bio-shoe polish from banana and turmeric" (Filed); "Honey-based polyherbal syrup composition to treat air pollution-induced inflammation and preparation method thereof" (Filed); "Process for preparing a caffeine free, antioxidant and nutrient rich beverage" (Filed); leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Meteorological Society, Jaipur (India) as Executive Council Member, Indian Chapter and DSTPURSE Program as member Secretary; all outside the submitted work. E Vounzoulaki reports grants or contracts from a National Institute for Health and Care Research (NIHR) Development and Skills Enhancement Award (DSE) until July 2026, outside the submitted work. Yichen Wang reports grants or contracts from Mayo Clinic Center for Digital Health and Mayo Clinic Office of Belonging (formerly the Office of Inclusion and Diversity) with support from Dalio Philanthropies, 2024 for an Artificial Intelligence-Machine Learning Award; support for attending meetings and/or travel

from The International Foundation for Gastrointestinal Disorders and University of Kansas Health Center; a provisional patent, "A Method to Automate International Classification of Diseases Coding using Large Language Model"; all outside the submitted work. J W Ward reports grants or contracts from Abbott, Gilead, AbbVie, Merck, Siemens, GSK, Cepheid, Zydus Life, governmental agencies, and philanthropic organisations to the Task Force for Global Health for the general support of the Coalition for Global Hepatitis Elimination; all outside the submitted work. P Willeit reports consulting fees from Novartis Pharmaceuticals; outside the submitted work. J F Wu reports grants or contracts from the National Heart, Lung, and Blood Institute (R38HL167238) and prior funding from the American Society of Hematology Hematology Opportunities for the Next Generation of Research Scientists (HONORS) Award; all outside the submitted work. Y Yasufuku reports grants or contracts from Shionogi & Co, Ltd; their employment expenses are paid from the joint research fund provided by this pharmaceutical company to The University of Osaka, outside the submitted work. S Zadey reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Think Global Health, The Hindu, and Harvard Public Health Magazine; leadership or fiduciary roles in other board, society, committee or advocacy group, paid or unpaid, with Association for Socially Applicable Research (ASAR) as Cofounding Director, Asia Working Group, The G4 Alliance as Chair, *Lancet* Citizens' Commission as a Fellow, Duke GEMINI Research Center as Research Aide Sr., Maharashtra State Mental Health Policy as a Drafting Committee Member, and Dr D. Y. Patil University as Adjunct Research Faculty; all outside the submitted work. G Zamagni reports support for the present manuscript from the Italian Ministry of Health (Ricerca Corrente 34/2017), payments made to the Institute for Maternal and Child Health IRCCS Burlo Garofolo. M Zielińska reports other financial or non-financial interests with Alexion and AstraZeneca Rare Disease as an employee; all outside the submitted work.

Data sharing

For detailed information on data sources and estimates, please visit the GHDx GBD 2023 website at http://ghdx.healthdata.org/gbd-2023.

Acknowledgments

Research reported in this publication was supported by the Gates Foundation (OPP1152504); Queensland Department of Health, Australia; UK Department of Health and Social Care; the Norwegian Institute of Public Health; St Jude Children's Research Hospital; and the New Zealand Ministry of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders. Collection of these data was made possible by the U.S. Agency for International Development (USAID) under the terms of cooperative agreement GPO-A-00–08–000_D3–00. The opinions expressed are those of the authors and do not necessarily reflect the views of USAID or the United States government. Data for this research was provided by MEASURE Evaluation, funded by the United States Agency for International Development (USAID). Views expressed do not necessarily reflect those of USAID, the US government, or MEASURE Evaluation. The data reported here have been supplied by the United States Renal Data System (USRDS). The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy or interpretation of the U.S. government. HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the 1997/98, 2001/02, 2005/06 and 2009/10 surveys was Prof Candace Currie and the Data Bank Manager for the 1997/98 survey was Prof Bente Wold, whereas for the following survey Prof Oddrun Samdal was the Databank Manager. A list of principal investigators in each country can be found at http://www.hbsc.org. This manuscript is based on data collected and shared by the International Vaccine Institute (IVI) from an original study it conducted with support from the Bill and Melinda Gates Foundation (BMGF). This analysis is based on the Canadian Heart Health Database 1986–92, which contains anonymised data collected in a coordinated