Global, regional, and national burden of chronic kidney disease in adults, 1990–2023, and its attributable risk factors: a systematic analysis for the Global Burden of Disease Study 2023

*GBD 2023 Chronic Kidney Disease Collaborators**

Summary

Background Chronic kidney disease (CKD) is common and ranks among the leading causes of mortality and morbidity. This analysis aimed to present global CKD estimates using the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2023 to inform evidence-based policies for CKD identification and treatment.

Methods This analysis focused on adults aged 20 years and older over the period 1990 to 2023, from 204 countries and territories. Data sources used were published literature, vital registration systems, kidney failure treatment registries, and household surveys. Estimates of CKD burden, including deaths, incidence, prevalence, and disability-adjusted life-years (DALYs), were produced using a Cause of Death Ensemble model and a Bayesian meta-regression analytical tool. A comparative risk assessment approach estimated the proportion of cardiovascular deaths attributable to impaired kidney function and estimated risk factors for CKD.

Findings Globally, in 2023, 788 million (95% uncertainty interval 743–843) people aged 20 years and older were estimated to have CKD, up from 378 million (354–407) in 1990. The global age-standardised prevalence of CKD in adults was 14·2% (13·4–15·2), a relative rise of 3·5% (2·7–4·1) from 1990. The region with the highest age-standardised prevalence was north Africa and the Middle East (18·0%; 16·9–19·4). Most people had stage 1–3 CKD, with a combined prevalence of 13·9% (13·1–15·0). In 2023, CKD was the ninth leading cause of death globally, accounting for 1·48 million (1·30–1·65) deaths, and the 12th leading cause of DALYs, with an age-standardised DALY rate of 769·2 (691·8–857·4) per 100 000. Impaired kidney function as a risk factor accounted for 11·5% (8·4–14·5) of cardiovascular deaths. High fasting plasma glucose, body-mass index, and systolic blood pressure were all leading risk factors for CKD DALYs.

Interpretation CKD is a major global health issue, with rising prevalence and increasing importance as a cause of death and as a risk factor for cardiovascular death. A better understating of aetiology, appropriate screening, and implementation programmes are needed to translate advances in CKD treatment into improved patient outcomes.

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Introduction

Chronic kidney disease (CKD), defined either by reduction in estimated glomerular filtration rate (eGFR) or by increased urinary excretion of albumin (or protein), is an important cause of mortality and morbidity globally. Since it is more common in older age, the burden of CKD has increased as the global population ages. The last report from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) on CKD documented a global age-standardised prevalence of CKD of 9·1% (697 million) in 2017, with a higher prevalence and attributable mortality compared to 1990.[1,2] Updating the global and country-specific estimates of CKD prevalence and risks, with a focus on adults, is important to develop priorities and plans for global health-care initiatives.

The burden associated with CKD extends beyond its most severe form: kidney failure requiring kidney replacement therapy (KRT). A separate GBD report has described the global rise of KRT from 1·59 million in 1990 to 4·59 million in 2023.[3] The population affected by CKD is orders of magnitude higher than that of KRT, since the majority of people with CKD experience mortality due to cardiovascular disease, acute kidney injury, and infectious causes including COVID-19[4,5] before reaching kidney failure. Estimates of the prevalence of CKD depend on the methodology of ascertainment and case definition, as well as region-specific risk factors, but a recent meta-analysis estimated the prevalence of CKD at 13% of adults, with disparities related to age, sex, and socioeconomic status.[6] Thus, the growing literature on

Research in context

Evidence before this study

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) has generated publicly available estimates of chronic kidney disease deaths, prevalence, years of life lost, years lived with disability, and disability-adjusted life-years across age, sex, and location since 1990. GBD produces estimates of CKD with each new cycle, but there has not been a comprehensive description and analysis of data, methods, and estimates since GBD 2017. Although several systematic reviews and meta-analyses have been done by other research groups, these analyses have not been as granular demographically and they have focused exclusively on prevalence or deaths. In this study, we present estimates of morbidity, mortality, and the burden of chronic kidney disease by severity. We conducted systematic reviews in PubMed from Jan 1, 1990, to Sep 13, 2022 (appendix 1 section 3.1), carrying out opportunistic searches of renal registries and incorporating data shared by country collaborators. To estimate the burden of cardiovascular disease due to kidney dysfunction, we acquired data on the risk relationship from a systematic review done from Jan 1, 1990, to April 25, 2023, and relative risk data from the Chronic Kidney Disease Prognosis Consortium (appendix 1 section 4.1).

Added value of this study

This study updates and expands on previously published estimates from GBD. We report epidemiological patterns from 1990 to 2023 and describe CKD patterns for adults by stages—a feature that was not included in the previous analysis and is not otherwise publicly available. We also explicitly quantify the proportion of the cardiovascular disease burden attributable to kidney dysfunction and chronic kidney disease burden attributable to selected risk factors. This information is essential to policy makers, health-care professionals, health researchers, and individuals with chronic kidney disease to understand the scale, magnitude, and trajectory of this disease and to guide resource allocation.

Implications of all the available evidence

Chronic kidney disease is a major health condition that both serves as a risk factor for diseases with high morbidity and mortality and is an important cause of disease burden in its own right. Despite its prominent role among non-communicable diseases, it does not engender the same type of attention as other leading causes of health loss from policy makers. This study serves to underscore and quantify the growing impact of chronic kidney disease across age, year, sex, and location that can be used to understand future research needs and areas for intervention as well as societal costs.

See Online for appendix 1

CKD prevalence indicates an even higher burden than previously appreciated.

GBD provides a systematic approach to quantifying not only health loss attributable to disease but also the prevalence of its risk factors. The principal primary cause of CKD globally is diabetes.[1] The rising prevalence of obesity and diabetes,[7,8] in addition to the ageing of the global population, is likely to lead to a rising burden of CKD.[9] Additionally, the understanding of specific causes of CKD and populations at risk have evolved. Risk variants in the *APOL1* gene are now established to be major contributors to the excess risk of CKD in people of Black ethnicity, both in North America and west Africa.[10] CKD of unknown aetiology (CKDu) is a major emergent public health concern in many countries in central America and south Asia.[11] Thus, while diabetes and hypertension continue to be leading risk factors for CKD,[1] the multifactorial nature of CKD is increasingly being recognised, as is the observation that CKD itself aggravates a range of other health problems, including hypertension.

A detailed estimation of the global prevalence of CKD is important for planning both current and future needs for diagnosis, care, and the corresponding workforce to meet a growing CKD burden. Fortunately, several effective interventions targeting the renin–angiotensin–aldosterone system (including angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, mineralocorticoid receptor antagonists [MRAs], SGLT2 inhibitors, and GLP-1 receptor agonists), can slow kidney disease progression and reduce the consequent risk of heart attacks, strokes, and heart failure.[2] GBD, with its broad collection of data sources and statistical modelling approaches, can deliver the most comprehensive estimates of CKD burden placed in the context of other causes of death and disability.[1] We aimed to summarise findings from GBD 2023 on CKD epidemiology in 204 countries and territories, expressed in terms of prevalence, mortality, and disability-adjusted life-years (DALYs) in people aged 20 years and older, as well as the proportion of cardiovascular disease mortality that can be attributed to kidney dysfunction and the contribution of metabolic, behavioural, and environmental risk factors to CKD DALYs. This paper was produced as part of the GBD Collaborator Network and in accordance with the GBD Protocol.[12]

Methods

Overview

This study used de-identified data and was approved by the University of Washington Institutional Review Board (study #9060). To allow comparison of estimates made in populations with different age structures, we report some of the results as age-standardised estimates for adults aged 20 years and older (ie, extrapolated to a

hypothetical population with a standardised age structure). We focused on adults aged 20 years and older since data in children are sparse and the epidemiology of CKD is different in childhood. The standard population was calculated with the non-weighted mean of the age-specific population proportional distributions for all national locations with 2019 populations greater than 5 million from GBD 2021.

This study complies with the GATHER recommendations (appendix 1 table S1).[13]

Mortality

We used 21845 sources since 1980 to estimate deaths for which CKD was the underlying cause (appendix 1 section 2.1). Diagnostic (International Classification of Diseases) codes directly mapped to CKD (appendix 1 table S2) and garbage codes[14] for which CKD could have been the underlying cause of death were eligible for inclusion in the CKD model. Most garbage codes redistributed to CKD were originally coded to hypertension, unspecified anaemia, or heart failure. In 2020, 33% of CKD deaths were defined as garbage codes; this fraction was similar in 2015 (33%) and lower than in 2010 (42%). General methods for processing and standardising mortality data in GBD 2023 are described elsewhere.[12]

We used the Cause of Death Ensemble model (CODEm)[12] to estimate CKD mortality. CODEm uses out-of-sample predictive validity testing to create ensembles of mixed-effects or spatiotemporal Gaussian regression models of mortality rates or cause fractions with varying combinations of predictive covariates. Covariates were assessed on the basis of established relationships with development or management of CKD, with nine covariates included (appendix 1 section 2.3). CODEm results for all causes are scaled to be consistent with all-cause mortality estimates by location, year, age, and sex, the details of which can be found elsewhere.[12]

Non-fatal estimation

We defined prevalent CKD as loss of kidney function, as indicated by eGFR and urinary albumin-to-creatinine ratio (ACR). GBD considers six categories of CKD as defined by level of eGFR (equivalent to Kidney Disease Improving Global Outcomes [KDIGO] G-stages) and ACR (equivalent to KDIGO A-stages) or receipt of kidney replacement therapy. The categories of CKD in GBD are CKD stage 1–2 (KGIDO stage G1–2 with A2–3), stage 3 (KDIGO stage G3), stage 4 (KDIGO stage G4), and stage 5 (KDIGO stage G5), end-stage kidney disease (ESKD) on maintenance dialysis, and kidney transplantation. Due to the nature of epidemiological studies used to estimate CKD prevalence and incidence, the GBD definition of CKD requires only one measurement of eGFR and ACR and therefore deviates from the KDIGO 2024 Clinical Practice Guidelines duration requirement of abnormalities for more than 3 months. The GBD case definitions by CKD category with corresponding KDIGO categories are presented in appendix 1 (section 3.2.1).

For GBD 2023, we conducted an updated systematic review[1,15] of the available literature for population-representative studies reporting prevalence or incidence of each CKD stage based on eGFR and ACR values (appendix 1 section 3.1). We considered the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) 2009 equation[16] as the reference equation for estimating GFR in adults aged 18 years and older and also included data estimating GFR using the newer CKD-EPI[17] formulas without adjustment. Data from studies using the older Modification of Diet in Renal Disease or Cockcroft–Gault formulas for estimating GFR were included after applying adjustment factors generated by the meta-regression–Bayesian, regularised, trimmed (MR-BRT)[18] tool. Similarly, CKD stage 1–2 data using alternative ACR thresholds (17 mg/g, 20 mg/g, or 25 mg/g) to define elevated urinary ACR were also adjusted to 30 mg/g before modelling (appendix 1 section 3.2.2). Prevalence and incidence data of dialysis and transplantation were largely obtained from national registries for ESKD. There were 2230 data sources in 133 of the 204 countries and territories included in GBD used in the CKD non-fatal estimation process (appendix 1 section 3.1).

We used a hierarchical Bayesian meta-regression modelling tool, DisMod-MR 2.1,[10] to estimate the prevalence of each CKD category separately from 1990 to 2023. DisMod-MR 2.1 applies differential equations to produce a consistent set of estimates based on data or priors for several epidemiological parameters, including prevalence, incidence, remission rate, and excess mortality rate. We also ran a DisMod-MR 2.1 model for CKD stages 3–5 combined. After modelling, we scaled age-sex-year-location-specific prevalence estimates of CKD stages 3, 4, and 5 to sum to the corresponding prevalence of stages 3–5 combined. More details on CKD non-fatal modelling, including covariates, are provided in appendix 1 (section 3.3).

Disability-adjusted life-years

The methods for calculating DALYs have been described elsewhere;[19] in brief, DALYs were the sum of years of life lost (the product of number of deaths and standard life expectancy at each age of death)[12] and years lived with disability (the product of the prevalence of each sequela before death and its corresponding disability weight).[19] For each CKD category, we calculated the proportion of the burden due to five aetiologies: type 1 diabetes, type 2 diabetes, glomerulonephritis, hypertension, and a residual category of other and unspecified causes (appendix 1 section 3.4.1). These aetiology proportions, along with proportions by anaemia severity and proportions by heart failure severity, were applied to prevalence estimates of CKD categories to estimate CKD sequela (appendix 1 sections 3.4.2–3.4.3).

