Global, regional, and national burden of epilepsy, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

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Summary

Background Epilepsy is one of the most common serious neurological disorders and affects individuals of all ages across the globe. The aim of this study is to provide estimates of the epilepsy burden on the global, regional, and national levels for 1990–2021.

Methods Using well established Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) methodology, we quantified the prevalence of active idiopathic (epilepsy of genetic or unknown origin) and secondary epilepsy (epilepsy due to an underlying abnormality of the brain structure or chemistry), as well as incidence, death, and disability-adjusted life-years (DALYs) by age, sex, and location (globally, 21 GBD regions and seven super-regions, World Bank country income levels, Socio-demographic Index [SDI], and 204 countries) and their trends from 1990 to 2021. Vital registrations and verbal autopsies provided information about deaths, and data on the prevalence and severity of epilepsy, largely came from population representative surveys. All estimates were calculated with 95% uncertainty intervals (UIs).

Findings In 2021, there were 51·7 million (95% UI 44·9–58·9) people with epilepsy (idiopathic and secondary combined) globally, with an age-standardised prevalence of 658 per 100 000 (569–748). Idiopathic epilepsy had an age-standardised prevalence of 307 per 100 000 (235–389) globally, with 24·2 million (18·5–30·7) prevalent cases, and secondary epilepsy had a global age-standardised prevalence of 350 per 100 000 (322–380). In 2021, 0·7% of the population had active epilepsy (0·3% attributed to idiopathic epilepsy and 0·4% to secondary epilepsy), and the age-standardised global prevalence of epilepsy from idiopathic and secondary epilepsy combined increased from 1990 to 2021 by 10·8% (1·1–21·3), mainly due to corresponding changes in secondary epilepsy. However, age-standardised death and DALY rates of idiopathic epilepsy reduced from 1990 to 2021 (decline of 15·8% [8·8–22·8] and 14·5% [4·2–24·2], respectively). There were three-fold to four-fold geographical differences in the burden of active idiopathic epilepsy, with the bulk of the burden residing in low-income to middle-income countries: 82·1% (81·1–83·4) of incident, 80·4% prevalent (79·7–82·7), 84·7% (83·7–85·1) fatal epilepsy, and 87·9% (86·2–89·2) epilepsy DALYs.

Interpretation Although the global trends in idiopathic epilepsy deaths and DALY rates have improved in the preceding decades, in 2021 there were almost 52 million people with active epilepsy (24 million from idiopathic epilepsy and 28 million from secondary epilepsy), with the bulk of the burden (>80%) residing in low-income to middle-income countries. Better treatment and prevention of epilepsy are required, along with further research on risk factors of idiopathic epilepsy, good-quality long-term epilepsy surveillance studies, and exploration of the possible effect of stigma and cultural differences in seeking medical attention for epilepsy.

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Introduction

Epilepsy is one of the most common serious brain conditions of increasing burden that affects individuals of all ages across the globe,[1,2] increases risk of premature death up to three times compared with the general population, and is characterised by recurrent, unprovoked seizures due to abnormal excessive or synchronous neuronal activity in the brain.[3] The disease imposes a substantial economic, psychosocial, physical, and mental burden for health systems, societies, and affected individuals and their families.[4–6]

In 2022, epilepsy was identified by the 75th World Health Assembly and WHO as one of the top priorities in prevention and control of non-communicable diseases, and a special intersectoral global action plan on epilepsy and other neurological disorders for 2022–31 was adopted.[6] To enable evidence-based actions and awareness campaigns, and to strengthen public and private efforts to improve quality of and access to care and reduce the effect of the disease, accurate and regularly updated data on epilepsy incidence, prevalence, death, and disability by age, sex, and location are of crucial importance.[2] From public

Research in context

Evidence before this study

Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2016 showed that despite a substantial decrease in age-standardised rates of idiopathic epilepsy mortality (24·5% [95% UI 10·8–31·8]) and disability-adjusted life-years (DALYs; 19·4% [9·0–27·7]) from 1990 to 2016, there was a small, although non-substantial, increase in the age-standardised prevalence (6% [–4·0 to 16·7]). The number of survivors with idiopathic epilepsy who remained disabled (as measured by DALYs) had increased: 15·3 million (11·5–19·6) and 11·3 million (8·6–14·1) in 1990 to 25·1 million (19·0–31·4) and 13·1 million (10·0–16·7) in 2016, respectively to prevalence and disability. We searched PubMed for papers from Jan 10, 2016, to Jan 28, 2022, without language restrictions, using the terms (2016/10/01(PDAT) : 3000(PDAT)) AND ("epilepsy"(MeSH Terms) OR "epilepsy, partial, motor"(MeSH Terms) OR "epilepsy, benign neonatal"(MeSH Terms) OR "epilepsy, reflex"(MeSH Terms) OR "myoclonic epilepsy, juvenile"(MeSH Terms) OR "epilepsy, frontal lobe"(MeSH Terms) OR "epilepsy, complex partial"(MeSH Terms) OR "epilepsy, post-traumatic"(MeSH Terms) OR "epilepsy, temporal lobe"(MeSH Terms) OR "epilepsy, absence"(MeSH Terms) OR "epilepsy, tonic-clonic"(MeSH Terms) OR "epilepsies, myoclonic"(MeSH Terms) OR "epilepsies, partial"(MeSH Terms) OR epilep*(Title/Abstract)) AND (inciden*(Title/Abstract) OR prevalen*(Title/Abstract)) NOT (animals(MeSH) NOT humans(MeSH)). Previous studies have often been hampered by incomplete data and lack of differentiation between idiopathic and secondary epilepsy. We aimed to overcome these limitations by integrating comprehensive data from population-representative surveys and vital registrations, and offer a more accurate and detailed picture of the global epilepsy burden.

Added value of this study

This systematic analysis of the GBD 1990–2021 data advances previous GBD estimates on the epilepsy burden and provides the most up-to-date prevalence estimates of not only active idiopathic epilepsy but also active secondary epilepsy on global, regional, and national (204 countries) levels by age and sex for the 1990–2021 period.

Implications of all the available evidence

These data are important for evidence-based implementation of the WHO Resolution WHA73·10 on integrated (multisectoral) response to epilepsy and other neurological disorders for global health policy and resource allocation. By identifying regions with the highest burden of epilepsy, this study provides crucial data for targeted interventions. Policy makers can use these insights to prioritise funding for epilepsy care, improve access to antiseizure medications, and implement training programmes for health-care providers in underserved regions. Additionally, the study underscores the need for ongoing surveillance and research to track progress and adapt strategies as needed. Urgent efforts must be made by all key stakeholders and decision makers to increase awareness and education about epilepsy, eliminate stigmatisation and discrimination associated with epilepsy, better control secondary causes of epilepsy (eg, stroke, CNS zoonotic diseases, and other infectious diseases), improve access to existing treatments in economically disadvantaged countries or populations, and foster workforce development, especially in low-income countries. Further research on risk factors of idiopathic epilepsy, good-quality long-term epilepsy surveillance studies, and exploration of the possible effect of stigma and cultural differences in seeking medical attention for epilepsy is required, in addition to developing new effective and affordable treatments.

health perspectives, it is important to provide burden estimates for idiopathic (genetic) epilepsy separately from and combined with secondary epilepsy (epilepsy syndrome due to an underlying abnormality of the brain structure or chemistry)[7] for identifying prognosis and opportunities for prevention efforts, which are clearly different between the two types of epileptic seizures. As in the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) report on epilepsy published in 2019,[8] causes of secondary epilepsy included, among others, stroke, neurodegenerative disorders, infections and inflammatory disorders, brain tumours, traumatic brain injuries, and congenital abnormalities. In this GBD study, these conditions were not considered risks, but rather quantified as sequelae of the underlying causes of secondary epilepsy. Therefore, the causes of secondary epilepsy are more amendable to prevention, but their treatment usually is less successful because they do not address the often severe comorbid disabilities from motor or intellectual impairments. This information might also be used for projections of the burden of epilepsy, which is also important for health-care planning and resource allocation.[9] As emphasised by WHO, an understanding of the development of epilepsy after a brain insult or parasitic infection is crucial to the development of secondary prevention strategies.[2]

Previous epilepsy burden reports of GBD[8] and GBD-based papers[10–13] from the 1990–2016 period, and were largely limited to the burden of idiopathic epilepsy. This GBD 2021 study aims to quantify idiopathic and secondary epilepsy prevalence, as well as incidence, death, and disability-adjusted life-years (DALYs) by age, sex, and location (globally, 21 GBD regions and seven super-regions,[14] World Bank country income levels,[15] Socio-demographic Index [SDI],[16] and 204 countries) and their trends from 1990 to 2021. This manuscript was produced as part of the GBD Collaborator Network and in accordance with the GBD Protocol.[17]

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
Global	**307·4 (234·7 to 389·0)**	**24 221 000 (18 477 000 to 30 678 000)**	**6·9% (–9·7 to 25·5)**	**350·5 (322·3 to 380·5)**	**27 478 000 (25 245 000 to 29 861 000)**	**14·5% (5·3 to 25·5)**	**657·8 (569·0 to 748·4)**	**51 699 000 (44 924 000 to 58 903 000)**	**10·8% (1·1 to 21·3)**
Central Europe, eastern Europe, and central Asia	**326·3 (228·0 to 425·3)**	**1 385 000 (965 000 to 1 806 000)**	**–1·2% (–19·8 to 20·8)**	**340·7 (310·4 to 374·2)**	**1 421 000 (1 275 000 to 1 572 000)**	**–5·3% (–15·5 to 8·1)**	**667·0 (557·0 to 777·8)**	**2 806 000 (2 368 000 to 3 300 000)**	**–3·3% (–13·8 to 8·6)**
Central Asia	449·7 (262·4 to 619·7)	426 000 (248 000 to 589 000)	7·8% (–32·8 to 70·7)	323·7 (294·9 to 355·8)	314 000 (286 000 to 345 000)	16·1% (0·5 to 33·5)	773·4 (593·0 to 947·5)	740 000 (567 000 to 907 000)	11·1% (–15·4 to 47·5)
Armenia	296·5 (95·5 to 496·2)	9 000 (3 000 to 15 000)	–3·1% (–72·1 to 282·9)	421·1 (367·8 to 475·1)	12 000 (11 000 to 14 000)	3·0% (–11·1 to 19·0)	717·5 (499·7 to 953·4)	21 000 (15 000 to 28 000)	0·4% (–34·9 to 58·5)
Azerbaijan	449·6 (133·3 to 745·2)	46 000 (14 000 to 77 000)	7·0% (–71·8 to 315·6)	319·2 (288·1 to 354·0)	33 000 (30 000 to 37 000)	33·5% (10·2 to 59·4)	768·8 (450·7 to 1 066·5)	79 000 (47 000 to 110 000)	16·6% (–39·3 to 137·2)
Georgia	357·5 (110·3 to 573·4)	13 000 (4 000 to 21 000)	–15·5% (–77·4 to 210·2)	392·0 (355·8 to 433·0)	15 000 (13 000 to 16 000)	8·2% (–4·5 to 23·3)	749·5 (494·7 to 973·4)	28 000 (18 000 to 36 000)	–4·6% (–44·4 to 69·5)
Kazakhstan	475·8 (136·7 to 769·9)	90 000 (26 000 to 145 000)	9·0% (–72·4 to 304·0)	349·1 (312·5 to 396·4)	67 000 (59 000 to 76 000)	1·7% (–11·7 to 18·3)	824·9 (474·7 to 1 112·7)	156 000 (90 000 to 210 000)	5·8% (–43·7 to 98·9)
Kyrgyzstan	416·9 (112·5 to 660·2)	28 000 (8 000 to 45 000)	–9·4% (–78·6 to 329·7)	320·3 (289·9 to 352·2)	23 000 (21 000 to 25 000)	28·6% (6·3 to 56·2)	737·2 (433·4 to 987·6)	51 000 (31 000 to 69 000)	4·0% (–48·0 to 129·9)
Mongolia	403·0 (82·2 to 672·8)	13 000 (3 000 to 22 000)	23·9% (–71·9 to 472·3)	439·3 (388·8 to 493·5)	15 000 (13 000 to 16 000)	40·3% (24·7 to 57·4)	842·2 (528·6 to 1 113·5)	28 000 (18 000 to 37 000)	31·9% (–25·7 to 139·5)
Tajikistan	417·8 (113·0 to 698·8)	41 000 (11 000 to 69 000)	–18·3% (–78·0 to 213·4)	327·6 (292·8 to 363·4)	36 000 (32 000 to 39 000)	36·5% (14·4 to 60·9)	745·4 (445·2 to 1 032·5)	77 000 (47 000 to 106 000)	–0·8% (–46·7 to 110·3)
Turkmenistan	459·8 (115·9 to 748·7)	24 000 (6 000 to 39 000)	18·5% (–70·9 to 300·8)	266·8 (239·1 to 296·4)	14 000 (13 000 to 16 000)	46·8% (18·7 to 80·2)	726·6 (374·9 to 1 012·0)	38 000 (20 000 to 53 000)	27·5% (–38·8 to 165·9)
Uzbekistan	479·2 (142·1 to 765·4)	162 000 (48 000 to 261 000)	19·8% (–65·0 to 421·7)	281·3 (253·6 to 311·4)	100 000 (90 000 to 110 000)	37·1% (11·8 to 66·1)	760·5 (423·6 to 1 045·6)	262 000 (148 000 to 359 000)	25·7% (–39·2 to 170·9)
Central Europe	387·9 (266·4 to 516·7)	469 000 (319 000 to 622 000)	1·0% (–24·5 to 36·9)	408·9 (372·0 to 451·6)	478 000 (431 000 to 534 000)	–4·6% (–14·8 to 8·4)	796·8 (655·6 to 937·0)	948 000 (787 000 to 1 126 000)	–1·9% (–14·6 to 14·1)
Albania	437·1 (113·6 to 705·2)	12 000 (3 000 to 19 000)	2·5% (–74·1 to 259·8)	372·3 (324·8 to 424·3)	9 000 (8 000 to 10 000)	–0·1% (–17·5 to 21·1)	809·4 (490·0 to 1 087·1)	21 000 (12 000 to 28 000)	1·3% (–43·4 to 81·9)
Bosnia and Herzegovina	379·1 (107·0 to 617·1)	13 000 (4 000 to 21 000)	16·2% (–70·4 to 325·8)	519·8 (458·2 to 580·7)	17 000 (15 000 to 19 000)	–5·3% (–11·9 to 2·3)	898·8 (614·2 to 1 157·1)	30 000 (20 000 to 38 000)	2·7% (–34·0 to 51·7)
Bulgaria	429·1 (118·8 to 682·0)	30 000 (8 000 to 47 000)	6·3% (–69·9 to 254·0)	383·1 (335·6 to 434·4)	22 000 (19 000 to 25 000)	–0·6% (–18·1 to 27·1)	812·1 (499·4 to 1 073·1)	52 000 (30 000 to 69 000)	3·0% (–38·5 to 75·9)
Croatia	443·8 (122·6 to 705·1)	20 000 (6 000 to 32 000)	–17·0% (–78·2 to 221·2)	456·7 (402·8 to 521·3)	20 000 (18 000 to 24 000)	–21·7% (–32·9 to –9·1)	900·5 (579·3 to 1 179·1)	41 000 (26 000 to 54 000)	–19·5% (–51·4 to 33·0)
Czechia	450·3 (126·9 to 694·6)	51 000 (15 000 to 79 000)	1·4% (–71·1 to 231·9)	375·8 (332·9 to 422·1)	35 000 (31 000 to 40 000)	–2·3% (–18·7 to 20·9)	826·0 (507·9 to 1 087·9)	87 000 (51 000 to 115 000)	–0·3% (–42·8 to 67·7)
Hungary	375·0 (118·2 to 588·8)	37 000 (12 000 to 58 000)	–12·6% (–73·7 to 229·6)	486·1 (431·8 to 544·4)	46 000 (41 000 to 53 000)	–12·4% (–23·9 to 3·3)	861·0 (591·0 to 1 105·3)	83 000 (57 000 to 108 000)	–12·5% (–44·3 to 35·9)
Montenegro	333·3 (89·4 to 532·7)	2 000 (1 000 to 3 000)	–4·7% (–73·3 to 249·2)	437·6 (388·5 to 487·1)	3 000 (2 000 to 3 000)	–7·5% (–14·6 to 2·5)	770·8 (523·4 to 998·7)	5 000 (3 000 to 6 000)	–6·3% (–38·0 to 42·7)
North Macedonia	341·9 (96·4 to 539·1)	8 000 (2 000 to 12 000)	–6·0% (–76·2 to 191·6)	464·4 (407·0 to 521·3)	10 000 (9 000 to 11 000)	–4·7% (–15·9 to 15·5)	806·3 (547·2 to 1 028·2)	18 000 (12 000 to 23 000)	–5·3% (–39·4 to 44·7)
Poland	350·7 (236·8 to 458·2)	141 000 (95 000 to 185 000)	18·1% (–14·7 to 59·7)	304·7 (266·5 to 345·8)	129 000 (109 000 to 152 000)	4·0% (–5·3 to 13·4)	655·4 (534·7 to 779·2)	271 000 (220 000 to 323 000)	11·1% (–4·7 to 30·2)

(Table 1 continues on next page)

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Romania	398·1 (121·7 to 617·6)	78 000 (24 000 to 122 000)	−3·1% (−69·7 to 238·3)	539·9 (482·8 to 609·4)	102 000 (90 000 to 116 000)	2·3% (−12·9 to 21·3)	938·0 (640·1 to 1 196·8)	179 000 (124 000 to 230 000)	−0·1% (−34·0 to 57·5)
Serbia	371·2 (109·1 to 567·6)	36 000 (11 000 to 55 000)	−12·8% (−73·9 to 217·2)	434·4 (393·9 to 482·7)	41 000 (36 000 to 46 000)	−8·0% (−20·1 to 6·0)	805·6 (529·5 to 1 020·8)	77 000 (50 000 to 97 000)	−10·3% (−44·4 to 44·0)
Slovakia	458·3 (136·9 to 727·4)	27 000 (8000 to 42 000)	6·2% (−69·1 to 235·9)	519·1 (464·3 to 580·3)	29 000 (26 000 to 33 000)	−14·7% (−23·4 to −5·5)	977·4 (631·9 to 1 257·2)	56 000 (35 000 to 73 000)	−6·0% (−40·5 to 46·7)
Slovenia	376·7 (120·6 to 590·9)	8 000 (3000 to 13 000)	−18·5% (−77·4 to 168·8)	373·0 (319·1 to 430·2)	7 000 (6000 to 8000)	0·1% (−17·4 to 26·0)	749·7 (481·6 to 980·0)	15 000 (9 000 to 20 000)	−10·2% (−46·7 to 57·5)
Eastern Europe	226·5 (152·2 to 303·9)	489 000 (333 000 to 658 000)	−15·6% (−36·9 to 10·4)	302·3 (265·4 to 339·1)	629 000 (550 000 to 710 000)	−11·8% (−22·2 to 4·0)	528·8 (425·3 to 623·6)	1 118 000 (919 000 to 1 331 000)	−13·5% (−25·2 to −0·2)
Belarus	234·2 (65·1 to 384·3)	23 000 (6000 to 37 000)	−25·5% (−78·7 to 161·6)	308·7 (275·5 to 347·3)	29 000 (26 000 to 33 000)	−18·7% (−31·6 to −2·7)	542·9 (361·0 to 700·1)	52 000 (35 000 to 67 000)	−21·8% (−51·5 to 23·7)
Estonia	420·7 (126·8 to 632·4)	6 000 (2000 to 9 000)	17·4% (−65·4 to 340·7)	425·0 (377·0 to 478·7)	6 000 (5000 to 7000)	−6·3% (−14·2 to 2·7)	845·7 (550·0 to 1 086·5)	12 000 (8000 to 15 000)	4·2% (−34·1 to 64·0)
Latvia	362·8 (117·0 to 571·2)	7 000 (2000 to 12 000)	16·5% (−65·0 to 377·4)	396·8 (348·4 to 446·7)	8 000 (7000 to 9000)	1·9% (−8·0 to 16·3)	759·5 (501·2 to 981·0)	15 000 (10 000 to 20 000)	8·4% (−31·0 to 72·4)
Lithuania	389·2 (123·9 to 586·2)	12 000 (4000 to 18 000)	6·7% (−68·6 to 282·7)	391·4 (348·8 to 437·0)	11 000 (10 000 to 13 000)	−8·1% (−18·5 to 3·6)	780·6 (519·4 to 985·9)	23 000 (15 000 to 29 000)	−1·3% (−40·1 to 58·0)
Moldova	247·5 (76·3 to 407·6)	9 000 (3000 to 15 000)	−22·5% (−79·0 to 183·2)	353·1 (314·2 to 391·6)	13 000 (11 000 to 14 000)	−13·8% (−25·7 to 0·1)	600·7 (418·8 to 776·8)	22 000 (15 000 to 28 000)	−17·6% (−48·7 to 27·5)
Russia	211·2 (143·6 to 281·8)	321 000 (220 000 to 436 000)	−15·2% (−30·1 to −1·9)	287·3 (246·2 to 327·5)	418 000 (364 000 to 478 000)	−11·1% (−21·1 to 6·0)	498·5 (404·5 to 592·2)	739 000 (609 000 to 891 000)	−12·8% (−21·6 to −2·5)
Ukraine	253·1 (77·6 to 403·7)	111 000 (34 000 to 176 000)	−16·0% (−73·4 to 176·9)	333·8 (297·2 to 369·9)	145 000 (127 000 to 162 000)	−11·1% (−22·6 to 4·1)	586·9 (393·9 to 748·9)	255 000 (175 000 to 328 000)	−13·3% (−43·9 to 31·6)
High income	**343·7 (233·4 to 454·9)**	**4 073 000 (2 740 000 to 5 373 000)**	**8·9% (−12·4 to 27·7)**	**295·2 (271·2 to 321·3)**	**3 116 000 (2 848 000 to 3 406 000)**	**4·4% (−6·4 to 15·4)**	**638·9 (524·1 to 757·3)**	**7 189 000 (5 826 000 to 8 590 000)**	**6·8% (−4·2 to 17·3)**
Australasia	316·1 (123·3 to 491·0)	102 000 (39 000 to 157 000)	−3·6% (−62·1 to 141·4)	248·1 (225·4 to 273·7)	71 000 (64 000 to 78 000)	−15·6% (−23·2 to −6·6)	564·3 (369·3 to 737·3)	172 000 (109 000 to 230 000)	−9·3% (−41·6 to 38·8)
Australia	316·5 (100·8 to 512·0)	85 000 (27 000 to 137 000)	−1·2% (−70·3 to 227·2)	251·9 (227·2 to 278·8)	60 000 (54 000 to 66 000)	−17·2% (−24·9 to −8·0)	568·4 (344·8 to 763·5)	145 000 (86 000 to 198 000)	−9·0% (−47·2 to 53·6)
New Zealand	312·9 (122·1 to 471·4)	16 000 (6000 to 24 000)	−14·2% (−64·2 to 119·6)	229·5 (206·5 to 254·0)	11 000 (10 000 to 12 000)	−5·5% (−26·8 to 14·0)	542·5 (344·3 to 698·5)	27 000 (17 000 to 35 000)	−10·7% (−42·8 to 47·3)
High-income Asia Pacific	276·7 (168·6 to 384·4)	563 000 (345 000 to 767 000)	5·4% (−28·5 to 49·2)	231·4 (212·5 to 251·5)	394 000 (358 000 to 430 000)	4·5% (−14·2 to 22·8)	508·1 (398·5 to 618·1)	957 000 (735 000 to 1 174 000)	5·0% (−15·6 to 28·9)
Brunei	418·3 (132·5 to 644·5)	2 000 (1000 to 3000)	−21·4% (−71·6 to 194·9)	365·5 (333·8 to 399·7)	2 000 (2000 to 2000)	−5·9% (−16·6 to 5·8)	783·8 (496·0 to 1 023·9)	4 000 (2000 to 5000)	−14·8% (−47·5 to 54·9)
Japan	261·6 (169·0 to 352·3)	377 000 (250 000 to 503 000)	11·3% (−7·7 to 31·9)	212·5 (192·0 to 233·9)	225 000 (203 000 to 248 000)	12·6% (−11·4 to 35·8)	474·1 (379·6 to 568·2)	602 000 (473 000 to 730 000)	11·9% (−4·5 to 27·1)
Singapore	271·3 (78·8 to 431·8)	15 000 (4000 to 24 000)	14·6% (−70·7 to 332·6)	246·2 (225·4 to 268·6)	13 000 (12 000 to 15 000)	1·0% (−10·4 to 14·2)	517·5 (322·8 to 679·6)	29 000 (17 000 to 38 000)	7·7% (−39·0 to 81·0)
South Korea	315·4 (84·6 to 484·7)	169 000 (45 000 to 262 000)	−5·2% (−73·8 to 207·0)	278·4 (252·0 to 306·2)	154 000 (136 000 to 174 000)	−14·7% (−25·0 to −4·4)	593·8 (357·9 to 768·0)	323 000 (197 000 to 424 000)	−9·9% (−49·4 to 47·5)

(Table 1 continues on next page)