series of Heart Health Surveys carried out in the ten Provinces of Canada between 1986 and 1992. The database was constructed by the Conference of Principal Investigators of Provincial Heart Health Programs from survey questions and clinical measures which were common to all surveys. All computations on these microdata were prepared by IHME and the responsibility for the use and interpretation of these data is entirely that of the author(s). The Palestinian Central Bureau of Statistics granted the researchers access to relevant data in accordance with license number SLN2019–8-64, after subjecting data to processing aiming to preserve the confidentiality of individual data in accordance with the General Statistics Law—2000. The researchers are solely responsible for the conclusions and inferences drawn upon available data. We thank the Russia Longitudinal Monitoring Survey, RLMS-HSE, conducted by the National Research University Higher School of Economics and ZAO "Demoscope" together with Carolina Population Center, University of North Carolina at Chapel Hill and the Institute of Sociology RAS for making these data available. This analysis is based on Statistics Canada Microdata file International Adult Literacy Skills Survey (Canada), 2003; International Adult Literacy Survey, 1994–1998; Adult Literacy and Life Skills Survey, 2003 which contains anonymised data collected in the 2003 Bermuda Adult Literacy and Life Skills Survey. All computations on these microdata were prepared by IHME and the responsibility for the use and interpretation of these data is entirely that of the authors. This paper uses data from the American Samoa 2004 STEPS survey, implemented by Department of Health (American Samoa) and Monash University (Australia) with the support of WHO. Collection of these data was made possible by the U.S. Agency for International Development (USAID) under the terms of cooperative agreement GPO-A-00–08–000_D3–00. The opinions expressed are those of the authors and do not necessarily reflect the views of USAID or the United States government. This paper uses data from the Botswana 2007 and 2014 STEPS surveys, implemented by Ministry of Health (Botswana) with the support of WHO. This paper uses data from the Cameroon 2003 STEPS survey, implemented by Health of Populations in Transition (HoPiT) Research Group (Cameroon) and Ministry of Public Health (Cameroon) with the support of WHO. This paper uses data from the Zambia—Lusaka 2008 STEPS survey, implemented by Ministry of Health (Zambia) with the support of WHO. This paper uses data from the Uruguay 2006 and 2013–2014 STEPS surveys, implemented by Ministry of Health (Uruguay) with the support of WHO. This paper uses data from the Tokelau 2005 STEPS survey, implemented by Tokelau Department of Health, Fiji School of Medicine with the support of WHO. This paper uses data from the Chad—Ville de N'Djamena 2008 STEPS survey, implemented by Ministry of Public Health (Chad) with the support of WHO. This paper uses data from the Seychelles 2004 STEPS survey, implemented by Ministry of Health (Seychelles) with the support of WHO. This paper uses data from the Sierra Leone 2009 STEPS survey, implemented by Ministry of Health and Sanitation (Sierra Leone) with the support of WHO. This paper uses data from the Nauru 2004 and 2015–2016 STEPS surveys, implemented by Ministry of Health (Nauru) with the support of WHO. This paper uses data from the Niger 2007 STEPS survey, implemented by Ministry of Health (Niger) with the support of WHO. This paper uses data from the Malawi 2009 and 2017 STEPS surveys, implemented by Ministry of Health (Malawi) with the support of WHO. This paper uses data from the Mauritania—Nouakchott 2006 STEPS survey, implemented by Ministry of Health (Mauritania) with the support of WHO. This paper uses data from the Mozambique 2005 STEPS survey, implemented by Ministry of Health (Mozambique) with the support of WHO. This paper uses data from the Mongolia 2005, 2009, and 2013 STEPS surveys, implemented by Ministry of Health (Mongolia) with the support of WHO. This paper uses data from the Madagascar—Antananarivo and Toliara 2005 STEPS survey, implemented by Ministry of Health and Family Planning (Madagascar) with the support of WHO. This paper uses data from the Laos—Viangchan 2008 STEPS survey, implemented by Ministry of Health (Laos) with the support of WHO. This paper uses data from the Kuwait 2006 and 2014 STEPS surveys, implemented by Ministry of Health (Kuwait) with the support of WHO. This paper uses data from the Kiribati 2004–2006 and 2016 STEPS surveys, implemented by Ministry of Health and Medical Services (Kiribati) with the support of WHO. This paper uses data from the Gabon—Estuaire 2009 STEPS survey, implemented by Ministry of Health and Public Hygiene (Gabon) with the support of WHO. This paper uses data from the Micronesia—Pohnpei 2002 STEPS survey, implemented by Centre for Physical Activity and Health, University of Sydney (Australia), Department of Health and