	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
Global	**788 000 (743 000 to 843 000)**	**14·2% (13·4 to 15·2)**	**3·5% (2·7 to 4·1)**	**1480 (1300 to 1650)**	**26·5 (23·1 to 29·5)**	**6·1% (–7·6 to 25·5)**
Low SDI	**111 000 (103 000 to 120 000)**	**15·2% (14·4 to 16·2)**	**–3·2% (–3·8 to –2·5)**	**200 (154 to 243)**	**35·4 (27·3 to 43·0)**	**–5·2% (–27·5 to 45·6)**
Low-middle SDI	**106 000 (99 000 to 114 000)**	**16·1% (15·2 to 17·3)**	**–6·5% (–7·1 to –5·8)**	**185 (146 to 223)**	**33·8 (26·7 to 40·8)**	**2·9% (–22·0 to 37·6)**
Middle SDI	**96 800 (90 600 to 104 000)**	**16·3% (15·3 to 17·6)**	**4·3% (3·7 to 5·0)**	**207 (171 to 240)**	**39·7 (32·4 to 46·0)**	**–4·5% (–24·5 to 24·0)**
High-middle SDI	**185 000 (175 000 to 197 000)**	**15·1% (14·3 to 16·2)**	**3·0% (2·0 to 3·9)**	**282 (251 to 310)**	**23·0 (20·5 to 25·3)**	**–23·8% (–36·0 to –7·8)**
High SDI	**283 000 (267 000 to 303 000)**	**12·2% (11·5 to 13·1)**	**4·4% (3·4 to 5·3)**	**594 (508 to 654)**	**20·7 (17·9 to 22·6)**	**14·3% (1·0 to 26·4)**
Central Europe, eastern Europe, and central Asia	**48 100 (45 100 to 51 200)**	**13·0% (12·2 to 13·8)**	**1·4% (0·8 to 2·1)**	**49·2 (45·7 to 52·7)**	**12·0 (11·1 to 12·8)**	**16·9% (6·3 to 28·0)**
Central Asia	9240 (8620 to 9860)	16·0% (15·0 to 17·0)	4·0% (2·6 to 5·4)	10·6 (9·77 to 11·6)	20·8 (18·9 to 22·5)	27·1% (11·3 to 44·8)
Armenia	444 (411 to 474)	15·8% (14·7 to 16·8)	3·2% (–0·5 to 6·8)	0·336 (0·303 to 0·375)	10·6 (9·5 to 11·8)	17·6% (–2·6 to 42·0)
Azerbaijan	1110 (1040 to 1190)	15·7% (14·7 to 16·7)	1·8% (0·0 to 3·8)	0·999 (0·774 to 1·25)	15·6 (11·9 to 19·6)	–8·9% (–34·3 to 35·9)
Georgia	535 (504 to 567)	16·3% (15·3 to 17·3)	4·0% (1·4 to 6·8)	0·597 (0·521 to 0·695)	16·2 (14·2 to 18·8)	101·6% (53·3 to 167·0)
Kazakhstan	2060 (1930 to 2190)	16·2% (15·2 to 17·2)	2·9% (–0·1 to 5·5)	2·75 (2·47 to 3·03)	23·6 (21·0 to 26·0)	109·0% (85·2 to 134·4)
Kyrgyzstan	588 (548 to 632)	16·0% (15·1 to 17·0)	2·8% (0·9 to 4·9)	0·479 (0·427 to 0·531)	15·8 (14·1 to 17·4)	–14·0% (–29·6 to 2·9)
Mongolia	279 (261 to 300)	15·9% (14·9 to 16·9)	0·5% (–1·4 to 2·5)	0·291 (0·236 to 0·359)	20·1 (15·6 to 25·0)	–24·7% (–44·0 to 7·1)
Tajikistan	691 (640 to 748)	14·8% (13·9 to 15·8)	–1·0% (–2·6 to 0·6)	0·606 (0·446 to 0·753)	18·9 (14·2 to 23·9)	17·2% (–18·7 to 76·6)
Turkmenistan	489 (457 to 523)	16·5% (15·4 to 17·6)	2·5% (0·9 to 4·4)	0·689 (0·597 to 0·792)	25·0 (21·8 to 28·7)	37·5% (17·3 to 64·0)
Uzbekistan	3040 (2810 to 3260)	16·2% (15·1 to 17·1)	8·2% (5·9 to 10·6)	3·89 (3·55 to 4·26)	25·1 (22·8 to 27·5)	–6·9% (–20·9 to 9·5)
Central Europe	10 200 (9540 to 10 800)	8·5% (8·0 to 9·0)	–1·2% (–2·0 to –0·4)	21·9 (20 to 23·3)	14·9 (13·7 to 15·8)	–5·5% (–12·4 to 2·9)
Albania	191 (178 to 203)	8·1% (7·6 to 8·7)	–1·5% (–3·4 to 0·1)	0·402 (0·303 to 0·541)	15·2 (11·6 to 20·3)	–31·8% (–45·9 to –4·2)
Bosnia and Herzegovina	277 (260 to 297)	8·5% (7·9 to 9·0)	3·6% (1·6 to 5·6)	0·605 (0·436 to 0·764)	15·4 (11·3 to 19·5)	–15·9% (–42·0 to 15·7)
Bulgaria	663 (619 to 707)	8·5% (8·0 to 9·0)	3·9% (2·1 to 5·9)	1·97 (1·76 to 2·19)	21·1 (18·9 to 23·6)	118·3% (91·0 to 147·5)
Croatia	373 (350 to 399)	8·4% (7·9 to 9·0)	1·4% (–0·4 to 3·2)	1·22 (1·09 to 1·33)	20·1 (18·0 to 22·0)	52·5% (36·4 to 74·1)
Czechia	909 (848 to 969)	8·0% (7·5 to 8·6)	–0·3% (–2·2 to 1·3)	1·64 (1·47 to 1·83)	11·4 (10·2 to 12·6)	–10·8% (–21·0 to 1·0)
Hungary	831 (777 to 882)	8·1% (7·7 to 8·6)	0·2% (–1·6 to 2·2)	2·61 (2·36 to 2·85)	19·8 (17·9 to 21·4)	117·8% (101·0 to 135·5)
Montenegro	52·5 (49·2 to 56·3)	8·7% (8·2 to 9·3)	4·5% (2·5 to 6·4)	0·165 (0·125 to 0·213)	24·5 (18·6 to 31·8)	5·9% (–23·7 to 55·3)
North Macedonia	176 (164 to 187)	9·8% (9·1 to 10·4)	1·8% (0·1 to 3·7)	0·378 (0·272 to 0·477)	19·0 (13·8 to 24·0)	–2·8% (–42·9 to 52·1)
Poland	3550 (3320 to 3790)	8·9% (8·4 to 9·5)	–5·4% (–6·1 to –4·8)	5·54 (4·91 to 6·12)	11·2 (9·9 to 12·3)	–42·7% (–49·9 to –35·4)

(Table continues on next page)

	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Romania	1730 (1640 to 1820)	8·5% (8·1 to 8·9)	−1·2% (−4·2 to 2·3)	3·43 (3·14 to 3·74)	14·2 (13·0 to 15·4)	3·2% (−5·4 to 13·3)
Serbia	634 (596 to 676)	7·4% (7·0 to 7·9)	3·5% (1·1 to 6·9)	2·53 (1·82 to 3·17)	26·6 (19·9 to 33·3)	3·0% (−24·6 to 43·2)
Slovakia	428 (398 to 457)	8·1% (7·6 to 8·6)	−0·4% (−1·9 to 1·5)	0·714 (0·61 to 0·854)	11·8 (10·1 to 14·0)	−33·1% (−46·8 to −15·8)
Slovenia	190 (178 to 203)	8·1% (7·6 to 8·6)	0·2% (−1·7 to 2·0)	0·356 (0·307 to 0·402)	10·5 (9·1 to 11·8)	−3·2% (−15·7 to 11·2)
Eastern Europe	28 700 (26 900 to 30 600)	14·6% (13·7 to 15·6)	0·1% (−0·5 to 0·7)	16·7 (15·2 to 18·4)	7·5 (6·8 to 8·3)	22·2% (5·7 to 40·7)
Belarus	1380 (1290 to 1470)	15·5% (14·5 to 16·5)	2·5% (0·6 to 4·5)	0·492 (0·435 to 0·559)	4·9 (4·3 to 5·6)	14·7% (−5·3 to 38·2)
Estonia	235 (222 to 250)	16·4% (15·3 to 17·5)	2·2% (0·4 to 4·1)	0·773 (0·677 to 0·864)	37·5 (32·9 to 41·7)	101·6% (74·1 to 134·9)
Latvia	331 (309 to 351)	16·1% (15·2 to 17·2)	4·4% (2·6 to 6·5)	0·46 (0·412 to 0·509)	16·9 (15·3 to 18·8)	110·5% (78·2 to 146·3)
Lithuania	489 (458 to 519)	16·2% (15·1 to 17·3)	3·8% (2·0 to 5·7)	0·403 (0·365 to 0·446)	10·4 (9·5 to 11·5)	55·6% (35·0 to 77·6)
Moldova	638 (601 to 677)	18·4% (17·3 to 19·6)	6·4% (3·1 to 9·4)	0·207 (0·185 to 0·232)	5·3 (4·8 to 5·9)	4·9% (−9·7 to 22·8)
Russia	19 300 (18 100 to 20 700)	14·2% (13·3 to 15·2)	−0·3% (−0·8 to 0·3)	12·8 (11·7 to 14·2)	8·3 (7·5 to 9·2)	10·0% (−4·9 to 26·5)
Ukraine	6330 (5900 to 6730)	15·2% (14·2 to 16·3)	1·0% (−0·8 to 2·9)	1·52 (1·35 to 1·7)	3·5 (3·1 to 3·9)	48·0% (17·3 to 76·8)
High income	**130 000 (123 000 to 138 000)**	**10·8% (10·2 to 11·5)**	**0·6% (0·0 to 1·2)**	**400 (330 to 448)**	**23·2 (19·6 to 25·8)**	**49·4% (33·0 to 67·4)**
Australasia	2820 (2640 to 3020)	8·9% (8·3 to 9·5)	−1·3% (−4·2 to 1·9)	6·72 (5·57 to 7·45)	15·6 (13·1 to 17·2)	14·0% (1·5 to 28·4)
Australia	2380 (2220 to 2550)	8·8% (8·3 to 9·5)	−1·6% (−5·2 to 2·3)	5·56 (4·58 to 6·19)	14·9 (12·4 to 16·5)	10·2% (−1·8 to 24·5)
New Zealand	444 (414 to 473)	9·2% (8·5 to 9·8)	0·4% (−1·2 to 2·1)	1·16 (1·01 to 1·29)	19·5 (17·0 to 21·6)	32·8% (18·0 to 51·8)
High-income Asia Pacific	35 300 (33 500 to 37 200)	14·2% (13·4 to 15·1)	−5·4% (−6·3 to −4·6)	67·6 (51 to 79·2)	15·4 (12·1 to 17·8)	−33·2% (−45·7 to −21·5)
Brunei	45·1 (41·9 to 48·6)	15·6% (14·7 to 16·6)	0·5% (−1·5 to 2·4)	0·0965 (0·0762 to 0·118)	46·4 (36·3 to 57·6)	−28·1% (−46·5 to 11·4)
Japan	28 600 (27 000 to 30 300)	15·6% (14·6 to 16·6)	0·4% (−0·2 to 1·0)	56 (42·1 to 65·8)	14·9 (11·7 to 17·3)	−32·8% (−43·7 to −20·9)
Singapore	868 (821 to 914)	16·3% (15·5 to 17·1)	−1·9% (−9·8 to 2·9)	1 (0·856 to 1·11)	17·2 (14·7 to 19·1)	−22·5% (−31·4 to −13·0)
South Korea	5780 (5530 to 6050)	10·5% (10·0 to 11·0)	−18·2% (−22·2 to −14·8)	10·5 (6·1 to 13·7)	16·7 (9·8 to 21·9)	−38·3% (−74·6 to −0·8)
High-income North America	42 100 (39 400 to 44 900)	11·5% (10·8 to 12·3)	3·5% (2·5 to 4·8)	156 (132 to 175)	34·9 (29·7 to 38·8)	177·5% (143·3 to 221·1)
Canada	3780 (3600 to 3960)	9·6% (9·2 to 10·1)	−6·9% (−12·3 to −2·1)	9·67 (8·21 to 10·6)	17·5 (15·0 to 19·1)	73·3% (57·9 to 90·6)
Greenland	4·47 (4·18 to 4·84)	10·9% (10·2 to 11·7)	2·4% (0·4 to 4·5)	0·00842 (0·00501 to 0·0118)	30·4 (17·4 to 43·3)	3·1% (−36·3 to 72·0)
USA	38 300 (35 800 to 40 900)	11·7% (11·0 to 12·6)	5·0% (4·0 to 6·2)	147 (124 to 164)	37·2 (31·5 to 41·4)	189·1% (152·4 to 235·9)
Southern Latin America	6420 (5980 to 6950)	11·8% (10·9 to 12·8)	5·0% (3·1 to 6·8)	25·7 (22·6 to 28·4)	40·3 (35·7 to 44·4)	−9·4% (−18·5 to 0·0)
Argentina	4160 (3860 to 4520)	11·6% (10·7 to 12·6)	6·5% (4·4 to 8·8)	19·2 (16·8 to 21·6)	46·2 (40·5 to 51·9)	−13·6% (−25·7 to −1·7)

(Table continues on next page)