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
High-income North America	334·7 (218·9 to 460·7)	1 316 000 (865 000 to 1 780 000)	12·7% (−13·1 to 37·0)	354·6 (319·3 to 392·4)	1 350 000 (1 199 000 to 1 511 000)	3·0% (−4·1 to 10·2)	689·4 (555·4 to 821·8)	2 666 000 (2 152 000 to 3 202 000)	7·5% (−4·8 to 18·6)
Canada	272·3 (76·4 to 430·2)	110 000 (32 000 to 171 000)	3·3% (−66·2 to 214·5)	263·3 (239·6 to 289·1)	89 000 (81 000 to 98 000)	2·3% (−8·4 to 14·0)	535·6 (340·2 to 693·1)	199 000 (121 000 to 261 000)	2·8% (−35·1 to 62·5)
Greenland	554·6 (167·4 to 870·9)	330 (100 to 520)	−10·8% (−73·2 to 209·6)	290·9 (264·5 to 320·9)	150 (140 to 170)	2·4% (−12·2 to 19·4)	845·5 (455·8 to 1167·6)	490 (260 to 680)	−6·7% (−52·6 to 101·9)
USA	341·6 (217·9 to 466·9)	1 205 000 (771 000 to 1 614 000)	13·7% (−13·5 to 37·7)	365·3 (327·5 to 405·1)	1 261 000 (1 113 000 to 1 419 000)	3·4% (−4·3 to 10·6)	706·9 (573·1 to 837·0)	2 466 000 (2 001 000 to 2 953 000)	8·1% (−4·8 to 20·3)
Southern Latin America	339·7 (161·0 to 515·6)	233 000 (113 000 to 355 000)	7·3% (−44·9 to 120·5)	391·4 (356·4 to 425·4)	266 000 (241 000 to 291 000)	3·9% (−5·2 to 14·5)	731·1 (542·5 to 906·6)	499 000 (370 000 to 621 000)	5·4% (−22·6 to 41·4)
Argentina	277·7 (71·5 to 454·7)	127 000 (33 000 to 207 000)	11·9% (−72·5 to 301·6)	366·6 (331·2 to 401·3)	166 000 (149 000 to 183 000)	2·2% (−5·8 to 11·4)	644·4 (435·3 to 830·4)	293 000 (197 000 to 380 000)	6·1% (−30·8 to 57·2)
Chile	478·8 (148·1 to 773·6)	92 000 (29 000 to 149 000)	−0·1% (−74·0 to 254·5)	447·8 (404·6 to 496·1)	87 000 (78 000 to 97 000)	2·8% (−11·1 to 16·1)	926·5 (579·5 to 1 215·7)	179 000 (112 000 to 236 000)	1·3% (−41·2 to 77·8)
Uruguay	394·4 (95·3 to 636·9)	14 000 (3 000 to 23 000)	13·7% (−73·9 to 305·3)	372·9 (334·6 to 414·1)	13 000 (12 000 to 15 000)	7·8% (−5·1 to 21·1)	767·4 (460·9 to 1 017·6)	27 000 (16 000 to 36 000)	10·8% (−38·3 to 90·5)
Western Europe	381·1 (238·1 to 502·5)	1 859 000 (1 139 000 to 2 480 000)	8·3% (−21·3 to 44·3)	258·5 (234·8 to 285·5)	1 035 000 (946 000 to 1 143 000)	1·7% (−10·9 to 15·5)	639·6 (495·8 to 764·1)	2 894 000 (2 197 000 to 3 534 000)	5·5% (−12·4 to 25·1)
Andorra	348·7 (100·7 to 530·1)	310 (90 to 460)	−5·9% (−64·3 to 142·6)	214·0 (193·6 to 236·4)	170 (150 to 190)	−6·8% (−20·2 to 6·4)	562·7 (319·8 to 745·6)	470 (260 to 630)	−6·2% (−46·3 to 58·8)
Austria	332·7 (99·5 to 511·7)	31 000 (10 000 to 48 000)	3·4% (−61·0 to 315·7)	401·4 (361·7 to 447·0)	36 000 (32 000 to 41 000)	24·5% (11·5 to 37·7)	734·1 (488·2 to 931·2)	68 000 (45 000 to 86 000)	14·0% (−23·4 to 90·4)
Belgium	425·6 (125·9 to 656·7)	56 000 (16 000 to 85 000)	14·1% (−69·6 to 297·4)	176·9 (160·4 to 196·9)	18 000 (16 000 to 20 000)	12·6% (−1·2 to 28·5)	602·5 (302·3 to 832·2)	74 000 (34 000 to 104 000)	13·7% (−48·6 to 141·4)
Cyprus	287·6 (81·0 to 450·5)	4 000 (1000 to 6000)	−5·5% (−74·5 to 267·4)	230·4 (203·7 to 261·8)	3 000 (3000 to 3000)	−13·4% (−27·3 to 5·2)	517·9 (305·6 to 690·0)	7 000 (4 000 to 9 000)	−9·2% (−48·2 to 56·4)
Denmark	266·1 (74·9 to 413·4)	17 000 (5000 to 26 000)	−1·5% (−65·6 to 208·5)	245·0 (218·8 to 277·4)	13 000 (11 000 to 15 000)	−5·3% (−18·7 to 12·0)	511·0 (311·0 to 663·6)	30 000 (17 000 to 40 000)	−3·4% (−38·5 to 56·1)
Finland	336·3 (91·5 to 529·4)	20 000 (6000 to 32 000)	9·3% (−68·2 to 217·8)	201·5 (183·1 to 222·0)	10 000 (9000 to 11 000)	−3·5% (−18·3 to 12·3)	537·7 (303·9 to 726·7)	30 000 (16 000 to 42 000)	4·1% (−45·2 to 86·2)
France	426·9 (155·3 to 661·3)	323 000 (119 000 to 501 000)	9·7% (−60·4 to 274·1)	191·0 (172·0 to 213·9)	112 000 (101 000 to 126 000)	−4·3% (−18·5 to 11·4)	617·9 (340·6 to 864·1)	436 000 (230 000 to 617 000)	4·9% (−42·7 to 107·7)
Germany	538·6 (163·0 to 815·6)	548 000 (171 000 to 827 000)	17·9% (−61·8 to 223·9)	349·2 (318·2 to 387·3)	256 000 (233 000 to 283 000)	−2·4% (−12·1 to 8·0)	887·8 (521·3 to 1 159·8)	804 000 (432 000 to 1 083 000)	9·0% (−36·6 to 88·5)
Greece	267·3 (68·7 to 422·8)	28 000 (7000 to 44 000)	0·1% (−74·9 to 218·2)	321·5 (290·3 to 352·2)	32 000 (29 000 to 37 000)	30·3% (13·9 to 48·5)	588·8 (390·2 to 752·6)	61 000 (40 000 to 78 000)	14·6% (−30·4 to 85·5)
Iceland	308·1 (88·0 to 484·8)	1 000 (0 to 2000)	11·0% (−66·5 to 250·3)	261·1 (237·5 to 285·6)	860 (780 to 940)	−3·1% (−15·1 to 9·8)	569·2 (346·5 to 749·5)	2 000 (1 000 to 3 000)	4·1% (−35·3 to 70·9)
Ireland	382·9 (113·0 to 589·7)	20 000 (6000 to 30 000)	13·7% (−64·2 to 302·2)	222·3 (200·7 to 246·5)	10 000 (9000 to 11 000)	−3·8% (−17·4 to 12·2)	605·2 (344·7 to 814·6)	30 000 (16 000 to 41 000)	6·6% (−41·6 to 93·7)
Israel	307·6 (105·5 to 466·1)	30 000 (10 000 to 46 000)	14·7% (−60·3 to 314·5)	291·5 (262·9 to 321·9)	28 000 (25 000 to 31 000)	−6·7% (−16·1 to 3·1)	599·1 (393·0 to 770·7)	59 000 (38 000 to 75 000)	3·2% (−34·0 to 60·4)
Italy	253·4 (174·1 to 344·3)	172 000 (116 000 to 234 000)	−3·7% (−28·3 to 25·3)	211·6 (192·2 to 234·5)	109 000 (99 000 to 121 000)	−4·7% (−25·7 to 16·0)	465·0 (377·0 to 561·2)	281 000 (224 000 to 344 000)	−4·2% (−20·6 to 13·7)

(Table 1 continues on next page)

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Luxembourg	439·9 (139·5 to 663·0)	3 000 (1 000 to 5 000)	7·6% (−66·2 to 252·4)	221·3 (193·0 to 253·6)	1 000 (1 000 to 2 000)	−12·8% (−31·2 to 9·0)	661·3 (368·2 to 884·0)	4 000 (2 000 to 6 000)	−0·2% (−47·6 to 88·0)
Malta	290·5 (82·7 to 458·4)	1 000 (0 to 2 000)	16·6% (−65·0 to 314·8)	237·2 (217·9 to 261·2)	920 (840 to 1010)	2·6% (−8·6 to 12·8)	527·7 (326·1 to 696·9)	2 000 (1 000 to 3 000)	9·9% (−35·3 to 82·8)
Monaco	356·4 (121·8 to 564·0)	150 (50 to 240)	6·4% (−67·8 to 269·3)	291·3 (261·3 to 325·2)	120 (100 to 140)	−4·0% (−14·3 to 6·4)	647·7 (406·4 to 860·7)	270 (170 to 370)	1·4% (−40·9 to 70·0)
Netherlands	347·3 (99·4 to 537·7)	65 000 (18 000 to 99 000)	11·7% (−66·5 to 292·6)	223·0 (200·9 to 248·6)	34 000 (31 000 to 38 000)	−2·2% (−19·9 to 17·1)	570·3 (319·8 to 758·6)	99 000 (52 000 to 133 000)	5·8% (−41·7 to 88·3)
Norway	413·3 (247·4 to 567·6)	24 000 (15 000 to 33 000)	−2·2% (−31·7 to 33·8)	312·7 (266·3 to 363·7)	16 000 (13 000 to 18 000)	−16·9% (−29·6 to 2·1)	726·0 (560·7 to 875·4)	40 000 (30 000 to 49 000)	−9·1% (−24·4 to 9·0)
Portugal	269·2 (73·8 to 420·7)	33 000 (9 000 to 51 000)	17·4% (−67·9 to 364·7)	207·5 (186·9 to 232·0)	19 000 (17 000 to 21 000)	5·4% (−11·2 to 22·8)	476·7 (277·2 to 634·4)	52 000 (27 000 to 70 000)	11·8% (−38·3 to 101·3)
San Marino	284·9 (78·7 to 448·8)	90 (30 to 150)	−1·7% (−70·8 to 228·4)	259·8 (235·1 to 285·0)	90 (80 to 100)	−6·1% (−16·0 to 3·4)	544·6 (328·5 to 706·4)	180 (110 to 240)	−3·8% (−41·9 to 60·5)
Spain	269·3 (85·1 to 429·5)	132 000 (43 000 to 209 000)	5·7% (−65·9 to 318·7)	261·7 (236·9 to 292·1)	132 000 (117 000 to 151 000)	−5·1% (−16·1 to 6·6)	531·0 (347·7 to 695·8)	264 000 (172 000 to 348 000)	0·1% (−38·5 to 63·7)
Sweden	245·2 (105·3 to 363·5)	27 000 (11 000 to 40 000)	−15·0% (−62·0 to 99·2)	282·4 (252·1 to 311·6)	26 000 (24 000 to 29 000)	6·2% (−9·6 to 24·2)	527·6 (378·3 to 657·8)	53 000 (37 000 to 67 000)	−4·8% (−31·6 to 38·6)
Switzerland	314·1 (92·6 to 495·1)	31 000 (9 000 to 48 000)	−7·8% (−72·0 to 236·9)	285·5 (253·2 to 324·2)	23 000 (20 000 to 26 000)	−0·5% (−15·1 to 17·6)	599·6 (370·1 to 782·7)	54 000 (31 000 to 72 000)	−4·4% (−42·0 to 59·4)
UK	413·6 (276·6 to 554·0)	289 000 (194 000 to 383 000)	2·4% (−12·3 to 15·4)	249·8 (214·6 to 287·0)	153 000 (131 000 to 176 000)	22·5% (2·4 to 45·1)	663·4 (523·3 to 809·0)	442 000 (347 000 to 537 000)	9·1% (−1·7 to 20·7)
Latin America and Caribbean	**470·6 (346·3 to 607·6)**	**2 811 000 (2 070 000 to 3 628 000)**	**−9·7% (−29·1 to 16·0)**	**482·7 (435·7 to 530·3)**	**2 899 000 (2 604 000 to 3 203 000)**	**10·3% (−2·1 to 22·2)**	**953·4 (813·1 to 1 103·3)**	**5 709 000 (4 853 000 to 6 613 000)**	**−0·5% (−12·5 to 13·8)**
Andean Latin America	561·9 (309·6 to 821·7)	372 000 (205 000 to 544 000)	−4·5% (−53·7 to 105·5)	478·8 (430·5 to 528·4)	314 000 (283 000 to 347 000)	−7·1% (−14·5 to 0·6)	1 040·7 (775·5 to 1 314·2)	686 000 (511 000 to 868 000)	−5·7% (−35·0 to 37·6)
Bolivia	421·1 (105·8 to 704·0)	49 000 (12 000 to 82 000)	−20·0% (−80·4 to 236·5)	401·3 (357·8 to 451·7)	46 000 (41 000 to 52 000)	−3·1% (−12·0 to 6·5)	822·4 (505·8 to 1 112·2)	95 000 (58 000 to 129 000)	−12·6% (−54·3 to 62·0)
Ecuador	710·8 (226·2 to 1 140·8)	129 000 (41 000 to 207 000)	4·4% (−70·0 to 359·3)	460·3 (412·6 to 511·5)	82 000 (74 000 to 91 000)	−6·5% (−15·3 to 3·3)	1 171·1 (691·3 to 1 600·2)	211 000 (124 000 to 288 000)	−0·2% (−48·5 to 96·9)
Peru	534·4 (155·1 to 856·1)	194 000 (56 000 to 311 000)	−5·2% (−72·4 to 314·9)	511·9 (462·3 to 566·1)	186 000 (167 000 to 206 000)	−7·8% (−15·7 to 1·1)	1 046·3 (667·5 to 1 377·7)	380 000 (243 000 to 503 000)	−6·5% (−46·2 to 68·0)
Caribbean	371·1 (236·3 to 507·4)	177 000 (114 000 to 241 000)	−3·3% (−37·2 to 47·2)	467·9 (431·5 to 505·1)	222 000 (204 000 to 240 000)	−2·7% (−8·7 to 3·7)	839·0 (691·7 to 996·8)	398 000 (329 000 to 472 000)	−3·0% (−19·3 to 17·1)
Antigua and Barbuda	662·3 (195·6 to 1 027·4)	610 (180 to 950)	−5·4% (−71·1 to 309·8)	379·7 (350·6 to 412·5)	330 (300 to 350)	0·8% (−13·8 to 16·3)	1 041·9 (583·7 to 1 406·1)	940 (510 to 1270)	−3·2% (−49·6 to 99·4)
The Bahamas	493·1 (155·9 to 765·5)	2 000 (1 000 to 3 000)	−12·3% (−72·8 to 199·4)	509·1 (462·0 to 561·3)	2 000 (2 000 to 2 000)	−10·0% (−17·6 to −0·8)	1 002·1 (659·1 to 1 281·8)	4 000 (3 000 to 5 000)	−11·2% (−44·0 to 43·2)
Barbados	463·0 (148·0 to 739·6)	1 000 (0 to 2 000)	−13·8% (−77·4 to 220·3)	515·1 (468·2 to 564·5)	2 000 (1 000 to 2 000)	−9·6% (−17·5 to −1·0)	978·1 (656·9 to 1 254·5)	3 000 (2 000 to 4 000)	−11·6% (−47·3 to 46·4)
Belize	401·3 (116·3 to 686·1)	2 000 (1 000 to 3 000)	8·8% (−72·9 to 402·8)	548·1 (498·5 to 596·7)	2 000 (2 000 to 3 000)	7·1% (−3·4 to 18·8)	949·4 (657·5 to 1 237·4)	4 000 (3 000 to 5 000)	7·8% (−31·4 to 77·5)
Bermuda	452·6 (139·4 to 709·8)	300 (90 to 470)	−18·1% (−74·0 to 201·7)	472·5 (428·7 to 516·7)	320 (280 to 360)	−16·8% (−23·7 to −9·2)	925·2 (605·3 to 1 195·9)	620 (410 to 810)	−17·4% (−48·9 to 36·7)

(Table 1 continues on next page)

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	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Cuba	270·1 (78·5 to 445·2)	29 000 (9 000 to 48 000)	−10·0% (−76·4 to 253·7)	270·3 (251·8 to 291·8)	27 000 (25 000 to 30 000)	−16·1% (−26·1 to −4·2)	540·4 (346·2 to 721·0)	56 000 (36 000 to 76 000)	−13·2% (−49·6 to 48·0)
Dominica	665·6 (224·1 to 1 029·3)	460 (150 to 710)	7·9% (−69·3 to 384·6)	595·9 (529·3 to 667·6)	410 (360 to 460)	−7·5% (−14·9 to 0·6)	1 261·5 (807·4 to 1 646·9)	860 (550 to 1130)	0·0% (−41·8 to 73·2)
Dominican Republic	423·0 (129·2 to 696·3)	47 000 (14 000 to 77 000)	29·2% (−63·5 to 408·4)	576·8 (521·8 to 625·7)	64 000 (58 000 to 69 000)	22·0% (12·5 to 32·9)	999·7 (689·5 to 1 293·7)	110 000 (76 000 to 142 000)	24·9% (−20·0 to 98·4)
Grenada	477·2 (131·8 to 790·3)	500 (140 to 820)	2·8% (−68·5 to 297·7)	557·1 (507·0 to 611·6)	580 (520 to 640)	−5·7% (−14·7 to 3·9)	1 034·3 (677·4 to 1 356·9)	1000 (1000 to 1000)	−1·9% (−37·9 to 62·6)
Guyana	502·4 (138·6 to 804·2)	4 000 (1 000 to 6 000)	17·4% (−67·0 to 302·5)	602·9 (547·4 to 665·9)	5000 (4000 to 5000)	−1·9% (−9·0 to 5·0)	1 105·4 (733·7 to 1 427·2)	8000 (6000 to 11 000)	6·0% (−33·3 to 58·8)
Haiti	324·3 (80·6 to 567·8)	42 000 (10 000 to 74 000)	−16·2% (−82·8 to 306·5)	465·3 (420·9 to 513·1)	59 000 (54 000 to 65 000)	−19·6% (−25·2 to −13·2)	789·6 (538·2 to 1 042·2)	101 000 (69 000 to 134 000)	−18·3% (−49·7 to 30·4)
Jamaica	426·3 (124·7 to 693·1)	12 000 (4000 to 20 000)	−2·2% (−71·1 to 250·9)	598·1 (540·5 to 652·2)	17 000 (15 000 to 18 000)	−4·1% (−11·8 to 3·1)	1 024·4 (723·0 to 1 318·1)	29 000 (21 000 to 37 000)	−3·4% (−35·7 to 47·9)
Puerto Rico	460·9 (129·5 to 727·0)	17 000 (5000 to 26 000)	−15·3% (−74·8 to 167·0)	502·4 (456·0 to 551·1)	17 000 (15 000 to 20 000)	−14·2% (−21·9 to −6·5)	963·3 (619·6 to 1 259·1)	34 000 (22 000 to 45 000)	−14·7% (−47·0 to 34·9)
Saint Kitts and Nevis	564·3 (166·3 to 909·6)	340 (100 to 540)	−20·8% (−75·6 to 219·4)	528·2 (474·0 to 592·7)	320 (280 to 370)	−18·8% (−27·5 to −10·0)	1 092·4 (694·8 to 1 427·4)	660 (420 to 860)	−19·8% (−50·5 to 38·2)
Saint Lucia	519·3 (139·4 to 852·3)	950 (260 to 1560)	−10·7% (−77·7 to 256·3)	740·9 (675·0 to 811·5)	1000 (1000 to 1000)	−14·3% (−20·0 to −7·3)	1 260·2 (878·6 to 1 609·9)	2000 (2000 to 3000)	−12·9% (−43·9 to 35·3)
Saint Vincent and the Grenadines	494·2 (132·8 to 812·4)	580 (150 to 940)	7·1% (−71·0 to 404·8)	571·8 (515·1 to 629·0)	670 (590 to 740)	2·0% (−7·5 to 12·7)	1 066·0 (716·2 to 1 381·9)	1000 (1000 to 2000)	4·3% (−38·1 to 71·4)
Suriname	542·9 (184·4 to 868·1)	3000 (1000 to 5000)	7·4% (−64·9 to 410·5)	588·8 (527·3 to 656·9)	3000 (3000 to 4000)	1·2% (−7·8 to 12·3)	1 131·7 (761·1 to 1 451·9)	7000 (4000 to 9000)	4·1% (−36·2 to 79·3)
Trinidad and Tobago	593·4 (168·6 to 955·2)	9000 (2000 to 14 000)	1·8% (−69·1 to 280·7)	781·0 (706·1 to 858·5)	11 000 (10 000 to 12 000)	−1·4% (−7·5 to 5·7)	1 374·5 (944·8 to 1 773·3)	20 000 (14 000 to 25 000)	0·0% (−35·6 to 54·2)
Virgin Islands	500·4 (152·1 to 777·4)	470 (150 to 720)	−2·6% (−70·5 to 285·6)	537·7 (490·8 to 592·2)	470 (420 to 540)	0·2% (−7·7 to 9·5)	1 038·1 (683·4 to 1 328·5)	940 (610 to 1230)	−1·2% (−38·4 to 60·0)
Central Latin America	537·4 (384·2 to 714·3)	1 367 000 (977 000 to 1 819 000)	−9·3% (−33·3 to 25·2)	535·9 (477·0 to 592·0)	1 366 000 (1 213 000 to 1 512 000)	5·3% (−8·7 to 18·3)	1 073·3 (905·6 to 1 258·9)	2 732 000 (2 297 000 to 3 214 000)	−2·5% (−16·5 to 16·3)
Colombia	504·4 (135·2 to 858·9)	250 000 (67 000 to 428 000)	−8·2% (−77·3 to 298·9)	413·5 (380·3 to 447·2)	203 000 (187 000 to 220 000)	6·3% (−6·4 to 20·2)	917·9 (549·7 to 1 273·7)	453 000 (271 000 to 630 000)	−2·2% (−47·4 to 92·2)
Costa Rica	495·7 (150·0 to 804·0)	24 000 (7000 to 38 000)	0·5% (−72·0 to 277·9)	431·9 (378·8 to 489·1)	21 000 (18 000 to 24 000)	−8·2% (−16·9 to 0·6)	927·6 (579·8 to 1 245·8)	45 000 (28 000 to 60 000)	−3·8% (−45·2 to 69·1)
El Salvador	401·8 (98·6 to 658·9)	26 000 (6000 to 43 000)	10·1% (−72·6 to 339·0)	453·0 (408·9 to 501·9)	29 000 (26 000 to 32 000)	6·1% (−4·9 to 17·1)	854·7 (556·5 to 1 120·2)	55 000 (36 000 to 73 000)	7·9% (−38·3 to 78·6)
Guatemala	505·2 (140·3 to 844·9)	81 000 (22 000 to 136 000)	11·5% (−69·6 to 424·1)	575·5 (507·1 to 638·7)	89 000 (78 000 to 98 000)	−3·6% (−11·3 to 5·9)	1 080·7 (702·2 to 1 432·0)	169 000 (109 000 to 226 000)	2·9% (−38·3 to 73·9)
Honduras	437·9 (96·9 to 757·0)	43 000 (10 000 to 74 000)	−9·1% (−80·1 to 375·8)	576·5 (520·3 to 635·0)	56 000 (51 000 to 62 000)	−3·4% (−12·1 to 6·5)	1 014·4 (659·8 to 1 333·2)	99 000 (65 000 to 130 000)	−6·0% (−43·7 to 63·7)
Mexico	582·8 (400·6 to 753·8)	755 000 (518 000 to 979 000)	−11·8% (−34·5 to 14·3)	603·3 (529·1 to 679·7)	788 000 (686 000 to 890 000)	9·0% (−9·1 to 26·9)	1 186·2 (989·1 to 1 389·0)	1 543 000 (1 285 000 to 1 816 000)	−2·3% (−16·4 to 14·4)

(Table 1 continues on next page)

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Nicaragua	364·8 (85·9 to 645·8)	24 000 (6000 to 42 000)	−12·2% (−78·9 to 338·9)	476·4 (428·0 to 521·9)	31 000 (28 000 to 34 000)	−8·3% (−16·6 to 1·3)	841·1 (563·5 to 1138·4)	55 000 (37 000 to 75 000)	−10·0% (−47·1 to 48·1)
Panama	571·5 (170·7 to 897·7)	25 000 (7000 to 39 000)	29·6% (−62·8 to 588·5)	463·9 (407·1 to 526·0)	20 000 (18 000 to 23 000)	3·6% (−6·4 to 13·7)	1 035·4 (642·0 to 1 379·4)	45 000 (28 000 to 60 000)	16·5% (−33·7 to 104·4)
Venezuela	520·8 (149·0 to 889·5)	139 000 (40 000 to 236 000)	−10·4% (−74·5 to 299·4)	469·5 (407·9 to 533·9)	128 000 (110 000 to 147 000)	−8·3% (−16·4 to 1·2)	990·3 (604·9 to 1 371·3)	267 000 (165 000 to 366 000)	−9·4% (−46·9 to 64·2)
Tropical Latin America	389·5 (262·4 to 529·0)	895 000 (602 000 to 1 213 000)	−15·9% (−39·8 to 26·5)	433·8 (393·0 to 477·4)	998 000 (901 000 to 1 104 000)	26·6% (11·3 to 45·0)	823·3 (688·2 to 964·6)	1 893 000 (1 582 000 to 2 240 000)	2·1% (−14·7 to 28·7)
Brazil	388·9 (262·2 to 526·5)	866 000 (581 000 to 1 166 000)	−16·5% (−39·7 to 25·5)	433·7 (392·7 to 477·8)	967 000 (872 000 to 1 070 000)	27·9% (12·0 to 47·0)	822·6 (685·4 to 963·3)	1 833 000 (1 527 000 to 2 167 000)	2·2% (−14·8 to 29·6)
Paraguay	399·9 (124·0 to 668·6)	29 000 (9000 to 48 000)	8·6% (−66·7 to 308·4)	435·4 (397·2 to 478·6)	31 000 (28 000 to 34 000)	−8·3% (−16·2 to 0·8)	835·3 (552·4 to 1 095·8)	60 000 (40 000 to 78 000)	−0·9% (−38·7 to 53·0)
North Africa and Middle East	**316·2 (217·5 to 430·7)**	**1 941 000 (1 323 000 to 2 650 000)**	**1·4% (−30·7 to 44·5)**	**313·0 (286·6 to 340·5)**	**2 017 000 (1 845 000 to 2 194 000)**	**11·8% (−3·0 to 28·1)**	**629·2 (519·2 to 744·5)**	**3 957 000 (3 268 000 to 4 685 000)**	**6·3% (−13·3 to 30·2)**
North Africa and Middle East									
Afghanistan	317·9 (70·6 to 594·2)	102 000 (23 000 to 192 000)	−18·4% (−79·9 to 417·3)	288·6 (263·2 to 314·0)	108 000 (98 000 to 118 000)	−4·9% (−14·9 to 7·1)	606·6 (351·8 to 886·8)	210 000 (129 000 to 300 000)	−12·5% (−54·4 to 72·5)
Algeria	284·4 (72·0 to 471·3)	124 000 (31 000 to 205 000)	−17·4% (−82·1 to 221·7)	246·0 (218·3 to 274·3)	111 000 (99 000 to 124 000)	9·7% (−5·3 to 27·5)	530·4 (318·5 to 716·3)	235 000 (143 000 to 316 000)	−6·7% (−50·7 to 81·1)
Bahrain	417·2 (115·7 to 663·3)	6000 (2000 to 9000)	−7·3% (−74·8 to 219·0)	339·6 (307·6 to 372·7)	5000 (5000 to 6 000)	4·4% (−12·6 to 26·0)	756·8 (464·6 to 1 002·6)	11 000 (7000 to 15 000)	−2·4% (−46·2 to 79·3)
Egypt	303·1 (81·0 to 484·3)	319 000 (83 000 to 515 000)	6·0% (−71·5 to 406·9)	379·2 (338·9 to 418·7)	431 000 (384 000 to 476 000)	7·2% (−6·2 to 22·9)	682·3 (454·8 to 881·5)	750 000 (505 000 to 964 000)	6·7% (−35·0 to 82·2)
Iran	305·4 (211·4 to 392·6)	248 000 (171 000 to 319 000)	−1·5% (−30·7 to 40·7)	252·3 (225·6 to 282·3)	215 000 (192 000 to 241 000)	80·4% (32·3 to 141·7)	557·7 (458·2 to 645·3)	463 000 (382 000 to 537 000)	23·9% (−1·7 to 61·0)
Iraq	278·9 (83·4 to 449·8)	116 000 (35 000 to 190 000)	6·2% (−70·7 to 336·9)	375·7 (324·9 to 417·2)	166 000 (143 000 to 185 000)	1·2% (−11·9 to 18·3)	654·7 (457·1 to 844·7)	283 000 (199 000 to 364 000)	3·3% (−33·6 to 62·6)
Jordan	268·8 (74·0 to 436·0)	33 000 (9 000 to 55 000)	−1·0% (−70·7 to 272·3)	335·7 (302·1 to 371·3)	43 000 (39 000 to 48 000)	−1·7% (−14·6 to 15·8)	604·5 (409·2 to 788·2)	77 000 (52 000 to 100 000)	−1·4% (−35·9 to 52·5)
Kuwait	358·1 (95·0 to 569·3)	15 000 (4 000 to 23 000)	−6·4% (−74·5 to 254·9)	343·8 (310·9 to 380·2)	16 000 (14 000 to 18 000)	31·7% (7·4 to 58·4)	701·9 (428·9 to 917·3)	31 000 (20 000 to 41 000)	9·0% (−39·3 to 100·1)
Lebanon	289·8 (93·5 to 476·6)	16 000 (5000 to 25 000)	0·6% (−71·9 to 356·7)	283·6 (254·1 to 315·9)	15 000 (14 000 to 17 000)	−9·3% (−23·7 to 6·8)	573·3 (373·5 to 756·8)	31 000 (20 000 to 41 000)	−4·6% (−44·2 to 64·8)
Libya	266·7 (80·2 to 428·6)	18 000 (5000 to 29 000)	−10·3% (−75·7 to 368·6)	247·7 (222·6 to 274·4)	17 000 (16 000 to 19 000)	0·7% (−16·7 to 20·6)	514·4 (321·5 to 673·1)	35 000 (22 000 to 46 000)	−5·3% (−47·9 to 83·5)
Morocco	281·1 (69·5 to 485·0)	103 000 (25 000 to 177 000)	9·3% (−71·4 to 353·2)	311·2 (284·0 to 340·4)	116 000 (106 000 to 127 000)	6·2% (−6·7 to 20·6)	592·3 (377·3 to 797·2)	219 000 (140 000 to 294 000)	7·6% (−36·7 to 88·5)
Oman	321·8 (89·0 to 497·8)	14 000 (4000 to 22 000)	27·0% (−62·3 to 500·2)	293·5 (267·1 to 323·6)	15 000 (13 000 to 16 000)	5·1% (−9·5 to 22·5)	615·3 (377·4 to 795·8)	29 000 (18 000 to 37 000)	15·5% (−31·6 to 100·1)
Palestine	279·0 (87·4 to 468·9)	15 000 (5000 to 25 000)	3·1% (−74·8 to 565·3)	282·2 (256·6 to 314·3)	16 000 (14 000 to 17 000)	−1·4% (−17·0 to 17·6)	561·2 (367·2 to 754·5)	30 000 (20 000 to 41 000)	0·8% (−41·8 to 84·1)
Qatar	381·3 (122·2 to 587·3)	10 000 (3000 to 15 000)	−20·1% (−77·8 to 172·5)	372·4 (335·2 to 414·1)	11 000 (10 000 to 13 000)	−8·1% (−23·1 to 7·6)	753·7 (494·9 to 964·5)	21 000 (14 000 to 28 000)	−14·5% (−49·9 to 49·0)