Social Affairs (Micronesia), Fiji School of Medicine, Micronesia Human Resources Development Center, Pohnpei State Department of Health Services with the support of WHO. This paper uses data from the Fiji 2002 STEPS survey, implemented by Fiji School of Medicine, Menzies Center for Population Health Research, University of Tasmania (Australia), Ministry of Health (Fiji) with the support of WHO. This paper uses data from the Eritrea 2004 and 2010 STEPS surveys, implemented by Ministry of Health (Eritrea) with the support of WHO. This paper uses data from the Algeria—Setif and Mostaganem 2003 STEPS survey, implemented by Ministry of Health, Population and Hospital Reform (Algeria) with the support of WHO. This paper uses data from the Congo—Brazzaville 2004 STEPS survey, implemented by Ministry of Health and Population (Congo) with the support of WHO. This paper uses data from the Democratic Republic of the Congo—Kinshasa 2005 STEPS survey, implemented by the Ministry of Public Health (Congo, DR) with the support of WHO. This paper uses data from the Cote D'Ivoire—Lagunes 2005 STEPS survey, implemented by Ministry of Health and Public Hygiene (Cote D'Ivoire) with the support of WHO. This paper uses data from the Bhutan—Thimphu 2007 STEPS survey, implemented by Ministry of Health (Bhutan) with the support of WHO. This paper uses data from the Benin—Littoral 2007 STEPS survey, implemented by Ministry of Health (Benin) with the support of WHO. This paper uses data from the Benin 2008 and 2015 STEPS surveys, implemented by Ministry of Health (Benin) with the support of WHO. This analysis is based on Statistics Canada Microdata file, product 62M0004XCB, which contains anonymised data collected in the Survey of Household Spending for the year 2009. All computations on these microdata were prepared by IHME and the responsibility for the use and interpretation of these data is entirely that of the author(s). Data for this research was provided by MEASURE Evaluation, funded by the United States Agency for International Development (USAID). Views expressed do not necessarily reflect those of USAID, the US government, or MEASURE Evaluation. This study is based on data from Eurostat, Malta European Health Interview Survey 2008 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This paper uses data from the Qatar 2012 STEPS survey, implemented by Supreme Council of Health (Qatar) with the support of WHO. This paper uses data from the Libya 2009 STEPS survey, implemented by Secretariat of Health and Environment (Libya) with the support of WHO. This paper uses data from the Palestine 2010–2011 STEPS survey, implemented by Ministry of Health (Palestine) with the support of WHO. This paper contains information licensed under the Open Government Licence Canada. https://open.canada.ca/en/open-government-licence-canada. This paper uses data from the Bangladesh 2009–2010 STEPS survey, implemented by Ministry of Health and Family Welfare (Bangladesh), Bangladesh Society of Medicine with the support of WHO. This paper uses data from the Micronesia—Chuuk 2006 STEPS survey, implemented by Department of Health and Social Affairs (Micronesia), Chuuk Department of Health Services (Micronesia) with the support of WHO. This paper uses data from the Cambodia 2010 STEPS survey, implemented by Ministry of Health (Cambodia) with the support of WHO. This paper uses data from the Solomon Islands 2005–2006 STEPS survey, implemented by Ministry of Health and Medical Services (Solomon Islands) with the support of WHO. This paper uses data from the Togo 2010–2011 STEPS survey, implemented by Ministry of Health (Togo) with the support of WHO. This paper uses data from the Ethiopia—Addis Ababa 2006 STEPS survey, implemented by School of Public Health, Addis Ababa University (Ethiopia) with the support of WHO. This paper uses data from the Fiji 2011 STEPS survey, implemented by Ministry of Health (Fiji) with the support of WHO. This paper uses data from the Lesotho 2012 STEPS survey, implemented by Ministry of Health and Social Welfare (Lesotho) with the support of WHO. This paper uses data from the Barbados 2007 STEPS survey, implemented by Ministry of Health (Barbados) with the support of WHO. This paper uses data from the Cape Verde 2007 STEPS survey, implemented by Ministry of Health, National Statistics Office with the support of WHO. This paper uses data from the Central African Republic—Bangui 2010 STEPS survey, implemented by Ministry of Health and Population (Central African Republic) with the support of WHO. This paper uses data from the Comoros 2011 STEPS survey, implemented by Ministry of Health (Comoros) with the support of WHO. This paper uses data from the Gambia 2010 STEPS survey, implemented by Ministry of Health and Social Welfare (Gambia) with the support of WHO. This paper uses data from the Guinea 2009 STEPS survey, implemented by Ministry of Public Health and Hygiene (Guinea) with the support of WHO. This paper uses data from the Liberia 2011 STEPS survey, implemented by Ministry of Health and Social Welfare (Liberia) with the support of WHO. This paper uses data from the Maldives 2011 STEPS survey, implemented by Health Protection Agency (Maldives) with the support of WHO. This paper uses data from the Mali 2007 STEPS survey, implemented by Ministry of Health (Mali) with the support of WHO. This paper uses data from the Marshall Islands 2002 STEPS survey, implemented by Ministry of Health (Marshall Islands) with the support of WHO. This paper uses data from the Micronesia—Pohnpei 2008 STEPS survey, implemented by FSM Department of Health and Social Affairs, Pohnpei State Department of Health Services with the support of WHO. This paper uses data from the Sao Tome and Principe 2008 and 2019 STEPS surveys, implemented by Ministry of Health (Sao Tome and Principe) with the support of WHO. This paper uses data from the Sri Lanka 2006, 2014–2015, and 2019 STEPS surveys, implemented by Ministry of Health (Sri Lanka) with the support of WHO. This paper uses data from the Swaziland 2007 and 2014 STEPS surveys, implemented by Ministry of Health (Swaziland) with the support of WHO. This paper uses data from the Tanzania 2012 STEPS survey, implemented by National Institute for Medical Research (Tanzania) with the support of WHO. This paper uses data from the Tonga 2004, 2011–2012, and 2017 STEPS surveys, implemented by Ministry of Health (Tonga) with the support of WHO. This paper uses data from the Vanuatu 2005 and 2011 STEPS surveys, implemented by Ministry of Health (Vanuatu) with the support of WHO. This paper uses data from the Virgin Islands, British 2009 STEPS survey, implemented by Ministry of Health and Social Development (British Virgin Islands) with the support of WHO. This paper uses data from the French Polynesia 2010 STEPS survey, implemented by Ministry of Health (French Polynesia) with the support of WHO. This research used data from the National Health Survey 2003. The author is grateful to the Ministry of Health, Survey copyright owner, allowing him to have the database. All results of the study are those of the author and in no way committed to the Ministry. This study is based on data from Eurostat, Slovenia European Health Interview Survey 2007–2008 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This paper uses data from the Cook Islands 2003–2004 and 2013–2015 STEPS surveys, implemented by Ministry of Health (Cook Islands) with the support of WHO. This paper uses data from the Tanzania—Zanzibar 2011 STEPS survey, implemented by Ministry of Health (Zanzibar) with the support of WHO. This research used data from the National Health Survey 2009–2010. The author is grateful to the Ministry of Health, Survey copyright owner, allowing him to have the database. All results of the study are those of the author and in no way committed to the Ministry. This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. Special acknowledgment is due to Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516–2524 (addhealth@unc.edu). No direct support was received from grant P01-HD31921 for this analysis. This study is based on data from Eurostat, Slovakia European Health Interview Survey 2009 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). The HRS (Health and Retirement Study) is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. This paper uses data from SHARE Waves 1, 2, 3 (SHARELIFE), 4, 5 and 6 (DOIs: 10.6103/SHARE.w1.611, 10.6103/SHARE.w2.611, 10.6103/SHARE.w3.611, 10.6103/SHARE.w4.611, 10.6103/SHARE.w5.611, and 10.6103/SHARE.w6.611), see Börsch-Supan et al (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812)