	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Chile	1880 (1740 to 2030)	12·0% (11·2 to 13·0)	2·1% (–1·1 to 6·7)	5·3 (4·6 to 5·77)	29·5 (25·8 to 32·0)	19·1% (7·4 to 33·1)
Uruguay	379 (354 to 408)	12·6% (11·7 to 13·6)	2·6% (0·1 to 5·2)	1·21 (1·05 to 1·37)	29·1 (25·5 to 32·9)	11·7% (–3·0 to 28·2)
Western Europe	43 700 (41 300 to 46 300)	8·5% (8·0 to 9·1)	–3·4% (–4·1 to –2·6)	144 (117 to 161)	17·6 (14·6 to 19·6)	35·7% (22·1 to 49·9)
Andorra	8·79 (8·25 to 9·4)	9·3% (8·8 to 10·0)	0·2% (–1·7 to 2·0)	0·0216 (0·0159 to 0·0286)	14·2 (10·7 to 18·4)	–14·8% (–39·3 to 33·2)
Austria	977 (921 to 1040)	9·6% (9·0 to 10·2)	3·3% (1·2 to 5·3)	3·96 (3·34 to 4·44)	26·7 (22·6 to 29·9)	163·7% (139·0 to 187·9)
Belgium	1180 (1110 to 1260)	9·4% (8·8 to 10·0)	7·4% (4·7 to 10·7)	3 (2·47 to 3·44)	15·2 (12·6 to 17·3)	–3·1% (–15·8 to 10·7)
Cyprus	116 (108 to 124)	9·8% (9·3 to 10·6)	0·7% (–1·2 to 2·7)	0·42 (0·315 to 0·548)	36·2 (27·5 to 46·9)	–13·1% (–41·2 to 41·7)
Denmark	625 (582 to 668)	9·6% (8·9 to 10·3)	3·0% (0·7 to 5·3)	1·99 (1·69 to 2·25)	21·6 (18·3 to 24·4)	181·8% (143·8 to 222·5)
Finland	683 (641 to 726)	10·1% (9·5 to 10·8)	–4·0% (–6·0 to –2·0)	0·869 (0·706 to 0·995)	8·3 (6·8 to 9·5)	61·1% (42·7 to 80·6)
France	5420 (5100 to 5800)	7·2% (6·7 to 7·8)	3·5% (0·1 to 7·0)	15·6 (13 to 18)	12·4 (10·4 to 14·3)	16·4% (0·6 to 33·0)
Germany	8850 (8450 to 9290)	8·4% (7·9 to 8·9)	–1·5% (–4·5 to 2·1)	42·4 (34·2 to 47·8)	24·2 (19·8 to 27·1)	67·2% (45·9 to 90·1)
Greece	1290 (1210 to 1370)	9·6% (9·0 to 10·2)	0·7% (–1·6 to 2·8)	7·26 (6·33 to 8·06)	34·6 (30·4 to 38·3)	0·3% (–10·8 to 13·6)
Iceland	28·1 (26·2 to 30·1)	8·1% (7·5 to 8·7)	0·8% (–1·8 to 3·5)	0·0443 (0·0363 to 0·0511)	10·3 (8·5 to 11·8)	70·7% (46·1 to 100·6)
Ireland	538 (513 to 568)	11·2% (10·6 to 11·9)	–1·4% (–4·9 to 2·7)	0·652 (0·536 to 0·76)	11·2 (9·2 to 13·0)	–8·3% (–21·4 to 6·3)
Israel	737 (692 to 785)	9·8% (9·2 to 10·5)	0·1% (–1·7 to 2·0)	2·91 (2·45 to 3·34)	31·0 (26·4 to 35·4)	–11·1% (–21·1 to 0·1)
Italy	6120 (5760 to 6560)	8·2% (7·7 to 8·8)	–3·9% (–4·5 to –3·2)	19·3 (15·2 to 22·2)	14·8 (11·9 to 17·0)	11·1% (–4·3 to 26·5)
Luxembourg	50·7 (48 to 53·6)	8·4% (8·0 to 8·9)	–2·4% (–5·8 to 1·3)	0·158 (0·135 to 0·179)	21·0 (18·0 to 23·8)	30·3% (12·4 to 52·8)
Malta	55 (51·6 to 58·5)	9·4% (8·9 to 10·1)	–3·0% (–5·0 to –1·4)	0·148 (0·125 to 0·172)	21·0 (17·8 to 24·3)	9·9% (–5·8 to 28·2)
Monaco	4·83 (4·51 to 5·18)	9·3% (8·7 to 10·0)	0·6% (–1·5 to 2·6)	0·0164 (0·0113 to 0·0234)	20·7 (14·3 to 29·6)	57·9% (0·6 to 169·6)
Netherlands	1650 (1540 to 1770)	9·0% (8·4 to 9·7)	–3·6% (–10·3 to 1·4)	4·46 (3·69 to 5·04)	16·3 (13·6 to 18·4)	57·4% (38·5 to 80·0)
Norway	555 (523 to 592)	10·0% (9·4 to 10·8)	9·2% (8·1 to 10·2)	0·869 (0·704 to 0·998)	11·1 (9·0 to 12·7)	97·1% (66·9 to 130·3)
Portugal	946 (890 to 1020)	7·7% (7·1 to 8·3)	–1·2% (–3·5 to 0·8)	4·73 (3·85 to 5·34)	21·9 (18·1 to 24·6)	14·5% (–1·8 to 30·9)
San Marino	3·83 (3·59 to 4·11)	9·1% (8·5 to 9·8)	–0·5% (–2·2 to 1·6)	0·00744 (0·00528 to 0·0102)	11·3 (8·0 to 15·3)	–16·7% (–43·6 to 36·8)
Spain	4860 (4500 to 5200)	8·6% (8·0 to 9·3)	0·6% (–2·6 to 3·1)	16·8 (13·5 to 19·2)	17·9 (14·6 to 20·5)	–12·7% (–23·2 to –0·6)
Sweden	1440 (1360 to 1520)	11·8% (11·1 to 12·6)	–4·7% (–6·3 to –2·8)	2·82 (2·31 to 3·13)	15·4 (12·8 to 17·1)	151·7% (116·9 to 187·0)
Switzerland	1170 (1100 to 1250)	11·7% (11·1 to 12·5)	4·8% (1·5 to 8·1)	3·13 (2·49 to 3·59)	19·7 (15·7 to 22·5)	73·0% (51·7 to 98·2)
UK	6330 (5910 to 6790)	8·4% (7·8 to 9·0)	–17·6% (–18·3 to –16·9)	12 (10·2 to 13·3)	11·3 (9·7 to 12·5)	68·4% (50·7 to 83·9)

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	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Latin America and Caribbean	**63 600 (59 600 to 67 600)**	**15·4% (14·4 to 16·4)**	**1·2% (0·7 to 1·6)**	**183 (170 to 193)**	**45·1 (41·6 to 47·6)**	**30·4% (19·3 to 42·6)**
Andean Latin America	4020 (3750 to 4340)	9·5% (8·9 to 10·3)	5·7% (4·1 to 7·1)	17·2 (15·3 to 19·4)	43·6 (38·6 to 49·1)	9·4% (–8·8 to 36·9)
Bolivia	706 (659 to 764)	10·4% (9·8 to 11·2)	1·1% (–0·7 to 3·1)	5·16 (3·98 to 6·61)	92·1 (70·9 to 117·8)	37·7% (0·0 to 121·2)
Ecuador	1150 (1080 to 1250)	10·0% (9·4 to 10·9)	4·6% (2·4 to 7·0)	5·77 (5·31 to 6·13)	52·7 (48·5 to 56·0)	22·8% (13·9 to 32·6)
Peru	2160 (2000 to 2340)	9·1% (8·4 to 9·8)	7·7% (5·0 to 9·8)	6·29 (5·12 to 7·79)	27·7 (22·6 to 34·4)	–17·3% (–34·7 to 10·1)
Caribbean	6080 (5710 to 6460)	17·7% (16·6 to 18·8)	4·9% (3·9 to 6·2)	17·3 (15·6 to 19)	49·0 (44·1 to 53·9)	65·3% (44·0 to 84·9)
Antigua and Barbuda	12·9 (12 to 13·7)	18·0% (16·8 to 19·1)	5·6% (3·8 to 7·4)	0·0503 (0·0445 to 0·0567)	71·1 (62·8 to 80·0)	46·4% (24·7 to 73·0)
The Bahamas	50·8 (47·4 to 54·3)	17·8% (16·6 to 19·0)	5·3% (3·5 to 7·4)	0·179 (0·154 to 0·206)	70·3 (60·5 to 80·5)	86·2% (57·1 to 126·0)
Barbados	51 (47·6 to 54·5)	17·2% (16·1 to 18·3)	5·3% (3·3 to 6·9)	0·17 (0·147 to 0·198)	51·0 (44·3 to 59·2)	54·3% (28·8 to 81·6)
Belize	39 (36·5 to 41·8)	17·8% (16·7 to 18·9)	4·0% (2·2 to 5·9)	0·147 (0·129 to 0·165)	79·8 (69·9 to 89·7)	88·1% (56·5 to 119·6)
Bermuda	11·4 (10·6 to 12·1)	15·8% (14·8 to 16·9)	–0·5% (–2·4 to 1·3)	0·0253 (0·0221 to 0·0288)	28·6 (25·0 to 32·4)	23·9% (7·3 to 46·1)
Cuba	1720 (1610 to 1830)	15·7% (14·7 to 16·7)	–1·1% (–2·9 to 0·7)	3·52 (3·13 to 3·97)	27·4 (24·4 to 30·8)	119·5% (95·4 to 147·5)
Dominica	10·5 (9·77 to 11·2)	18·1% (16·9 to 19·3)	6·3% (4·5 to 8·1)	0·036 (0·0259 to 0·0477)	55·8 (40·3 to 73·7)	46·1% (–0·8 to 114·6)
Dominican Republic	1170 (1090 to 1250)	17·4% (16·2 to 18·6)	4·0% (2·0 to 6·0)	3·65 (2·89 to 4·57)	59·8 (47·5 to 75·0)	81·6% (12·4 to 180·4)
Grenada	17·6 (16·5 to 18·7)	18·9% (17·7 to 20·1)	6·8% (5·0 to 8·4)	0·0718 (0·0618 to 0·0804)	73·9 (64·0 to 82·6)	37·4% (18·7 to 64·5)
Guyana	89·3 (83·4 to 95·5)	18·4% (17·3 to 19·6)	4·7% (3·0 to 6·6)	0·476 (0·413 to 0·55)	106·3 (92·0 to 122·9)	136·0% (95·5 to 188·9)
Haiti	1300 (1210 to 1390)	22·1% (20·7 to 23·6)	9·5% (6·4 to 13·8)	3·08 (2·08 to 4·81)	65·9 (44·4 to 102·9)	41·1% (0·6 to 137·0)
Jamaica	346 (323 to 371)	17·0% (15·9 to 18·2)	4·4% (2·4 to 6·4)	1·06 (0·921 to 1·22)	51·0 (44·2 to 58·6)	35·3% (15·3 to 58·7)
Puerto Rico	714 (669 to 761)	17·5% (16·4 to 18·7)	3·8% (1·8 to 5·7)	2·84 (2·52 to 3·13)	51·0 (45·8 to 56·0)	9·9% (–3·2 to 25·5)
Saint Kitts and Nevis	5·9 (5·5 to 6·3)	16·1% (15·0 to 17·1)	3·4% (1·2 to 5·7)	0·0289 (0·0255 to 0·0327)	84·0 (74·0 to 95·0)	34·8% (13·6 to 62·0)
Saint Lucia	26·4 (24·5 to 28·1)	17·7% (16·4 to 18·8)	2·5% (0·7 to 4·6)	0·0934 (0·0821 to 0·106)	60·9 (53·5 to 69·2)	17·8% (0·5 to 40·6)
Saint Vincent and the Grenadines	16·8 (15·7 to 17·9)	17·8% (16·6 to 18·9)	6·2% (4·2 to 8·0)	0·0584 (0·0517 to 0·0666)	58·0 (51·3 to 66·2)	57·6% (33·1 to 89·3)
Suriname	71·1 (66·1 to 76·1)	17·2% (16·0 to 18·5)	1·8% (0·0 to 3·6)	0·235 (0·193 to 0·288)	58·8 (48·2 to 72·5)	29·0% (–7·9 to 99·1)
Trinidad and Tobago	207 (193 to 222)	17·9% (16·7 to 19·1)	6·2% (4·5 to 8·3)	0·947 (0·803 to 1·1)	88·9 (76·3 to 101·9)	91·7% (61·4 to 122·7)
Virgin Islands	16·8 (15·7 to 17·8)	17·3% (16·3 to 18·4)	3·2% (1·7 to 4·6)	0·055 (0·0472 to 0·0627)	47·0 (40·7 to 53·5)	20·1% (0·2 to 43·6)
Central Latin America	30 800 (28 900 to 32 800)	18·0% (16·8 to 19·1)	2·0% (1·4 to 2·5)	102 (95·6 to 108)	62·0 (57·7 to 65·7)	44·6% (32·1 to 61·1)
Colombia	6010 (5630 to 6410)	16·2% (15·2 to 17·2)	–1·8% (–3·6 to –0·1)	7·7 (6·94 to 8·27)	20·5 (18·5 to 22·0)	–32·0% (–37·1 to –27·6)