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	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Saudi Arabia	518·0 (145·1 to 805·9)	187 000 (52 000 to 291 000)	30·4% (–62·4 to 457·6)	282·7 (257·8 to 310·5)	112 000 (102 000 to 123 000)	14·6% (–4·5 to 39·2)	800·7 (437·9 to 1 091·1)	298 000 (168 000 to 405 000)	24·3% (–38·5 to 151·9)
Sudan	242·3 (64·5 to 411·8)	111 000 (30 000 to 189 000)	6·0% (–71·9 to 426·6)	255·9 (230·8 to 284·1)	122 000 (110 000 to 135 000)	32·4% (14·0 to 53·8)	498·2 (318·1 to 673·2)	233 000 (151 000 to 314 000)	18·1% (–37·2 to 127·9)
Syria	229·3 (61·2 to 381·0)	32 000 (9 000 to 53 000)	7·7% (–72·2 to 398·5)	295·0 (265·2 to 323·6)	42 000 (37 000 to 46 000)	–6·7% (–16·3 to 4·8)	524·3 (356·2 to 684·3)	74 000 (50 000 to 96 000)	–0·9% (–39·0 to 55·2)
Tunisia	257·9 (75·8 to 429·9)	29 000 (9 000 to 49 000)	10·0% (–73·9 to 350·9)	271·5 (247·3 to 300·9)	31 000 (29 000 to 35 000)	1·6% (–13·2 to 20·9)	529·4 (347·0 to 710·3)	61 000 (40 000 to 81 000)	5·5% (–40·5 to 79·5)
Türkiye	405·8 (127·1 to 642·6)	328 000 (101 000 to 516 000)	–2·4% (–71·3 to 276·7)	322·2 (290·0 to 358·6)	264 000 (237 000 to 293 000)	–5·3% (–19·8 to 8·6)	728·0 (435·7 to 969·4)	591 000 (355 000 to 784 000)	–3·7% (–47·7 to 75·0)
United Arab Emirates	482·4 (148·1 to 748·3)	43 000 (14 000 to 68 000)	–15·0% (–72·7 to 171·8)	341·1 (309·6 to 378·4)	34 000 (31 000 to 38 000)	0·0% (–14·9 to 14·7)	823·5 (491·7 to 1 092·0)	77 000 (49 000 to 102 000)	–9·4% (–49·0 to 68·7)
Yemen	197·4 (36·9 to 352·4)	71 000 (13 000 to 127 000)	–3·6% (–82·2 to 555·5)	322·0 (269·0 to 366·3)	123 000 (101 000 to 141 000)	–5·3% (–17·9 to 9·5)	519·4 (349·2 to 695·1)	194 000 (131 000 to 260 000)	–4·6% (–39·9 to 55·1)
South Asia	**259·7 (190·7 to 329·9)**	**4 708 000 (3 434 000 to 6 020 000)**	**4·9% (–25·0 to 57·7)**	**406·5 (350·2 to 464·2)**	**7 499 000 (6 386 000 to 8 614 000)**	**0·7% (–7·6 to 11·7)**	**666·2 (558·2 to 776·5)**	**12 207 000 (10 168 000 to 14 275 000)**	**2·3% (–11·2 to 18·9)**
South Asia									
Bangladesh	199·3 (59·0 to 356·3)	325 000 (96 000 to 583 000)	–1·5% (–73·7 to 422·2)	321·3 (262·9 to 382·9)	538 000 (438 000 to 645 000)	–13·5% (–22·7 to –4·6)	520·7 (359·1 to 712·3)	864 000 (595 000 to 1 182 000)	–9·3% (–41·9 to 35·5)
Bhutan	297·6 (78·9 to 525·4)	2000 (1000 to 4000)	10·5% (–73·2 to 491·2)	473·0 (423·5 to 526·6)	4000 (3 000 to 4 000)	–8·0% (–15·0 to 0·1)	770·6 (532·4 to 1 012·6)	6000 (4000 to 8000)	–1·6% (–36·8 to 51·0)
India	256·2 (185·6 to 325·7)	3 550 000 (2 570 000 to 4 559 000)	4·4% (–25·2 to 51·1)	416·3 (357·0 to 476·8)	5 849 000 (4 969 000 to 6 714 000)	–0·3% (–9·2 to 11·6)	672·5 (563·4 to 794·5)	9 399 000 (7 854 000 to 11 179 000)	1·5% (–11·7 to 18·4)
Nepal	339·5 (68·8 to 609·1)	103 000 (21 000 to 185 000)	1·8% (–78·4 to 464·7)	556·6 (500·2 to 618·0)	171 000 (153 000 to 189 000)	–17·1% (–23·1 to –9·9)	896·1 (619·0 to 1 197·6)	274 000 (189 000 to 365 000)	–10·8% (–42·2 to 38·1)
Pakistan	308·5 (157·1 to 447·3)	727 000 (365 000 to 1 075 000)	2·5% (–46·3 to 141·9)	365·6 (316·6 to 416·5)	938 000 (806 000 to 1 071 000)	26·6% (12·4 to 48·2)	674·1 (502·5 to 835·5)	1 665 000 (1 242 000 to 2 078 000)	14·3% (–15·7 to 65·2)
Southeast Asia, east Asia, and Oceania	**232·2 (168·0 to 298·2)**	**5 041 000 (3 658 000 to 6 516 000)**	**15·7% (–13·6 to 51·6)**	**272·9 (249·2 to 298·7)**	**5 864 000 (5 279 000 to 6 448 000)**	**19·0% (2·4 to 37·4)**	**505·0 (432·5 to 579·7)**	**10 904 000 (9 320 000 to 12 538 000)**	**17·4% (1·2 to 37·1)**
East Asia	216·1 (149·9 to 279·2)	3 220 000 (2 285 000 to 4 176 000)	12·3% (–18·8 to 56·7)	250·7 (226·9 to 275·4)	3 701 000 (3 333 000 to 4 139 000)	13·0% (–4·1 to 32·8)	466·7 (397·1 to 542·9)	6 921 000 (5 825 000 to 8 079 000)	12·7% (–4·3 to 33·8)
China	214·7 (150·1 to 278·6)	3 086 000 (2 177 000 to 4 021 000)	13·4% (–18·7 to 59·1)	249·6 (225·7 to 274·8)	3 565 000 (3 207 000 to 3 993 000)	13·9% (–3·6 to 34·4)	464·4 (392·5 to 539·1)	6 651 000 (5 573 000 to 7 767 000)	13·7% (–3·6 to 36·2)
North Korea	177·8 (47·7 to 304·9)	46 000 (12 000 to 79 000)	–31·0% (–82·5 to 203·9)	267·3 (241·6 to 292·4)	69 000 (62 000 to 76 000)	–11·6% (–26·2 to 6·4)	445·1 (312·4 to 583·0)	115 000 (81 000 to 151 000)	–20·5% (–49·9 to 29·9)
Taiwan (province of China)	334·2 (84·6 to 509·7)	87 000 (22 000 to 132 000)	11·8% (–68·0 to 325·6)	291·0 (266·0 to 318·5)	67 000 (61 000 to 76 000)	–1·2% (–12·3 to 10·7)	625·3 (374·1 to 798·7)	155 000 (90 000 to 199 000)	5·3% (–38·5 to 84·6)
Oceania	248·8 (111·2 to 390·5)	34 000 (14 000 to 54 000)	–2·9% (–57·7 to 120·6)	309·2 (282·0 to 338·5)	44 000 (41 000 to 48 000)	–5·7% (–11·9 to 1·4)	558·0 (418·0 to 710·8)	78 000 (59 000 to 100 000)	–4·5% (–31·9 to 33·9)
American Samoa	366·2 (92·7 to 594·3)	180 (50 to 290)	5·0% (–70·9 to 288·9)	382·6 (347·1 to 420·8)	190 (170 to 210)	–4·8% (–12·0 to 3·5)	748·8 (479·1 to 979·5)	370 (240 to 480)	–0·2% (–39·4 to 62·9)

(Table 1 continues on next page)

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Cook Islands	364·6 (115·3 to 578·1)	70 (20 to 110)	2·6% (–70·9 to 287·0)	345·0 (314·1 to 381·9)	60 (50 to 60)	–4·9% (–13·3 to 4·5)	709·6 (456·5 to 936·7)	120 (80 to 170)	–1·2% (–41·8 to 70·3)
Federated States of Micronesia	289·1 (62·6 to 488·8)	290 (60 to 500)	–5·5% (–78·5 to 274·7)	334·3 (300·3 to 366·8)	350 (320 to 390)	–7·8% (–15·0 to 0·9)	623·5 (392·6 to 830·7)	650 (410 to 860)	–6·7% (–44·4 to 53·9)
Fiji	381·3 (111·3 to 598·0)	3000 (1000 to 5000)	7·6% (–66·6 to 379·1)	329·6 (299·3 to 362·0)	3000 (3000 to 3000)	–1·2% (–11·5 to 9·6)	710·9 (434·9 to 939·1)	7000 (4000 to 9000)	3·3% (–38·4 to 81·1)
Guam	351·4 (123·2 to 567·2)	570 (200 to 920)	4·6% (–65·1 to 280·9)	327·9 (298·1 to 362·2)	500 (450 to 550)	0·0% (–9·2 to 10·2)	679·3 (446·3 to 890·2)	1000 (1000 to 1000)	2·3% (–36·9 to 69·2)
Kiribati	317·8 (79·1 to 551·9)	380 (90 to 670)	–10·9% (–81·1 to 282·5)	330·5 (297·4 to 365·1)	420 (370 to 460)	–1·3% (–9·3 to 8·8)	648·3 (408·0 to 892·9)	800 (510 to 1100)	–6·3% (–47·3 to 70·7)
Marshall Islands	278·6 (67·4 to 492·3)	160 (40 to 270)	2·1% (–79·8 to 393·8)	320·1 (288·0 to 351·6)	190 (170 to 210)	–8·2% (–14·8 to –0·9)	598·7 (376·7 to 818·4)	340 (220 to 470)	–3·7% (–44·3 to 67·7)
Nauru	376·9 (99·3 to 611·3)	40 (10 to 70)	–13·9% (–77·9 to 309·9)	309·4 (279·6 to 341·3)	40 (30 to 40)	–9·4% (–17·5 to 0·5)	686·3 (411·0 to 928·5)	80 (50 to 100)	–11·9% (–52·2 to 68·2)
Niue	347·9 (108·6 to 551·5)	6 (2 to 9)	3·6% (–64·7 to 313·9)	354·1 (323·5 to 391·7)	6 (5 to 6)	1·5% (–9·2 to 12·5)	701·9 (459·1 to 910·0)	10 (10 to 20)	2·5% (–34·4 to 70·2)
Northern Mariana Islands	326·8 (80·8 to 516·1)	160 (40 to 250)	–13·6% (–78·4 to 265·0)	358·4 (323·5 to 395·4)	170 (160 to 190)	–5·4% (–13·0 to 4·5)	685·2 (434·7 to 881·7)	330 (210 to 420)	–9·5% (–46·6 to 52·2)
Palau	403·1 (115·7 to 631·4)	70 (20 to 110)	–1·2% (–72·5 to 331·9)	325·1 (296·4 to 356·7)	60 (50 to 60)	3·2% (–7·9 to 16·4)	728·2 (430·6 to 955·9)	130 (70 to 170)	0·7% (–45·4 to 89·0)
Papua New Guinea	227·3 (54·7 to 402·6)	24 000 (6 000 to 42 000)	0·5% (–74·5 to 376·3)	305·6 (278·0 to 336·8)	33 000 (30 000 to 36 000)	–5·1% (–11·4 to 2·5)	532·9 (355·3 to 717·1)	57 000 (38 000 to 76 000)	–2·8% (–38·4 to 61·0)
Samoa	295·3 (90·6 to 476·0)	610 (190 to 990)	3·3% (–71·8 to 406·8)	328·1 (296·0 to 364·9)	700 (630 to 770)	–9·3% (–17·0 to –0·9)	623·3 (415·3 to 811·7)	1000 (1000 to 2000)	–3·7% (–41·9 to 56·0)
Solomon Islands	256·7 (61·9 to 458·6)	2 000 (0 to 3 000)	2·8% (–75·7 to 385·8)	325·8 (293·8 to 361·3)	2000 (2000 to 3000)	–9·3% (–15·9 to –1·3)	582·5 (381·0 to 794·1)	4000 (3000 to 5000)	–4·3% (–41·7 to 55·0)
Tokelau	268·2 (64·5 to 454·5)	4 (1 to 6)	1·8% (–78·3 to 359·3)	319·2 (287·6 to 350·1)	4 (4 to 5)	–3·8% (–13·2 to 6·8)	587·4 (382·0 to 777·7)	8 (5 to 11)	–1·3% (–41·0 to 66·1)
Tonga	261·6 (79·9 to 422·3)	270 (80 to 450)	7·6% (–72·3 to 341·5)	253·8 (227·3 to 284·6)	270 (240 to 300)	–3·9% (–15·7 to 10·2)	515·4 (327·3 to 675·8)	540 (350 to 710)	1·6% (–41·4 to 68·8)
Tuvalu	272·2 (74·7 to 438·5)	30 (10 to 50)	1·0% (–73·4 to 279·4)	263·8 (237·1 to 294·1)	30 (30 to 40)	20·4% (3·8 to 39·2)	536·0 (340·6 to 709·6)	70 (40 to 90)	9·7% (–39·6 to 98·4)
Vanuatu	254·8 (56·8 to 433·2)	780 (170 to 1350)	2·5% (–75·6 to 384·7)	327·7 (296·6 to 357·2)	1000 (1000 to 1000)	–3·9% (–11·8 to 6·5)	582·5 (377·7 to 774·7)	2000 (1000 to 2000)	–1·2% (–39·2 to 68·1)
Southeast Asia	263·0 (186·3 to 349·7)	1 787 000 (1 253 000 to 2 367 000)	19·3% (–12·8 to 64·9)	304·7 (278·2 to 334·2)	2 118 000 (1 921 000 to 2 323 000)	27·3% (12·7 to 43·2)	567·6 (477·8 to 663·7)	3 905 000 (3 287 000 to 4 559 000)	23·5% (5·3 to 46·5)
Cambodia	233·4 (73·5 to 429·0)	39 000 (12 000 to 72 000)	8·8% (–70·0 to 491·5)	333·7 (298·5 to 369·4)	58 000 (52 000 to 64 000)	–0·2% (–10·1 to 12·4)	567·1 (405·1 to 770·0)	97 000 (70 000 to 131 000)	3·3% (–33·6 to 68·0)
Indonesia	219·0 (147·8 to 294·1)	584 000 (393 000 to 785 000)	17·6% (–19·2 to 76·1)	241·0 (214·7 to 268·9)	677 000 (603 000 to 756 000)	100·7% (46·8 to 164·5)	460·0 (380·9 to 549·3)	1 261 000 (1 044 000 to 1 503 000)	50·2% (18·8 to 94·5)
Laos	252·3 (60·5 to 427·9)	18 000 (4 000 to 31 000)	12·6% (–75·3 to 677·6)	323·7 (290·5 to 360·9)	24 000 (22 000 to 27 000)	7·4% (–5·9 to 22·7)	576·0 (388·3 to 767·3)	42 000 (29 000 to 56 000)	9·6% (–36·4 to 88·4)

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	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
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Malaysia	353·4 (94·8 to 559·1)	110 000 (30 000 to 174 000)	13·5% (–67·4 to 279·2)	358·4 (323·9 to 390·0)	115 000 (104 000 to 126 000)	–4·5% (–15·5 to 8·2)	711·8 (447·9 to 925·2)	225 000 (143 000 to 291 000)	3·6% (–37·8 to 69·3)
Maldives	376·5 (120·1 to 631·7)	2000 (1000 to 3000)	–6·2% (–71·1 to 382·9)	355·4 (323·7 to 393·1)	2000 (2000 to 2000)	–6·4% (–20·3 to 10·0)	731·9 (472·9 to 987·5)	4000 (2000 to 5000)	–6·3% (–44·2 to 69·9)
Mauritius	630·3 (207·5 to 981·0)	8000 (3000 to 13 000)	31·4% (–62·1 to 543·2)	547·5 (500·9 to 597·8)	7000 (6000 to 7000)	17·3% (2·8 to 34·8)	1177·7 (735·6 to 1536·9)	15 000 (9000 to 20 000)	24·5% (–30·3 to 117·6)
Myanmar	292·2 (84·4 to 518·6)	164 000 (47 000 to 291 000)	15·9% (–70·5 to 482·6)	305·9 (274·7 to 340·8)	173 000 (155 000 to 193 000)	22·7% (9·6 to 41·2)	598·1 (386·9 to 829·2)	337 000 (219 000 to 466 000)	19·3% (–31·1 to 112·8)
Philippines	243·5 (175·2 to 319·5)	271 000 (193 000 to 360 000)	3·8% (–17·0 to 30·6)	325·7 (289·8 to 362·7)	376 000 (331 000 to 419 000)	31·5% (10·9 to 56·1)	569·2 (478·9 to 663·0)	646 000 (540 000 to 756 000)	18·0% (2·1 to 35·2)
Sri Lanka	476·5 (117·2 to 777·7)	108 000 (26 000 to 176 000)	2·4% (–77·5 to 320·0)	511·9 (470·2 to 557·8)	112 000 (103 000 to 122 000)	–13·8% (–20·8 to –6·2)	988·4 (618·0 to 1303·7)	220 000 (136 000 to 291 000)	–6·7% (–44·1 to 52·6)
Seychelles	331·8 (94·3 to 560·3)	340 (100 to 580)	11·7% (–65·9 to 292·1)	353·2 (321·5 to 388·7)	360 (330 to 400)	–2·8% (–12·6 to 7·4)	685·0 (447·6 to 919·4)	700 (460 to 950)	3·7% (–35·9 to 65·0)
Thailand	344·2 (111·1 to 559·4)	236 000 (74 000 to 382 000)	49·3% (–53·9 to 565·2)	405·3 (368·8 to 438·1)	257 000 (235 000 to 279 000)	15·9% (2·7 to 30·3)	749·5 (509·3 to 973·5)	492 000 (329 000 to 644 000)	29·2% (–15·7 to 107·0)
Timor-Leste	251·7 (69·0 to 428·9)	4000 (1000 to 6000)	14·7% (–69·2 to 561·7)	354·1 (311·4 to 399·6)	5000 (5000 to 6000)	–0·7% (–10·5 to 11·0)	605·8 (412·9 to 805·9)	9000 (6000 to 12 000)	5·2% (–33·9 to 65·6)
Viet Nam	246·7 (56·2 to 409·7)	241 000 (55 000 to 398 000)	37·9% (–69·7 to 544·2)	311·3 (280·5 to 340·3)	310 000 (278 000 to 340 000)	1·9% (–9·0 to 13·0)	558·0 (371·2 to 733·8)	551 000 (367 000 to 724 000)	15·2% (–29·4 to 80·0)
Sub-Saharan Africa	**386·3 (286·7 to 491·3)**	**4 264 000 (3 099 000 to 5 546 000)**	**4·1% (–17·0 to 37·2)**	**417·5 (381·6 to 460·0)**	**4 662 000 (4 247 000 to 5 113 000)**	**34·0% (21·6 to 48·2)**	**803·8 (693·4 to 922·4)**	**8 926 000 (7 605 000 to 10 225 000)**	**17·8% (2·7 to 36·1)**
Central sub-Saharan Africa	394·3 (177·8 to 625·8)	525 000 (235 000 to 847 000)	–4·7% (–59·2 to 153·9)	479·0 (429·2 to 527·1)	596 000 (541 000 to 650 000)	11·6% (3·0 to 22·0)	873·3 (648·2 to 1118·6)	1 121 000 (818 000 to 1 456 000)	3·6% (–27·5 to 53·7)
Angola	542·0 (142·7 to 917·0)	169 000 (45 000 to 283 000)	11·2% (–75·6 to 480·1)	560·0 (483·1 to 634·9)	157 000 (140 000 to 174 000)	15·3% (7·0 to 25·9)	1102·0 (689·5 to 1484·9)	326 000 (201 000 to 442 000)	13·2% (–38·3 to 102·1)
Central African Republic	325·7 (65·0 to 600·6)	18 000 (4000 to 33 000)	–10·7% (–80·2 to 419·3)	421·9 (373·1 to 466·0)	21 000 (18 000 to 23 000)	–5·7% (–12·0 to 2·0)	747·6 (482·7 to 1032·3)	38 000 (24 000 to 54 000)	–7·9% (–47·9 to 64·3)
Congo (Brazzaville)	515·4 (144·1 to 887·6)	26 000 (7000 to 45 000)	–1·9% (–74·7 to 389·7)	582·0 (512·7 to 649·8)	29 000 (26 000 to 32 000)	9·0% (–0·6 to 20·3)	1097·4 (719·1 to 1477·0)	56 000 (36 000 to 75 000)	3·6% (–41·5 to 82·3)
Democratic Republic of the Congo	327·0 (73·1 to 584·1)	290 000 (64 000 to 529 000)	–14·4% (–81·5 to 382·3)	443·0 (400·1 to 489·4)	370 000 (338 000 to 404 000)	11·0% (0·3 to 23·4)	770·0 (500·9 to 1042·3)	660 000 (428 000 to 903 000)	–1·4% (–41·7 to 77·3)
Equatorial Guinea	706·0 (172·0 to 1150·4)	10 000 (2000 to 17 000)	75·4% (–58·7 to 1085·1)	577·8 (498·3 to 663·7)	8000 (7000 to 9000)	25·8% (14·5 to 39·6)	1283·8 (750·4 to 1754·2)	18 000 (10 000 to 25 000)	49·0% (–18·6 to 185·3)
Gabon	688·2 (146·3 to 1158·0)	12 000 (3000 to 20 000)	1·9% (–73·6 to 397·7)	671·9 (590·2 to 760·2)	12 000 (10 000 to 13 000)	1·9% (–7·3 to 12·6)	1360·0 (822·9 to 1833·1)	23 000 (14 000 to 32 000)	1·9% (–43·7 to 89·6)
Eastern sub-Saharan Africa	355·2 (242·0 to 477·8)	1 507 000 (1 015 000 to 2 022 000)	2·7% (–25·3 to 57·7)	428·7 (390·3 to 474·7)	1 854 000 (1 669 000 to 2 040 000)	49·3% (32·8 to 67·6)	783·8 (658·0 to 921·0)	3 361 000 (2 792 000 to 3 932 000)	23·8% (3·1 to 53·5)
Burundi	306·8 (57·7 to 602·2)	41 000 (8000 to 81 000)	–23·1% (–84·5 to 418·3)	423·7 (381·3 to 471·2)	55 000 (50 000 to 62 000)	26·5% (11·0 to 45·9)	730·5 (469·2 to 1028·7)	96 000 (62 000 to 136 000)	–0·5% (–43·8 to 101·0)
Comoros	378·8 (108·6 to 661·6)	3000 (1000 to 5000)	–4·8% (–74·5 to 471·1)	453·3 (409·2 to 500·7)	4000 (3000 to 4000)	70·3% (42·1 to 106·2)	832·1 (566·0 to 1130·7)	6000 (4000 to 9000)	25·3% (–30·8 to 168·3)

(Table 1 continues on next page)

	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Djibouti	429·9 (113·8 to 738·0)	5000 (1000 to 9000)	4·4% (–74·4 to 459·3)	361·6 (315·4 to 409·0)	5 000 (4 000 to 6 000)	100·0% (61·2 to 144·1)	791·5 (465·3 to 1 116·7)	10 000 (6 000 to 14 000)	33·6% (–33·7 to 213·1)
Eritrea	380·1 (98·2 to 676·6)	25 000 (6000 to 45 000)	8·6% (–74·9 to 601·0)	452·1 (407·3 to 507·9)	31 000 (28 000 to 34 000)	43·8% (28·4 to 65·1)	832·2 (539·2 to 1 131·5)	56 000 (37 000 to 76 000)	25·3% (–30·5 to 149·7)
Ethiopia	257·5 (139·1 to 372·4)	277 000 (148 000 to 406 000)	0·2% (–47·4 to 151·5)	413·2 (368·7 to 459·3)	455 000 (405 000 to 509 000)	66·0% (41·2 to 97·8)	670·7 (538·4 to 804·8)	733 000 (575 000 to 886 000)	32·6% (–2·8 to 94·7)
Kenya	411·9 (308·0 to 527·6)	202 000 (147 000 to 267 000)	3·0% (–22·4 to 45·3)	503·7 (452·4 to 563·1)	253 000 (225 000 to 281 000)	30·8% (12·3 to 51·9)	915·6 (786·0 to 1 060·7)	455 000 (385 000 to 533 000)	16·6% (–0·1 to 39·9)
Madagascar	337·3 (88·4 to 620·0)	97 000 (25 000 to 180 000)	–12·2% (–80·0 to 278·1)	450·7 (408·2 to 499·3)	131 000 (118 000 to 145 000)	43·2% (25·7 to 65·2)	788·0 (531·1 to 1 078·8)	228 000 (154 000 to 313 000)	12·8% (–36·3 to 108·4)
Malawi	338·2 (75·6 to 610·6)	68 000 (15 000 to 124 000)	–4·4% (–76·2 to 384·8)	426·7 (386·1 to 475·2)	84 000 (76 000 to 94 000)	42·4% (25·0 to 64·7)	764·9 (506·5 to 1 043·4)	152 000 (102 000 to 210 000)	17·1% (–31·6 to 127·5)
Mozambique	409·6 (77·4 to 763·8)	127 000 (23 000 to 236 000)	28·0% (–73·4 to 656·0)	457·1 (404·9 to 520·1)	143 000 (128 000 to 160 000)	43·8% (30·5 to 60·3)	866·8 (530·2 to 1 227·2)	269 000 (167 000 to 378 000)	35·9% (–28·0 to 148·7)
Rwanda	360·5 (77·4 to 634·1)	48 000 (10 000 to 85 000)	–11·1% (–81·4 to 351·0)	414·1 (368·2 to 466·5)	54 000 (48 000 to 61 000)	30·6% (14·2 to 52·2)	774·6 (486·1 to 1 043·4)	102 000 (63 000 to 137 000)	7·2% (–42·5 to 109·3)
Somalia	211·5 (34·2 to 459·8)	46 000 (7000 to 102 000)	–11·1% (–84·3 to 560·1)	282·1 (243·8 to 319·4)	70 000 (61 000 to 79 000)	97·4% (68·1 to 131·5)	493·6 (306·4 to 744·8)	116 000 (75 000 to 176 000)	29·6% (–37·4 to 205·8)
South Sudan	334·8 (76·4 to 623·4)	32 000 (8000 to 61 000)	–18·9% (–84·4 to 276·2)	274·7 (242·8 to 311·8)	29 000 (25 000 to 32 000)	54·1% (36·5 to 75·6)	609·5 (345·2 to 893·8)	61 000 (35 000 to 89 000)	3·1% (–53·9 to 127·8)
Tanzania	425·8 (103·0 to 749·0)	251 000 (59 000 to 445 000)	12·2% (–68·0 to 523·8)	410·8 (367·5 to 461·4)	251 000 (223 000 to 279 000)	64·1% (42·4 to 86·0)	836·6 (525·0 to 1 163·3)	502 000 (318 000 to 693 000)	32·9% (–28·2 to 181·0)
Uganda	404·7 (85·8 to 722·6)	178 000 (39 000 to 320 000)	10·7% (–75·8 to 578·0)	462·5 (416·4 to 520·9)	202 000 (180 000 to 225 000)	48·6% (30·8 to 69·3)	867·2 (552·5 to 1 191·2)	380 000 (242 000 to 527 000)	28·1% (–31·7 to 150·2)
Zambia	547·3 (147·9 to 944·1)	106 000 (28 000 to 184 000)	6·3% (–69·9 to 376·4)	443·3 (390·9 to 501·9)	86 000 (77 000 to 96 000)	26·0% (11·9 to 42·4)	990·6 (574·7 to 1 401·3)	192 000 (111 000 to 271 000)	14·3% (–40·1 to 128·2)
Southern sub-Saharan Africa	403·7 (271·2 to 545·3)	316 000 (207 000 to 431 000)	–2·5% (–33·0 to 47·1)	535·3 (479·8 to 593·4)	422 000 (377 000 to 467 000)	18·6% (3·9 to 36·2)	939·0 (790·6 to 1 101·4)	738 000 (625 000 to 867 000)	8·5% (–8·2 to 29·0)
Botswana	513·1 (142·2 to 844·8)	12 000 (3000 to 20 000)	39·5% (–58·8 to 434·0)	678·1 (607·3 to 757·2)	16 000 (14 000 to 18 000)	22·1% (12·1 to 36·0)	1191·1 (799·4 to 1 549·3)	28 000 (19 000 to 36 000)	29·1% (–17·7 to 97·0)
Eswatini	449·0 (107·6 to 751·3)	5000 (1000 to 8000)	26·0% (–74·1 to 591·4)	492·9 (422·3 to 561·4)	5 000 (4 000 to 6 000)	18·2% (5·5 to 34·0)	941·9 (604·9 to 1 276·3)	10 000 (7 000 to 14 000)	21·8% (–31·3 to 118·3)
Lesotho	360·1 (79·7 to 602·7)	7000 (1000 to 11 000)	45·4% (–70·6 to 537·8)	437·4 (378·7 to 494·7)	8 000 (7 000 to 9 000)	24·8% (8·6 to 40·7)	797·5 (519·1 to 1 055·8)	14 000 (9 000 to 19 000)	33·4% (–20·9 to 119·3)
Namibia	405·5 (123·2 to 688·0)	9000 (3000 to 16 000)	15·4% (–68·7 to 384·6)	581·7 (525·0 to 645·0)	14 000 (12 000 to 15 000)	16·1% (4·6 to 30·4)	987·1 (684·5 to 1 291·7)	23 000 (16 000 to 30 000)	15·8% (–26·7 to 80·2)
South Africa	407·3 (266·3 to 544·6)	229 000 (148 000 to 306 000)	–6·8% (–39·1 to 45·2)	532·4 (476·0 to 589·6)	300 000 (267 000 to 334 000)	21·9% (5·1 to 44·0)	939·6 (771·1 to 1 116·4)	528 000 (433 000 to 629 000)	7·6% (–12·4 to 33·2)
Zimbabwe	380·2 (89·8 to 677·6)	55 000 (13 000 to 98 000)	1·2% (–76·0 to 409·1)	556·4 (495·1 to 616·3)	79 000 (71 000 to 88 000)	9·4% (–1·9 to 21·8)	936·6 (648·9 to 1 240·2)	134 000 (94 000 to 178 000)	5·9% (–32·1 to 73·5)
Western sub-Saharan Africa	404·5 (293·9 to 526·1)	1 916 000 (1 369 000 to 2 514 000)	9·6% (–15·1 to 52·1)	364·1 (331·7 to 402·8)	1 790 000 (1 623 000 to 1 964 000)	38·4% (27·4 to 50·8)	768·6 (655·9 to 889·8)	3 706 000 (3 135 000 to 4 294 000)	21·6% (3·8 to 47·6)