and FP7 (SHARE-PREP: N 211909, SHARE-LEAP: N 227822, SHARE M4: N 261982). Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org). This paper uses data from the Rwanda 2012–2013 STEPS survey, implemented by Ministry of Health (Rwanda) with the support of WHO. HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the 1997/98, 2001/02, 2005/06 and 2009/10 surveys was Prof Candace Currie and the Data Bank Manager for the 1997/98 survey was Prof Bente Wold, whereas for the following survey Prof Oddrun Samdal was the Databank Manager. A list of principal investigators in each country can be found at http://www.hbsc.org. This paper uses data from the WHO Study on global AGEing and adult health (SAGE). This study is based on data from Eurostat, Latvia European Health Interview Survey 2008 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Romania European Health Interview Survey 2008 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This paper uses data from the Moldova 2013 and 2021 STEPS surveys, implemented by Ministry of Health (Moldova) with the support of WHO. This paper uses data from the Cayman Islands 2012 STEPS survey, implemented by Ministry of Health, Environment, Youth, Sports and Culture (Cayman Islands) with the support of WHO. This paper uses data from the Grenada 2010–2011 STEPS survey, implemented by Ministry of Health (Grenada) with the support of WHO. This paper uses data from the Nepal 2012–2013 STEPS survey, implemented by the Nepal Health Research Council with the support of WHO. This publication uses data provided by Statistics Botswana. This paper uses data from the Namibia 2005 STEPS survey, implemented by the Ministry of Health with the support of WHO. Researchers interested in using TILDA data may access the data for free from the following sites: Irish Social Science Data Archive (ISSDA) at University College Dublin http://www.ucd.ie/issda/data/tilda/; Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/34315. Data for this research were accessed via the Irish Social Science Data Archive (www.ucd.ie/issda). The original creators bear no responsibility for analysis or interpretation of them. This analysis is based on the Statistics Canada Canadian Community Health Survey Microdata File which contains anonymised data collected in the 2013–2014 Canadian Community Health Survey. All computations, use and interpretation of these data are entirely that of IHME. This paper uses data from the Kenya 2015 STEPS survey, implemented by Kenya National Bureau of Statistics, Ministry of Health (Kenya) with the support of WHO. This analysis uses data or information from the LASI Pilot micro data and documentation. The development and release of the LASI Pilot Study was funded by the National Institute on Ageing / National Institute of Health (R21AG032572, R03AG043052, and R01 AG030153). The data used in this paper come from the 2009–10 Ghana Socioeconomic Panel Study Survey which is a nationally representative survey of over 5000 households in Ghana. The survey is a joint effort undertaken by the Institute of Statistical, Social and Economic Research (ISSER) at the University of Ghana, and the Economic Growth Centre (EGC) at Yale University. It was funded by the Economic Growth Center. At the same time, ISSER and the EGC are not responsible for the estimations reported by the analyst(s). This paper uses data from the Bhutan 2014 and 2019 STEPS surveys, implemented by Ministry of Health (Bhutan) with the support of WHO. This paper uses data from the Uganda 2014 STEPS survey, implemented by Ministry of Health (Uganda) with the support of WHO. This paper uses data from the Timor-Leste 2014 STEPS survey, implemented by Ministry of Health (Timor-Leste) with the support of WHO. The CRELES project (Costa Rican Longevity and Healthy Aging Study) is a longitudinal study by the University of Costa Rica's Centro Centroamericano de Población and Instituto de Investigaciones en Salud, in collaboration with the University of California at Berkeley. The original pre-1945 cohort was funded by the Wellcome Trust (grant 072406), and the 1945–1955 Retirement Cohort was funded by the U.S. National Institute on Aging (grant R01AG031716). The study Principal Investigators are Luis Rosero-Bixby and William H. Dow, and co-Principal Investigators Xinia Fernández and Gilbert Brenes. This paper uses data from the Ghana—Greater Accra Region 2006 STEPS survey, implemented by Ghana Health Service with the support of WHO. The CRELES project (Costa Rican Longevity and Healthy Aging Study) is a longitudinal study by the University of Costa Rica's Centro Centroamericano de Población and Instituto de Investigaciones en Salud, in collaboration with the University of California at Berkeley. The original pre-1945 cohort was funded by the Wellcome Trust (grant 072406), and the 1945–1955 Retirement Cohort was funded by the U.S. National Institute on Aging (grant R01AG031716). The study Principal Investigators are Luis Rosero-Bixby and William H. Dow, and co-Principal Investigators Xinia Fernández and Gilbert Brenes. This paper uses data from the Myanmar 2014 STEPS survey, implemented by Ministry of Health (Myanmar) with the support of WHO. HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the 2013/2014 surveys was Prof Candace Currie and the Data Bank Manager was Prof Oddrun Samdal. A list of principal investigators in each country can be found at http://www.hbsc.org. The Canada Health Measures Survey 2016–2017 contains information licensed under the Open Government License Canada. This research used information from the Health Surveys for epidemiological surveillance of the Undersecretary of Public Health. The author thanks the Ministry of Health of Chile, having allowed them to have access to the database. All the results obtained from the study or research are the responsibility of the author and in no way compromise that institution. In this paper use is made of data of the DNB Household Survey administered by Centerdata (Tilburg University, The Netherlands). Those who carried out the original collection and analysis of the Jamaica Survey of Living Conditions bear no responsibility for their further analysis or interpretation. This paper uses data from China Family Panel Studies (CFPS), funded by 985 Program of Peking University and carried out by the Institute of Social Science Survey of Peking University. This paper uses data from the Vietnam 2009 and 2015 STEPS surveys, implemented by Ministry of Health (Vietnam) with the support of WHO. This paper uses data from the Pakistan 2013–2014 STEPS survey, implemented by Ministry of National Health Services, Regulation and Coordination, Pakistan Health Research Council with the support of WHO. This paper uses data from WHO's Study on Global Ageing and Adult Health (SAGE). SAGE is supported by the US National Institute on Aging through Interagency Agreements OGHA 04034785; YA1323–08-CN-0020; Y1-AG-1005–0) and through research grants R01-AG034479 and R21-AG034263. Adapted from Statistics Canada, Canada Tobacco, Alcohol and Drugs Survey 2015. This does not constitute an endorsement by Statistics Canada of this product. This study is based in part on data from Eurostat, European Union Labor Force Survey, 1992–2016. The responsibility for all conclusions drawn from the data lies entirely with the authors. This study is based on data from Eurostat, Belgium Health Interview Survey 2008 and 2009. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Cyprus Health Interview Survey 2008–2009. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Czech Republic European Health Interview Survey 2006–2009 and 2013–2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Estonia European Health Interview Survey 2006–2007 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Greece European Health Interview Survey 2009 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based in part on data from Eurostat, Poland European Health Interview Survey 2009. The responsibility for all conclusions drawn from the data lies entirely with the authors. This study is based in part on data from Eurostat, Spain European Health Interview Survey 2009–2010. The responsibility for all conclusions drawn from the data lies entirely with the authors. This study is based in part on data from Eurostat, France European Health Interview Survey 2008. The responsibility for all conclusions drawn from the data lies entirely with