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	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Costa Rica	718 (670 to 768)	18·7% (17·5 to 20·0)	−1·0% (−4·4 to 2·6)	2·07 (1·84 to 2·31)	55·4 (49·0 to 61·7)	113·8% (94·4 to 139·5)
El Salvador	615 (585 to 651)	15·5% (14·7 to 16·4)	1·3% (−1·9 to 4·3)	4·97 (3·31 to 6·55)	129·7 (86·5 to 170·7)	141·0% (9·4 to 366·6)
Guatemala	1490 (1390 to 1590)	18·4% (17·2 to 19·7)	9·8% (8·1 to 11·6)	5·98 (5·4 to 6·71)	88·4 (79·1 to 98·4)	67·1% (43·1 to 94·3)
Honduras	860 (799 to 925)	17·0% (15·8 to 18·2)	0·5% (−1·5 to 2·5)	2·03 (1·49 to 2·88)	52·9 (38·7 to 75·1)	33·9% (−5·9 to 138·1)
Mexico	16 600 (15 500 to 17 600)	18·9% (17·6 to 20·1)	3·4% (2·8 to 3·9)	59·4 (55·3 to 63·2)	69·9 (65·0 to 74·4)	42·1% (28·7 to 61·9)
Nicaragua	654 (611 to 702)	18·4% (17·2 to 19·6)	6·8% (2·9 to 10·5)	3·25 (2·24 to 3·98)	107·3 (77·9 to 129·2)	52·2% (−17·1 to 144·5)
Panama	595 (566 to 622)	20·9% (19·9 to 21·9)	9·5% (5·3 to 14·1)	1·42 (1·28 to 1·56)	48·9 (44·2 to 53·4)	116·0% (88·8 to 148·6)
Venezuela	3280 (3060 to 3510)	17·3% (16·2 to 18·5)	−2·2% (−3·7 to −0·6)	15·4 (12·7 to 18·1)	88·8 (73·1 to 105·1)	172·6% (121·6 to 232·9)
Tropical Latin America	22 700 (21 200 to 24 200)	13·8% (12·9 to 14·7)	−1·2% (−1·9 to −0·6)	46·7 (41·6 to 50·9)	28·1 (25·0 to 30·6)	4·7% (−4·1 to 13·7)
Brazil	22 200 (20 700 to 23 700)	13·8% (12·9 to 14·7)	−1·3% (−2·0 to −0·6)	45·1 (40·2 to 49·1)	27·7 (24·6 to 30·1)	3·5% (−5·9 to 11·8)
Paraguay	525 (493 to 565)	14·0% (13·1 to 15·0)	1·6% (−0·3 to 3·6)	1·6 (1·12 to 1·97)	49·7 (34·7 to 61·5)	69·9% (10·6 to 142·6)
North Africa and Middle East	**64 100 (59 800 to 69 300)**	**18·0% (16·9 to 19·4)**	**6·2% (5·5 to 7·1)**	**163 (128 to 198)**	**64·9 (50·7 to 79·0)**	**−14·7% (−41·4 to 25·8)**
North Africa and Middle East	64 100 (59 800 to 69 300)	18·0% (16·9 to 19·4)	6·2% (5·5 to 7·1)	163 (128 to 198)	64·9 (50·7 to 79·0)	−14·7% (−41·4 to 25·8)
Afghanistan	2190 (2010 to 2420)	18·0% (16·8 to 19·5)	7·7% (5·4 to 10·2)	3·24 (2·27 to 4·23)	63·3 (44·4 to 81·2)	−17·5% (−44·3 to 21·2)
Algeria	4570 (4240 to 4940)	17·1% (16·0 to 18·5)	4·2% (2·1 to 6·3)	11·6 (7·95 to 15·5)	53·7 (36·8 to 72·7)	0·7% (−38·2 to 53·7)
Bahrain	166 (153 to 182)	17·3% (16·2 to 18·6)	0·4% (−1·4 to 2·5)	0·23 (0·158 to 0·317)	60·3 (40·3 to 82·1)	−15·8% (−45·2 to 27·3)
Egypt	9430 (8720 to 10 200)	17·7% (16·5 to 19·0)	10·1% (8·1 to 12·9)	46·9 (35·2 to 59·6)	146·2 (107·3 to 185·4)	7·5% (−34·9 to 68·2)
Iran	12 700 (12 000 to 13 700)	22·7% (21·3 to 24·2)	17·2% (15·7 to 18·9)	13·1 (9·16 to 17)	31·9 (22·5 to 41·6)	−24·1% (−52·8 to 25·0)
Iraq	3800 (3490 to 4140)	18·1% (16·9 to 19·5)	2·6% (0·5 to 4·6)	7·62 (5·43 to 10·3)	64·8 (46·7 to 89·6)	−7·7% (−39·5 to 47·8)
Jordan	1140 (1060 to 1250)	16·5% (15·4 to 17·7)	−3·3% (−5·2 to −1·6)	2·83 (2·26 to 3·46)	64·9 (51·1 to 79·6)	−1·8% (−30·0 to 50·3)
Kuwait	477 (436 to 525)	16·5% (15·4 to 17·9)	−3·6% (−6·0 to −1·4)	0·385 (0·329 to 0·445)	38·7 (32·1 to 45·5)	−41·9% (−51·0 to −31·3)
Lebanon	662 (616 to 717)	17·1% (16·1 to 18·5)	1·5% (−0·5 to 3·6)	1·72 (1·27 to 2·18)	43·1 (31·7 to 53·8)	10·2% (−24·6 to 86·3)
Libya	825 (759 to 899)	18·8% (17·5 to 20·4)	10·8% (8·2 to 13·1)	2·06 (1·17 to 3·07)	69·2 (39·6 to 103·6)	34·8% (−33·8 to 120·2)
Morocco	3730 (3450 to 4050)	15·3% (14·1 to 16·4)	1·0% (−1·2 to 3·3)	16·1 (12 to 21·5)	85·2 (64·0 to 115·5)	2·3% (−32·3 to 46·9)
Oman	463 (421 to 516)	17·3% (16·2 to 18·8)	8·1% (6·1 to 10·2)	0·604 (0·427 to 0·793)	64·8 (46·6 to 84·8)	23·8% (−24·0 to 95·2)
Palestine	404 (373 to 443)	16·9% (15·8 to 18·2)	0·3% (−1·5 to 2·1)	0·806 (0·616 to 1·01)	56·8 (42·6 to 72·0)	−12·5% (−39·5 to 21·2)
Qatar	299 (268 to 334)	16·7% (15·6 to 17·9)	−2·6% (−5·0 to −0·4)	0·164 (0·128 to 0·208)	51·6 (38·1 to 64·7)	−39·7% (−60·5 to −14·9)

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	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Saudi Arabia	2960 (2710 to 3260)	17·2% (16·2 to 18·6)	−1·0% (−2·8 to 1·0)	7·28 (5·41 to 9·41)	113·7 (84·0 to 147·1)	12·7% (−28·0 to 61·4)
Sudan	3170 (2940 to 3460)	17·5% (16·4 to 19·0)	3·6% (1·2 to 5·8)	8·88 (5·85 to 12)	75·5 (49·9 to 102·0)	−10·2% (−45·3 to 30·4)
Syria	1750 (1630 to 1900)	17·2% (16·2 to 18·6)	1·5% (−0·5 to 3·2)	5·78 (3·68 to 7·95)	94·1 (59·4 to 129·4)	21·9% (−20·9 to 81·7)
Tunisia	1390 (1300 to 1500)	16·5% (15·4 to 17·8)	1·3% (−0·9 to 3·8)	2·93 (2·14 to 3·82)	38·8 (28·7 to 49·9)	−26·9% (−50·3 to 11·4)
Türkiye	10 500 (9770 to 11 300)	17·0% (15·8 to 18·3)	0·7% (−1·6 to 3·1)	26·8 (21·4 to 34·1)	47·5 (37·7 to 60·1)	−31·6% (−55·2 to 5·6)
United Arab Emirates	1120 (1010 to 1250)	16·8% (15·7 to 18·2)	−2·3% (−4·5 to 0·2)	0·872 (0·568 to 1·15)	72·9 (47·3 to 100·0)	13·6% (−41·4 to 104·5)
Yemen	2250 (2060 to 2500)	16·1% (15·0 to 17·3)	2·1% (0·1 to 4·1)	3·22 (2·18 to 4·99)	44·9 (31·0 to 68·1)	−22·5% (−50·0 to 15·2)
South Asia	**170 000 (160 000 to 183 000)**	**15·8% (14·9 to 16·9)**	**−11·2% (−12·0 to −10·4)**	**173 (134 to 218)**	**18·8 (14·5 to 23·5)**	**−21·9% (−43·0 to 11·6)**
South Asia	170 000 (160 000 to 183 000)	15·8% (14·9 to 16·9)	−11·2% (−12·0 to −10·4)	173 (134 to 218)	18·8 (14·5 to 23·5)	−21·9% (−43·0 to 11·6)
Bangladesh	14 000 (13 100 to 15 000)	15·1% (14·3 to 16·0)	3·8% (1·2 to 7·2)	20·9 (16·4 to 26·8)	27·1 (21·2 to 34·6)	−16·9% (−40·1 to 26·1)
Bhutan	70·7 (66·2 to 76·3)	15·4% (14·5 to 16·4)	2·4% (0·7 to 4·1)	0·147 (0·0747 to 0·234)	34·7 (17·7 to 55·2)	−7·7% (−37·7 to 37·9)
India	138 000 (129 000 to 148 000)	16·0% (15·1 to 17·1)	−14·6% (−15·4 to −13·7)	124 (94·8 to 163)	16·8 (12·8 to 21·9)	−26·0% (−48·1 to 5·8)
Nepal	2440 (2270 to 2620)	14·0% (13·1 to 15·0)	−0·7% (−3·8 to 2·7)	3·15 (2·08 to 4·25)	19·9 (13·2 to 26·7)	−9·8% (−42·2 to 31·0)
Pakistan	15 900 (14 800 to 17 100)	15·2% (14·3 to 16·1)	9·3% (7·9 to 10·9)	24·9 (12·8 to 35·3)	28·4 (14·6 to 40·1)	4·9% (−30·9 to 51·9)
Southeast Asia, east Asia, and Oceania	**242 000 (228 000 to 259 000)**	**13·9% (13·0 to 15·0)**	**7·9% (6·4 to 9·1)**	**337 (291 to 379)**	**18·3 (15·8 to 20·8)**	**−31·7% (−45·1 to −9·5)**
East Asia	158 000 (148 000 to 170 000)	12·3% (11·5 to 13·3)	7·1% (5·2 to 8·8)	167 (138 to 193)	11·7 (9·6 to 13·6)	−50·0% (−62·9 to −29·4)
China	152 000 (142 000 to 164 000)	12·3% (11·5 to 13·2)	7·6% (5·5 to 9·3)	153 (124 to 179)	11·0 (9·0 to 13·0)	−52·3% (−65·3 to −31·4)
North Korea	2440 (2280 to 2620)	12·2% (11·4 to 13·1)	−0·5% (−2·4 to 1·6)	4·51 (3·09 to 6·24)	23·6 (16·0 to 32·6)	11·3% (−23·6 to 81·2)
Taiwan*	3440 (3170 to 3660)	14·1% (13·2 to 15·0)	−5·5% (−9·8 to −3·5)	9·9 (8·19 to 11·3)	33·8 (28·3 to 38·3)	−8·1% (−19·9 to 5·5)
Oceania	994 (920 to 1080)	15·4% (14·4 to 16·5)	5·0% (3·7 to 6·3)	1·68 (1·29 to 2·01)	36·1 (27·3 to 44·4)	7·5% (−26·1 to 50·1)
American Samoa	5·18 (4·81 to 5·6)	17·6% (16·4 to 18·9)	7·3% (5·1 to 9·3)	0·0279 (0·0204 to 0·0359)	107·3 (79·0 to 139·0)	43·0% (1·1 to 125·7)
Cook Islands	1·76 (1·65 to 1·9)	16·2% (15·2 to 17·5)	1·3% (−1·2 to 3·8)	0·00443 (0·00328 to 0·00569)	37·6 (28·0 to 48·6)	25·3% (−10·5 to 103·0)
Federated States of Micronesia	8·65 (8·05 to 9·41)	16·1% (15·0 to 17·3)	6·1% (3·6 to 8·1)	0·0392 (0·0309 to 0·0491)	93·5 (73·3 to 118·8)	−3·0% (−37·4 to 41·7)
Fiji	90·1 (83·8 to 97·2)	16·9% (15·8 to 18·2)	5·4% (3·5 to 7·3)	0·371 (0·269 to 0·491)	83·1 (60·4 to 110·6)	62·0% (−3·5 to 143·8)
Guam	19·4 (18·3 to 20·9)	16·2% (15·2 to 17·4)	8·4% (6·4 to 10·3)	0·0594 (0·0531 to 0·0662)	48·1 (42·9 to 53·7)	65·7% (43·3 to 94·6)
Kiribati	9·97 (9·19 to 10·9)	16·6% (15·5 to 17·8)	6·5% (4·8 to 8·4)	0·0215 (0·0147 to 0·0285)	42·6 (28·6 to 57·8)	44·3% (−9·5 to 103·6)
Marshall Islands	3·12 (2·89 to 3·4)	16·1% (15·0 to 17·2)	5·5% (3·4 to 7·5)	0·021 (0·0141 to 0·0289)	148·2 (99·1 to 203·4)	54·5% (3·8 to 135·7)