(Table 1 continues on next page)

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	Prevalence of idiopathic epilepsy			Prevalence of secondary epilepsy			Prevalence of idiopathic and secondary epilepsy combined		
	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021	2021 age-standardised prevalence per 100 000	2021 counts*	Percentage change in age-standardised rates, 1990–2021
(Continued from previous page)									
Benin	391·2 (96·6 to 719·4)	52 000 (13 000 to 96 000)	2·2% (–78·0 to 556·0)	494·3 (441·4 to 549·5)	60 000 (54 000 to 67 000)	14·6% (5·5 to 25·0)	885·6 (581·5 to 1 226·2)	112 000 (71 000 to 159 000)	8·8% (–38·3 to 95·1)
Burkina Faso	362·1 (66·6 to 692·2)	82 000 (15 000 to 157 000)	9·2% (–78·8 to 445·4)	264·2 (238·0 to 298·2)	61 000 (55 000 to 69 000)	11·9% (1·7 to 24·1)	626·4 (335·3 to 961·6)	143 000 (77 000 to 219 000)	10·3% (–48·2 to 140·5)
Cameroon	402·8 (99·8 to 694·6)	124 000 (31 000 to 214 000)	4·8% (–74·0 to 387·9)	399·5 (357·6 to 444·4)	118 000 (107 000 to 130 000)	9·8% (1·2 to 20·6)	802·3 (506·7 to 1 091·7)	242 000 (151 000 to 332 000)	7·2% (–41·8 to 96·5)
Cabo Verde	500·8 (125·8 to 858·8)	3000 (1000 to 5000)	29·1% (–69·1 to 558·0)	677·2 (610·4 to 746·0)	4000 (3000 to 4000)	12·8% (1·9 to 25·2)	1 178·0 (797·2 to 1 537·5)	6000 (4000 to 9000)	19·2% (–25·8 to 100·7)
Chad	342·1 (60·3 to 649·1)	61 000 (11 000 to 116 000)	21·2% (–71·8 to 514·6)	246·7 (220·8 to 278·8)	45 000 (41 000 to 51 000)	30·5% (18·4 to 43·8)	588·7 (306·3 to 894·5)	106 000 (56 000 to 160 000)	24·9% (–40·8 to 172·7)
Côte d'Ivoire	446·6 (109·5 to 797·9)	119 000 (29 000 to 214 000)	9·8% (–74·9 to 454·0)	516·5 (453·4 to 579·3)	133 000 (118 000 to 147 000)	20·0% (10·0 to 32·5)	963·1 (609·7 to 1 324·0)	252 000 (160 000 to 351 000)	15·1% (–35·5 to 100·2)
The Gambia	334·6 (77·4 to 578·0)	8000 (2000 to 14 000)	15·6% (–76·0 to 505·4)	467·6 (415·1 to 519·3)	12 000 (11 000 to 14 000)	47·7% (23·1 to 76·8)	802·2 (536·2 to 1 071·6)	20 000 (14 000 to 27 000)	32·4% (–22·7 to 141·5)
Ghana	387·6 (104·4 to 634·9)	129 000 (35 000 to 214 000)	27·5% (–67·7 to 520·9)	465·1 (416·1 to 516·1)	152 000 (137 000 to 168 000)	25·8% (14·9 to 37·9)	852·7 (575·6 to 1 122·1)	281 000 (187 000 to 371 000)	26·6% (–26·4 to 116·8)
Guinea	374·1 (81·7 to 702·2)	50 000 (11 000 to 95 000)	8·8% (–74·8 to 515·4)	268·1 (240·3 to 298·3)	40 000 (36 000 to 44 000)	55·0% (39·7 to 72·4)	642·2 (346·4 to 965·0)	90 000 (50 000 to 135 000)	24·3% (–40·7 to 206·5)
Guinea-Bissau	385·9 (71·8 to 712·7)	8000 (1000 to 14 000)	–4·3% (–82·1 to 496·2)	385·3 (347·4 to 429·6)	8000 (8000 to 9000)	29·2% (16·0 to 46·6)	771·2 (461·9 to 1 104·1)	16 000 (10 000 to 23 000)	9·9% (–46·4 to 125·7)
Liberia	365·3 (72·6 to 657·7)	19 000 (4000 to 35 000)	–12·3% (–83·9 to 398·1)	533·0 (481·5 to 579·2)	27 000 (25 000 to 30 000)	22·7% (10·3 to 38·9)	898·3 (618·5 to 1 209·1)	47 000 (32 000 to 63 000)	5·6% (–37·5 to 90·5)
Mali	288·3 (64·0 to 547·2)	68 000 (15 000 to 132 000)	36·7% (–67·2 to 687·9)	255·4 (228·0 to 285·9)	70 000 (62 000 to 79 000)	62·2% (44·8 to 81·8)	543·6 (316·0 to 804·3)	138 000 (85 000 to 200 000)	47·6% (–29·9 to 212·6)
Mauritania	384·2 (106·1 to 649·1)	16 000 (5000 to 28 000)	0·4% (–74·2 to 367·6)	536·4 (456·7 to 605·4)	26 000 (21 000 to 29 000)	24·6% (4·6 to 50·6)	920·6 (623·5 to 1 218·3)	42 000 (29 000 to 56 000)	13·2% (–29·2 to 89·9)
Niger	264·6 (48·4 to 540·1)	67 000 (12 000 to 136 000)	–6·6% (–81·7 to 451·7)	254·9 (228·0 to 284·6)	74 000 (66 000 to 82 000)	66·4% (48·1 to 85·8)	519·5 (305·0 to 784·8)	142 000 (87 000 to 210 000)	19·0% (–43·2 to 185·4)
Nigeria	443·4 (326·7 to 580·9)	984 000 (707 000 to 1 293 000)	10·7% (–15·8 to 57·3)	346·5 (313·5 to 386·3)	821 000 (738 000 to 908 000)	52·2% (36·6 to 69·0)	789·9 (673·0 to 928·3)	1 805 000 (1 518 000 to 2 101 000)	25·8% (4·6 to 55·4)
São Tomé and Príncipe	439·0 (133·7 to 723·0)	930 (280 to 1550)	28·3% (–68·3 to 547·7)	614·5 (557·4 to 672·7)	1000 (1000 to 1000)	36·0% (24·9 to 50·8)	1 053·6 (735·6 to 1 365·5)	2000 (2000 to 3000)	32·7% (–17·4 to 120·1)
Senegal	400·8 (89·7 to 717·9)	62 000 (14 000 to 113 000)	13·4% (–77·5 to 701·7)	411·2 (366·4 to 458·0)	72 000 (64 000 to 80 000)	92·7% (66·4 to 121·2)	812·0 (494·0 to 1 122·0)	134 000 (84 000 to 183 000)	43·2% (–29·6 to 218·4)
Sierra Leone	346·4 (73·4 to 636·3)	31 000 (6000 to 57 000)	2·6% (–79·0 to 462·9)	249·7 (222·8 to 279·8)	24 000 (21 000 to 27 000)	49·2% (33·3 to 67·0)	596·1 (322·7 to 892·3)	55 000 (31 000 to 81 000)	18·0% (–43·8 to 173·2)
Togo	399·6 (86·9 to 733·2)	33 000 (7000 to 61 000)	–21·9% (–82·4 to 282·0)	525·9 (469·4 to 580·7)	41 000 (37 000 to 45 000)	–1·1% (–10·0 to 10·9)	925·4 (611·3 to 1 263·1)	74 000 (48 000 to 101 000)	–11·3% (–48·4 to 57·4)

Age-standardised rates in the main text of this Article were rounded to the nearest integer. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study. *Counts in millions and hundreds of thousands were rounded to the nearest thousand; counts less than one thousand were rounded to the nearest ten; counts less than one hundred were presented in exact numbers.

Table 1: **Prevalence of idiopathic epilepsy, secondary epilepsy, and idiopathic and secondary epilepsy combined, in 2021, and percentage change in age-standardised prevalence globally and by seven GBD super-regions, 21 GBD regions, and 204 individual countries or territories**

Methods

Mortality estimates

The GBD study systematically models 371 diseases and injuries at the global, regional, and national level (in select countries; also at the subnational level), with subnational analyses in selected countries.[18–20]

For assessment of mortality due to epilepsy, we used underlying cause-of-death data, making corrections for misclassifications and under-reporting.[18] Data used to estimate epilepsy mortality included vital registration, verbal autopsy, and mortality surveillance data. The International Classification of Diseases (ICD) codes were used to reassign intermediary or unspecified causes to more specific categories. The codes for epilepsy for both ICD-9 (code 345) and ICD-10 (codes G40 and G41) were used. A Cause of Death Ensemble model[18] was used, which combines multiple models to improve mortality estimation accuracy. This is a method produced specifically for cause of death analysis in the GBD study. Further details on the methodology have been published elsewhere[18,21] and are provided in appendix 1 (p 3–32).

See Online for appendix 1

Non-fatal estimates

The guidelines for epidemiological studies on epilepsy, its classification, and definition from the International League Against Epilepsy[3,22] formed the basis for our reference definition. An epilepsy case was defined as someone with an active, recurring condition of epileptic seizures, at least two seizures, unprovoked by any immediate cause, and who has had at least one epileptic seizure in the past 5 years regardless of antiepileptic drug treatment.[3] We used data from additional sources from Jan 10, 2016, to Jan 28, 2022. This latest systematic review included data from Jan 10, 2016, to Jan 28, 2022, because some relevant data for the 1990–2021 period might have been published after 2021. This review yielded 24 new sources on two measures (appendix 1 p 5). The studies included were population-based, representative surveys that reported prevalence, incidence, remission rate, excess mortality rate, relative risk of mortality, standardised mortality ratio, or with-condition mortality rate. Studies that had no clearly defined sample were excluded. Studies that recorded the lifetime recall of epilepsy were crosswalked (the process of adjusting data for known biases) to the reference definition for epilepsy. Using a GBD meta-regression–Bayesian, regularised, trimmed method[23] on the log male:female ratio of prevalence, we split observations where sex was reported for males and females combined into observations for males and females separately. Data that covered an age period of more than 25 years were split into 5-year age bands using the age patterns discerned from DisMod-MR 2·1,[19] a Bayesian meta-regression tool, built on a subset of the epilepsy data with age bands less than 25 years. DisMod-MR 2·1 was also used to model prevalence and incidence for idiopathic and secondary epilepsy combined.

Idiopathic and secondary epilepsy

In GBD 2021, overall epilepsy was split into idiopathic epilepsy, in which the underlying cause is unknown or genetic in nature, and secondary epilepsy, in which the underlying cause is known (eg, epilepsy due to abnormality of the brain structure or chemistry). We make explicit estimates of secondary epilepsy due to neonatal, cerebral malaria, neonatal tetanus, meningitis, cystic echinococcosis, cysticercosis, and neonatal conditions. The majority of our epidemiological data sources use the International League Against Epilepsy 1985 proposal for classification of epilepsies and epileptic syndromes, definition for idiopathic (unknown cause but generally considered to be genetically determined) epilepsy,[24–28] and therefore, for this review we also used this definition. Our systematic review covering Jan 10, 2016, to Jan 28, 2022, discovered no additional unique sources of the proportion of idiopathic epilepsy due to genetic or unknown causes beyond the 89 already identified, covering 18 of 21 world regions. Not all sources use MRI or CT scans as well as electroencephalograms to diagnose secondary epilepsy. Studies that did not use advanced diagnostic methods were readjusted to the study region where all possible diagnostic methods for secondary epilepsy were used using a binary covariate for study quality based on whether the study explicitly described use of neuroimaging diagnostics across all study participants. A mixed-effects model with random effects on super-region (the 21 world regions aggregated into seven groups defined in GBD) was built using these data. The prediction of the proportion of idiopathic epilepsy obtained from this model for each year and location combination was then used in conjunction with the incidence and prevalence results from the DisMod-MR 2·1 model to calculate incidence and prevalence for idiopathic and secondary epilepsy considered separately and combined. Consistent with previous GBD 2019 report on burden of epilepsy,[8] secondary epilepsy was quantified as long-term consequences of meningitis, tetanus, malaria, cysticercosis, cystic echinococcosis, preterm birth complications, neonatal encephalopathy, neonatal sepsis, and neonatal haemolytic disease. Secondary epilepsy from other causes, such as brain cancer, traumatic brain injury, congenital anomalies, or stroke, was not quantified explicitly but assumed to be subsumed in the severity distributions and corresponding disability weights for those conditions.[29]

Disability-adjusted life-years (DALYs) are the sum of years of life lost and years lived with disability (YLDs). Uncertainty is propagated through each computation step by sampling 500 draws at each step. By ordering the draws, we were able to use the 2·5 and the 97·5 percentile values to form the uncertainty intervals. Differences between two draw sets are significant if the uncertainty level of the difference does not include zero. YLDs were calculated as prevalence multiplied by the category-specific disability

weight. Further details on the methodology have been published elsewhere[19] and are in appendix 1 (pp 3–32). This report adheres to the GATHER[30] recommendations.

Role of the funding source

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

Results

In 2021, there were 51·7 million (95% UI 44·9–58·9) people with epilepsy (idiopathic and secondary combined) globally (table 1), and the global age-standardised prevalence rate was 658 per 100 000 (569–748). Idiopathic epilepsy (appendix 1 pp 25–36) had an age-standardised prevalence rate of 307 per 100 000 (235–389) globally, with 24·2 million (18·5–30·7) prevalent cases (46·9% [41·1–52·1] of epilepsy from idiopathic and secondary epilepsy combined). Secondary epilepsy had a global age-standardised prevalence rate of 350 per 100 000 (322–380) and a combined number of 27·5 million (25·2–29·9) prevalent cases (53·1% [50·7–56·2] of epilepsy from idiopathic and secondary epilepsy combined).

In 2021, the age-standardised prevalence of epilepsy from idiopathic and secondary epilepsy combined ranged from 445 per 100 000 (95% UI 312–583) in North Korea to 1374 (945–1773) in Trinidad and Tobago (table 1). By World Bank country income level, the highest age-standardised prevalence of epilepsy from idiopathic and secondary epilepsy combined (appendix 1 p 50) was observed in low-income countries (LICs; 672 per 100 000 [563–789]), followed by lower-middle-income countries (LMICs; 665 per 100 000 [570–765]); high-income countries (HICs; 662 per 100 000 [544–779]); and upper-middle-income countries (UMICs; 626 per 100 000 [539–718]). There were no significant differences in the age-standardised prevalence of idiopathic and secondary epilepsy between GBD super-regions, except for South Asia, where the prevalence of secondary epilepsy of 407 per 100 000 (350–464) was over 1·5 times greater than the prevalence of idiopathic epilepsy (260 [191–330]).

Over the 1990–2021 period (table 1), there was a substantial increase in age-standardised prevalence of secondary and combined epilepsy (14·5% [95% UI 5·3 to 25·5] and 10·8% [1·1 to 21·3]), but a small increase in the age-standardised prevalence of idiopathic epilepsy (6·9% [–9·7 to 25·5]). Over the past three decades (table 1), the largest increase in combined epilepsy prevalence was observed in Indonesia (50·2% [18·8 to 94·5]), where the prevalence of combined epilepsy remains one of the lowest in the world since 1990, while the largest decrease was observed in Russia (12·8% [2·5 to 21·6]). From 1990 to 2021, no country showed substantial increase in the age-standardised prevalence of idiopathic epilepsy, and only Russia had a substantial decrease in the age-standardised prevalence of idiopathic epilepsy (15·2% [1·9 to 30·1]).

There was no substantial sex difference in the prevalence of epilepsy from idiopathic and secondary epilepsy combined (males: 685 per 100 000 [95% UI 593–778]; females: 631 [548–721]) and idiopathic epilepsy (males: 322 [247–405]; females 293 [223–373]; figure 1). The prevalence of idiopathic epilepsy increased from birth (174 per 100 000 [109–276]; age 0–6 days) to age 19 years (343 [227–487]; age 15–19 years), then decreased

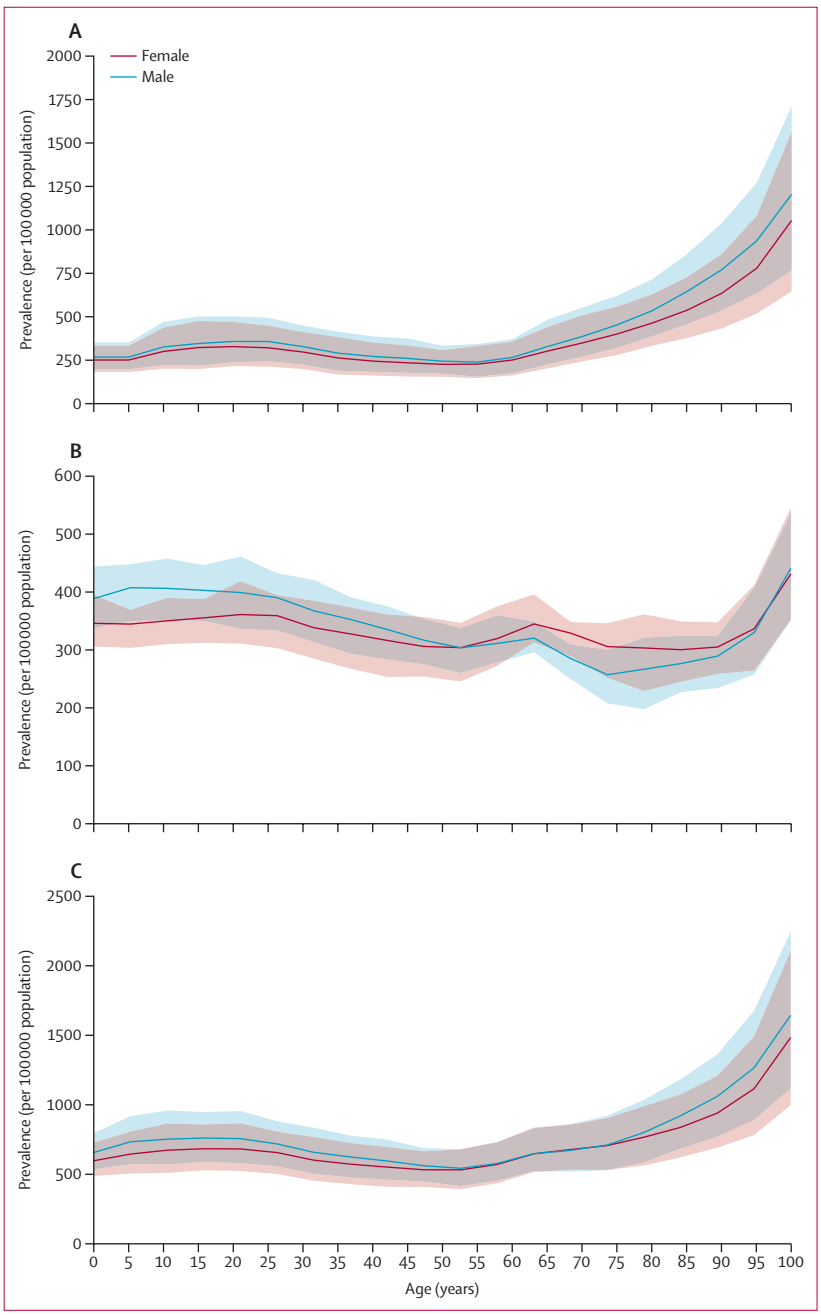

Figure 1: **Global age-specific prevalence of idiopathic epilepsy, secondary epilepsy, and combined epilepsy from idiopathic and secondary epilepsy, by age and sex, 2021**
(A) Global prevalence of idiopathic epilepsy. (B) Global prevalence of secondary epilepsy. (C) Global prevalence of combined epilepsy. Shadowed areas represent 95% UIs.

to age 50 (233 [150–339]; age 50–54 years), and then increased with age steeply after age 55 years, with no substantial sex differences in the age pattern. Although age and sex prevalence patterns were largely similar for idiopathic and secondary epilepsy, secondary epilepsy prevalence showed consistently greater values than idiopathic epilepsy up to age 65 years, after which the age-specific prevalence of idiopathic epilepsy was substantially greater than that for secondary epilepsy (figure 1; table 1).

Globally, in 2021, there were approximately 3·3 million (95% UI 2·4–4·1) new cases of active idiopathic epilepsy (age-standardised incidence rate 42·8 per 100 000 [31·2–53·7]), 140 000 deaths (117 000–153 000; age-standardised death rate 1·7 [1·5–1·9]), and 13·9 million DALYs (10·7–17·6; age-standardised DALYs rate 177·8 [137·7–225·9]) due to active idiopathic epilepsy (table 2; appendix 1 pp 25–50). Among global deaths and DALYs from idiopathic and secondary epilepsy combined, idiopathic epilepsy accounted for 0·21% (0·17–0·22) of deaths and 0·48% (0·38–0·59) of DALYs, ranking it as the 72nd most common cause of death and 44th most common cause of death and disability combined in the world. Over the past three decades, there was a substantial reduction in the age-standardised death and DALY rates in both males and females (table 2; figure 2; appendix 1 pp 50,52). There were no substantial sex differences in the incidence and DALY rates of idiopathic epilepsy (appendix 1 pp 50,52) in 2021, but death rates in males (2·1 [1·8–2·4]) were substantially greater than in females (1·4 [1·0–1·5]). The global age-standardised prevalence in 2021 was not substantially different between males and females: 322 per 100 000 (247–405) for males and 293 per 100 000 (223–373) for females. The prevalence of idiopathic epilepsy has not changed substantially for either males (302 per 100 000 [227–379]) or females

	Incidence		Prevalence		Deaths		DALYs	
	Counts	Percentage change in age-standardised rates, 1990–2021	Counts	Percentage change in age-standardised rates, 1990–2021	Counts	Percentage change in age-standardised rates, 1990–2021	Counts	Percentage change in age-standardised rates, 1990–2021
Global	3 273 000 (2 404 000 to 4 125 000)	12·3% (−4·8 to 32·6)	24 221 000 (18 477 000 to 30 678 000)	6·9% (−9·7 to 25·5)	140 000 (117 000 to 153 000)	−15·8% (−22·8 to −8·8)	13 878 000 (10 733 000 to 17 620 000)	−14·5% (−24·2 to −4·2)
Countries categorised by the World Bank income level								
High-income countries	585 000 (398 000 to 778 000)	10·3% (−10·5 to 29·0)	4 750 000 (3 203 000 to 6 234 000)	9·5% (−10·0 to 27·1)	21 000 (19 000 to 23 000)	13·9% (3·4 to 20·3)	1 675 000 (1 155 000 to 2 427 000)	−4·7% (−18·5 to 9·8)
Upper-middle-income countries	936 000 (669 000 to 1 200 000)	16·6% (−5·6 to 43·6)	7 540 000 (5 502 000 to 9 564 000)	7·9% (−13·4 to 33·0)	29 000 (25 000 to 32 000)	−41·1% (−47·9 to −34·2)	3 485 000 (2 480 000 to 4 648 000)	−30·3% (−42·1 to −15·8)
Lower-middle-income countries	1 383 000 (995 000 to 1 762 000)	13·2% (−10·8 to 50·0)	9 768 000 (7 446 000 to 12 218 000)	8·5% (−14·9 to 44·0)	65 000 (50 000 to 73 000)	−21·5% (−31·5 to −10·7)	6 473 000 (5 066 000 to 8 074 000)	−17·3% (−28·7 to −2·2)
Low-income countries	365 000 (241 000 to 507 000)	5·2% (−22·8 to 49·0)	2 141 000 (1 434 000 to 2 900 000)	−2·4% (−28·1 to 40·9)	25 000 (20 000 to 30 000)	−15·6% (−26·7 to −1·4)	2 231 000 (1 736 000 to 2 840 000)	−12·7% (−26·3 to 3·4)
Countries categorised by SDI								
Low SDI regions	566 000 (371 000 to 776 000)	6·5% (−16·7 to 49·5)	3 443 000 (2 343 000 to 4 625 000)	−0·2% (−22·5 to 40·4)	37 000 (30 000 to 44 000)	−18·4% (−28·1 to −7·5)	3 320 000 (2 620 000 to 4 187 000)	−16·0% (−27·6 to −2·0)
Low-middle SDI regions	799 000 (581 000 to 1 033 000)	13·3% (−15·5 to 57·4)	5 744 000 (4 245 000 to 7 424 000)	8·6% (−18·6 to 50·7)	43 000 (33 000 to 48 000)	−18·5% (−29·7 to −6·1)	4 116 000 (3 208 000 to 5 234 000)	−16·0% (−29·5 to 3·4)
Middle SDI regions	965 000 (694 000 to 1 234 000)	14·8% (−8·0 to 45·1)	7 331 000 (5 384 000 to 9 313 000)	8·6% (−13·3 to 37·8)	29 000 (25 000 to 32 000)	−37·1% (−42·4 to −31·4)	3 519 000 (2 606 000 to 4 601 000)	−26·7% (−39·0 to −12·6)
High-middle SDI regions	426 000 (289 000 to 568 000)	10·9% (−12·4 to 36·6)	3 488 000 (2 452 000 to 4 628 000)	1·6% (−20·3 to 24·3)	14 000 (12 000 to 15 000)	−37·7% (−44·7 to −31·0)	1 444 000 (1 022 000 to 2 022 000)	−33·1% (−45·4 to −17·5)
High SDI regions	514 000 (342 000 to 685 000)	10·8% (−11·6 to 32·1)	4 193 000 (2 842 000 to 5 536 000)	10·5% (−11·6 to 31·3)	17 000 (16 000 to 19 000)	7·5% (−1·4 to 13·3)	1 466 000 (992 000 to 2 150 000)	−5·5% (−20·2 to 10·2)

DALYs=disability-adjusted life-years. SDI=Socio-demographic Index.