the authors. The responsibility for analysis and processing is that of the authors and not ISTAT. This paper uses data from the Lebanon 2016–2017 STEPS survey, implemented by Ministry of Public Health (Lebanon) with the support of WHO. This paper uses data from the Zambia 2017 STEPS survey, implemented by Ministry of Health (Zambia) with the support of WHO. This paper uses data from the Armenia 2016 STEPS survey, implemented by Ministry of Health (Armenia), National Institute of Health with the support of WHO. This paper uses data from the Belarus 2016–2017 STEPS survey, implemented by Republican Scientific and Practical Center of Medical Technologies, Informatization, Management and Economics of Public Health (Belarus) with the support of WHO. This paper uses data from the Iraq 2015 STEPS survey, implemented by Ministry of Health (Iraq) with the support of WHO. This paper uses data from the Brunei 2015–2016 STEPS survey, implemented by Ministry of Health (Brunei) with the support of WHO. This paper uses data from the Samoa 2002 and 2013 STEPS surveys, implemented by Ministry of Health (Samoa) with the support of WHO. The data are from China Family Panel Studies (CFPS), funded by 985 Program of Peking University and carried out by the Institute of Social Science Survey of Peking University. This paper uses data from the Algeria 2016–2017 STEPS survey, implemented by Ministry of Health (Algeria) with the support of WHO. This paper uses data from the Azerbaijan 2017 STEPS survey, implemented by Ministry of Health (Azerbaijan) with the support of WHO. This paper uses data from the Kyrgyzstan 2013 STEPS survey, implemented by Ministry of Health (Kyrgyzstan) with the support of WHO. This paper uses data from the Laos 2013 STEPS survey, implemented by Ministry of Health (Laos) with the support of WHO. This paper uses data from the Micronesia—Kosrae 2009 STEPS survey, implemented by FSM Department of Health and Social Affairs with the support of WHO. This paper uses data from the Micronesia—Yap 2009 STEPS survey, implemented by Ministry of Health and Social Affairs (Micronesia) with the support of WHO. This paper uses data from the Palau 2011–2013 and 2016 STEPS surveys, implemented by Ministry of Health (Palau) with the support of WHO. This paper uses data from the Tajikistan 2016 STEPS survey, implemented by Ministry of Health (Tajikistan) with the support of WHO. This paper uses data from the Tokelau 2014 STEPS survey, implemented by the Department of Health with the support of WHO. This paper uses data from the Sudan 2016 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Morocco 2017 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Georgia 2016 STEPS survey, implemented by the National Center for Disease Control and Public Health with the support of WHO. This paper uses data from the Guyana 2016 STEPS survey, implemented by the Ministry of Public Health with the support of WHO. The MHAS (Mexican Health and Aging Study) is partly sponsored by the National Institutes of Health/National Institute on Aging (grant number NIH R01AG018016) and the INEGI in Mexico. Data files and documentation are public use and available at www.MHASweb.org. The Irish Longitudinal study on Ageing (TILDA) Wave 4, 2016 was accessed via the Irish Social Science Data Archive—www.ucd.ie/issda. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. The Estonian National Dietary Survey 2014. https://www.globaldietarydatabase.org/management/microdata-surveys/657, Aug 28, 2020]. The harmonisation of the dataset was performed by the data owner (The Estonian National Dietary Survey 2014 (RTU2014), 2014, National Institute for Health Development], and the overall process was overseen by EFSA (European Food Safety Authority. EFSA Comprehensive European Food Consumption Database. http://www.efsa.europa.eu/en/food-consumption/comprehensive-database] and GDD. This paper uses data from the Bahamas 2011–2012 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Central African Republic—Bangui and Ombella M'Poko 2017 STEPS survey, implemented by the Ministry of Health and Population with the support of WHO. This paper uses data from the Micronesia—Chuuk STEPS 2016 survey, implemented by the Federated States of Micronesia Department of Health and Social Affairs, Department of Health Services of the State of Chuuk, FSM with the support of WHO. This paper uses data from the Tuvalu 2015 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Solomon Islands 2015 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Mali—Kati, Ouélésséboungou, Koulikoro, Ségou and Bamako District 2013 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Marshall Islands 2017–2018 STEPS survey, implemented by the Ministry of Health and Human Services with the support of WHO. This research is based on data from the National Health Interview Survey of the National Center for Health Statistics. The analyses, interpretations, and conclusions of this paper are the author's own. The NCHS is responsible only for the initial data. This paper uses data from the Nepal 2019 STEPS survey, implemented by Nepal Health Research Council, Ministry of Health and Population with the support of WHO. This paper uses data from the Bangladesh 2018 STEPS survey, implemented by the National Institute of Preventive and Social Medicine with the support of WHO. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. Nutrition and Nutritional Status of Children under 5 years in Bulgaria [NUTRICHILD] 2007. https://www.globaldietarydatabase.org/management/microdata-surveys/649, accessed Aug 28, 2020). The harmonisation of the dataset was jointly performed by the data owner (Nutrition and Nutritional Status of Children under 5 years in Bulgaria [NUTRICHILD], 2007) and EFSA (European Food Safety Authority. EFSA Comprehensive European Food Consumption Database. http://www.efsa.europa.eu/en/food-consumption/comprehensive-database), and the overall process was overseen by EFSA and GDD. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. Canadian Community Health Survey—Nutrition [CCHS-Nutrition], 2015. https://www.globaldietarydatabase.org/management/microdata-surveys/650; accessed Aug 28, 2020). The harmonisation of the original dataset was performed by GDD. The data was adapted from Statistics Canada, Canadian Community Health Survey: Public Use Microdata File, 2015/2016 (Statistics Canada. Canadian Community Health Survey—Nutrition [CCHS-Nutrition], 2015); this does not constitute an endorsement by Statistics Canada of this product. The data is used under the terms of the Statistics Canada Open Licence (Statistics Canada. Statistics Canada Open License. https://www.statcan.gc.ca/eng/reference/licence). The harmonised dataset was downloaded from the GDD website (Global Dietary Database. Compilation of existing individual food consumption data collected within the most recent national dietary surveys in Europe (SK-MON) 2008. https://www.globaldietarydatabase.org/management/microdata-surveys/652; Sept 21, 2020). The harmonisation of the dataset was jointly performed by the data owner (National nutrition survey in Slovakia (NDS), 2008, Food Research Institute and Public Health Authority) and EFSA (European Food Safety Authority. EFSA Comprehensive European Food Consumption Database. http://www.efsa.europa.eu/en/food-consumption/comprehensive-database), and the overall process was overseen by EFSA. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. National dietary survey in adults in Sweden, Riksmaten adults 2010–2011. https://www.globaldietarydatabase.org/management/microdata-surveys/174; accessed Sept 23, 2020). The harmonisation of the dataset was performed by the data owner (National dietary survey in adults in Sweden, Riksmaten adults 2010–11, Swedish Food Agency), and the overall process was overseen by EFSA (European Food Safety Authority. EFSA Comprehensive European Food Consumption Database. http://www.efsa.europa.eu/en/food-consumption/comprehensive-database) and GDD. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. DIETA-PILOT Survey Adults, Children 2012. https://www.globaldietarydatabase.org/management/microdata-surveys/661. accessed 10/7/20). The harmonisation of the dataset was performed by the data owner (DIETA-PILOT Survey, 2012, Dunarea de Jos University of Galați, Romania), and the overall process was overseen by EFSA (European Food Safety Authority. EFSA Comprehensive European Food Consumption Database. http://www.efsa.europa.eu/en/food-consumption/comprehensive-database) and GDD. This paper uses data from the Afghanistan 2018 STEPS survey, implemented by Ministry of Public Health with the support of WHO. This paper uses data from the Ecuador 2018 STEPS survey, implemented by Ministry of Public Health with the support of WHO. This paper uses data from the