(Table continues on next page)

	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Nauru	0·825 (0·76 to 0·904)	16·6% (15·6 to 17·8)	3·4% (1·4 to 5·2)	0·00828 (0·00381 to 0·0126)	239·7 (111·8 to 364·2)	37·5% (–5·8 to 105·1)
Niue	0·223 (0·209 to 0·24)	16·9% (15·7 to 18·1)	5·2% (3·3 to 7·2)	0·00104 (0·000694 to 0·00144)	73·2 (48·7 to 100·5)	43·2% (–14·9 to 120·3)
Northern Mariana Islands	5·14 (4·78 to 5·55)	16·6% (15·6 to 17·9)	8·7% (6·5 to 10·8)	0·0255 (0·0199 to 0·0322)	109·2 (86·0 to 136·0)	38·4% (0·7 to 106·6)
Palau	2·24 (2·1 to 2·43)	16·6% (15·6 to 17·8)	1·6% (–0·1 to 3·7)	0·00867 (0·00626 to 0·0117)	76·7 (54·9 to 104·0)	25·4% (–15·3 to 96·1)
Papua New Guinea	692 (640 to 756)	14·9% (13·9 to 16·0)	6·0% (4·3 to 8·0)	0·692 (0·499 to 0·91)	20·4 (14·0 to 27·0)	–1·8% (–31·4 to 52·3)
Samoa	18·3 (17·1 to 19·7)	16·6% (15·6 to 17·9)	8·2% (6·2 to 10·4)	0·072 (0·0476 to 0·102)	67·3 (44·5 to 95·2)	56·5% (3·6 to 130·5)
Solomon Islands	60 (55·5 to 65·1)	16·2% (15·2 to 17·4)	8·7% (5·9 to 11·6)	0·154 (0·119 to 0·205)	52·7 (39·4 to 68·4)	3·9% (–35·1 to 51·9)
Tokelau	0·182 (0·171 to 0·195)	16·5% (15·5 to 17·8)	6·7% (4·7 to 8·9)	0·000673 (0·000429 to 0·000929)	57·8 (37·1 to 79·9)	34·6% (–16·3 to 111·8)
Tonga	8·94 (8·33 to 9·66)	16·4% (15·3 to 17·7)	6·3% (4·3 to 8·6)	0·0464 (0·0246 to 0·0709)	90·9 (48·4 to 139·6)	74·7% (3·4 to 164·7)
Tuvalu	1·03 (0·961 to 1·11)	17·2% (16·1 to 18·4)	8·5% (6·5 to 10·8)	0·00668 (0·00416 to 0·00938)	134·2 (82·5 to 188·5)	49·3% (–4·5 to 127·2)
Vanuatu	25 (23·1 to 27·2)	16·6% (15·6 to 17·8)	4·5% (2·1 to 6·4)	0·0509 (0·0331 to 0·0827)	39·8 (26·0 to 65·0)	27·7% (–13·3 to 107·5)
Southeast Asia	83 200 (78 300 to 89 800)	17·9% (16·9 to 19·3)	3·8% (2·9 to 4·8)	168 (137 to 201)	38·6 (31·8 to 46·6)	3·2% (–18·0 to 43·8)
Cambodia	1640 (1520 to 1780)	16·7% (15·6 to 18·1)	1·5% (–0·5 to 3·6)	1·79 (1·25 to 2·42)	21·0 (14·4 to 28·4)	–23·2% (–50·1 to 25·7)
Indonesia	33 400 (31 100 to 36 200)	18·4% (17·2 to 19·9)	5·6% (4·7 to 6·5)	54·8 (38·5 to 73·6)	31·7 (21·9 to 43·6)	9·1% (–24·1 to 59·5)
Laos	682 (631 to 744)	17·4% (16·4 to 18·8)	–0·5% (–2·4 to 1·5)	2·2 (1·67 to 2·88)	69·0 (52·7 to 90·6)	16·3% (–21·7 to 103·0)
Malaysia	4580 (4380 to 4810)	20·7% (19·8 to 21·6)	6·5% (2·2 to 10·7)	7·55 (5·6 to 9·32)	40·4 (29·8 to 50·3)	6·2% (–22·5 to 57·2)
Maldives	58·3 (53·2 to 64·4)	18·0% (16·8 to 19·3)	1·6% (–0·7 to 3·5)	0·135 (0·103 to 0·163)	85·5 (65·8 to 104·5)	1·6% (–24·0 to 63·0)
Mauritius	204 (191 to 218)	19·2% (18·0 to 20·5)	5·9% (4·1 to 7·9)	1·28 (1·18 to 1·37)	114·8 (105·8 to 122·7)	–1·8% (–9·0 to 5·5)
Myanmar	6060 (5610 to 6560)	17·9% (16·6 to 19·3)	2·9% (1·0 to 5·3)	14·2 (9·21 to 20·6)	46·3 (29·8 to 68·1)	–12·5% (–40·2 to 48·1)
Philippines	11 500 (10 700 to 12 500)	18·5% (17·3 to 19·9)	2·9% (2·4 to 3·4)	29·5 (24·4 to 35·1)	58·3 (48·0 to 69·5)	16·6% (–9·6 to 59·2)
Seychelles	14·7 (13·7 to 15·9)	19·2% (18·0 to 20·9)	5·3% (3·1 to 7·4)	0·0471 (0·0352 to 0·0616)	62·9 (47·0 to 82·2)	20·2% (–20·1 to 89·1)
Sri Lanka	3050 (2850 to 3290)	17·8% (16·7 to 19·3)	0·7% (–1·4 to 2·8)	7·44 (5·55 to 9·51)	40·1 (30·1 to 50·9)	–5·9% (–33·1 to 42·1)
Thailand	10 700 (10 300 to 11 100)	17·2% (16·6 to 17·9)	–3·1% (–6·9 to 0·8)	29·6 (22·9 to 36·4)	41·2 (32·0 to 50·7)	–1·1% (–29·9 to 49·4)
Timor-Leste	121 (112 to 132)	18·0% (16·7 to 19·4)	5·8% (3·4 to 8·1)	0·266 (0·19 to 0·381)	47·4 (34·3 to 67·8)	–15·5% (–40·8 to 35·3)
Viet Nam	11 200 (10 400 to 12 200)	15·8% (14·7 to 17·1)	3·4% (1·0 to 6·0)	18·7 (11·7 to 26·6)	26·9 (16·5 to 38·3)	–19·6% (–47·0 to 23·2)
Sub-Saharan Africa	**69 500 (64 500 to 75 500)**	**15·6% (14·7 to 16·7)**	**2·4% (1·9 to 2·9)**	**177 (136 to 220)**	**53·0 (40·5 to 65·9)**	**6·4% (–22·6 to 55·4)**
Central sub-Saharan Africa	8700 (8080 to 9490)	17·7% (16·6 to 19·0)	–1·1% (–2·4 to 0·1)	17·8 (12·9 to 23·2)	45·5 (33·2 to 59·4)	10·8% (–21·3 to 66·4)

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	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
Angola	2040 (1880 to 2220)	17·9% (16·7 to 19·2)	1·8% (0·3 to 3·6)	3·41 (2·44 to 4·43)	38·5 (28·1 to 49·4)	–6·1% (–33·3 to 46·8)
Central African Republic	383 (356 to 414)	18·4% (17·3 to 19·6)	1·8% (0·1 to 3·7)	0·624 (0·415 to 0·877)	37·8 (25·6 to 53·8)	3·9% (–27·7 to 59·2)
Congo (Brazzaville)	417 (387 to 455)	18·5% (17·4 to 19·9)	2·4% (0·7 to 4·4)	0·832 (0·531 to 1·17)	51·2 (32·6 to 71·7)	30·0% (–9·8 to 91·0)
DR Congo	5600 (5190 to 6100)	17·5% (16·4 to 18·8)	–2·5% (–4·3 to –0·9)	12·2 (8·54 to 16·3)	47·1 (32·5 to 64·4)	14·1% (–21·5 to 74·1)
Equatorial Guinea	96·8 (89·4 to 106)	18·4% (17·2 to 19·6)	4·1% (2·2 to 6·2)	0·227 (0·138 to 0·316)	61·6 (37·8 to 85·3)	9·6% (–27·6 to 72·6)
Gabon	161 (151 to 172)	18·3% (17·3 to 19·5)	1·7% (–0·1 to 3·9)	0·485 (0·221 to 0·763)	63·2 (28·8 to 99·2)	42·1% (–12·5 to 97·0)
Eastern sub-Saharan Africa	21 800 (20 100 to 24 100)	12·5% (11·6 to 13·6)	4·2% (3·4 to 5·0)	73·4 (57·6 to 91·4)	57·1 (44·8 to 71·1)	2·8% (–24·6 to 58·2)
Burundi	636 (577 to 709)	12·8% (11·9 to 14·0)	3·9% (1·6 to 6·1)	1·53 (1·06 to 2·17)	46·1 (32·3 to 65·5)	6·9% (–26·9 to 80·7)
Comoros	56·3 (52 to 61·3)	13·0% (12·1 to 14·1)	3·3% (1·0 to 5·8)	0·104 (0·0705 to 0·139)	26·2 (17·7 to 35·1)	–10·7% (–40·5 to 31·6)
Djibouti	78·6 (72·1 to 86·4)	12·4% (11·4 to 13·4)	5·3% (3·3 to 7·7)	0·178 (0·127 to 0·236)	40·3 (28·3 to 52·9)	–13·3% (–41·7 to 34·0)
Eritrea	354 (326 to 388)	11·9% (11·0 to 13·0)	2·8% (0·7 to 5·1)	1·05 (0·717 to 1·48)	43·3 (29·7 to 60·6)	–2·7% (–34·3 to 48·9)
Ethiopia	5840 (5400 to 6400)	12·5% (11·6 to 13·5)	8·2% (7·0 to 9·3)	24·7 (19·4 to 32·3)	65·0 (50·4 to 85·6)	9·0% (–23·8 to 96·7)
Kenya	2830 (2610 to 3100)	12·6% (11·7 to 13·6)	3·3% (2·8 to 3·8)	12·4 (8·87 to 16)	73·6 (52·2 to 93·3)	1·9% (–35·2 to 58·5)
Madagascar	1450 (1320 to 1610)	12·5% (11·7 to 13·6)	1·7% (–0·4 to 3·8)	4·48 (3·22 to 6·24)	66·2 (47·8 to 91·6)	–14·2% (–40·9 to 37·1)
Malawi	926 (846 to 1030)	12·4% (11·5 to 13·4)	–3·0% (–5·5 to –0·4)	2·91 (2·19 to 3·65)	55·3 (41·7 to 70·7)	3·8% (–26·3 to 53·6)
Mozambique	1510 (1380 to 1670)	13·0% (12·0 to 14·1)	4·1% (1·7 to 6·4)	2·64 (1·91 to 3·57)	32·4 (24·1 to 43·6)	5·1% (–37·3 to 96·7)
Rwanda	729 (671 to 804)	12·3% (11·5 to 13·4)	–1·0% (–3·3 to 1·3)	2·78 (2 to 3·59)	65·0 (46·9 to 83·1)	–10·6% (–38·8 to 43·4)
Somalia	927 (853 to 1020)	12·3% (11·5 to 13·4)	5·6% (3·1 to 7·9)	2·07 (1·35 to 2·82)	37·3 (24·1 to 50·6)	13·9% (–26·9 to 66·6)
South Sudan	458 (421 to 503)	12·5% (11·6 to 13·6)	3·9% (1·7 to 6·2)	1·97 (1·5 to 2·57)	75·6 (56·1 to 97·4)	0·7% (–29·7 to 57·2)
Uganda	1870 (1710 to 2090)	12·0% (11·0 to 13·0)	–5·4% (–8·2 to –2·8)	7·01 (5·3 to 9·22)	65·6 (48·0 to 87·1)	–4·2% (–33·4 to 46·7)
Tanzania	3250 (2980 to 3600)	12·7% (11·8 to 13·8)	7·7% (5·7 to 10·1)	6·56 (4·61 to 8·39)	34·9 (24·1 to 44·5)	–3·5% (–32·8 to 44·9)
Zambia	900 (814 to 995)	12·9% (11·9 to 14·0)	9·8% (7·3 to 12·0)	2·89 (2·13 to 3·74)	63·9 (46·0 to 81·2)	–0·3% (–33·7 to 49·0)
Southern sub-Saharan Africa	8600 (8050 to 9240)	18·3% (17·2 to 19·5)	4·1% (3·3 to 4·8)	16·3 (12·9 to 19·4)	40·7 (31·8 to 48·6)	31·2% (–10·5 to 85·0)
Botswana	224 (210 to 240)	17·7% (16·6 to 19·0)	2·5% (0·7 to 4·3)	0·249 (0·177 to 0·35)	22·9 (16·3 to 32·1)	26·5% (–22·4 to 110·5)
Eswatini	99·3 (92·8 to 107)	18·2% (17·2 to 19·5)	5·2% (3·0 to 7·0)	0·22 (0·135 to 0·313)	46·6 (28·8 to 66·0)	–21·6% (–54·3 to 25·6)
Lesotho	164 (154 to 177)	17·9% (16·8 to 19·1)	5·7% (3·6 to 7·6)	0·366 (0·27 to 0·494)	46·7 (34·2 to 63·4)	8·6% (–35·3 to 75·9)
Namibia	225 (207 to 243)	17·2% (16·1 to 18·4)	–1·9% (–3·6 to 0·3)	0·312 (0·225 to 0·457)	28·7 (20·5 to 42·4)	–8·2% (–39·8 to 41·3)