Table 2: **Incidence, prevalence, deaths, and DALYs for idiopathic epilepsy in 2021, and percentage change in age-standardised rates by location, and by World Bank country income level and SDI level**

(274 per 100 000 [205–347]) since 1990. The highest prevalence of idiopathic epilepsy in 2021 was in Ecuador, with an age-standardised prevalence of 711 per 100 000 (226–1141). North Korea had the lowest age-standardised prevalence of 178 per 100 000 (48–305).

Geographical variations in the age-standardised YLD rates were four-fold, with the highest estimates (figure 3B) in sub-Saharan Africa (particularly in Gabon [470 per 100 000; 220–815]) and central and Latin America (particularly in Guyana [400 per 100 000; 195–654]), and lowest in western Europe (particularly in Italy [105 per 100 000; 54–187]). Lower age-standardised YLD rates were observed in the regions of high-income Asia Pacific, east Asia, Australasia, and eastern Europe. Similar to the geographical differences in age-standardised prevalence and YLDs of epilepsy from idiopathic and secondary epilepsy combined, the age-standardised prevalence of idiopathic epilepsy showed four-fold geographical variations (figure 3A; appendix 1 pp 25–36), with the highest rates in some sub-Saharan African countries (Gabon: 688 per 100 000 [146–1158]; Angola: 542 per 100 000 [143–917]; and Zambia: 547 per 100 000 [148–944]), Latin America countries (Ecuador: 711 per 100 000 [226–1141]), central Latin America (Mexico: 583 per 100 000 [401–754]), some western European countries (Germany: 539 per 100 000 [163–816]), and central Asia (Kazakhstan, Uzbekistan, and Turkmenistan, with a range of 460–479 per 100 000 [116–770]). The lowest rates were in North Korea (178 per 100 000 [48–305]), Yemen (197 per 100 000 [37–352]), Bangladesh (199 per 100 000 [59–356]), Russia (211 per 100 000 [144–282]), Somalia (212 per 100 000 [34–460]), and China (215 per 100 000 [150–279]). The lowest age-standardised prevalence of epilepsy from idiopathic and secondary epilepsy combined was observed in east Asia (especially North Korea: 445 per 100 000 [312–583]; Indonesia: 460 per 100 000 [381–549]; and China: 464 per 100 000 [393–539]), and

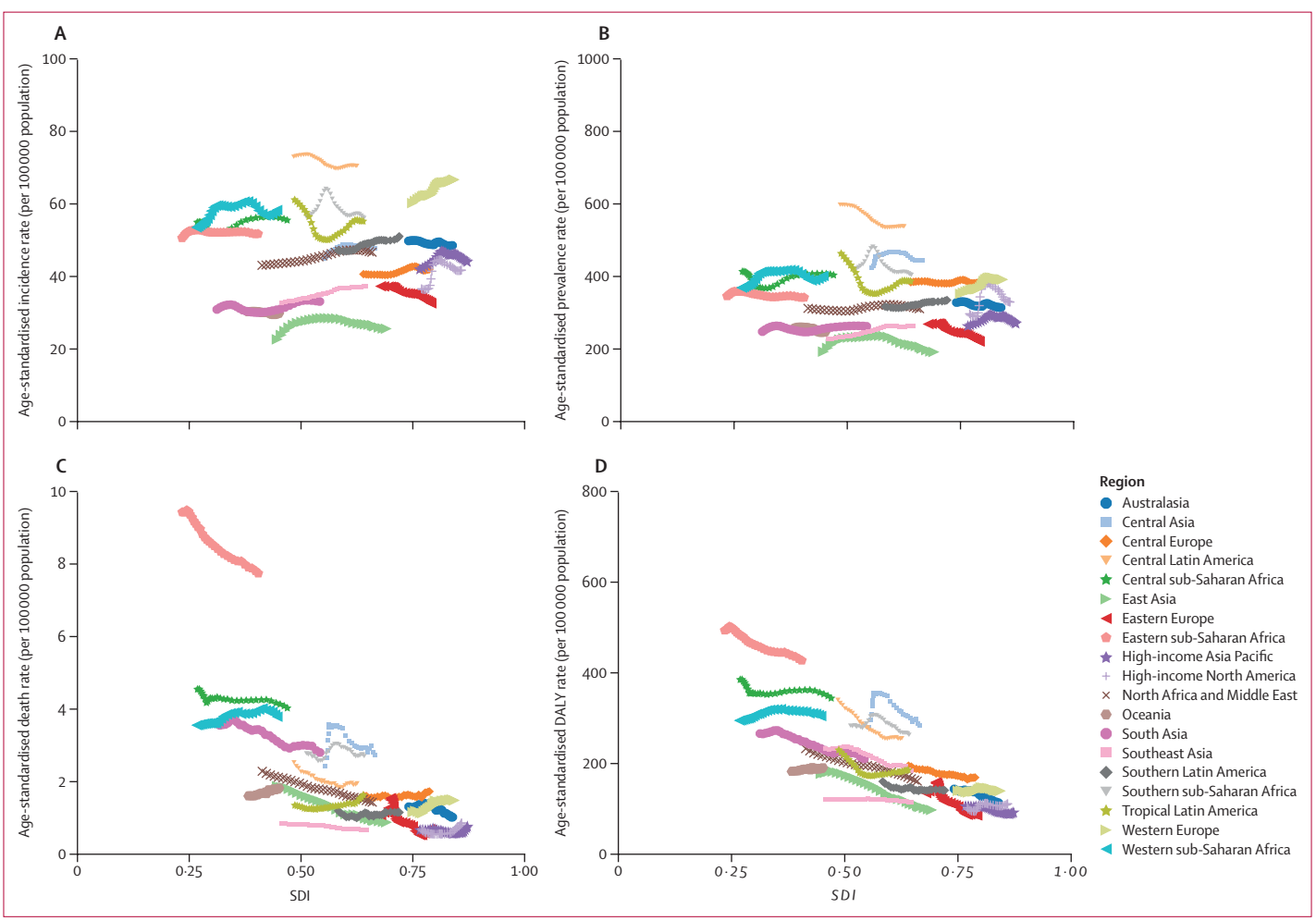

Figure 2: **Age-standardised incidence, prevalence, death, and DALY rates for idiopathic epilepsy per 100 000 people in 21 GBD regions by SDI, both sexes, 1990–2021**
(A) Age-standardised incidence rates for epilepsy. (B) Age-standardised prevalence rates for epilepsy. (C) Age-standardised death rates for epilepsy. (D) Age-standardised DALY rates for epilepsy. Age-standardised DALY rates are plotted for 21 GBD regions between 1990 and 2021 against their SDI values. Points from left to right represent the values from 1990 to 2021. DALYs=disability-adjusted life-years. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study. SDI=Socio-demographic Index.

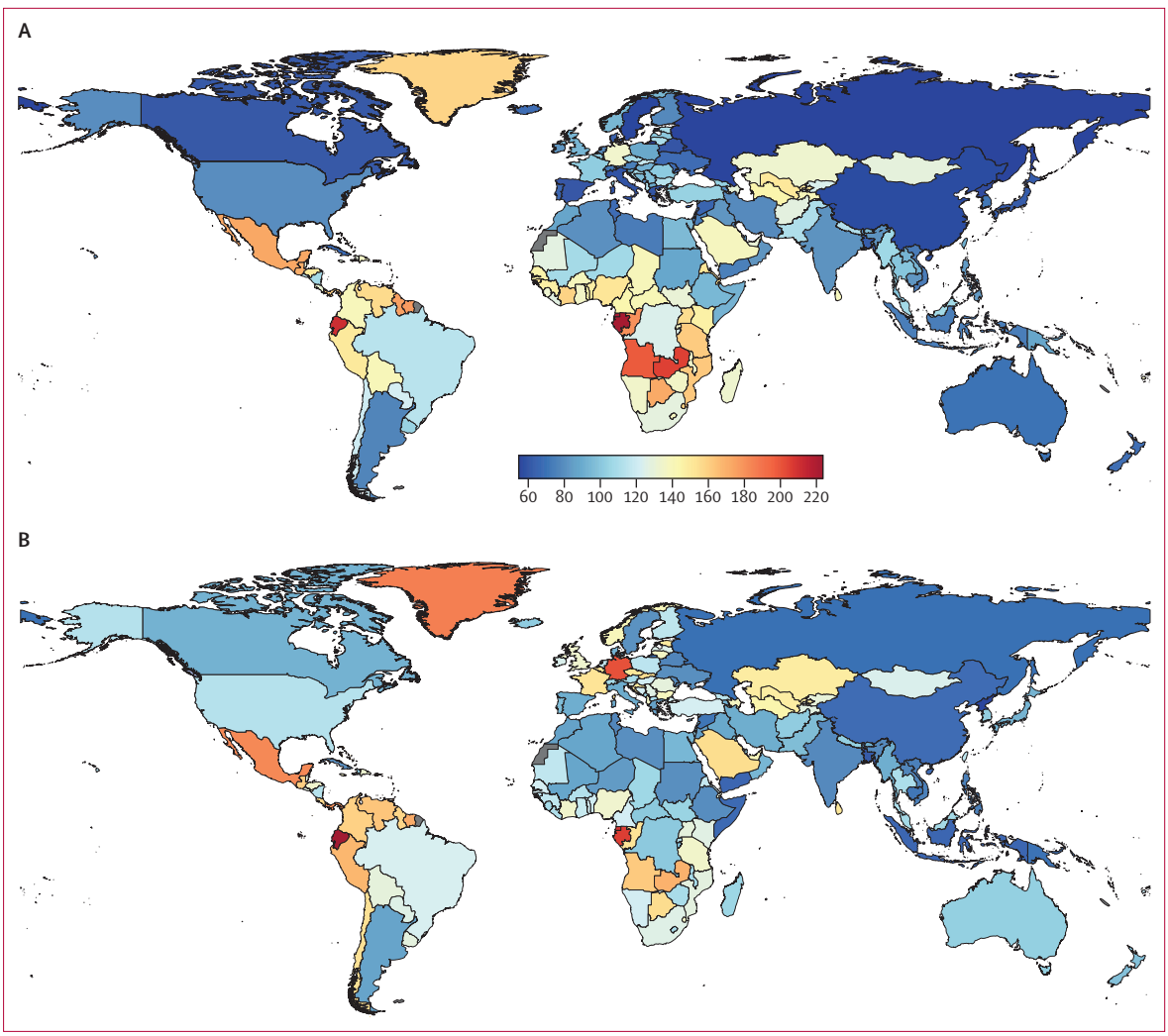

Figure 3: **Age-standardised years lived with disability and prevalence of idiopathic epilepsy per 100 000 people, both sexes, 2021**
(A) Age-standardised years lived with disability per 100 000 people. (B) Prevalence of idiopathic epilepsy per 100 000 people.

eastern Europe (Russia 498 per 100 000 [404–592]), whereas the highest age-standardised prevalence was in some countries of the Latin America and Caribbean region (Trinidad and Tobago: 1374 per 100 000 [945–1773]; and Dominica: 1262 per 100 000 [807–1647]) and some sub-Saharan African countries (Gabon: 1360 per 100 000 [823–1833]; and Equatorial Guinea: 1284 per 100 000 [750–1754]; table 1).

The age-standardised prevalence of idiopathic epilepsy showed four-fold geographical variations (figure 1A; appendix 1 pp 25–36), with the highest rates in some sub-Saharan African countries (Gabon: 688 per 100 000 [146–1158]; Angola: 542 [143–917]; and Zambia: 547 [148–944]), Latin America countries (Ecuador: 711 [226–1141]), central Latin America (Mexico: 583 [401–754]), some western European countries (Germany: 539 [163–816]), and central Asia (Kazakhstan, Uzbekistan, and Turkmenistan, with a range of 460–479 [116–770]). The lowest rates were in North Korea (178 [48–305]), Yemen (197 [37–352]), Bangladesh (199 [59–356]), Russia (211 [144–282]), Somalia (212 [34–460]), and China (215 [150–279]). The lowest age-standardised prevalence of epilepsy from idiopathic and secondary epilepsy combined was observed in east Asia (especially in North Korea: 445 per 100 000 [312–583]; Indonesia: 460 [381–549]; and China: 464 [393–539]), and eastern Europe (Russia: 498 [404–592]), whereas the highest age-standardised prevalence was in some countries of the Latin America and Caribbean region (Trinidad and Tobago: 1374 [945–1773]; and Dominica: 1262 [807–1647]) and some sub-Saharan African countries (Gabon: 1360 [823–1833]; and Equatorial Guinea: 1284 [750–1754]; table 1).

Age-standardised idiopathic epilepsy incidence, prevalence, death, and DALY rates per 100 000 people in GBD regions by SDI quintiles are presented in figure 2. Globally, across all SDI quintiles in almost all GBD regions, there was a trend towards reduction of

age-standardised idiopathic epilepsy death and DALY rates, but an increase in the age-standardised idiopathic epilepsy incidence rate and some increase in age-standardised death rates in the high SDI quintile, although not substantially (appendix 1 pp 25–36, 53). The bulk of the idiopathic epilepsy incidence (82·1%), prevalence (80·4%), deaths (84·7%), and DALYs (87·9%) occurred in LMICs. From 1990 to 2021 (appendix 1 pp 51, 53), age-standardised death rates substantially increased in HICs (13·9% [3·4–20·3]) but substantially reduced in UMICs (41·1% decline [34·2–47·9]), LMICs (21·5% decline [10·7–31·5]), and LICs (15·6% decline [1·4–26·7]). Over the same period, UMICs and LMICs also had a substantial reduction in age-standardised DALY rates (30·3% [15·8–42·1] and 17·3% [2·2–28·7] decrease, respectively), and similar trend patterns were observed in age-standardised DALY rates by SDI quintiles—some reduction in the rates in high and lower SDI regions (appendix 1 p 54). However, no substantial changes from 1990 to 2021 were observed in age-standardised incidence rates and prevalence in any of the World Bank country income levels (appendix 1 p 53).

Although the global age-standardised incidence rates and prevalence of idiopathic epilepsy did not change substantially from 1990 to 2021 (12·3% [95% UI –4·8 to 32·6] and 6·9% [–9·7 to 25·5], respectively), the age-standardised death and DALY rates over that time reduced substantially (15·8% [8·8–22·8] and 14·5% [4·2–24·2] decline, respectively; appendix 1 pp 25–36). Age-standardised death rates in LICs (4·6 per 100 000 [3·9–5·6]) and LMICs (2·2 per 100 000 [1·7–2·5]), and age-standardised rates of DALYs in LICs (313·6 per 100 000 [248·0–392·3]) were greater than those in HICs and UMICs (LICs: 1·2 per 100 000 [1·1–1·2]; HICs and UMICs: 1·0 per 100 000 [0·9–1·1]; LICs: 129·2 per 100 000 [87·7–189·7]; and HICs and UMICs: 136·1 per 100 000 [97·8–182·2], respectively), especially in males (appendix 1 p 52). In 2021 (appendix 1 pp 25–36), there were large between-country variations in the age-standardised death rate of idiopathic epilepsy: the lowest rates were in Viet Nam (0·1 per 100 000 [0·0–0·3]) and San Marino (0·1 per 100 000 [0·1–0·2]) and the highest rates in Zambia (12·9 per 100 000 [9·5–17·1]) and Somalia (10·3 per 100 000 [6·7–16·9]). Similarly, there were large variations in the age-standardised DALY rates: the lowest rates were in San Marino (67·0 per 100 000 [20·3–146·5]), Russia (72·8 per 100 000 [48·2–110·6]), and Viet Nam (79·1 per 100 000 [18·1–169·2]), and the highest rates were in Zambia (746·5 per 100 000 [505·8–1031·4]) and Somalia (505·5 per 100 000 [305·5–770·1]).

In 2021, the lowest age-standardised incidence rate of idiopathic epilepsy (appendix 1 pp 25–36) was observed in North Korea (21·7 per 100 000 [95% UI 5·9–38·7]), Bangladesh (25·7 per 100 000 [7·4–45·5]), Papua New Guinea (27·9 per 100 000 [6·6–50·8]), and China (28·2 per 100 000 [19·0–37·9]), with the highest incidence rates in Ecuador (94·9 per 100 000 [29·9–160·5]), Germany (91·8 per 100 000 [27·5–140·5]), Equatorial Guinea (84·9 per 100 000 [20·6–140·9]), and Gabon (82·8 per 100 000 [17·8–140·9]).

Discussion

Globally in 2021, across all ages, 0·7% of the population had active epilepsy. The overall global prevalence of active epilepsy from idiopathic and secondary epilepsy combined in our study (658 per 100 000 [95% UI 569–748]) is similar to the results of a recent meta-analysis of 197 epilepsy prevalence studies (638 per 100 000 [557–730]).[31] Our estimates of the combined number of prevalent active epilepsy cases (51·7 million people), with the majority of the cases in LMICs (83·7%), were similar to those estimated by WHO in 2024.[32] Similar to previous studies,[31] we found no substantial difference in the age-standardised prevalence of active epilepsy between LMICs and HICs. However, from 1990 to 2021, there was a substantial increase in the age-standardised prevalence of secondary epilepsy in southeast Asia and sub-Saharan Africa, and a substantial decrease in age-standardised death and DALY rates from idiopathic epilepsy. We also found that the age-standardised prevalence of secondary epilepsy as well as age-standardised death and DALY rates of idiopathic epilepsy are higher in LICs than in HICs, but the age-standardised prevalence of idiopathic epilepsy or all-cause epilepsy does not have a substantial difference by income level. The observed reduction in death and DALY rates from idiopathic epilepsy might be related to improved access and treatment of idiopathic epilepsy.[5]

The substantial increase in the prevalence of secondary epilepsy in non-high-income regions was likely related to the greater exposure of the population of these countries to perinatal risk factors[33] and higher rates of CNS zoonotic and other infections.[34,35] In addition, poorer treatment (limited availability of antiseizure medications and access to specialist antiepileptic services) might also contribute to the greater age-standardised prevalence and DALYs in LICs and some LMICs compared with HICs and countries with higher SDI. It is also possible that case verification of epilepsy in high-income regions is better than in non-high-income regions, which might contribute to the observed differences. The true gap between the burden of epilepsy in HICs or high SDI countries and LICs or low SDI countries is probably even greater because of possible under-reporting of cases of epilepsy in LICs or low SDI countries, often due to stigmatisation of the disease in many countries.[36]

We also found three-fold to four-fold geographical variations in the prevalence of idiopathic and secondary epilepsy combined, secondary epilepsy, and idiopathic epilepsy, with slightly greater age-standardised prevalence in males compared with females. Substantial geographical variations in the prevalence of active epilepsy, with the predominance in LMICs, and slightly

higher rates in males were also shown in other studies,[31,37,38] whereas some studies found significant greater burden of epilepsy in males compared with females.[10] Congruent with previous studies, we found that the prevalence of idiopathic epilepsy was relatively low early in life, increased during adolescence, and decreased after age 30 years,[31] but unlike previous studies that showed fairly constant prevalence after age 30 years,[31,39] we found a substantial increase in the prevalence of idiopathic epilepsy after age 55 years, especially noticeable for secondary epilepsy. The large increase in the prevalence of secondary epilepsy in the elderly (after age 90 years) is likely to be related to the increase in the prevalence of stroke, brain injuries, and neurodegenerative disorders in this age group.[20] Another likely reason is the reluctance to investigate underlying causes of epilepsy in the elderly, particularly if they have dementia, stroke, or other degenerative diseases. Many older people only have a CT scan that can only detect gross structural lesions, and cannot reliably detect temporal lobe lesions, whereas MRI is the investigation of choice in epilepsy. This investigation is often not done in older people because the need to keep still for longer and can sometimes require a general anaesthetic.

In 2021, active idiopathic epilepsy led to almost 14 million DALYs, or 0·5% of DALYs from idiopathic and secondary epilepsy combined; the age-standardised incidence, death, and DALY rates of active idiopathic epilepsy were 42·8 per 100 000 (95% UI 31·2–53·7), 1·7 per 100 000 (1·5–1·9), and 177·8 per 100 000 (137·7–225·9), respectively. Although the age-standardised death and DALY rates of idiopathic epilepsy substantially decreased over time (appendix 1 p 52), the age-standardised incidence rate showed a non-significant trend towards increasing. Greater incidence of epilepsy (mainly epilepsy from idiopathic and secondary epilepsy combined) in LMICs was also found in a recent meta-analysis.[31] The very low age-standardised incidence and death rates in some LMICs, such as Viet Nam and San Marino, is difficult to explain, but at least part of it might be related to the possible effect of stigma and cultural or organisational differences in epilepsy reporting.[31] Data sources for epilepsy are also very limited in some countries. For example, there were no non-fatal epilepsy data source in San Marino, and the last cause-of-death source was from 2005. There were two non-fatal data sources in Viet Nam, both from rural areas, and only two cause-of-death sources (no vital registration system). Similarly, the causes for decreasing death and DALY rates (particularly in LMICs) are not clear but might be related to the emerging better treatment, improved identification of less severe events, with lower death rates of epilepsy and CNS infections in these countries.[20,40] The increasing incidence of idiopathic epilepsy (particularly in middle-income countries) might reflect better identification of cases of idiopathic epilepsy in these countries over that time period.

Globally, between 1990 and 2021, there was a substantial increase not only in prevalent cases of all types of epilepsy, but also an increase in the age-standardised prevalence of secondary and combined epilepsy, whereas the age-standardised prevalence of idiopathic epilepsy did not change substantially. As prevalence of many neurological conditions (eg, cerebral malaria, neonatal encephalopathy, neonatal sepsis, and nervous system cancer) have increased over the past three decades,[20] it is probably not surprising that the prevalence of secondary epilepsy, often related to them, also increased from 1990 to 2021.

The effect of the COVID-19 pandemic on patients with epilepsy has been substantial, including increased poor COVID-19 outcomes, mental health challenges, and difficulties in the self-management of epilepsy.[41] For example, a survey in Brazil reported worsening of seizure control due to cancellation of appointments and challenges in access to medications.[42] COVID-19 was also associated with decreased confidence of health care in remote management of epilepsy,[43] worsening or aggravating of pre-existing epilepsy,[44–46] and the risk of de novo seizures,[47] which exceeds the risk of seizure or epilepsy after influenza.[48] These observations highlight the necessity of further research on the long-term consequences of decreased epilepsy diagnosis and care, and its subsequent increase in epilepsy-associated mortality.[46] Addressing these issues can help the scientific community and health-care policy makers at both global and national levels recognise gaps and insufficiencies. This awareness can lead to better preparedness for managing similar global health challenges in the future, thereby reducing the additional burden on epilepsy patients.

The major strength of this study is that it provides the most up-to-date prevalence estimates of active idiopathic epilepsy and active secondary epilepsy, as well as the prevalence of active epilepsy from idiopathic and secondary epilepsy combined on the global, regional, and national (204 countries) levels by age and sex for the 1990–2021 period. These data are of crucial importance for health-care planning, prevention, resource allocation, and workforce development. However, there are some general and epilepsy-specific limitations of the study detailed in our previous 1990–2016 GBD epilepsy burden paper.[8] The most important limitation of the study is the scarcity of reliable population-based epidemiological studies on various types of epilepsy in most countries of the world. In addition, the GBD study cannot provide analysis of all causes of secondary epilepsy (eg, stroke, degenerative diseases, and zoonotic diseases) and various phenotypes of idiopathic epilepsy (eg, juvenile myoclonic epilepsy, childhood absence epilepsy, juvenile absence epilepsy, and genetic generalised epilepsy) due to the scarcity of such reliable estimates in most countries. Although from previous research we know that the most common structural causes of secondary epilepsy include various neurological conditions, including traumatic brain injury, stroke, CNS zoonotic disorders, neuro-infectious diseases, neurodegenerative diseases, brain tumour, and various neural development lesions,[49]

accounting for remaining aetiologies explicitly would be desirable in future GBD rounds. We also acknowledge that many studies on epilepsy included in the GBD analysis are not nationally representative but instead focus on smaller populations within a geographic location and we had limited ability to adjust for quality of studies. Another important limitation was the scarcity of reliable data on risk factors of idiopathic epilepsy sufficient for the GBD modelling.

In conclusion, our estimates of incidence, death, prevalence, and DALYs show diverging trends in the burden of epilepsy in the world, with the bulk of the burden residing in LMICs. Urgent efforts must be made by all key stakeholders and decision makers to increase awareness and education about epilepsy, eliminate stigmatisation and discrimination associated with epilepsy, better control secondary causes of epilepsy (stroke, CNS zoonotic diseases, and other infectious diseases), improve access to existing treatments in economically disadvantaged countries or populations, and foster workforce development, especially in LMICs. Such initiatives are important for the implementation of the WHO intersectoral global action plan on epilepsy and other neurological disorders 2022–2031 and Universal Health Coverage,[6,50] and particularly for LMICs, in which three-quarters of people with epilepsy do not get the treatment they need,[32] and access to specialised neurological care is very limited.[20] Further research on risk factors of idiopathic epilepsy, good-quality long-term epilepsy surveillance studies, and examination of the possible effects of stigma and cultural differences on seeking medical attention for epilepsy, as well as developing new effective and affordable treatments, need to be explored.

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Please see appendix 2 (p 17–23) 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.

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Data sharing

To download GBD data used in these analyses, please visit the GBD 2021 Sources Tool website. To download forecasted estimates used in these analyses, please visit the GBD visualisation tools at https://collab2021.healthdata.org/gbd-compare/.

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References

1 Thijs RD, Surges R, O'Brien TJ, Sander JW. Epilepsy in adults. *Lancet* 2019; **393:** 689–701.

2 WHO. Epilepsy: a public health imperative. Geneva: World Health Organization, 2019.

3 Fisher RS, Acevedo C, Arzimanoglou A, et al. ILAE official report: a practical clinical definition of epilepsy. *Epilepsia* 2014; **55:** 475–82.

4 Begley C, Wagner RG, Abraham A, et al. The global cost of epilepsy: a systematic review and extrapolation. *Epilepsia* 2022; **63:** 892–903.

5 Beghi E. The epidemiology of epilepsy. *Neuroepidemiology* 2020; **54:** 185–91.

6 WHO. Follow-up to the political declaration of the third high-level meeting of the General Assembly on the prevention and control of non-communicable diseases. Geneva: World Health Organization, 2022.

7 Sarmast ST, Abdullahi AM, Jahan N. Current classification of seizures and epilepsies: scope, limitations and recommendations for future action. *Cureus* 2020; **12:** e10549.

8 Beghi E, Giussani G, Nichols E, et al. Global, regional, and national burden of epilepsy, 1990–2016: a systematic analysis for the Global Burden of Diseases Study 2016. *Lancet Neurol* 2019; **18:** 357–75.

9 England MJ, Liverman CT, Schultz AM, Strawbridge LM, eds. Epilepsy across the spectrum: promoting health and understanding. Washington, DC: National Academies Press, 2012.

10 Hu Y, Shan Y, Du Q, et al. Gender and socioeconomic disparities in global burden of epilepsy: an analysis of time trends from 1990 to 2017. *Front Neurol* 2021; **12:** 643450.

11 Pacheco-Barrios K, Navarro-Flores A, Cardenas-Rojas A, et al. Burden of epilepsy in Latin America and The Caribbean: a trend analysis of the Global Burden of Disease Study 1990–2019. *Lancet Reg Health Am* 2021; **8:** 100140.

12 Liu W, Xu Y, Lin Y, et al. Burden of epilepsy in China and its provinces, 1990 to 2019: findings from the Global Burden of Disease Study 2019. *Chin Med J (Engl)* 2023; **136:** 305–12.

13 Zhang YJ, Kong XM, Lv JJ, et al. Analysis of the global burden of disease study highlights the global, regional, and national trends of idiopathic epilepsy epidemiology from 1990 to 2019. *Prev Med Rep* 2023; **36:** 102522.

14 Institute for Health Metrics and Evaluation. Frequently asked questions. https://www.healthdata.org/research-analysis/about-gbd (accessed Nov 14, 2024).