Generations and Gender Programme (www.ggp-i.org). The Generations and Gender Programme has received funding from the European Commission, its Consortium Board Members and National Funding Bodies which are gratefully acknowledged. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. National Survey of Food Intake and Nutritional Status (NSFIN) 2004. https://www.globaldietarydatabase.org/management/microdata-surveys/648, accessed Aug 28, 2020). The harmonisation of the dataset was jointly performed by the data owner (National Survey of Food Intake and Nutritional Status (NSFIN), National Nutrition Monitoring in Bulgaria, 2004) and EFSA (European Food Safety Authority. EFSA Comprehensive European Food Consumption Database. http://www.efsa.europa.eu/en/food-consumption/comprehensive-database), and the overall process was overseen by EFSA and GDD. The harmonised dataset was downloaded from the GDD website (Global Dietary Database. Mabat Youth—First Israeli National Health and Nutrition Survey in 7th-12th grade students 2003–2004. https://www.globaldietarydatabase.org/management/microdata-surveys/180; accessed Sept 17, 2020). The harmonisation of the dataset was jointly performed by the data owner (MABAT Youth First Israeli National Health and Nutrition Survey in 7th-12th grade students 2003–2004. Israel Center for Disease Control, Ministry of Health, State of Israel) and GDD, and the overall process was overseen by GDD. VACS data are owned by the Government of Cote d'Ivoire and made available by the Centers for Disease Control and Prevention through a Data Use Agreement. This paper uses data from the Mongolia 2019 STEPS survey, implemented by the Ministry of Health, Public Health Institute with the support of WHO. This paper uses data from the Jordan 2019 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Turkmenistan 2018 STEPS survey, implemented by the Ministry of Health and Medical Industry with the support of WHO. This study is based on data from Eurostat, Austria European Health Interview Survey 2006–2007 and 2013–2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Belgium European Health Interview Survey 2013 and 2013–2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Cyprus European Health Interview Survey 2013–2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Germany European Health Interview Survey 2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Denmark European Health Interview Survey 2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Spain European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Finland European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, France European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Hungary European Health Interview Survey 2008 and 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Croatia European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Ireland European Health Interview Survey 2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Iceland European Health Interview Survey 2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Italy European Health Interview Survey 2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Lithuania European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Netherlands European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Norway European Health Interview Survey 2015. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Poland European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Portugal European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Sweden European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, European Union Statistics on Income and Living Conditions, Cross-sectional Data Collection 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, and 2020. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, European Union Statistics on Income and Living Conditions, Longitudinal Data Collection 2005, 2006, and 2007. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This paper uses data from the Ukraine 2019 STEPS survey, implemented by the Ministry of Health with the support of WHO. This study is based on data from Eurostat, United Kingdom European Health Interview Survey 2013. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This study is based on data from Eurostat, Luxembourg European Health Interview Survey 2014. The responsibility for all conclusions drawn from the data lies entirely with the author(s). This research uses data from the study on "Understanding the Lives of Adolescents and Young Adults (UDAYA) in Bihar and Uttar Pradesh" which was collected by the Population Council. Data collection funded by Bill & Melinda Gates Foundation and the David and Lucile Packard Foundation. Data for the Seychelles Heart Study IV was provided by the Global Dietary Database and Tufts University in association with the Ministry of Health and University of Lausanne. HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the 2017/2018 surveys was Prof Jo Inchley and the Data Bank Manager was Prof Oddrun Samdal. A list of principal investigators in each country can be found at http://www.hbsc.org. This paper uses data from the Global School-Based Student Health Survey (GSHS). GSHS is supported by WHO and the US Centers for Disease Control and Prevention. This paper uses data from the Bolivia 2019 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Cabo Verde 2020 STEPS survey, implemented by the Ministry of Health, National Institute of Statistics with the support of WHO. This paper uses data from the WHO Well-being of Older People Study (WOPS) a Study on Global AGEing and Adult Health (SAGE) sub-study. Research reported in this publication was supported by the National Institute on Aging of the National Institutes of Health under Award Number R01AG044917. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. This paper uses data from the Saint Lucia 2019 STEPS survey, implemented by the Ministry of Health with the support of WHO. This paper uses data from the Viet Nam 2021 STEPS survey, implemented by the Ministry of Health with the support of WHO. Parts of this material are based on data and information provided by the Canadian Institute for Health Information. However, the analyses, conclusions, opinions and statements expressed herein are those of the author and not those of the Canadian Institute for Health information. The views and opinions of the authors expressed herein do not necessarily state or reflect those of ECDC. The accuracy of the authors' statistical analysis and the findings they report are not the responsibility of ECDC. ECDC is not responsible for the conclusions or opinions drawn from the data provided. ECDC is not responsible for the correctness of the data and for data management, data merging and data collation after provision of the data. ECDC shall not be held liable for improper or incorrect use of the data.