(Table continues on next page)

	Prevalence			Deaths		
	Count (thousands), 2023	Age-standardised prevalence (%), 2023	Percentage change in age-standardised prevalence between 1990 and 2023 (%)	Count (thousands), 2023	Age-standardised rate per 100 000, 2023	Percentage change in age-standardised rates between 1990 and 2023 (%)
(Continued from previous page)						
South Africa	6730 (6310 to 7220)	18·4% (17·3 to 19·6)	3·7% (2·8 to 4·6)	13·8 (10·8 to 16·8)	44·5 (34·7 to 54·3)	35·1% (–3·5 to 84·9)
Zimbabwe	1150 (1070 to 1240)	17·9% (16·8 to 19·1)	5·7% (3·4 to 7·9)	1·35 (0·96 to 1·82)	24·4 (17·4 to 32·9)	23·2% (–29·7 to 111·1)
Western sub-Saharan Africa	30 300 (28 300 to 32 900)	17·2% (16·2 to 18·2)	2·3% (1·6 to 3·1)	69·9 (51·4 to 90·8)	54·7 (39·7 to 70·8)	4·1% (–26·5 to 51·9)
Benin	734 (677 to 799)	14·8% (13·9 to 15·9)	1·5% (–0·7 to 3·7)	1·49 (1·06 to 1·92)	40·8 (28·8 to 52·1)	–20·0% (–44·1 to 23·2)
Burkina Faso	1210 (1120 to 1320)	14·4% (13·6 to 15·5)	3·6% (1·7 to 5·6)	3 (2·19 to 3·84)	47·5 (34·1 to 61·9)	–20·2% (–43·0 to 20·5)
Cabo Verde	43·8 (40·7 to 47·4)	14·8% (13·8 to 15·9)	3·2% (1·0 to 5·6)	0·0925 (0·0624 to 0·126)	32·2 (22·0 to 43·4)	26·9% (–20·3 to 119·6)
Cameroon	1980 (1850 to 2160)	17·2% (16·2 to 18·2)	11·2% (8·4 to 13·7)	6·69 (4·25 to 9·3)	86·0 (55·1 to 121·3)	–2·5% (–34·7 to 37·7)
Chad	783 (723 to 861)	14·4% (13·5 to 15·5)	3·1% (1·0 to 5·1)	2·04 (1·48 to 2·8)	54·8 (40·2 to 74·6)	–1·8% (–31·0 to 57·1)
Côte d'Ivoire	1890 (1730 to 2090)	15·4% (14·4 to 16·5)	2·0% (–0·1 to 4·3)	4·25 (2·96 to 5·67)	52·7 (36·2 to 70·3)	12·6% (–25·6 to 66·3)
The Gambia	146 (135 to 159)	15·3% (14·4 to 16·5)	6·6% (4·4 to 9·0)	0·29 (0·204 to 0·377)	40·6 (28·4 to 53·2)	17·8% (–22·8 to 84·2)
Ghana	1810 (1660 to 2010)	12·1% (11·2 to 13·2)	2·0% (–0·2 to 4·7)	7·32 (5·35 to 9·56)	67·6 (48·9 to 88·4)	9·3% (–27·5 to 60·9)
Guinea	760 (705 to 834)	15·0% (14·1 to 16·2)	6·5% (4·6 to 9·0)	1·91 (1·42 to 2·45)	49·5 (37·1 to 65·0)	–16·0% (–40·4 to 36·9)
Guinea-Bissau	116 (107 to 128)	15·5% (14·5 to 16·6)	4·7% (2·3 to 6·9)	0·319 (0·221 to 0·402)	62·6 (43·3 to 78·7)	14·2% (–17·4 to 73·4)
Liberia	351 (324 to 386)	15·5% (14·5 to 16·5)	4·6% (2·5 to 7·0)	1·27 (0·784 to 1·79)	79·7 (49·1 to 113·6)	1·9% (–30·7 to 54·3)
Mali	1160 (1070 to 1270)	14·7% (13·7 to 15·8)	4·7% (2·4 to 7·0)	2·36 (1·73 to 3·09)	41·2 (30·1 to 54·2)	–5·1% (–30·0 to 47·9)
Mauritania	257 (237 to 280)	14·5% (13·6 to 15·6)	0·6% (–1·3 to 2·6)	0·95 (0·615 to 1·25)	69·8 (45·3 to 92·3)	22·2% (–13·7 to 87·6)
Niger	1040 (958 to 1140)	13·9% (13·0 to 14·9)	3·0% (1·2 to 4·9)	2·14 (1·42 to 3·12)	44·9 (30·3 to 64·5)	–10·6% (–36·6 to 49·3)
Nigeria	16 100 (15 000 to 17 400)	20·3% (19·1 to 21·5)	3·9% (3·1 to 4·8)	31 (21·9 to 44·1)	53·5 (37·4 to 76·8)	10·1% (–24·8 to 67·3)
São Tomé and Príncipe	15·6 (14·5 to 17)	16·0% (15·0 to 17·1)	4·3% (2·4 to 6·4)	0·0387 (0·027 to 0·05)	50·7 (35·0 to 65·8)	11·1% (–24·7 to 64·2)
Senegal	975 (894 to 1070)	13·3% (12·3 to 14·3)	–0·3% (–2·6 to 1·9)	2·1 (1·51 to 2·86)	38·6 (27·3 to 53·0)	5·6% (–27·8 to 65·9)
Sierra Leone	478 (443 to 529)	15·0% (14·1 to 16·1)	2·6% (0·4 to 5·0)	1·39 (1·06 to 1·74)	62·2 (47·8 to 78·0)	–1·8% (–32·9 to 46·5)
Togo	506 (469 to 548)	14·7% (13·7 to 15·6)	1·5% (–0·4 to 3·4)	1·24 (0·912 to 1·61)	49·4 (36·0 to 63·5)	1·5% (–28·0 to 46·7)

Data in parentheses are 95% uncertainty intervals. All count data reported are presented to three significant figures, while rates and percentages are presented to one decimal place. GBD super-regions are created by grouping countries based on epidemiological and geographical similarity into 21 regions, with these regions further grouped into seven, mutually exclusive super-regions. The high-income super-region includes Australasia, high-income Asia Pacific, high income North America, Southern Latin America and western Europe (see appendix section 6, table S17 for the full GBD location hierarchy). SDI=Socio-demographic Index. *UN convention recognises Taiwan as a province of China. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

Table: **Prevalence of, and deaths due to, chronic kidney disease in 2023, and percentage change of age-standardised rates by location, 1990 to 2023, for adults aged 20 years and older**

Risk-attributable burden

We estimated CKD stage 1–5 not including kidney replacement therapy, termed kidney dysfunction, as a risk factor for cardiovascular disease (including ischaemic heart disease, stroke, and peripheral vascular disease). We also estimated seven risk factor groups for CKD: high fasting plasma glucose, high body-mass index (BMI), high systolic blood pressure, dietary risks

(diet low in fruits, vegetables, or whole grains, or high in sodium, red meat, processed meat, or sugar-sweetened beverages), low physical activity, non-optimal temperature (low and high, representing acute cold and heat exposures[20]), and lead exposure in bone.

We estimated the relative risk of each outcome occurring as a function of exposure to the given risk factor by following the burden of proof approach established by Zheng and colleagues.[18,21] In brief, we conducted systematic reviews of the available literature that estimated cardiovascular or CKD risk relative to risk factor exposure. Literature data on the cardiovascular risk relative to kidney dysfunction exposure were supplemented by relative risk data provided by the Chronic Kidney Disease Prognosis Consortium.[4] We used the MR-BRT tool to synthesise input data to generate a relative risk curve by relying on an ensemble spline method to capture the potentially non-linear shape of the risk–outcome relationship; integrating over varying exposure ranges in different comparison groups; trimming potentially distorting outliers; and quantifying remaining between-study heterogeneity through random-effects modelling and incorporating this value into uncertainty around the mean relative risk curve.

We used DisMod-MR 2.1 or spatiotemporal Gaussian process regression to estimate exposure distributions for each risk factor by sex, age, year, and location, as established previously.[22] We set the theoretical minimum risk exposure level (TMREL) for kidney dysfunction at an ACR of 30 mg/g or lower and eGFR of 60 mL/min per 1·73 m² or higher, given that this population is at the lowest risk for cardiovascular disease events secondary to kidney dysfunction.[23] Details about the TMREL for the remaining risk factors are provided in appendix 1 (section 4). Exposure, relative risk, and TMREL were used to calculate population attributable fractions (PAFs) for each outcome and risk by location, age, sex, and year. PAFs were multiplied by metrics of disease burden—in this case, CKD DALYs or cardiovascular mortality—to estimate the risk-attributable burden.

Uncertainty and presentation of results

At each modelling step described above, 250 samples from each age-sex-location-year-specific parameter distribution were drawn to propagate parameter uncertainty forward through each subsequent analysis step. 95% uncertainty intervals (UIs) for final estimates were calculated by generating 250 random draws from the estimate distribution and taking the 2·5th and 97·5th percentile values across the 250 draws, linearly interpolating between the sixth and seventh, and the 243rd and 244th of ordered draws.

All count data reported are presented to three significant figures, while rates and percentages are presented to one decimal place.

Geographical locations reported

CKD estimates were generated for 204 countries and territories grouped on the basis of epidemiological and geographical similarity into 21 regions, with these regions further grouped into seven mutually exclusive super-regions (see appendix 1 section 6, table S17, for the full GBD location hierarchy). Socio-demographic Index (SDI) is a summary measure of development, calculated as a composite of a country's total fertility rate for women younger than 25 years, educational attainment, and lag-distributed income per capita.[24] Locations at the most granular level estimated by GBD were grouped into SDI quintile groups based on their 2023 SDI values (appendix 1 section 6, table S18).

Data and code availability

Metadata for GBD estimates (including the measure, metrics, risk factors, cause, location, age, sex, and year) are publicly available and can be extracted by registered users via the GBD Results tool. Analyses were done with R (version 4.4.1).

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

Role of the funding source

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

Results

Total CKD prevalence

Globally in 2023, an estimated 788 million (95% UI 743–843) people aged 20 years and older were living with CKD, a marked rise from 378 million (354–407) in 1990 and 627 million (589–671) in 2013 (table; appendix 1 table S13). The countries with the highest number of individuals with CKD in 2023 were China (152 million; 142–164) and India (138 million; 129–148), with the USA, Indonesia, Japan, Brazil, Russia, Mexico, Nigeria, Pakistan, Bangladesh, Iran, the Philippines, Viet Nam, Thailand, and Türkiye all having more than 10 million adults with CKD.