15 World Bank. World Bank country classification by income level. July 1, 2022. https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2022-2023 (accessed Nov 14, 2024).

16 Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD 2017) Socio-demographic Index (SDI) 1950–2017. Institute for Health Metrics and Evaluation, 2018.

17 Institute for Health Metrics and Evaluation. Protocol for the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) version 4. Institute for Health Metrics and Evaluation, 2020.

18 Naghavi M, Ong KL, Aali A, et al. 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.

19 Ferrari AJ, Santomauro DF, Aali A, et al. 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.

20 Steinmetz JD, Seeher KM, Schiess N, et al. Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Neurol* 2024; **23:** 344–81.

21 Schumacher AE, Kyu HH, Aali A, et al. Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021. *Lancet* 2024; **403:** 1989–2056.

22 Epilepsia. Guidelines for epidemiologic studies on epilepsy. Commission on epidemiology and prognosis, international league against epilepsy. *Epilepsia* 1993; **34:** 592–96.

23 Zheng P, Barber R, Sorensen RJD, Murray CJL, Aravkin AY. Trimmed constrained mixed effects models: formulations and algorithms. *J Comput Graph Stat* 2021; **30:** 544–56.

24 Zuberi SM, Wirrell E, Yozawitz E, et al. ILAE classification and definition of epilepsy syndromes with onset in neonates and infants: position statement by the ILAE Task Force on Nosology and Definitions. *Epilepsia* 2022; **63:** 1349–97.

25 Specchio N, Wirrell EC, Scheffer IE, et al. International League Against Epilepsy classification and definition of epilepsy syndromes with onset in childhood: position paper by the ILAE Task Force on Nosology and Definitions. *Epilepsia* 2022; **63:** 1398–442.

26 Riney K, Bogacz A, Somerville E, et al. International League Against Epilepsy classification and definition of epilepsy syndromes with onset at a variable age: position statement by the ILAE Task Force on Nosology and Definitions. *Epilepsia* 2022; **63:** 1443–74.

27 Hirsch E, French J, Scheffer IE, et al. ILAE definition of the idiopathic generalized epilepsy syndromes: position statement by the ILAE Task Force on Nosology and Definitions. *Epilepsia* 2022; **63:** 1475–99.

28 Wirrell EC, Nabbout R, Scheffer IE, et al. Methodology for classification and definition of epilepsy syndromes with list of syndromes: report of the ILAE Task Force on Nosology and Definitions. *Epilepsia* 2022; **63:** 1333–48.

29 Salomon JA, Haagsma JA, Davis A, et al. Disability weights for the Global Burden of Disease 2013 study. *Lancet Glob Health* 2015; **3:** e712–23.

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

31 Fiest KM, Sauro KM, Wiebe S, et al. Prevalence and incidence of epilepsy: a systematic review and meta-analysis of international studies. *Neurology* 2017; **88:** 296–303.

32 WHO. Epilepsy. Feb 7, 2024. https://www.who.int/news-room/fact-sheets/detail/epilepsy (accessed April 4, 2024).

33 Ketata I, Ellouz E, Mizouri R. Impact of prenatal, neonatal, and postnatal factors on epilepsy risk in children and adolescents: a systematic review and meta-analysis. *Acta Epileptol* 2024; **6:** 1.

34 Stelzle D, Schmidt V, Keller L, et al. Characteristics of people with epilepsy and neurocysticercosis in three eastern African countries—a pooled analysis. *PLoS Negl Trop Dis* 2022; **16:** e0010870.

35 Vezzani A, Fujinami RS, White HS, et al. Infections, inflammation and epilepsy. *Acta Neuropathol* 2016; **131:** 211–34.

36 Chen Z, Brodie MJ, Ding D, Kwan P. Editorial: epidemiology of epilepsy and seizures. *Front Epidemiol* 2023; **3:** 1273163.

37 Ngugi AK, Bottomley C, Kleinschmidt I, Sander JW, Newton CR. Estimation of the burden of active and life-time epilepsy: a meta-analytic approach. *Epilepsia* 2010; **51:** 883–90.

38 Ettore B, Massimiliano B. Gender difference in epidemiology and comorbidities of epilepsy. In: Harden C L, Thomas S V, Tomson T, eds. Epilepsy in women. John Wiley & Sons, 2013: 1–10.

39 Forsgren L, Beghi E, Õun A, Sillanpää M. The epidemiology of epilepsy in Europe—a systematic review. *Eur J Neurol* 2005; **12:** 245–53.

40 Singh B, Mahajan N, Singh G, Sander JW. Temporal trends in the epilepsy treatment gap in low- and low-middle-income countries: a meta-analysis. *J Neurol Sci* 2022; **434:** 120174.

41 Dugan P, Carroll E, Thorpe J, et al. Impact of the COVID-19 pandemic on people with epilepsy: findings from the US arm of the COV-E study. *Epilepsia Open* 2022; **7:** 645–56.

42 Andraus M, Thorpe J, Tai XY, et al. Impact of the COVID-19 pandemic on people with epilepsy: findings from the Brazilian arm of the COV-E study. *Epilepsy Behav* 2021; **123:** 108261.

43 Thorpe J, Ashby S, Cross JH, et al. The impact of COVID-19 on epilepsy care: perspectives from UK healthcare workers. *Epilepsy Behav Rep* 2021; **16:** 100487.

44 Asadi-Pooya AA, Kouhanjani MF, Nemati H, Emami A, Javanmardi F. A follow-up study of patients with COVID-19 presenting with seizures. *Epilepsy Behav* 2021; **122:** 108207.

45 Strafford H, Hollinghurst J, Lacey AS, et al. Epilepsy and the risk of COVID-19-related hospitalization and death: a population study. *Epilepsia* 2024; **65:** 1383–93.

46 Strafford H, Hollinghurst J, Lacey AS, et al. Health care utilization and mortality for people with epilepsy during COVID-19: a population study. *Epilepsia* 2024; **65:** 1394–405.

47 Asadi-Pooya AA, Simani L, Shahisavandi M, Barzegar Z. COVID-19, de novo seizures, and epilepsy: a systematic review. *Neurol Sci* 2021; **42:** 415–31.

48 Taquet M, Devinsky O, Cross JH, Harrison PJ, Sen A. Incidence of epilepsy and seizures over the first 6 months after a COVID-19 diagnosis: a retrospective cohort study. *Neurology* 2023; **100:** e790–99.

49 Manole AM, Sirbu CA, Mititelu MR, et al. Ionita Radu F. State of the art and challenges in epilepsy—a narrative review. *J Pers Med* 2023; **13:** 623.

50 WHO. Universal health coverage: overview. 2024. https://www.who.int/health-topics/universal-health-coverage#tab=tab_1 (accessed Nov 14, 2024).

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Supplementary appendix 1

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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Appendix 1: Authorship appendix to "Global, regional, and national burden of epilepsy, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021"

This appendix provides further authorship detail for "Global, regional, and national burden of epilepsy, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021"

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Supplementary appendix 2

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: GBD Epilepsy Collaborators. Global, regional, and national burden of epilepsy, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Public Health* 2025; published online Feb 24. https://doi.org/10.1016/S2468-2667(24)00302-5.

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Supplementary appendix

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Supplement to: GBD 2021 Epilepsy Collaborators. Global, regional, and national burden of epilepsy, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021.

Most of the supplementary materials on the study methodology were adapted from the previous GBD publications:

1. Global, regional, and national burden of epilepsy, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol*. 2019;18:357-375
2. Naghavi M, Ong KL, Aali A, Ababneh HS, Abate YH, Abbafati C, . . . Murray CJL. 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. *The Lancet*. 2024;403:2100-2132
3. Ferrari AJ, Santomauro DF, Aali A, Abate YH, Abbafati C, Abbastabar H, . . . Murray CJL. 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. *The Lancet*. 2024;403:2133-2161.
4. Steinmetz JD, Seeher KM, Schiess N, Nichols E, Cao B, Servili C, . . . Dua T. Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *The Lancet Neurology*. 2024;23:344-381
5. Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *The Lancet*. 2024;403:2162-2203.
6. Schumacher AE, Kyu HH, Aali A, Abbafati C, Abbas J, Abbasgholizadeh R, . . . Murray CJL. Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950-2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021. *The Lancet*. 2024;403:1989-2056

Table of contents

Summary of general Global Burden of Disease study methods

A Cause of Death Ensemble model can find optimal coverage of input data by specific combinations of predictive covariates through the use of out-of-sample predictive validity testing. The input data for the Cause of Death Ensemble model included both vital registration (3460 site-years) and verbal autopsy data (54 site-years). A site-year is a unique combination of calendar year, location, and data source. The Cause of Death Ensemble model for epilepsy also utilised predictive covariates for pigs (per capita), proxy for neurocysticercosis infection, SEV scalar: epilepsy, mean systolic blood pressure (mmHg), Healthcare Access and Quality Index, mean body-mass index, mean serum total cholesterol (mmol/L), cumulative cigarettes (10 years), cumulative cigarettes (5 years), education (years per capita), log LDI (per capita), and Socio-demographic Index. More information on calculations can be found in the appendix and in the GBD 2021 risk factor overview paper.[1]

The Institute for Health Metrics and Evaluation, with a growing collaboration of scientists, produces annual updates of the Global Burden of Disease study. Estimates span the period from 1990 to the most recent completed year. Annual updates allow incorporation of new data and method improvements to ensure that the most up-to-date information is available to policy makers in a timely fashion to help make resource allocation decisions.

In the methods section, we present a summary of the general methods of the Global Burden of Disease (GBD). The guiding principle of GBD is to assess health loss due to mortality and disability comprehensively, where we define disability as any departure from full health. In GBD 2021, estimates were made for 204 countries and territories and 579 subnational locations, for 21 years starting from 1990, for 23 age groups and both sexes. Deaths were estimated for 264 diseases and injuries, while prevalence and incidence were estimated for 328 diseases and injuries. In order to allow meaningful comparisons between deaths and non-fatal disease outcomes as well as between diseases, the data on deaths and prevalence are summarised in a single indicator, the disability-adjusted life-year (DALY). DALYs are the sum of years of life lost (YLLs) and years lived with disability (YLDs). YLLs are estimated as the multiplication of counts of death and a standard, “ideal”, remaining life expectancy at the age of death. The standard life expectancy is derived from the lowest observed mortality rates in any population in the world greater than 5 million.[2] YLDs are estimated as the product of prevalence of individual consequences of disease (or “sequelae”) times a disability weight that quantifies the relative severity of a sequela as a number between zero (representing “full health”) and 1 (representing death). Disability weights have been estimated in nine population surveys and an open-access internet survey in which respondents are asked to choose the “healthier”[2] between random pairs of health states that are presented with a short description of the main features.

All-cause mortality rates are estimated from vital registration data in countries with complete coverage. For other countries, the probabilities of death before age 5 and between ages 15 and 60 are estimated from censuses and surveys asking mothers to provide a history of children ever born and those still alive, and surveys asking adults about siblings who are alive or have passed away. Using model life tables, these probabilities of death are transformed into age-specific death rates by location, year, and sex. GBD has collated a large database of cause of death data from vital registrations and verbal autopsy surveys in which relatives are asked a standard set of questions to ascertain the likely cause of death, supplemented with police and mortuary data for injury deaths in countries with no other data. For countries with vital registration data, the completeness is assessed with demographic methods based on comparing recorded deaths with population counts between two successive censuses. The cause of death information is provided in a large number of different classification systems based on versions of the International Classification of Diseases or bespoke classifications in some countries. All data are mapped into the disease and injury categories of GBD. All classification systems contain codes that are less informative because they lack a specific diagnosis (e.g., unspecified cancer) or refer to codes that cannot be underlying cause of death (e.g., low back pain or senility) or are intermediate causes (e.g., heart failure or sepsis). Such deaths are redistributed to more precise

underlying causes of death.[4] After these redistributions and corrections for under-registration, the data are analysed in CODEm (Cause of Death Ensemble model), a highly systematised tool that runs many different models on the same data and chooses an ensemble of models that best reflects all the available input data. Models are chosen with variations in the statistical approach ("mixed effects" of spatiotemporal Gaussian process regression), in the unit of analysis (rates or cause fractions), and the choice of predictive covariates. The statistical performance of all models is tested by holding out 30% of the data and checking how well a model covers the data that were held out. To enforce consistency from CODEm, the sum of all cause-specific mortality rates is scaled to that of the all-cause mortality rates in each age, sex, location, and year category.

Our Global Health Data Exchange (GHDx, http://ghdx.healthdata.org/) is the largest repository of health data globally. We first set a reference case definition and/or study method that best quantifies each disease or injury or consequence thereof. If there is evidence of a systematic bias in data that used different case definitions or methods compared to reference data, we adjust those datapoints to reflect what its value would have been if measured as the reference. This is a necessary step if one wants to use all data pertaining to a particular quantity of interest rather than choosing a small subset of data of the highest quality only. DisMod-MR 2.1, a Bayesian meta-regression tool, is our main method of analysing non-fatal data. It is designed as a geographical cascade where a first model is run on all the world's data, which produces an initial global fit and estimates coefficients for predictor variables and the adjustments for alternative study characteristics. The global fit adjusted by the values of random effects for each of seven GBD super-regions, the coefficients on sex and country predictors, are passed down as data to a model for each super-region together with the input data for that geography. The same steps are repeated going from super-region to 21 region fits and then to 204 fits by country and, where applicable, a further level down to subnational units. Below the global fit, all models are run separately by sex and for six time periods: 1990, 1995, 2000, 2005, 2010, and 2019 and 2021. During each fit, all data on prevalence, incidence, remission (i.e., cure rate) and mortality are forced to be internally consistent. For most diseases, the bulk of data on prevalence or incidence is at the disease level, with fewer studies providing data on the proportions of cases of disease in each of the sequelae defined for the disease. The proportions in each sequela are pooled using DisMod-MR 2.1 or meta-analysis or derived from analyses of patient-level datasets. The multiplication of prevalent cases for each disease sequela and the appropriate disability weight produces YLD estimates that do not yet take into account comorbidity. To correct for comorbidity, these data are used in a simulation to create hypothetical individuals in each age, sex, location, and year combination who experience no, one, or multiple sequelae simultaneously. We assume that disability weights are multiplicative rather than additive as this avoids assigning a combined disability weight value in any individual to exceed 1, i.e., be worse than a "year lost due to death". This comorbidity adjustment leads to an average scaling down of disease-specific YLDs ranging from about 2% in young children up to 17% in oldest ages.

All our estimates of causes of death are categorical: each death is assigned to a single underlying cause. This has the attractive property that all estimates add to 100%. For risks, we use a different, "counterfactual" approach, i.e., answering the question: "what would the burden have been if the population had been exposed to a theoretical minimum level of exposure to a risk?" Thus, we need to define what level of exposure to a risk factor leads to the lowest amount of disease. We then analyse data on the prevalence of exposure to a risk and derive relative risks for any risk-outcome pair for which we find sufficient evidence of a causal relationship. Prevalence of exposure is estimated in DisMod-MR 2.1, using spatiotemporal Gaussian process regression, or from satellite imagery in the case of ambient air pollution. Relative risk data are pooled using meta-analysis of cohort, case-control, and/or intervention studies. For each risk and outcome pair, we evaluate the evidence and judge if the evidence falls into the categories of "convincing" or "probable" as defined by the World Cancer Research Fund.[5] From the prevalence and relative risk results, population attributable fractions are estimated relative to the theoretical minimum risk exposure level (TMREL). When we aggregate estimates for clusters of risks, e.g., metabolic or behavioural risks, we use a multiplicative function rather than simple addition and take into account how much of each risk is mediated through another

risk. For instance, some of the risk of high body-mass index is directly onto stroke as an outcome, but much of its impact is mediated through high blood pressure, high cholesterol, or high fasting plasma glucose, and we would not want to double count the mediated effects when we estimate aggregates across risk factors.[3]

Uncertainty is propagated through each computation step by sampling 500 draws at each prevalence, death, YLL, YLD, or DALY estimate and performing aggregations across causes and locations at the level of each of the 1,000 values for all intermediate steps in the calculation. The lower and upper bounds of the 95% uncertainty interval are the 25th and 975th values of the ordered 1000 values. For all age-standardised rates, GBD uses a standard population calculated as the non-weighted average across all countries of the percentage of the population in each five-year age group for the years 2010 to 2035 from the United Nations Population Division's World Population Prospects (2022 revision).[4,5]

GBD uses a composite indicator of sociodemographic development, SDI, which reflects the geometric mean of normalised values of a location's income per capita, the average years of schooling in the population 15 and over, and the total fertility rate. Countries and territories are grouped into five quintiles of high, high-middle, middle, low-middle, and low SDI based on their 2016 values.[6]

Details on data sources

Overall, we had 343 unique sources of prevalence data for 20 of 21 world regions, 86 unique incidence regions for 15 of 21 world regions, and three unique sources on remission for three of 21 world regions. There are several locations where we are lacking data, primarily eastern Europe and Russia.

Sources used for epilepsy regressions

Idiopathic regression

Huang DH, Zheng JO, Chen J, Yu L. Treatment gaps of epilepsy and retention rates of sodium valproate in rural Guangxi, China. *Genet Mol Res*. 2014; 13(3): 6202-12.
Kong ST, Ho CS, Ho PC, Lim SH. Prevalence of drug resistant epilepsy in adults with epilepsy attending a neurology clinic of a tertiary referral hospital in Singapore. *Epilepsy Res*. 2014; 108(7): 1253-62.
Choudhary A, Gulati S, Sagar R, Kabra M, Sapra S. Behavioral comorbidity in children and adolescents with epilepsy. *J Clin Neurosci*. 2014; 21(8): 1337-40.
Stefan H, May TW, Pfafflin M, Brandt C, Furatsch N, Schmitz B, Wandschneider B, Kretz R, Runge U, Geithner J, Karakizlis C, Rosenow F, Kerling F. Epilepsy in the elderly: comparing clinical characteristics with younger patients. *Acta Neurol Scand*. 2014; 129(5): 283-93.
Kim DW, Lee SY, Chung SE, Cheong HK, Jung KY. Clinical characteristics of patients with treated epilepsy in Korea: a nationwide epidemiologic study. *Epilepsia*. 2014; 55(1): 67-75.
Pandey S, Singhi P, Bharti B. Prevalence and treatment gap in childhood epilepsy in a north Indian city: a community-based study. *J Trop Pediatr*. 2014; 60(2): 118-23.
Joseph N, Kumar GS, Nelliyanil M. Pattern of seizure cases in tertiary care hospitals in Karnataka state of India. *Ann Indian Acad Neurol*. 2013; 16(3): 347-51.
Torres-Ferrus M, Toledo M, Gonzalez-Cuevas M, Sero-Ballesteros L, Santamarina E, Raspall-Chaure M, Sueiras-Gil M, Cambrodi-Masip R, Sarria S, Alvarez-Sabin J, Salas-Puig J. [Aetiology and treatment of epilepsy in a series of 1,557 patients]. *Rev Neurol*. 2013; 57(7): 306-12.
Tanaka A, Akamatsu N, Shouzaki T, Toyota T, Yamano M, Nakagawa M, Tsuji S. Clinical characteristics and treatment responses in new-onset epilepsy in the elderly. *Seizure*. 2013; 22(9): 772-5.

Chong J, Hesdorffer DC, Thurman DJ, Lopez D, Harris RB, Hauser WA, Labiner ET, Velarde A, Labiner DM. The prevalence of epilepsy along the Arizona-Mexico border. *Epilepsy Res*. 2013; 105(2-Jan): 206-15.

Nickels KC, Grossardt BR, Wirrell EC. Epilepsy-related mortality is low in children: a 30-year population-based study in Olmsted County, MN. *Epilepsia*. 2012; 53(12): 2164-71.

Hunter E, Rogathi J, Chigudu S, Jusabani A, Jackson M, McNally R, Gray W, Whittaker RG, Iqbal A, Birchall D, Aris E, Walker R. Prevalence of active epilepsy in rural Tanzania: a large community-based survey in an adult population. *Seizure*. 2012; 21(9): 691-8.

Garcia-Martin G, Perez-Errazquin F, Chamorro-Munoz MI, Romero-Acebal M, Martin-Reyes G, Dawid-Milner MS. Prevalence and clinical characteristics of epilepsy in the South of Spain. *Epilepsy Res*. 2012; 102(1-2): 100-8.

Zhao Y-H, Zhang Q, Long N, Yang C, Hong J, Mu L, Zhou D. Prevalence of epilepsy and alcohol-related risk in Zayul County, Tibet Autonomous Region in China: an initial survey. *Epilepsy Behav*. 2010; 19(4): 635-8.

Suastegui R, Gutierrez J, Ramos R, Bouchan S, Navarrete H, Ruiz J, Plascencia N, Jauri S, Leon C, Castillo V, Ojeda EA. [Clinical characteristics of the late-onset epilepsy in Mexico to the beginning of the new millennium: 455 cases]. *Rev Invest Clin*. 2009; 61(5): 354-63.

Tse E, Hamiwka L, Sherman EM, Wirrell E. Social skills problems in children with epilepsy: prevalence, nature and predictors. *Epilepsy Behav*. 2007; 11(4): 499-505.

Dura Trave T, Yoldi Petri ME. [Epilepsy and epileptic syndromes among primary school children (6-12 years)]. *An Pediatr* (Barc). 2007; 66(1): 11-6.

Oun A, Haldre S, Magi M. Use of antiepileptic drugs in Estonia: an epidemiologic study of adult epilepsy. *Eur J Neurol*. 2006; 13(5): 465-70.

Arruda WO. Etiology of epilepsy. A prospective study of 210 cases. *Arq Neuropsiquiatr*. 1991;49(3): 251-4.

Valença MM, Valença LP. [Etiology of the epileptic seizures in Recife city, Brazil: study of 249 patients]. *Arq Neuropsiquiatr*. 2000; 58(4): 1064-72.

Kwong KL, Chak WK, Wong SN, So KT. Epidemiology of childhood epilepsy in a cohort of 309 Chinese children. *Pediatr Neurol*. 2001; 24(4): 276-82.

Ng KK, Ng PW, Tsang KL, Hong Kong Epilepsy Study Group. Clinical characteristics of adult epilepsy patients in the 1997 Hong Kong epilepsy registry. *Chin Med J* (Engl). 2001; 114(1): 84-7.

Hui AC, Wong A, Wong HC, Man BL, Au-Yeung KM, Wong KS. Refractory epilepsy in a Chinese population. *Clin Neurol Neurosurg*. 2007; 109(8): 672-5.

Fong GCY, Mak W, Cheng TS, Chan KH, Fong JKY, Ho SL. A prevalence study of epilepsy in Hong Kong. *Hong Kong Med J*. 2003; 9(4): 252-7.

Pi X, Cui L, Liu A, Zhang J, Ma Y, Liu B, Cai C, Zhu C, Zhou T, Chen J, Zhou Z, Wang C, Li L, Li S, Wu J, Xiao B. Investigation of prevalence, clinical characteristics and management of epilepsy in Yueyang city of China by a door-to-door survey. *Epilepsy Res*. 2012; 101(1-2): 129-34.

Dechef G. Notions sur l'épidémiologie de l'épilepsie au Congo (Kinshasa). *Afr J Med Sci*. 1970;1(3): 309-14.

Chaves-Sell F, Dubuisson-Schonemberg V. [Profile of epilepsy in a neurology clinic in Costa Rica]. *Rev Neurol*. 2001; 33(5): 411-13.

Pascual López MA, Pascual Gispert J, Rodrıguez Rivera L, Rojas Ochoa F, Tejeiros A. [Epilepsy: epidemiological study in a child population]. *Bol Med Hosp Infant Mex*. 1980; 37(4): 811-21.

Arteaga-Rodríguez C, Ramírez-Chávez J, Rodríguez-Rivera L, Moréra-Mendez F, Hernández-Fustes OJ. Aetiological factors of the epilepsies. *Rev Neurol*. 1998; 27: 427-30.

Nieto Barrera M. [Neuroepidemiology of epilepsies]. *An Esp Pediatr*. 1988; 29(Supp 33): 59-63.

Dur-Trav, T, Yoldi-Petri ME, Gallinas-Victoriano F. Incidence of epilepsies and epileptic syndromes among children in Navarre, Spain: 2002 through 2005. *J Child Neurol*. 2008; 23(8): 878-82.

Rakitin A, Liik M, Oun A, Haldre S. Mortality risk in adults with newly diagnosed and chronic epilepsy: a population-based study. *Eur J Neurol*. 2011; 18(3): 465-70.

Beilmann A, Napa A, Hämarik M, Sööt A, Talvik I, Talvik T. Incidence of childhood epilepsy in Estonia. *Brain Dev*. 1999; 21(3): 166-74.

Tekle-Haimanot R, Forsgren L, Ekstedt J. Incidence of epilepsy in rural central Ethiopia. *Epilepsia*. 1997; 38(5): 541-6.

Rantala H, Ingalsuo H. Occurrence and outcome of epilepsy in children younger than 2 years. *J Pediatr*. 1999; 135(6): 761-4.

Lomidze G, Kasradze S, Kvernadze D, Okujava N, Toidze O, de Boer HM, Dua T, Sander JW. The prevalence and treatment gap of epilepsy in Tbilisi, Georgia. *Epilepsy Res*. 2012; 98(2-3): 123-9.

Medina MT, Durón RM, Martínez L, Osorio JR, Estrada AL, Zúniga C, Cartagena D, Collins JS, Holden KR. Prevalence, incidence, and etiology of epilepsies in rural Honduras: the Salama Study. *Epilepsia*. 2005; 46(1): 124-31.

Goel D, Dhanai JS, Agarwal A, Mehlotra V, Saxena V. Neurocysticercosis and its impact on crude prevalence rate of epilepsy in an Indian community. *Neurol India*. 2011; 59(1): 37-40.

Olafsson E, Hauser WA. Prevalence of epilepsy in rural Iceland: a population-based study. *Epilepsia*. 1999; 40(11): 1529-34.

Olafsson E, Ludvigsson P, Gudmundsson G, Hesdorffer D, Kjartansson O, Hauser WA. Incidence of unprovoked seizures and epilepsy in Iceland and assessment of the epilepsy syndrome classification: a prospective study. *Lancet Neurol*. 2005; 4(10): 627-34.

Battaglia D, Randò T, Deodato F, Bruccini G, Baglio G, Frisone MF, Pantò T, Tortorella G, Guzzetta F. Epileptic disorders with onset in the first year of life: neurological and cognitive outcome. *Eur J Paediatr Neurol*. 1999; 3(3): 95-103.

Gallitto G, Serra S, La Spina P, Postorino P, Lagan… A, Tripodi F, Gangemi S, Calabrò S, Savica R, Di Perri R, Beghi E, Musolino R. Prevalence and characteristics of epilepsy in the Aeolian islands. *Epilepsia*. 2005; 46(11): 1828-35.

Mwinzi SMG, Ruberti FR, Stewart JD. Epilepsy in the Kenyan Africa. *Med Afr Noire*. 1976; 23: 331-334.

Feksi AT, Kaamugisha J, Sander JW, Gatiti S, Shorvon SD. Comprehensive primary health care antiepileptic drug treatment programme in rural and semi-urban Kenya. ICBERG (International Community-based Epilepsy Research Group). *Lancet*. 1991; 337(8738): 406-9.

Sridharan R, Radhakrishnan K, Ashok PP, Mousa ME. Epidemiological and clinical study of epilepsy in Benghazi, Libya. *Epilepsia*. 1986; 27(1): 60-5.

Andriantseheno LM, Andrianasy TF. The features of epilepsy in the Malagasy: a hospital study on 213 cases from the North Western part of Madagascar. *Afr J Neurol Sci*. 1997; 16: 28-33.

Medina MT, Rosas E, Rubio-Donnadieu F, Sotelo J. Neurocysticercosis as the main cause of late-onset epilepsy in Mexico. *Arch Intern Med*. 1990; 150(2): 325-7.

Uuriintuya M, Ulziibayar D, Bayarmaa D. Epilepsy in Mongolia. *Neurology Asia*. 2007; 12: 61-63.

Dada TO. Epilepsy in Lagos, Nigeria. *Afr J Med Sci*. 1970; 1: 161-184.

Danesi MA, Oni K. Features of partial epilepsy in Nigerians: a 3 year clinical and electroencephalographic study of 282 cases seen at the Lagos University Teaching Hospital. *Afr J Neurol Sci*. 1983; 2: 1-6.