Editorial note: The Lancet Group takes a neutral position with respect to territorial claims in published maps and institutional affiliations.

References

1 IHME COVID-19 Forecasting Team. Modeling COVID-19 scenarios for the United States. *Nat Med* 2021; **27:** 94–105.

2 Azad A. Model cited by White House says 82,000 people could die from coronavirus by August, even with social distancing. CNN. March 30, 2020. https://www.cnn.com/2020/03/30/health/coronavirus-us-ihme-model-us/index.html (accessed March 12, 2025).

3 COVID-19 Excess Mortality Collaborators. Estimating excess mortality due to the COVID-19 pandemic: a systematic analysis of COVID-19-related mortality, 2020–21. *Lancet* 2022; **399:** 1513–36.

4 Murray CJL. The Global Burden of Disease Study at 30 years. *Nat Med* 2022; **28:** 2019–26.

5 Jamison DT, Summers LH, Chang AY, et al. Global health 2050: the path to halving premature death by mid-century. *Lancet* 2024; **404:** 1561–614.

6 WHO. The global health observatory. Noncommunicable diseases: mortality https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ncd-mortality (accessed Feb 25, 2025).

7 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; published online Oct 12. https://doi.org/10.1016/S0140-6736(25)01330-3.

8 Sauerberg M, Luy M. Standardized mean age at death (MADstd): exploring its potentials as a measure of human longevity. *Demogr Res* 2024; **50:** 871–98.

9 Garmany A, Yamada S, Terzic A. Longevity leap: mind the healthspan gap. *NPJ Regen Med* 2021; **6:** 57.

10 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; published online Oct 12. https://doi.org/10.1016/S0140-6736(25)01637-X.

11 WHO. WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020. https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020 (accessed March 11, 2025).

12 Polizzi A, Zhang L, Timonin S, et al. Indirect effects of the COVID-19 pandemic: a cause-of-death analysis of life expectancy changes in 24 countries, 2015 to 2022. *PNAS Nexus* 2024; **4:** pgae508.

13 Institute for Health Metrics and Evaluation. 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 March 21, 2025).

14 GBD 2021 Causes of Death Collaborators. Global burden of 288 causes of death and life expectancy decomposition in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet* 2024; **403:** 2100–32.

15 Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; **380:** 2095–128.

16 GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age–sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015; **385:** 117–71.

17 GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016; **388:** 1459–544.

18 GBD 2016 Causes of Death Collaborators. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017; **390:** 1151–210.

19 GBD 2017 Causes of Death Collaborators. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018; **392:** 1736–88.

20 Johnson SC, Cunningham M, Dippenaar IN, et al. Public health utility of cause of death data: applying empirical algorithms to improve data quality. *BMC Med Inform Decis Mak* 2021; **21:** 175.

21 PAHO/WHO. Monitoring the premature mortality from the four major noncommunicable diseases (cardiovascular diseases, cancer, diabetes mellitus, and chronic respiratory diseases) in the Region of the Americas, 2000–2019. Pan American Health Organization, 2021. https://www.paho.org/en/enlace/risk-dying-prematurely-ncds (accessed Feb 25, 2025).

22 National Cancer Institute, National Institutes of Health. NCI Dictionary of Cancer Terms: premature death. Feb 2, 2011. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/premature-death (accessed Feb 25, 2025).

23 García MC, Rossen LM, Matthews K, et al. Preventable premature deaths from the five leading causes of death in nonmetropolitan and metropolitan counties, United States, 2010–2022. *MMWR Surveill Summ* 2024; **73:** 1–11.

24 França EB, Ishitani LH, de Abreu DMX, et al. Measuring misclassification of COVID-19 as garbage codes: results of investigating 1365 deaths and implications for vital statistics in Brazil. *PLOS Glob Public Health* 2022; **2:** e0000199.

25 US Centers for Disease Control and Prevention. Excess deaths associated with COVID-19. Sept 28, 2023. https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm (accessed Jan 13, 2025).

26 Birnbaum JK, Murray CJ, Lozano R. Exposing misclassified HIV/AIDS deaths in South Africa. *Bull World Health Organ* 2011; **89:** 278–85.

27 COVID-19 Forecasting Team. Forecasting the trajectory of the COVID-19 pandemic into 2023 under plausible variant and intervention scenarios: a global modelling study. *medRxiv* 2023; published online March 8. https://doi.org/10.1101/2023.03.07.23286952 (preprint).

28 GBD 2019 Healthcare Access and Quality Collaborators. Assessing performance of the Healthcare Access and Quality Index, overall and by select age groups, for 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019. *Lancet Glob Health* 2022; **10:** e1715–43.