In 2023, the global age-standardised prevalence of CKD was 14·2% (95% UI 13·4–15·2) of adults, up from 13·7% (12·9–14·7) in 1990 and 13·8% (13·0–14·7) in 2013 (table; appendix 1 table S13). The crude prevalence increased from 12·3% (11·5–13·2) in 1990 to 13·3% (12·5–14·2) in 2013 and 14·6% (13·8–15·6) in 2023, an 18·9% (16·7–20·9) rise reflecting the ageing of the world's population, compared to a rise of 3·5% (2·7–4·1) in the age-standardised prevalence (table; appendix 1 tables S13–S14). There was notable variation across geographical regions (figure 1A). In 2023, the GBD super-regions with the highest age-standardised prevalence of CKD were north Africa and the Middle East (18·0%; 16·9–19·4), south Asia (15·8%; 14·9–16·9), sub-Saharan Africa (15·6%; 14·7–16·7), and Latin America and the Caribbean (15·4%; 14·4–16·4). The high-income super-region had the lowest age-standardised prevalence of

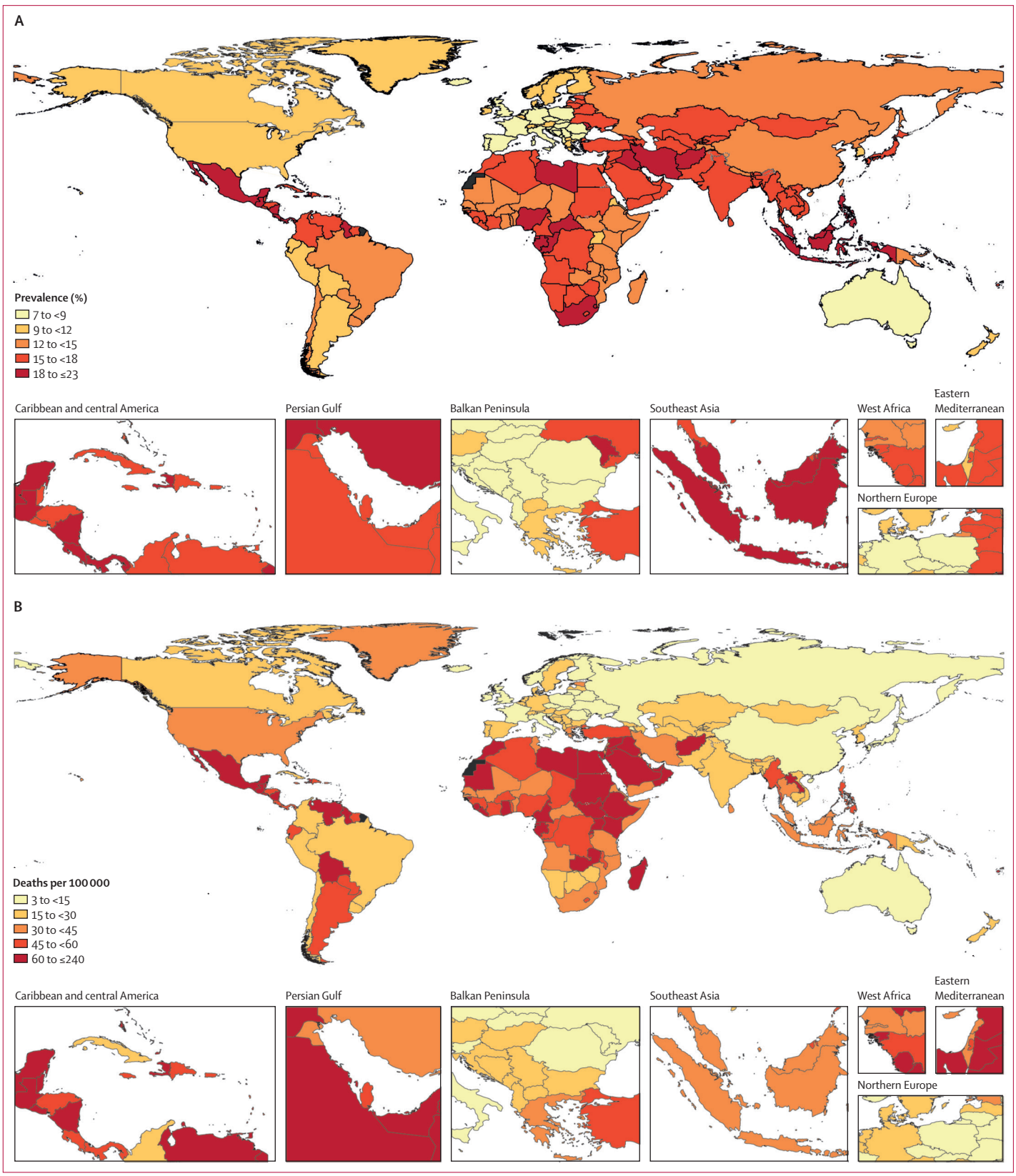


Figure 1: **Global age-standardised total chronic kidney disease prevalence (A) and death rates per 100 000 (B) in 2023 in people aged 20 years and older**

CKD (10·8%; 10·2–11·5; table). The countries with the highest age-standardised prevalence of CKD were Iran, Haiti, Panama, Nigeria, Mauritius, Seychelles, Grenada, Mexico, Libya, and Costa Rica (table, figure 1A).

CKD prevalence by stage and kidney replacement therapy

The majority of people with CKD were reported to have stage 1–3 CKD (figure 2). Overall, the breakdown of the global age-standardised prevalence of CKD not requiring kidney replacement therapy was 9·0% (95% UI 8·3–9·9) for stage 1–2, 4·5% (4·2–4·9) for stage 3, 0·4% (0·3–0·5) for stage 4, and 0·2% (0·1–0·2) for stage 5; the combined prevalence of stage 1–3 CKD was 13·9% (13·1–15·0; appendix 1 table S15). There was notable variation in the prevalence of CKD stages by age, where a predominance of more severe stages was seen in older adults (figure 2, appendix 1 table S15). By contrast, the prevalence of patients treated with dialysis and transplant rose with age and then fell at the oldest ages. The high-income super-region had the highest prevalence of patients receiving dialysis and transplant despite generally having a prevalence of stages 1–5 that is lower than the global estimate. Although globally the prevalence of people receiving dialysis was considerably greater than those with a kidney transplant, this imbalance was particularly notable in southeast Asia, east Asia, and Oceania; Latin America and the Caribbean; and north Africa and the Middle East. There was an extremely low relative prevalence of both dialysis and transplantation in sub-Saharan Africa (appendix 1 table S15).

Total CKD mortality

In 2023, globally, there were 1·48 million (95% UI 1·30–1·65) deaths for which CKD was the underlying cause in adults aged 20 years and older (table). The global age-standardised death rate due to CKD was 26·5 (23·1–29·5) deaths per 100 000, with marked variation across SDI quintiles and geographical regions (table, figure 1B). There were 35·4 (27·3–43·0) deaths per 100 000 in the lowest SDI quintile compared to 20·7 (17·9–22·6) deaths per 100 000 in the highest SDI quintile.

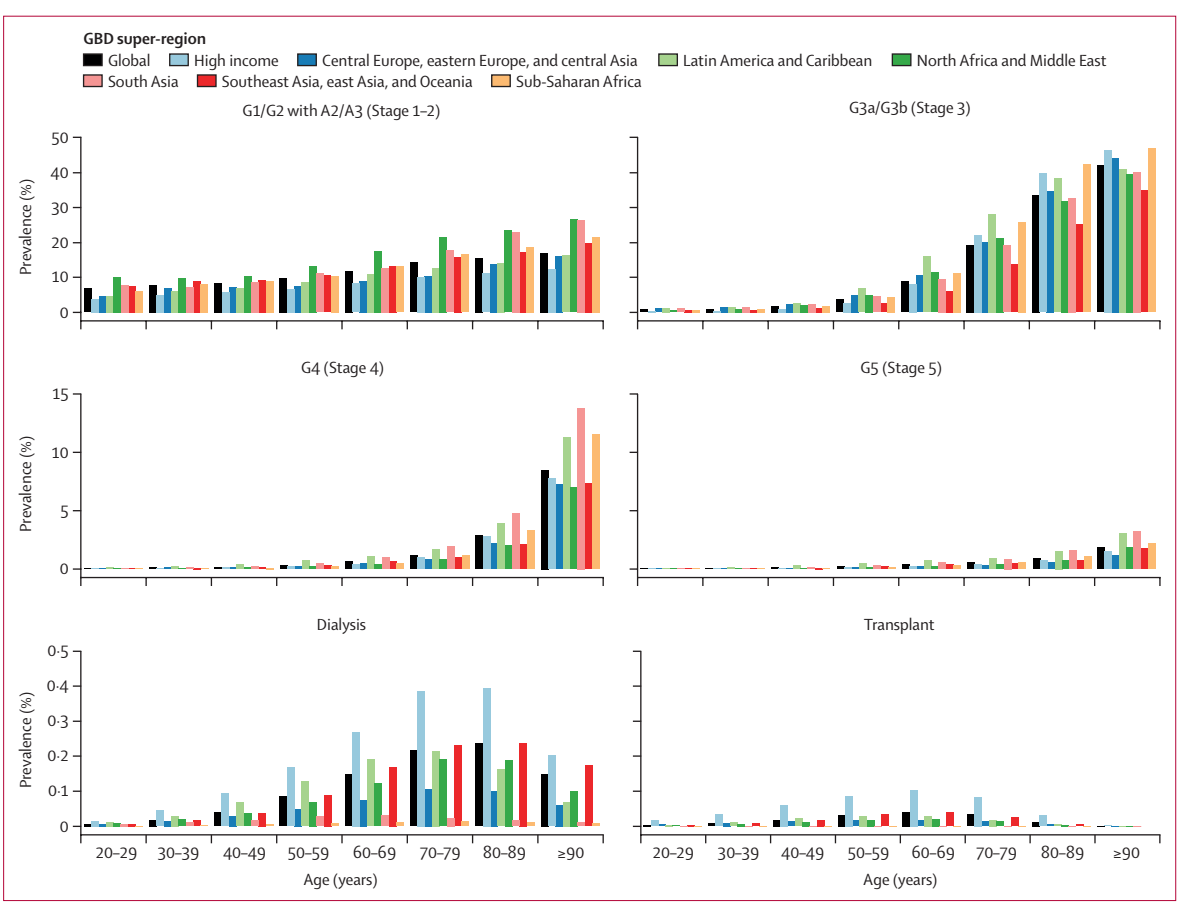


Figure 2: **Chronic kidney disease stage prevalence by age, globally, and by GBD super-region in 2023**
GBD super-regions are created by grouping countries based on epidemiological and geographical similarity into 21 regions, with these regions further grouped into seven, mutually exclusive super-regions. The high-income super-region includes Australasia, high-income Asia Pacific, high-income North America, southern Latin America and western Europe (see appendix section 6, table S17, for the full GBD location hierarchy). GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

2023

Leading causes of death	Death rate per 100 000
1 Ischaemic heart disease	158·4 (142·7 to 171·5)
2 Stroke	119·4 (105·8 to 131·2)
3 Chronic obstructive pulmonary disease	60·6 (51·9 to 74·0)
4 Alzheimer's disease and other dementias	40·6 (10·2 to 97·4)
5 Tracheal, bronchus, and lung cancer	35·1 (31·6 to 38·2)
6 Diabetes	34·8 (29·4 to 40·6)
7 Lower respiratory infections	31·9 (27·9 to 36·4)
8 Hypertensive heart disease	26·6 (21·4 to 32·3)
9 Chronic kidney disease	26·5 (23·1 to 29·5)
10 Cirrhosis and other chronic liver diseases	22·1 (19·8 to 24·7)
11 Road injuries	20·7 (16·0 to 24·0)
12 Colorectal cancer	19·4 (17·6 to 21·1)
13 Tuberculosis	16·4 (13·3 to 20·0)
14 Stomach cancer	16·3 (13·9 to 18·5)
15 Falls	14·8 (12·5 to 17·1)
16 HIV/AIDS	14·1 (12·3 to 16·2)
17 COVID-19	13·9 (12·3 to 15·1)
18 Breast cancer	13·7 (12·0 to 15·4)
19 Diarrhoeal diseases	13·1 (8·6 to 20·1)
20 Self-harm	12·9 (11·4 to 14·4)

2023

Leading causes of DALYs	Death rate per 100 000
1 Ischaemic heart disease	3381·5 (3069·2 to 3680·1)
2 Stroke	2678·3 (2412·1 to 2947·9)
3 Diabetes	1553·0 (1277·4 to 1842·5)
4 Chronic obstructive pulmonary disease	1302·5 (1147·5 to 1533·6)
5 Falls	1213·1 (959·8 to 1559·3)
6 Low back pain	1184·4 (829·7 to 1605·3)
7 Road injuries	1081·0 (861·2 to 1239·0)
8 Depressive disorders	881·9 (599·0 to 1261·3)
9 Age-related and other hearing loss	880·5 (620·0 to 1194·4)
10 Tracheal, bronchus, and lung cancer	799·7 (721·8 to 871·2)
11 Other musculoskeletal disorders	799·5 (568·6 to 1075·6)
12 Chronic kidney disease	769·2 (691·8 to 857·4)
13 Cirrhosis and other chronic liver diseases	723·0 (645·4 to 811·5)
14 HIV/AIDS	720·2 (638·2 to 807·2)
15 Alzheimer's disease and other dementias	714·2 (323·2 to 1451·3)
16 Headache disorders	711·6 (485·0 to 981·3)
17 Anxiety disorders	696·1 (470·1 to 1020·3)
18 Lower respiratory infections	643·5 (558·9 to 748·7)
19 Tuberculosis	639·6 (532·2 to 775·9)
20 Self-harm	571·3 (497·0 to 643·5)

2023

Leading CVD mortality risk factors	Population attributable fraction (%)
1 High systolic blood pressure	55·1 (45·6 to 62·6)
2 Dietary risks	30·8 (12·0 to 44·8)
3 Air pollution	20·7 (16·2 to 25·2)
4 High LDL cholesterol	19·0 (11·8 to 27·6)
5 Other environmental risks	18·0 (14·4 to 21·7)
6 Tobacco	15·3 (13·0 to 17·7)
7 Kidney dysfunction	11·5 (8·4 to 14·5)
8 High fasting plasma glucose	9·9 (8·3 to 12·2)
9 High body-mass index	9·4 (5·5 to 13·3)
10 Non-optimal temperature	6·1 (5·3 to 7·4)
11 Low physical activity	1·9 (0·6 to 3·2)
12 High alcohol use	0·9 (0·2 to 2·2)

Communicable, maternal, neonatal and nutritional diseases
Non-communicable diseases
Injuries

Environmental and occupational risks
Behavioural risks
Metabolic risks

Figure 3: **Leading causes of global deaths, DALYs, and leading CVD mortality risk factors in 2023, age-standardised for people aged 20 years and older**
The listed population attributable fractions do not take into account mediation between risk factors. Therefore, the sum of the population attributable fractions might exceed 100%. CVD=cardiovascular disease. DALY=disability-adjusted life-year.