Danesi MA. Acquired aetiological factors in Nigerian epileptics (an investigation of 378 patients). *Trop Geogr Med*. 1983; 35(3): 293-297.

Ojuawo A, Joiner KT. Childhood epilepsy in Ilorin, Nigeria. *East Afr Med J*. 1997; 74(2): 72-75.

Breteler M, de la Court A, Meinardi H, Hauser WA, Grobbee D, Hofman A. Prevalence of epilepsy in the elderly: the Rotterdam Study. *Epilepsia*. 1996; 37(2): 141-7.

Gaffo AL, Guillén-Pinto D, Campos-Olazábal P, Burneo JG. [Cysticercosis as the main cause of partial seizures in children in Peru]. *Rev Neurol*. 2004; 39(10): 924-6.

Collomb H, Girard PL, Konate S. L'épilepsie en milieu hospitalier à Dakar. *Med Afr Noire*. 1976; 23: 299-304.

Lee WL, Low PS, Murugasu B, Rajan U. Epidemiology of epilespy in Singapore children. *Neurol J Southeast Asia*. 1997; 2: 31-35.

Larsson K, Eeg-Olofsson O. A population based study of epilepsy in children from a Swedish county. *Eur J Paediatr Neurol*. 2006; 10(3): 107-13.

Adelöw C, Andell E, Amark P, Andersson T, Hellebro E, Ahlbom A, Tomson T. Newly diagnosed single unprovoked seizures and epilepsy in Stockholm, Sweden: First report from the Stockholm Incidence Registry of Epilepsy (SIRE). *Epilepsia*. 2009; 50(5): 1094-101.

Velioglu SK, Bakirdemir M, Can G, Topbas M. Prevalence of epilepsy in northeast Turkey. *Epileptic Disord*. 2010; 12(1): 22-37.

Matuja WB. Aetological factors in Tanzanian epileptics. *East Afr Med J*. 1989; 66(5): 343-348.

Dent W, Helbok R, Matuja WBP, Scheunemann S, Schmutzhard E. Prevalence of active epilepsy in a rural area in South Tanzania: a door-to-door survey. *Epilepsia*. 2005; 46(12): 1963-9.

Tuan NA, Cuong LQ, Allebeck P, Chuc NTK, Persson HE, Tomson T. The prevalence of epilepsy in a rural district of Vietnam: a population-based study from the EPIBAVI project. *Epilepsia*. 2008; 49(9):1634-7.

Chuke PO, Muras J. Experience in epilepsy in Lusaka. *Med J Zambia*. 1977; 11: 65-70.

Levy LF. Epilepsy in Rhodesia, Zambia, and Malawi. *Afr J Med Sci*. 1970; 1: 291-203.

Khedr EM, Shawky OA, Ahmed MA, Elfetoh NA, Al Attar G, Ali AM, Kandil MR, Farweez H. A community based epidemiological study of epilepsy in Assiut Governorate/Egypt. *Epilepsy Res*. 2013; 103(3-Feb): 294-302.

Al Rajeh S, Awada A, Bademosi O, Ogunniyi A. The prevalence of epilepsy and other seizure disorders in an Arab population: a community-based study. *Seizure*. 2001; 10(6): 410-4.

Ablah E, Hesdorffer DC, Liu Y, Paschal AM, Hawley S, Thurman D, Hauser WA. Prevalence of epilepsy in rural Kansas. *Epilepsy Res*. 2014; 108(4): 792-801.

El-Tallawy HN, Farghaly WM, Shehata GA, Abdel-Hakeem NM, Rageh TA, Abo-Elftoh NA, Hegazy A, Badry R. Epidemiology of epilepsy in New Valley Governorate, Al Kharga District, Egypt. *Epilepsy Res*. 2013; 104(2-Jan): 167-74.

Saha, SP, Bhattachrya, S, Roy, BK, Basu, A, Roy, T, Maity, B, Das, SK. (2008). A prospective incidence study of epilepsy in a rural community of West-Bengal, India. *Neurology Asia*, 13, 41-48.

Josipovic-Jelic Z, Sonicki Z, Soljan I, Demarin V, Collaborative Group for Study of Epilepsy Epidemiology in Sibenik-Knin County, Croatia. Prevalence and socioeconomic aspects of epilepsy in the Croatian county of Sibenik-Knin: community-based survey. *Epilepsy Behav*. 2011; 20(4): 686-90.

Gaily E, Lommi M, Lapatto R, Lehesjoki AE. Incidence and outcome of epilepsy syndromes with onset in the first year of life: A retrospective population-based study. *Epilepsia*. 2016; nan.

Nilsson G, Fernell E, Arvidsson T, Neville B, Olsson I, Gillberg C. Prevalence of Febrile Seizures, Epilepsy, and Other Paroxysmal Attacks in a Swedish Cohort of 4-Year-Old Children. *Neuropediatrics*. 2016; nan.

El-Tallawy HN, Farghaly WM, Rageh TA, Shehata GA, Metwally NA, Badry R, Sayed MA, Abdelwarith AM, Kandil MR, Hamed MA, Mohamed KO, Tohamy AM. Spectrum of epilepsy - prevalence, impact, and treatment gap: an epidemiological study from Al-Quseir, Egypt. *Neuropsychiatr Dis Treat*.2016; 12: 1111-8.

Serrano-Castro PJ, Mauri-Llerda JA, Hernandez-Ramos FJ, Sanchez-Alvarez JC, Parejo-Carbonell B, Quiroga-Subirana P, Vazquez-Gutierrez F, Santos-Lasaosa S, Mendez-Lucena C, Redondo-Verge L, Tejero-Juste C, Morandeira-Rivas C, Sancho-Rieger J, Matias-Guiu J. Adult Prevalence of Epilepsy in Spain: EPIBERIA, a Population-Based Study. *Scientific World Journal*. 2015; 2015: 602710.

Hara HS, Gupta A, Singh M, Raj R, Singh H, Pawar G, Hara PK, Singh J. Epilepsy in Punjab (India): A Population-Based Epidemiologic Study. *Neuroepidemiology*. 2015; 45(4): 273-81.

Hashem S, Al-Kattan M, Ibrahim SY, Shalaby NM, Shamloul RM, Farrag M. Epilepsy prevalence in Al-Manial Island, Egypt. A door-to-door survey. *Epilepsy Res*. 2015; 117: 133-7.

Fawi G, Khedr EM, El-Fetoh NA, Thabit MN, Abbass MA, Zaki AF. Community-based epidemiological study of epilepsy in the Qena governorate in Upper Egypt, a door-to-door survey. *Epilepsy Res*. 2015; 113: 68-75.

San-Juan D, Alvarado-Leon S, Barraza-Diaz J, Davila-Avila NM, Ruiz AH, Anschel DJ. Prevalence of epilepsy, beliefs and attitudes in a rural community in Mexico: A door-to-door survey. *Epilepsy Behav*. 2015; 46: 140-3.

Syvertsen M, Nakken KO, Edland A, Hansen G, Hellum MK, Koht J. Prevalence and etiology of epilepsy in a Norwegian county-A population based study. *Epilepsia*. 2015; 56(5): 699-706.

Bourrous M, Elibrahimi I, Draiss G, Safini F, Amine M, Bouskraoui M. [Characteristics of the children with epilepsy followed in the Marrakech University Hospital]. *Rev Neurol* (Paris). 2010;166(11): 921-6.

Wright J, Pickard N, Whitfield A, Hakin N. A population-based study of the prevalence, clinical characteristics and effect of ethnicity in epilepsy. *Seizure*. 2000; 9(5): 309-13.

Muir TM, Bradley A, Wood SF, Murray GD, Brodie MJ. An audit of treated epilepsy in Glasgow. West of Scotland Epilepsy Research Group. *Seizure*. 1996; 5(1): 41-6.

Aziz H, Güvener A, Akhtar SW, Hasan KZ. Comparative epidemiology of epilepsy in Pakistan and Turkey: population-based studies using identical protocols. *Epilepsia*. 1997; 38(6): 716-22.

Tran D-S, Odermatt P, Le T-O, Huc P, Druet-Cabanac M, Barennes H, Strobel M, Preux P-M. Prevalence of epilepsy in a rural district of central Lao PDR. *Neuroepidemiology*. 2006; 26(4): 199-206.

Okuma T, Kumashiro H. Natural history and prognosis of epilepsy: report of a multi-institutional study in Japan. The group for the study of prognosis of epilepsy in Japan. *Epilepsia*. 1981; 22(1): 35-53.

Manonmani V, Tan CT. A study of newly diagnosed epilepsy in Malaysia. *Singapore Med J*. 1999; 40(1): 32-5.

Andriantseheno LM, Ralaizandriny D. Prévalence communautaire de l'épilepsie chez les Malgaches. *Epilepsies*. 2004; 16(2): 83-6.

Farnarier G, Diop S, Coulibaly B, Arborio S, Dabo A, Diakite M, Traore S, Banou A, Nimaga K, Vaz T, Doumbo O. [Onchocerciasis and epilepsy. Epidemiological survey in Mali]. *Med Trop* (Mars).2000; 60(2): 151-5.

Kun LN, Ling LW, Wah YW, Lian TT. Epidemiologic study of epilepsy in young Singaporean men. *Epilepsia*. 1999; 40(10): 1384-7.

Severe regression

Choudhary A, Gulati S, Sagar R, Kabra M, Sapra S. Behavioral comorbidity in children and adolescents with epilepsy. *J Clin Neurosci*. 2014; 21(8): 1337-40.

Garcia-Martin G, Perez-Errazquin F, Chamorro-Munoz MI, Romero-Acebal M, Martin-Reyes G, Dawid-Milner MS. Prevalence and clinical characteristics of epilepsy in the South of Spain. *Epilepsy Res*. 2012; 102(1-2): 100-8.

Zhao Y-H, Zhang Q, Long N, Yang C, Hong J, Mu L, Zhou D. Prevalence of epilepsy and alcohol-related risk in Zayul County, Tibet Autonomous Region in China: an initial survey. *Epilepsy Behav*. 2010; 19(4): 635-8.

Tse E, Hamiwka L, Sherman EM, Wirrell E. Social skills problems in children with epilepsy: prevalence, nature and predictors. *Epilepsy Behav*. 2007; 11(4): 499-505.

Debouverie M, Kabore J, Dumas M, Weber M, Duboz P, Vaugelade J. Epidemiology of Epilepsy in Burkina Faso. In: Dumas M, Giordano C, Gentilini M, Chieze F, editors. *Neurologie Tropicale*. Paris, France: John Libbey Eurotext, 1993. 57-61.

Kwong KL, Chak WK, Wong SN, So KT. Epidemiology of childhood epilepsy in a cohort of 309 Chinese children. *Pediatr Neurol*. 2001; 24(4): 276-82.

Zhao Y, Zhang Q, Tsering T, Sangwan, Hu X, Liu L, Shang H, Chen Q, Liu Y, Yang X, Wang W, Li S, Wu J, Sander JW, Zhou D. Prevalence of convulsive epilepsy and health-related quality of life of the population with convulsive epilepsy in rural areas of Tibet Autonomous Region in China: an initial survey. *Epilepsy Behav*. 2008; 12(3): 373-81.

Pascual López MA, Pascual Gispert J, Rodríguez Rivera L, Rojas Ochoa F, Tejeiros A. [Epilepsy: epidemiological study in a child population]. *Bol Med Hosp Infant Mex*. 1980; 37(4): 811-21.

Del Brutto OH, Santibáñez R, Idrovo L, Rodrìguez S, Díaz-Calderón E, Navas C, Gilman RH, Cuesta F, Mosquera A, Gonzalez AE, Tsang VCW, García HH. Epilepsy and neurocysticercosis in Atahualpa: a door-to-door survey in rural coastal Ecuador. *Epilepsia*. 2005; 46(4): 583-7.

Cruz-Campos GA, Baquero-Toledo M. [Epilepsies in an outpatient setting: a study of 150 cases]. *Rev Neurol*. 2000; 30(12): 1108-12.

Josipovic-Jelic Z, Sonicki Z, Soljan I, Demarin V, Collaborative Group for Study of Epilepsy Epidemiology in Sibenik-Knin County, Croatia. Prevalence and socioeconomic aspects of epilepsy in the Croatian county of Sibenik-Knin: community-based survey. *Epilepsy Behav*. 2011; 20(4): 686-90.

Singh A, Kaur A. Epilepsy in rural Haryana – prevalence and treatment seeking behaviour. *J Indian Med Assoc*. 1997; 95(2): 37-47.

Cornaggia CM, Canevini MP, Christe W, Giuccioli D, Facheris MA, Sabbadini M, Canger R. Epidemiologic survey of epilepsy among Army draftees in Lombardy, Italy. *Epilepsia*. 1990; 31(1): 27-32.
Okuma T, Kumashiro H. Natural history and prognosis of epilepsy: report of a multi-institutional study in Japan. The group for the study of prognosis of epilepsy in Japan. *Epilepsia*. 1981; 22(1): 35-53.
Feksi AT, Kaamugisha J, Gatiti S, Sander JW, Shorvon SD. A comprehensive community epilepsy programme: the Nakuru project. *Epilepsy Res*. 1991; 8(3): 252-9.
Manonmani V, Tan CT. A study of newly diagnosed epilepsy in Malaysia. *Singapore Med J*. 1999; 40(1): 32-5.
Waaler PE, Blom BH, Skeidsvoll H, Mykletun A. Prevalence, classification, and severity of epilepsy in children in western Norway. *Epilepsia*. 2000; 41(7): 802-10.
Simms V, Atijosan O, Kuper H, Nuhu A, Rischewski D, Lavy C. Prevalence of epilepsy in Rwanda: a national cross-sectional survey. *Trop Med Int Health*. 2008; 13(8): 1047-53.
Mrabet H, Mrabet A, Zouari B, Ghachem R. Health-related quality of life of people with epilepsy compared with a general reference population: a Tunisian study. *Epilepsia*. 2004; 45(7): 838-43.
Sahin A, Bolayir E, Sumer H, Tas A, Mollaoglu M, Dener S. Epidemiologic evaluation of epileptic and nonepileptic seizures in Sivas region of middle Anatolia. *Neurol Psych Brain Res*. 2004; 11(2):97-102.
Calisir N, Bora I, Irgil E, Boz M. Prevalence of epilepsy in Bursa city center, an urban area of Turkey. *Epilepsia*. 2006; 47(10): 1691-9.
Chen R-C, Chang Y-C, Chen TH-H, Wu H-M, Liou H-H. Mortality in adult patients with epilepsy in Taiwan. *Epileptic Disord*. 2005; 7(3): 213-9.
Haerer AF, Anderson DW, Schoenberg BS. Prevalence and clinical features of epilepsy in a biracial United States population. *Epilepsia*. 1986; 27(1): 66-75.
Nwani PO, Nwosu MC, Asomugha LA, Enwereji KO, Arinzechi EO, Ogunniyi AO. Epidemiology of active epilepsy in a suburban community in Southeast Nigeria: A door-to-door survey. *Niger J Clin Pract*. 2015; 18(4): 527-33.
Hart YM, Shorvon SD. The nature of epilepsy in the general population. I. Characteristics of patients receiving medication for epilepsy. *Epilepsy Res*. 1995; 21(1): 43-9.
Tidman L, Saravanan K, Gibbs J. Epilepsy in mainstream and special educational primary school settings. *Seizure*. 2003; 12(1): 47-51.
Moran NF, Poole K, Bell G, Solomon J, Kendall S, McCarthy M, McCormick D, Nashef L, Sander J, Shorvon SD. Epilepsy in the United Kingdom: seizure frequency and severity, anti-epileptic drug utilization and impact on life in 1652 people with epilepsy. *Seizure*. 2004; 13(6): 425-33.
Winkler AS, Kerschbaumsteiner K, Stelzhammer B, Meindl M, Kaaya J, Schmutzhard E. Prevalence, incidence, and clinical characteristics of epilepsy--a community-based door-to-door study in northern Tanzania. *Epilepsia*. 2009; 50(10): 2310-3.
Koul R, Razdan S, Motta A. Prevalence and pattern of epilepsy (Lath/Mirgi/Laran) in rural Kashmir, India. *Epilepsia*. 1988; 29(2): 116-22.

Treated without fits regression

Kong ST, Ho CS, Ho PC, Lim SH. Prevalence of drug resistant epilepsy in adults with epilepsy attending a neurology clinic of a tertiary referral hospital in Singapore. *Epilepsy Res*. 2014; 108(7): 1253-62.
Fruchter E, Kapara O, Reichenberg A, Yoffe R, Fono-Yativ O, Kreiss Y, Davidson M, Weiser M. Longitudinal association between epilepsy and schizophrenia: a population-based study. *Epilepsy Behav*. 2014; 31: 291-4.
Tanaka A, Akamatsu N, Shouzaki T, Toyota T, Yamano M, Nakagawa M, Tsuji S. Clinical characteristics and treatment responses in new-onset epilepsy in the elderly. *Seizure*. 2013; 22(9): 772-5.
Nickels KC, Grossardt BR, Wirrell EC. Epilepsy-related mortality is low in children: a 30-year population-based study in Olmsted County, MN. *Epilepsia*. 2012; 53(12): 2164-71.
Picot M-C, Baldy-Moulinier M, Daurès J-P, Dujols P, Crespel A. The prevalence of epilepsy and pharmacoresistant epilepsy in adults: a population-based study in a Western European country. *Epilepsia*. 2008; 49(7): 1230-8.
Tse E, Hamiwka L, Sherman EM, Wirrell E. Social skills problems in children with epilepsy: prevalence, nature and predictors. *Epilepsy Behav*. 2007; 11(4): 499-505.
Ding D, Hong Z, Chen GS, Dai XY, Wu JZ, Wang WZ, De Boer HM, Sander JW, Prilipko L, Chisholm D. Primary care treatment of epilepsy with phenobarbital in rural China: Cost-outcome analysis from the WHO/ILAE/IBE global campaign against epilepsy demonstration project. *Epilepsia*. 2008; 49(3):535-9.
Houinato D, Yemadje L-P, Glitho G, Adjien C, Avode G, Druet-Cabanac M, Preux P-M. Epidemiology of epilepsy in rural Benin: prevalence, incidence, mortality, and follow-up. *Epilepsia*. 2013; 54(4): 757-63.
Hunter E, Rogathi J, Chigudu S, Jusabani A, Jackson M, Whittaker RG, Gray W, McNally RJ, Aris E, Mushi D, Walker R. The epilepsy treatment gap in rural Tanzania: A community-based study in adults. *Seizure*. 2016; 36: 49-56.
Kun LN, Ling LW, Wah YW, Lian TT. Epidemiologic study of epilepsy in young Singaporean men. *Epilepsia*. 1999; 40(10): 1384-7.

Treatment gap regression

Huang DH, Zheng JO, Chen J, Yu L. Treatment gaps of epilepsy and retention rates of sodium valproate in rural Guangxi, China. *Genet Mol Res*. 2014; 13(3): 6202-12.
Pandey S, Singhi P, Bharti B. Prevalence and treatment gap in childhood epilepsy in a north Indian city: a community-based study. *J Trop Pediatr*. 2014; 60(2): 118-23.
Farghaly WM, El-Tallawy HN, Rageh TA, Mohamed EM, Metwally NA, Shehata GA, Badry R, Abd-Elhamed MA. Epidemiology of uncontrolled epilepsy in the Al-Kharga District, New Valley, Egypt. *Seizure*. 2013; 22(8): 611-6.
Hunter E, Rogathi J, Chigudu S, Jusabani A, Jackson M, McNally R, Gray W, Whittaker RG, Iqbal A, Birchall D, Aris E, Walker R. Prevalence of active epilepsy in rural Tanzania: a large community-based survey in an adult population. *Seizure*. 2012; 21(9): 691-8.
Mbuba CK, Ngugi AK, Fegan G, Ibinda F, Muchohi SN, Nyundo C, Odhiambo R, Edwards T, Odermatt P, Carter JA, Newton CR. Risk factors associated with the epilepsy treatment gap in Kilifi, Kenya: a cross-sectional study. *Lancet Neurol*. 2012; 11(8): 688-96.
Malik MA, Akram RM, Tarar MA, Sultan A. Childhood epilepsy. *J Coll Physicians Surg Pak*. 2011;21(2): 74-8.

Zhao Y-H, Zhang Q, Long N, Yang C, Hong J, Mu L, Zhou D. Prevalence of epilepsy and alcohol-related risk in Zayul County, Tibet Autonomous Region in China: an initial survey. *Epilepsy Behav*. 2010;19(4): 635-8.

Nicoletti A, Sofia V, Vitale G, Bonelli SI, Bejarano V, Bartalesi F, Tran DS, Preux PM, Zappia M, Bartoloni A. Natural history and mortality of chronic epilepsy in an untreated population of rural Bolivia: a follow-up after 10 years. *Epilepsia*. 2009; 50(10): 2199-206.

Kobau R, Zahran H, Grant D, Thurman DJ, Price PH, Zack MM. Prevalence of active epilepsy and health-related quality of life among adults with self-reported epilepsy in California: California Health Interview Survey, 2003. *Epilepsia*. 2007; 48(10): 1904-13.

Noronha ALA, Borges MA, Marques LHN, Zanetta DMT, Fernandes PT, de Boer H, Espíndola J, Miranda CT, Prilipko L, Bell GS, Sander JW, Li LM. Prevalence and pattern of epilepsy treatment in different socioeconomic classes in Brazil. *Epilepsia*. 2007; 48(5): 880-5.

Oun A, Haldre S, Magi M. Use of antiepileptic drugs in Estonia: an epidemiologic study of adult epilepsy. *Eur J Neurol*. 2006; 13(5): 465-70.

Kochen S, Melcon MO. Prognosis of epilepsy in a community-based study: 8 years of follow-up in an Argentine community. *Acta Neurol Scand*. 2005; 112(6): 370-4.

Somoza MJ, Forlenza RH, Brussino M, Licciardi L. Epidemiological survey of epilepsy in the primary school population in Buenos Aires. *Neuroepidemiology*. 2005; 25(2): 62-8.

Gomes Md M da M, Zeitoune RG, Kropf LAL, van Beeck Ed E da S. A house-to-house survey of epileptic seizures in an urban community of Rio de Janeiro, Brazil. *Arq Neuropsiquiatr*. 2002; 60(3-B): 708-11.

Wang W, Wu J, Wang D, Chen G, Wang T, Yuan C, Yang B, Zhao D. [Epidemiological survey on epilepsy among rural populations in five provinces in China]. *Nat Med J Chin*. 2002; 82(7): 449-52.

Zhao Y, Zhang Q, Tsering T, Sangwan, Hu X, Liu L, Shang H, Chen Q, Liu Y, Yang X, Wang W, Li S, Wu J, Sander JW, Zhou D. Prevalence of convulsive epilepsy and health-related quality of life of the population with convulsive epilepsy in rural areas of Tibet Autonomous Region in China: an initial survey. *Epilepsy Behav*. 2008; 12(3): 373-81.

Placencia M, Shorvon SD, Paredes V, Bimos C, Sander JW, Suarez J, Cascante SM. Epileptic seizures in an Andean region of Ecuador. Incidence and prevalence and regional variation. *Brain*. 1992;115 (Pt 3): 771-82.

Del Brutto OH, Santibáñez R, Idrovo L, Rodrìguez S, Díaz-Calderón E, Navas C, Gilman RH, Cuesta F, Mosquera A, Gonzalez AE, Tsang VCW, García HH. Epilepsy and neurocysticercosis in Atahualpa: a door-to-door survey in rural coastal Ecuador. *Epilepsia*. 2005; 46(4): 583-7.

Benavente I, Rubio E, Morales C, Tajada N, Tamargo P. Prevalence of epilepsy amongst adolescents in Huesca, Spain: a community-based study. *Eur J Neurol*. 2009; 16(10): 1138-43.

Tekle-Haimanot R, Forsgren L, Ekstedt J. Incidence of epilepsy in rural central Ethiopia. *Epilepsia*. 1997; 38(5): 541-6.

Almu S, Tadesse Z, Cooper P, Hackett R. The prevalence of epilepsy in the Zay Society, Ethiopia – an area of high prevalence. *Seizure*. 2006; 15(3): 211-3.

Löfgren E, Pouta A, von Wendt L, Tapanainen J, Isojärvi JIT, Järvelin M-R. Epilepsy in the northern Finland birth cohort 1966 with special reference to fertility. *Epilepsy Behav*. 2009; 14(1): 102-7.

Jallon P. [Evaluation of the prevalence of epilepsy in a military selection centre]. *Rev Neurol* (Paris). 1991; 147(4): 319-22.

Ross EM, Peckham CS, West PB, Butler NR. Epilepsy in childhood: findings from the National Child Development Study. *BMJ*. 1980; 280(6209): 207-10.

Coleman R, Loppy L, Walraven G. The treatment gap and primary health care for people with epilepsy in rural Gambia. *Bull World Health Organ*. 2002; 80(5): 378-83.

Medina MT, Durón RM, Martínez L, Osorio JR, Estrada AL, Zúniga C, Cartagena D, Collins JS, Holden KR. Prevalence, incidence, and etiology of epilepsies in rural Honduras: the Salama Study. *Epilepsia*. 2005; 46(1): 124-31.

Koul R, Razdan S, Motta A. Prevalence and pattern of epilepsy (Lath/Mirgi/Laran) in rural Kashmir, India. *Epilepsia*. 1988; 29(2): 116-22.

Mani KS, Rangan G, Srinivas HV, Kalyanasundaram S, Narendran S, Reddy AK. The Yelandur study: a community-based approach to epilepsy in rural South India – epidemiological aspects. *Seizure*. 1998; 7(4): 281-8.

Saha SP, Bhattacharya S, Das SK, Maity B, Roy T, Raut DK. Epidemiological study of neurological disorders in a rural population of Eastern India. *J Indian Med Assoc*. 2003; 101(5): 299-304.

Hackett RJ, Hackett L, Bhakta P. The prevalence and associated factors of epilepsy in children in Calicut District, Kerala, India. *Acta Paediatr*. 1997; 86(11): 1257-60.

Banerjee TK, Ray BK, Das SK, Hazra A, Ghosal MK, Chaudhuri A, Roy T, Raut DK. A longitudinal study of epilepsy in Kolkata, India. *Epilepsia*. 2010; 51(12): 2384-91.

Sureka RK, Sureka R. Prevalence of epilepsy in rural Rajasthan--a door-to-door survey. *J Assoc Physicians India*. 2007; 55: 741-2.

Edwards T, Scott A, Munyoki G, Odera V, Chengo E, Bauni E, Kwasa T, Sander L, Neville B, Newton C. Active convulsive epilepsy in a rural district of Kenya: a study of prevalence and possible risk factors. *Lancet Neurol*. 2008; 7(1): 50-6.

Tran D-S, Odermatt P, Le T-O, Huc P, Druet-Cabanac M, Barennes H, Strobel M, Preux P-M. Prevalence of epilepsy in a rural district of central Lao PDR. *Neuroepidemiology*. 2006; 26(4): 199-206.

Traore M, Tahny R, Sacko M. Prévalence de l'épilepsie chez les enfants de 3 à 15 ans dans 2 communes du district de Bamako. *Rev Neurol* (Paris). 2000; 156(Suppl 1): S18.

Brodtkorb E, Sjaastad O. Epilepsy prevalence by individual interview in a Norwegian community. *Seizure*. 2008; 17(7): 646-50.

Svendsen T, Lossius M, Nakken KO. Age-specific prevalence of epilepsy in Oppland County, Norway. *Acta Neurol Scand*. 2007; 116(5): 307-11.

Aziz H, Güvener A, Akhtar SW, Hasan KZ. Comparative epidemiology of epilepsy in Pakistan and Turkey: population-based studies using identical protocols. *Epilepsia*. 1997; 38(6): 716-22.

Ndoye NF, Sow AD, Diop AG, Sessouma B, Séne-Diouf F, Boissy L, Wone I, Touré K, Ndiaye M, Ndiaye P, de Boer H, Engel J, Mandlhate C, Meinardi H, Prilipko L, Sander JWAS. Prevalence of epilepsy its treatment gap and knowledge, attitude and practice of its population in sub-urban Senegal an ILAE/IBE/WHO study. *Seizure*. 2005; 14(2): 106-11.

Karaagaç N, Yeni SN, Senocak M, Bozluolçay M, Savrun FK, Ozdemir H, Cagatay P. Prevalence of epilepsy in Silivri, a rural area of Turkey. *Epilepsia*. 1999; 40(5): 637-42

Topalkara K, Akyuz A, Sumer H, Bekar D, Topaktas S, Dener S. An epilepsy prevalence study performed using a stratified sampling method among urban residents of Sivas. *Epilepsi*. 1999; 5(1): 24-9.