29 GBD 2021 Diseases and Injuries Collaborators. Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet* 2024; **403:** 2133–61.

30 Institute for Health Metrics and Evaluation. GBD Results. https://vizhub.healthdata.org/gbd-results (accessed July 14, 2025).

31 Stevens GA, Alkema L, Black RE, et al. Guidelines for Accurate and Transparent Health Estimates Reporting: the GATHER statement. *Lancet* 2016; **388:** e19–23.

32 Lewis S, Ewald L, Duber HC, Mokdad AH, Gakidou E. Determinants of unmet healthcare needs during the final stage of the COVID-19 pandemic: insights from a 21-country online survey. *Int J Public Health* 2024; **69:** 1607639.

33 Bill Gates. How to prevent the next pandemic. Penguin Books, 2023.

34 Otto SP, MacPherson A, Colijn C. Endemic does not mean constant as SARS-CoV-2 continues to evolve. *Evolution* 2024; **78:** 1092–108.

35 Johnson NPAS, Mueller J. Updating the accounts: global mortality of the 1918–1920 'Spanish' influenza pandemic. *Bull Hist Med* 2002; **76:** 105–15.

36 Murray CJ, Lopez AD, Chin B, Feehan D, Hill KH. Estimation of potential global pandemic influenza mortality on the basis of vital registry data from the 1918–20 pandemic: a quantitative analysis. *Lancet* 2006; **368:** 2211–18.

37 UN Office on Drugs and Crime. World drug report 2024. https://www.unodc.org/unodc/en/data-and-analysis/world-drug-report-2024.html (accessed March 17, 2025).

38 Montesanti SR. The role of structural and interpersonal violence in the lives of women: a conceptual shift in prevention of gender-based violence. *BMC Womens Health* 2015; **15:** 93.

39 Pirkis J, Dandona R, Silverman M, Khan M, Hawton K. Preventing suicide: a public health approach to a global problem. *Lancet Public Health* 2024; **9:** e787–95.

40 UN Office for the Coordination of Humanitarian Affairs. Reported impact snapshot: Gaza Strip (8 January 2025). https://www.ochaopt.org/content/reported-impact-snapshot-gaza-strip-8-january-2025 (accessed Feb 28, 2025).

41 Guillot M, Draidi M, Cetorelli V, Silva JHCMD, Lubbad I. Life expectancy losses in the Gaza Strip during the period October, 2023, to September, 2024. *Lancet* 2025; **405:** 478–85.

42 GBD 2021 Suicide Collaborators. Global, regional, and national burden of suicide, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Public Health* 2025; **10:** e189–202.

43 Yan Y, Jiang Y, Liu R, et al. Impact of pesticide regulations on mortality from suicide by pesticide in China: an interrupted time series analysis. *Front Psychiatry* 2023; **14:** 1189923.

44 Cai Z, Chen M, Ye P, Yip PSF. Socio-economic determinants of suicide rates in transforming China: a spatial-temporal analysis from 1990 to 2015. *Lancet Reg Health West Pac* 2022; **19:** 100341.

45 WHO. Comprehensive mental health action plan 2013–2030. Sept 21, 2021. https://www.who.int/publications/i/item/9789240031029 (accessed Jan 24, 2025).

46 Razeghian-Jahromi I, Ghasemi Mianrood Y, Dara M, Azami P. Premature death, underlying reasons, and preventive experiences in Iran: a narrative review. *Arch Iran Med* 2023; **26:** 403–10.

47 GBD 2021 Tuberculosis Collaborators. Global, regional, and national age-specific progress towards the 2020 milestones of the WHO End TB Strategy: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Infect Dis* 2024; **24:** 698–725.

48 Troeger CE, Khalil IA, Blacker BF, et al. GBD 2017 Lower Respiratory Infections Collaborators. Quantifying risks and interventions that have affected the burden of lower respiratory infections among children younger than 5 years: an analysis for the Global Burden of Disease Study 2017. *Lancet Infect Dis* 2020; **20:** 60–79.

49 Niessen L. Comparative impact assessment of child pneumonia interventions. *Bull World Health Organ* 2009; **87:** 472–80.

50 GBD 2021 Diarrhoeal Diseases Collaborators. Global, regional, and national age-sex-specific burden of diarrhoeal diseases, their risk factors, and aetiologies, 1990–2021, for 204 countries and territories: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Infect Dis* 2024; **25:** 519–36.

51 GBD 2023 Vaccine Collaborators. Global, regional, and national trends in routine childhood vaccination coverage from 1980 to 2023 with forecasts to 2030: a systematic analysis for the Global Burden of Disease Study 2023. *Lancet* 2025; **406:** 235–260.

52 WHO. The End TB Strategy. 2022. https://www.who.int/teams/global-tuberculosis-programme/the-end-tb-strategy (accessed Jan 27, 2025).

53 WHO. Child health. https://www.who.int/health-topics/child-health (accessed Jan 27, 2025).

54 UN Department of Economic and Social Affairs. Sustainable Development: the 17 Goals. https://sdgs.un.org/goals (accessed Feb 28, 2025).

55 NCD Countdown 2030 Collaborators. NCD Countdown 2030: pathways to achieving Sustainable Development Goal target 3.4. *Lancet* 2020; **396:** 918–34.

56 NCD Countdown 2030 Collaborators. NCD Countdown 2030: efficient pathways and strategic investments to accelerate progress towards the Sustainable Development Goal target 3.4 in low-income and middle-income countries. *Lancet* 2022; **399:** 1266–78.

57 Ngowi JE, Munishi C, Ndumwa HP, et al. Efforts to address the burden of non-communicable diseases need local evidence and shared lessons from high-burden countries. *Ann Glob Health* 2023; **89:** 78.

58 Boutayeb A. The burden of communicable and non-communicable diseases in developing countries. In: Preedy VR, Watson RR, eds. Handbook of disease burdens and quality of life measures. Springer, 2010: 531–46.