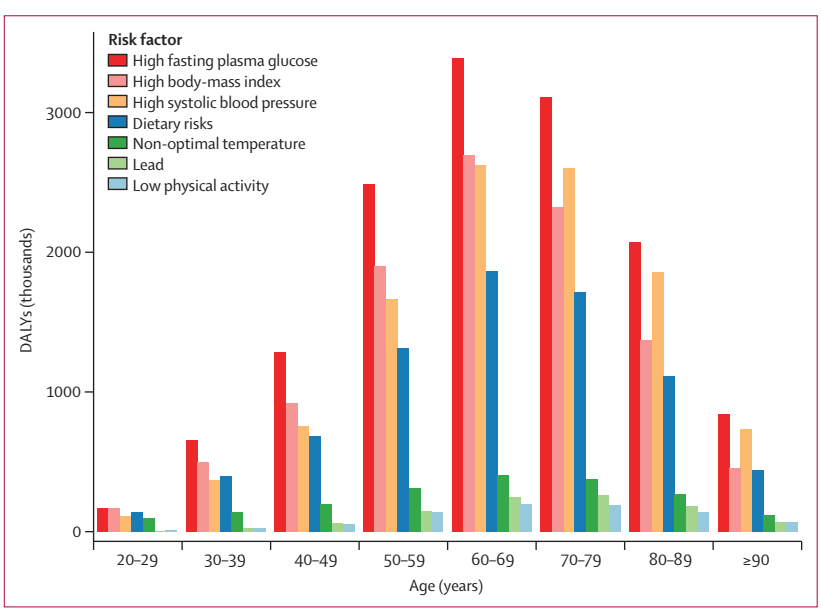


Figure 4: **Number of chronic kidney disease DALYs attributable to risk factors globally by age in 2023**
DALYs might be attributed to more than one risk factor or not be attributed to any risk factor. Therefore, the sum of the attributable DALYs might not be equal to the total chronic kidney disease DALYs. DALY=disability-adjusted life-year.

Between 1990 and 2023, global age-standardised mortality rates due to CKD in adults rose from 24·9 (95% UI 21·0 to 28·8) per 100 000 to 26·5 (23·1 to 29·5) per 100 000, an increase of 6·1% (–7·6 to 25·5; table; appendix 1 figure S19). In 2023, CKD was ranked ninth among causes of death (figure 3). Of the other top ten leading causes of death globally, only the rate of deaths due to Alzheimer's disease and diabetes rose from 1990 to 2023 (appendix 1 figure S19). The ten countries with the highest age-standardised mortality rates due to CKD were Nauru, Marshall Islands, Egypt, Tuvalu, El Salvador, Mauritius, Saudi Arabia, Northern Mariana Islands, American Samoa, and Nicaragua (table, figure 1B).

DALYs due to CKD

In 2023, globally, CKD resulted in 769·2 (95% UI 691·8–857·4) age-standardised DALYs per 100 000 among adults aged 20 years and older. Globally, CKD was the 12th leading cause of DALYs in 2023 (figure 3). There were regional differences, with CKD accounting for 1408·6 (1127·4–1714·8) DALYs per 100 000 in sub-Saharan Africa, and north Africa and the Middle East (1360·3 [1102·3–1597·0] per 100 000) and Latin America and the Caribbean (1320·8 [1225·2–1426·7] per 100 000) having age-standardised DALY rates attributable to CKD that were more than 70% higher than global rates (appendix 1 table S16).

Attributable fraction of cardiovascular mortality

PAFs for cardiovascular mortality, the leading cause of death globally, rank kidney dysfunction seventh among the environmental and occupational, behavioural, and metabolic risk factors examined. In 2023, 11·5% (95% UI 8·4–14·5) of global deaths due to cardiovascular disease were attributable to kidney dysfunction (figure 3). The proportion of cardiovascular deaths attributable to kidney dysfunction as a risk factor rose steadily with age (appendix 1 figure S20). Globally, kidney dysfunction ranked seventh as a risk factor for deaths due to cardiovascular disease, below systolic blood pressure but above high fasting plasma glucose and high BMI (figure 3).

Risk factors for CKD DALYs

The five leading risk factors contributing to age-standardised DALYs due to CKD by PAF were high fasting plasma glucose (31·9%; 95% UI 19·8–46·9), high systolic blood pressure (24·5%; 11·7–37·4), high BMI (23·5%; 12·6–34·5), diet (17·6%; 9·6–26·7), and non-optimal temperature (4·4%; 3·1–6·1; appendix 1 figure S19C). High BMI was a proportionately smaller risk factor in south Asia (14·1%; 7·0–23·1) and southeast Asia and Oceania (12·7%; 6·4–21·3); the leading risk factors were otherwise similar across GBD super-regions. The number of CKD DALYs attributable to a risk factor rose with each increasing decade in age from 20 to 69 years. The rise with age was strongest for high systolic blood pressure, which overtook BMI at age 70 years, while high fasting plasma glucose remained the highest contributor to CKD DALYs at all ages (figure 4).

Discussion

This updated GBD report highlights the continued rise in CKD prevalence and associated DALYs over the past three decades.[1] In 2023, 788 million people were estimated to have CKD. The global age-adjusted prevalence of CKD was 14·2% among adults aged 20 years and older. The high CKD prevalence aligns with global population growth and ageing. In 2023, CKD was the ninth leading cause of death, the 12th leading cause of DALYs, and the seventh leading cause of cardiovascular mortality, behind high systolic blood pressure and dietary risks and ahead of high blood glucose and high BMI, all of which are also CKD risk factors. These data support the WHO decision "to advance kidney disease as a non-communicable disease of increasing global priority, in addition to cancer, cardiovascular diseases (heart disease and stroke), diabetes and respiratory diseases, as well as mental health, which have been recognized as the major causes of death and disability".[25]

The persistently high age-standardised prevalence and mortality attributable to CKD is global but most notable in regions with a high prevalence of diabetes, such as the Middle East and Oceania. Since the last report, our understanding of factors beyond diabetes and hypertension driving the epidemic of CKD has evolved. The high burden of CKD in central America is likely to be related to CKDu,[26] a disease of reduced kidney function in the absence of diabetes, glomerulonephritis, or kidney structural abnormality, classically described in agricultural workers in central America. The more rapidly progressive and deadly course of CKDu might account for increasing age-standardised deaths and DALYs due to CKD in these and other tropical or sub-tropical regions. The aetiology of CKDu is still unknown, but excess heat stress (which might include global warming), infections, and toxins have been implicated.[11] Climate change, through rising average global temperatures and an increasing frequency of extreme weather events, is likely to cause a rise in CKD and accelerated decline in kidney function attributed to non-optimal temperature.[20,27] The high burden of CKD in west Africa is likely to be driven in part by both vascular risk factors and *APOL1* genetic variants, which increase susceptibility to CKD while being a protective factor for endemic infections.[10] Other genetic factors might be revealed with exome sequencing in up to 10% of people who otherwise have an unknown cause of CKD.[28] Most studies of CKD do not report the cause of the disease despite it being a criterion in the classification of CKD along with stage determined by GFR and albuminuria categories.[2]

CKD DALYs are very high around the world. Preventing cardiovascular events and slowing CKD progression are key to reducing the economic and functional consequences of CKD in both high and low SDI regions. Beyond long established, inexpensive treatments (eg, to improve hyperglycaemia and blood pressure control), newly proven therapies including SGLT2 inhibitors, non-steroidal MRAs, and GLP-1 receptor agonists complement the established strategies for renal angiotensin–aldosterone system inhibition to prevent major adverse cardiovascular and kidney events in people with CKD.[29–31] The most effective protective treatments for CKD are more recently established and have been implemented less uniformly than prevention programmes for communicable diseases (eg, improved sanitation and vaccinations), and non-communicable diseases (eg, cancer screening and cholesterol lowering), which reduced the mortality attributable to the other leading causes of death, resulting in an older population at risk of CKD and contributed to its rising rank as a cause of death.[2,32]

With increasing age, CKD incidence and prevalence increases markedly.[2] However, the outcomes associated with CKD change with age, as the risk of kidney failure replacement therapy and the relative risk of mortality decrease at the oldest ages, while attributable risk of mortality increases. As kidney dysfunction becomes a more prominent risk factor for cardiovascular disease with increasing age, implementing risk-reduction strategies, with appropriate consideration of the potential for harm, also becomes more important with advancing age. Beyond CKD associated with ageing and cardiometabolic disease, for specific causes of CKD such as *APOL1* kidney disease and IgA nephropathy, there are additional new disease-specific agents. All of these general and disease-specific therapies are under-prescribed in high-income countries,[26] with potentially less use globally, where limitations could be due to the cost to individuals or health-care systems or shortage of testing and programmes to implement therapies. Political conflicts and instability further challenge effective CKD management, including life-sustaining dialysis therapy.

Contributing to suboptimal disease prevention, all treatment strategies for CKD rely on detection of a largely asymptomatic condition. Albuminuria is

reversibly and strongly associated with adverse kidney and cardiovascular outcomes.[4] Despite strong guideline-based recommendations for widespread testing of albuminuria in people at risk of CKD, uptake has been limited (ie, 35% of individuals with diabetes and only 4% of individuals with hypertension), even in high-income regions.[33] Even where electronic health-care records could support automated detection of CKD, approximately 30% of affected individuals do not have a diagnosis of CKD in their clinical record.[34] This report can inform strategies to recognise and diagnose CKD more efficiently and easily, integrate CKD into general medical care, and target education and planning efforts for the clinical workforce needed for effective nephroprotective therapies.

As highlighted in other reports, the approach used by GBD has the strengths of allowing comprehensive reporting of the mortality and morbidity associated with CKD, without omitting regions where data are scarce. GBD continues to update input data and methodology (appendix 1 sections 3.1–3.2) so comparisons should be within a given GBD model, but we did confirm that including all updates in the current model is within 4% of the previously published 2017 CKD prevalence estimate. In contrast to previous reports on CKD, we focused on adults aged 20 years and older to address the public health implications of CKD in the context of the ageing and increasingly multimorbid global population,[1] and also to recognise the need for different sampling methodologies and statistics for quantifying CKD in children, in whom the disease can be severe but uncommon. Our approach is complementary to that of the International Society of Nephrology Global Kidney Health Atlas[35]: although the data are not validated and might not be reliable, their approach focuses on existing CKD registries and workforce surveys of nephrology providers to provide estimates of the CKD burden, as well as providing estimates of the availability of nephrology diagnostics and treatments by world region.

This report has some limitations. First, we relied on published estimates and modelling. Second, cross-sectional prevalence estimates typically rely on estimates from a single visit without following guidance to confirm CKD at a second visit or with clinical information: this can inflate CKD prevalence estimates as it does for other non-communicable diseases, including diabetes and hypertension. Third, CKD prevalence estimates can vary according to the GFR estimate used. Published studies have not yet updated GFR estimates from the 2009 CKD-EPI GFR estimating equations to the more recent 2021 equations, and qualitative dipstick measures of albuminuria were not included. Although we standardised alternative case definitions to a gold standard, we did not have access to the level of detail and nuance needed to understand the impact of the selected GFR equation on CKD prevalence estimates across world regions. Fourth, populations with heterogeneous features will introduce additional biases and uncertainty in risk factor attribution. Fifth, data on albuminuria are often missing, so we were unable to account for it in more severe levels of CKD. Sixth, our estimates filled in data for all countries and years, but source data were scarce, particularly in Africa and low SDI regions, for albuminuria (appendix 1 figures S5–S11) and for risk factors in these regions. Robust data collection in these areas would provide more reliable estimates of the true prevalence and impact of CKD in these areas and warrant specific attention. Seventh, data on children and adolescents with CKD (aged <20 years) are not robust and merit their own analysis, so we did not include this age group in this study. Detailed estimates by sex can be tabulated in the GBD Results tool. Eighth, the underlying cause of CKD is rarely known in population-based studies. Ninth, assigning the underlying cause of death involves uncertainty for all causes, including CKD. Finally, comparisons of trends are valid within a given GBD analysis but not between reports that use different standard populations, and major world-events including conflicts and COVID-19 were not analysed.

In summary, the number of people with CKD and the age-standardised death rate due to CKD continues to rise, in contrast to most of the other top ten leading causes of death globally. This is happening despite the growing number of evidence-based therapies to slow progression of CKD, mitigate its associated excess cardiovascular mortality, and postpone the need for expensive kidney replacement therapies. The wide variation in the availability of kidney replacement therapy globally remains an important health concern. Urgent actions are required to address the data gaps on CKD prevalence estimates, underlying causes of CKD (particularly diabetes), and ensure widespread availability of therapies to improve outcomes for people with CKD.

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Please see appendix 2 (pp 20–25) for more detailed information about individual author contributions to the research, divided into the following categories: providing data or critical feedback on data sources; developing methods or computational machinery; providing critical feedback on methods or results; drafting the manuscript or revising it critically for important intellectual content; and managing the estimation or publications process.

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Data sharing

Citations for the data used in these analyses are provided in appendix 1 (table S19), with further information available on the Global Health Data Exchange website: https://ghdx.healthdata.org. The statistical code used for data processing and analysis is available upon request via email to the corresponding author.

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