Sahin A, Bolayir E, Sumer H, Tas A, Mollaoglu M, Dener S. Epidemiologic evaluation of epileptic and nonepileptic seizures in Sivas region of middle Anatolia. *Neurol Psych Brain Res*. 2004; 11(2): 97-102.

Calisir N, Bora I, Irgil E, Boz M. Prevalence of epilepsy in Bursa city center, an urban area of Turkey. *Epilepsia*. 2006; 47(10): 1691-9.

Su C, Chang S, Chen Z, Lee C, Chen R. Neuroepidemiological survey in Ilan, Taiwan (NESIT): (4) Prevalence of epilepsy. *Acta Neurol Taiwan*. 1998; 7(2): 75-84.

Dent W, Helbok R, Matuja WBP, Scheunemann S, Schmutzhard E. Prevalence of active epilepsy in a rural area in South Tanzania: a door-to-door survey. *Epilepsia*. 2005; 46(12): 1963-9.

Winkler AS, Kerschbaumsteiner K, Stelzhammer B, Meindl M, Kaaya J, Schmutzhard E. Prevalence, incidence, and clinical characteristics of epilepsy--a community-based door-to-door study in northern Tanzania. *Epilepsia*. 2009; 50(10): 2310-3.

Chiang KL, Cheng CY. Prevalence and neuro-psychiatric comorbidities of pediatric epilepsy in Taiwan: a national population-based study. *Epilepsy Res*. 2014; 108(8): 1451-60.

Khedr EM, Shawky OA, Ahmed MA, Elfetoh NA, Al Attar G, Ali AM, Kandil MR, Farweez H. A community based epidemiological study of epilepsy in Assiut Governorate/Egypt. *Epilepsy Res*. 2013; 103(3-Feb): 294-302.

Hu J, Si Y, Zhou D, Mu J, Li J, Liu L, Zhu CR, Deng Y, He J, Zhang NM, Chen XF. Prevalence and treatment gap of active convulsive epilepsy: a large community-based survey in rural West China. *Seizure*. 2014; 23(5): 333-7.

Nwani PO, Nwosu MC, Enwereji KO, Asomugha AL, Arinzechi EO, Ogunniyi AO. Epilepsy treatment gap: prevalence and associated factors in Southeast Nigeria. *Acta Neurol Scand*. 2013; 128(2): 83-90.

El-Tallawy HN, Farghaly WM, Shehata GA, Abdel-Hakeem NM, Rageh TA, Abo-Elftoh NA, Hegazy A, Badry R. Epidemiology of epilepsy in New Valley Governorate, Al Kharga District, Egypt. *Epilepsy Res*. 2013; 104(2-Jan): 167-74.

Pi X, Zhou L, Cui L, Liu A, Zhang J, Ma Y, Liu B, Cai C, Zhu C, Zhou T, Chen J, Zhou Z, Wang C, Li L, Li S, Wu J, Xiao B. Prevalence and clinical characteristics of active epilepsy in southern Han Chinese. *Seizure*. 2014; 23(8): 636-40.

Lomidze G, Kasradze S, Kvernadze D, Okujava N, Toidze O, de Boer HM, Dua T, Sander JW. The prevalence and treatment gap of epilepsy in Tbilisi, Georgia. *Epilepsy Res*. 2012; 98(2-3): 123-9.

Goel D, Dhanai JS, Agarwal A, Mehlotra V, Saxena V. Neurocysticercosis and its impact on crude prevalence rate of epilepsy in an Indian community. *Neurol India*. 2011; 59(1): 37-40.

Velioglu SK, Bakirdemir M, Can G, Topbas M. Prevalence of epilepsy in northeast Turkey. *Epileptic Disord*. 2010; 12(1): 22-37.

El-Tallawy HN, Farghaly WM, Rageh TA, Shehata GA, Metwally NA, Badry R, Sayed MA, Abdelwarith AM, Kandil MR, Hamed MA, Mohamed KO, Tohamy AM. Spectrum of epilepsy - prevalence, impact, and treatment gap: an epidemiological study from Al-Quseir, Egypt. *Neuropsychiatr Dis Treat*. 2016; 12: 1111-8.

Hunter E, Rogathi J, Chigudu S, Jusabani A, Jackson M, Whittaker RG, Gray W, McNally RJ, Aris E, Mushi D, Walker R. The epilepsy treatment gap in rural Tanzania: A community-based study in adults. *Seizure*. 2016; 36: 49-56.

Serrano-Castro PJ, Mauri-Llerda JA, Hernandez-Ramos FJ, Sanchez-Alvarez JC, Parejo-Carbonell B, Quiroga-Subirana P, Vazquez-Gutierrez F, Santos-Lasaosa S, Mendez-Lucena C, Redondo-Verge L, Tejero-Juste C, Morandeira-Rivas C, Sancho-Rieger J, Matias-Guiu J. Adult Prevalence of Epilepsy in Spain: EPIBERIA, a Population-Based Study. *Scientific World Journal*. 2015; 2015: 602710.

Hashem S, Al-Kattan M, Ibrahim SY, Shalaby NM, Shamloul RM, Farrag M. Epilepsy prevalence in Al-Manial Island, Egypt. A door-to-door survey. *Epilepsy Res*. 2015; 117: 133-7.

Sebera F, Munyandamutsa N, Teuwen DE, Ndiaye IP, Diop AG, Tofighy A, Boon P, Dedeken P. Addressing the treatment gap and societal impact of epilepsy in Rwanda--Results of a survey conducted in 2005 and subsequent actions. *Epilepsy Behav*. 2015; 46: 126-32.

Banerjee TK, Dutta S, Ray BK, Ghosal M, Hazra A, Chaudhuri A, Das SK. Epidemiology of epilepsy and its burden in Kolkata, India. *Acta Neurol Scand*. 2015; 132(3): 203-11.

Wang WZ, Wu JZ, Wang DS, Dai XY, Yang B, Wang TP, Yuan CL, Scott RA, Prilipko LL, de Boer HM, Sander JW. The prevalence and treatment gap in epilepsy in China: an ILAE/IBE/WHO study. *Neurology*. 2003; 60(9): 1544–5.

Nizamie SH, Akthar S, Banerjee I, Goyal N. Health care delivery model in epilepsy to reduce treatment gap: World Health Organization study from a rural tribal population of India. *Epilepsy Res*. 2009; 84(2–3): 146–52.

Banerjee TK, Hazra A, Biswas A, Ray J, Roy T, Raut DK, Chaudhuri A, Das SK. Neurological disorders in children and adolescents. *Indian J Pediatr*. 2009; 76(2): 139-46.

Goel D, Agarwal A, Dhanai JS, Semval VD, Mehrotra V, Saxena V, Maithili B. Comprehensive rural epilepsy surveillance programme in Uttarakhand state of India. *Neurol India*. 2009; 57(3): 355–6.

Pal DK, Das T, Sengupta S. Comparison of key informant and survey methods for ascertainment of childhood epilepsy in West Bengal, India. *Int J Epidemiol*. 1998; 27(4): 672–6.

Levy LF. Epilepsy in Rhodesia, Zambia, and Malawi. *Afr J Med Sci*. 1970; 1: 291-203.

Kun LN, Ling LW, Wah YW, Lian TT. Epidemiologic study of epilepsy in young Singaporean men. *Epilepsia*. 1999; 40(10): 1384-7.

Non-fatal estimates

The guidelines for epidemiological studies on epilepsy, its classification and definition from the International League Against Epilepsy (ILAE)[7,8] formed the basis for our reference definition. An epilepsy case was defined as someone with an active, recurring condition of epileptic seizures, at least two, unprovoked by any immediate cause, and who has had at least one epileptic seizure in the past five years regardless of antiepileptic drug treatment.[7] We utilised data from additional sources from 2016 to January 2022. This latest systematic review covered January 10, 2016, to January 28, 2022. This review yielded 24 new sources on two measures (see appendix p. 6 for details). The studies that were included were population-based, representative surveys that reported prevalence, incidence, remission rate, excess mortality rate, relative risk of mortality, standardised mortality ratio, or with-condition mortality rate. Studies that had no clearly defined sample were excluded. Studies that recorded the lifetime recall of epilepsy were crosswalked (the process of adjusting data for known biases) to the reference definition for epilepsy. We used clinical claims data from Poland in 2018 and Taiwan (province of China) from 2016. These data were defined in ICD-10 terms. When a study reported both age- and sex-specific data separately, the male:female proportion was taken from the sex-specific data and was applied to the individual age-specific data to get age- and sex-specific estimates. Using a GBD meta-regression—Bayesian, regularised, trimmed (MR-BRT) method[9] on the

log male:female ratio of prevalence, we split observations where sex was reported for males and females combined into observations for males and females separately. Data which covered an age period of more than 25 years were split into five-year age bands using the age patterns discerned from DisMod-MR 2.1,[10] a Bayesian meta-regression tool, built on a subset of the epilepsy data with age bands less than 25 years. DisMod-MR 2.1 was also used to model prevalence and incidence for overall epilepsy. The log-transformed lag-distributed income per capita (LDI)[11] was used as a covariate for the excess mortality rate to account for the expected lower mortality rate of epilepsy in countries with higher Socio-demographic Index (SDI, a composite measure of lag-distributed income per capita, average years of education for those aged 15 years or older, and fertility rates among females younger than 25 years). Similarly, the log-transformed age-standardised GBD health indicator summary exposure value (SEV, a single, interpretable measure which captures risk-weighted exposure for a population, or risk-weighted prevalence of an exposure), was a covariate for prevalence and summarised the epilepsy exposure risk level for each country.

Cause of Death Ensemble model

For assessment of mortality due to epilepsy, we used underlying cause of death (CoD), with corrections made to CoD data.[12] Data used to estimate epilepsy mortality included vital registration (VR), verbal autopsy, and China mortality surveillance data The International Classification of Diseases (ICD) was used to re-assign intermediary or unspecified causes. The codes for epilepsy for both ICD-9 (Code 345) and ICD-10 (Codes G40 and G41) were used. A Cause of Death Ensemble model[12] was used to model mortality. This is a method produced specifically for cause of death analysis in the GBD study. A site-year is a unique combination of calendar year, location, and data source. The Cause of Death Ensemble model for epilepsy also utilised predictive covariates for pigs (per capita), proxy for neurocysticercosis infection, SEV scalar: epilepsy, mean systolic blood pressure (mmHg), Healthcare Access and Quality Index, mean body-mass index, mean serum total cholesterol (mmol/L), cumulative cigarettes (10 years), cumulative cigarettes (5 years), education (years per capita), log LDI (per capita), and Socio-demographic Index. More information on calculations can be found in in the GBD 2021 risk factor overview paper.[13]

GATHER compliance table

GATHER checklist of information that should be included in reports of global health estimates, with description of compliance and location of information for GBD 2021 (Table 1).

Table 1. GATHER checklist

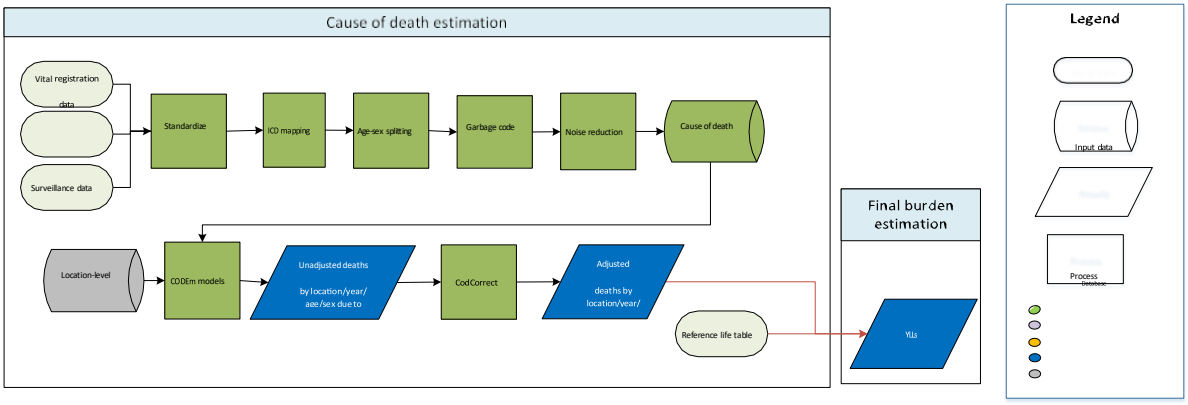
#	GATHER checklist item	Description of compliance	Reference
Objectives and funding			
1	Define the indicators, populations, and time periods for which estimates were made.	Narrative provided in paper and appendix describing indicators, definitions, and populations	Main text (Methods) and appendix
2	List the funding sources for the work.	Funding sources listed in paper	Summary (Funding)
Data Inputs			
For all data inputs from multiple sources that are synthesised as part of the study:			

3	Describe how the data were identified and how the data were accessed.	Narrative description of data seeking methods provided	Main text (Methods) and appendix
4	Specify the inclusion and exclusion criteria. Identify all ad-hoc exclusions.	Narrative about inclusion and exclusion criteria by data type provided; ad hoc exclusions in cause-specific write-ups	Main text (Methods) and appendix
5	Provide information on all included data sources and their main characteristics. For each data source used, report reference information or contact name/institution, population represented, data collection method, year(s) of data collection, sex and age range, diagnostic criteria or measurement method, and sample size, as relevant.	An interactive, online data source tool that provides metadata for data sources by component, geography, cause, risk, or impairment has been developed	Online data citation tools: http://ghdx.healthdata.org/gbd-2016
6	Identify and describe any categories of input data that have potentially important biases (e.g., based on characteristics listed in item 5).	Summary of known biases by cause included in appendix	Appendix
For data inputs that contribute to the analysis but were not synthesised as part of the study:			
7	Describe and give sources for any other data inputs.	Included in online data source tool	http://ghdx.healthdata.org/gbd-2016
For all data inputs:			
8	Provide all data inputs in a file format from which data can be efficiently extracted (e.g., a spreadsheet as opposed to a PDF), including all relevant meta-data listed in item 5. For any data inputs that cannot be shared due to ethical or legal reasons, such as third-party ownership, provide a contact name or the name of the institution that retains the right to the data.	Downloads of input data available through online tools, including data visualisation tools and data query tools; input data not available in tools will be made available upon request	Online data visualisation tools, data query tools, and the Global Health Data Exchange
Data analysis			
9	Provide a conceptual overview of the data analysis method. A diagram may be helpful.	Flow diagrams of the overall methodological processes, as well as cause-specific modelling processes, have been provided	Main text (Methods) and appendix
10	Provide a detailed description of all steps of the analysis, including mathematical formulae. This description should cover, as relevant, data cleaning, data pre-processing, data adjustments and weighting of data sources, and mathematical or statistical model(s).	Flow diagrams and corresponding methodological write- ups for each cause, as well as the databases and modelling processes, have been provided	Main text (Methods) and appendix
11	Describe how candidate models were evaluated and how the final model(s) were selected.	Provided in the methodological write- ups	Appendix
12	Provide the results of an evaluation of model performance, if done, as well as the results of any relevant sensitivity analysis.	Provided in the methodological write- ups	Appendix

13	Describe methods for calculating uncertainty of the estimates. State which sources of uncertainty were, and were not, accounted for in the uncertainty analysis.	Appendix	Appendix
14	State how analytic or statistical source code used to generate estimates can be accessed.	Appendix	http://ghdx.healthdata.o rg/gbd-2016-code
Results and Discussion			
15	Provide published estimates in a file format from which data can be efficiently extracted.	GBD 2016 results are available through online data visualisation tools, the Global Health Data Exchange, and the online data query tool	Main text, and online data tools (data visualisation tools, data query tools, and the Global Health Data Exchange)
16	Report a quantitative measure of the uncertainty of the estimates (e.g. uncertainty intervals).	Uncertainty intervals are provided with all results	Main text, appendix, and online data tools (data visualisation tools, data query tools, and the Global Health Data Exchange)
17	Interpret results in light of existing evidence. If updating a previous set of estimates, describe the reasons for changes in estimates.	Discussion of methodological changes between GBD rounds provided in the narrative of the manuscript and appendix	Main text (Methods and Discussion) and appendix
18	Discuss limitations of the estimates. Include a discussion of any modelling assumptions or data limitations that affect interpretation of the estimates.	Discussion of limitations provided in the narrative of the main paper, as well as in the methodological write-ups in the appendix	Main text (Limitations) and appendix

Epilepsy mortality

Flowchart



Input data

Data used to estimate epilepsy mortality included vital registration (VR), verbal autopsy, and China mortality surveillance data from the cause of death (CoD) database. Our outlier criteria were to exclude datapoints that (1) were implausibly high or low relative to global or regional patterns, (2) substantially conflicted with established age or temporal patterns, or (3) significantly conflicted with other data sources from the same locations or locations with similar characteristics (i.e., Socio-demographic Index).

Based on these criteria, we excluded ICD-9 BTL data for Sri Lanka, Fiji, and Kiribati, as the estimates varied from year to year between zero and high values. We also excluded the Survey of Causes of Death Data and Medical Certification of Cause of Death Data for India, as these data types were not consistent with the Sample Registration System Data and would have led to discontinuities in our estimates over time.

Modelling strategy

The standard CODEm modelling approach was applied to estimate deaths due to epilepsy. Separate models were conducted for male and female mortality, and the age range for both models was 28 days – 95+ years. For GBD 2021, the health systems access covariate was replaced with the Healthcare Access and Quality Index covariate. There were no other substantial changes for GBD 2021. The covariates used are displayed below (Table 2).

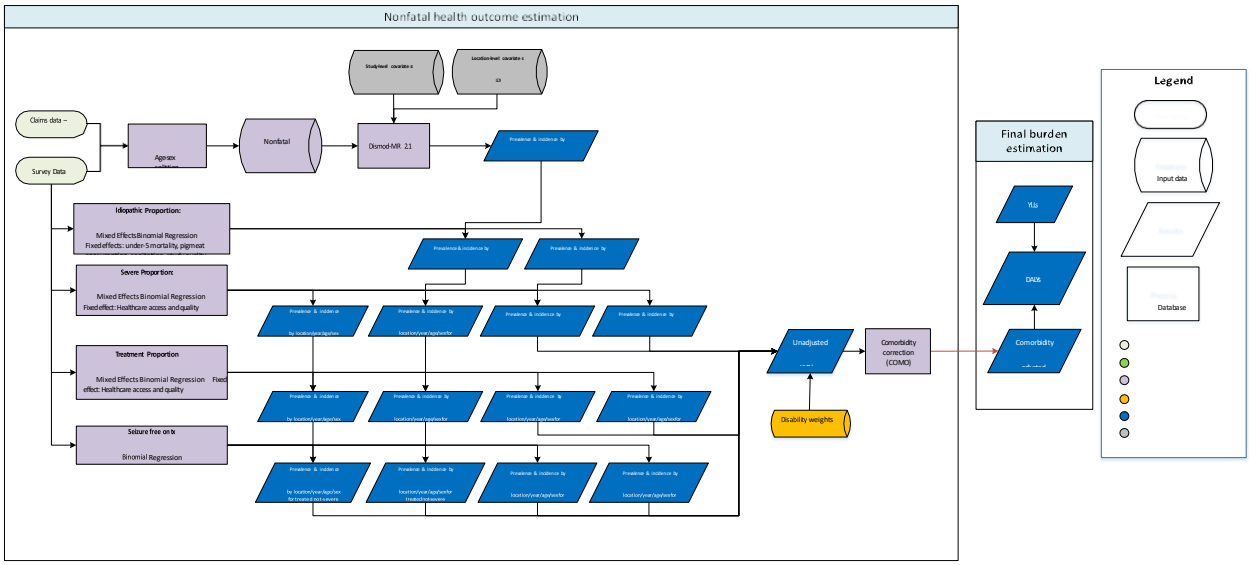
Table 2. List of covariates

Level	Covariate	Direction
1	pig meat consumption (kcal per capita)	+
	pigs (per capita)	+
	SEV scalar: epilepsy	+
	mean systolic blood pressure (mmHg)	+
2	Healthcare Access and Quality Index	-
	mean body-mass index	+
	mean serum total cholesterol (mmol/L)	+
3	cumulative cigarettes (10 years)	+
	cumulative cigarettes (5 years)	+

	education (years per capita)	-
	log LDI (per capita)	-
	Socio-demographic Index	-
	mean systolic blood pressure (mmHg)	+
2	Healthcare Access and Quality Index	-
	mean body-mass index	+
	mean serum total cholesterol (mmol/L)	+
3	cumulative cigarettes (10 years)	+
	cumulative cigarettes (5 years)	+
	education (years per capita)	-
	log LDI (per capita)	-
	Socio-demographic Index	-

Epilepsy impairment

Flowchart



Case definition

Since GBD 2013, we have used the following definitions from the "Guidelines for Epidemiologic Studies on Epilepsy": 1) Epilepsy: a condition characterised by recurrent (two or more) epileptic seizures, unprovoked by any immediate identified cause, and 2) "Active" epilepsy: a prevalent case of active epilepsy is defined as a person with epilepsy who has had at least one epileptic seizure in the previous five years, regardless of antiepileptic drug (AED) treatment. We also use the following ICD-10 codes for epilepsy: G40 (Neuro, epilepsy, total) and G41 (Neuro, epilepsy, status epilepticus). We defined severe epilepsy as having seizures one or more times per month.

Input data

The inputs for the regressions used to split the epilepsy impairment envelope were also updated for GBD 2021. These regressions are used to determine the proportion of epilepsy that is primary or idiopathic.

Disability weights

To adjust for differences in methodological quality, all prevalence studies included in GBD were scored according to a modified version (dichotomised variables) of published methodological quality criteria for epilepsy epidemiological studies, taking into account the representativeness of the population of interest (representative of country or community versus selected population), quality of sampling (random sample of the population of interest versus not random sample), recall period (one-year prevalence versus other recall period), participation rate (≥70% versus <70%), survey method (face to face with epilepsy expert or trained interviewer versus other), validation of diagnostic instrument (sensitivity or specificity ≥70% versus <70% or no validation). In DisMod-MR, these methodological variables were evaluated for a systematic difference and corrected accordingly.

Modelling strategy

We modelled the prevalence of epilepsy in two steps: first, we created an epilepsy impairment envelope. Second, we split the envelope into primary (or idiopathic) and secondary epilepsies. Each of these were subdivided into "severe" (on average one or more fits per month) and "non-severe." Non-severe cases were subdivided into "treated" and "untreated." Finally, "treated" cases were divided into "treated cases with fits" (between one and 11 fits on average in the preceding year) and "treated cases without fits" (no fits reported in the preceding year).

In the first step, we used the DisMod-MR tool for the epilepsy impairment envelope to model a consistent fit between incidence, prevalence, remission, and standardised mortality ratio data while using meta-regression to correct datapoints with non-reference study quality characteristics. We found no systematic bias for the covariate "non-standard case definition", indicating studies that did not define "active epilepsy"; additionally, the covariate was not significant as a "z-cov", which acts as a multiplier applied to the standard error and thus results in these datapoints being given less weight in the analysis than the "reference" datapoints. Therefore, we excluded this covariate from the model. We also included data on lifetime prevalence and therefore added a covariate on lifetime prevalence datapoints. We also included country-level covariates on prevalence for the SEV epilepsy scalar, which summarises the epilepsy risk exposure level for each country, and pig meat consumption per capita, which is used as a proxy for the level of neurocysticercosis, a common cause of secondary epilepsy. We included cause-specific mortality rate (CSMR) results from the epilepsy mortality model as input data to the DisMod model. Where age-specific prevalence data were available, we calculated excess mortality rate (EMR) from prevalence and CSMR. We included the log of the lag-distributed income (LDI) as a covariate on EMR to account for lower mortality in developed countries. We included Bayesian priors on remission to account for the scarcity of remission data. We set bounds on remission from 0 to 0.25 from age 0 to 60 and 0 to 0.05 from age 61 to 100.

In the second step, we used a mixed-effects generalised linear model (binomial family) to predict the proportion of idiopathic epilepsy, the proportion of severe epilepsy, the proportion of treated epilepsy, and the proportion of epilepsy that is treated without fits.

Because not all of the data on the proportion of idiopathic epilepsy use optimal case-finding methods (using CT scans or MRIs in addition to EEGs in order to diagnose secondary epilepsy), for GBD 2021 we decided to add a covariate to crosswalk studies with non-optimal case-finding methods to those with adequate methods. The regression for the proportion of epilepsy that is idiopathic therefore has fixed effects on this study quality covariate as well as the under-5 mortality rate, the log of pig meat consumption (per capita), and the proportion of a country with access to proper sanitation, as well as a random effect on super-region.

We used similar models to predict the proportion of severe epilepsy and treatment gap based on the reported proportions extracted from the systematic review. To predict the proportion of severe epilepsy and the treatment gap, we used mixed-effects models with a fixed effect on the log of HAQ Index and a random effect on super-region.

For GBD 2015, a meta-analysis was used to generate two different pooled estimates for proportion of treated epilepsy that is seizure-free in developing and developed countries, as there were not enough data to run a regression. However, for GBD 2021, the expanded dataset allowed for the implementation of a generalised linear model (binomial family) to generate predictions for the proportion of treated epilepsy that is seizure-free. We used a fixed effect on the log of HAQ Index.

Studies which did not use advanced diagnostic methods were readjusted to those that used in a similar region all possible diagnostic methods for secondary epilepsy using a binary covariate for study quality based on whether the study explicitely described use of neuroimaging diagnostics across all study participants. We tagged estimates in both HICs and LMICs as having done 'proper'/full work-up or not and adjusted them accordingly. In other words, we used a binary covariate for study quality based on whether the study explicitly described use of imaging diagnostics across all study participants. "High quality" tags were not unique to "high-income" countries. We've copied below an example of breakdown of how studies were tagged by country. Therefore, the adjustments in LMICs and HICs were made based upon similar to economic development areas that did use advanced methods as shown in the screenshot.

	A	B	C
1	**Country**	**Imaging used for all participants**	**Imaging not used for all participants**
2	Brazil	2	0
3	Canada	0	1
4	China	4	3
5	Costa Rica	1	0
6	Croatia	1	0
7	Cuba	1	1
8	DRC	1	0
9	Egypt	4	1
10	Estonia	2	1
11	Ethiopia	0	1
12	Finland	0	2
13	France	0	1
14	Georgia	1	0
15	Germany	1	0
16	Honduras	1	0
17	Iceland	2	0
18	India	2	4
19	Italy	1	1
20	Japan	1	1
21	Kenya	0	2
22	Lao	0	1
23	Libya	0	1
24	Madagascar	0	2
25	Malaysia	0	1
26	Mali	1	0
27	Mexico	1	2
28	Mongolia	1	0
29	Netherlands	0	1
30	Nigeria	1	3
31	Norway	1	0
32	Pakistan	1	0
33	Peru	0	1
34	Saudi Arabia	1	0
35	Senegal	1	0
36	Singapore	1	2
37	South Korea	1	0
38	Spain	3	3
39	Sweden	1	2
40	Tanzania	0	3
41	Turkey	2	0
42	UK	2	0
43	USA	3	1
44	Vietnam	0	1
45	Zambia	0	1
46	Zimbabwe	0	1
47			

We tested a fixed effect on Socio-demographic Index (SDI) and random effects on region and country in different models, but they did not improve the model. We generated 500 draws of country-specific estimates for each year between 1980 and 2021 for each of the models.

Definition of GBD super-regions and regions

Table 7. GBD super-regions and regions

Super-region	Region_name
East Asia, southeast Asia and Oceania	East Asia
	Southeast Asia
	Oceania
Central Asia, central Europe, eastern Europe	Central Asia
	Central Europe
	Eastern Europe
High income	High-income Asia Pacific
	Australasia
	Western Europe
	High-income North America
	Southern Latin America
Latin America & Caribbean	Caribbean
	Andean Latin America
Central Latin America	
	Tropical Latin America
North Africa and Middle East	North Africa and Middle East
South Asia	South Asia
Sub-Saharan Africa	Central sub-Saharan Africa
	Eastern sub-Saharan Africa
	Southern sub-Saharan Africa
	Western sub-Saharan Africa

Tables of the epilepsy burden estimates

Table 1. Absolute number, with 95% uncertainty intervals (UI), of deaths, DALYs, and incidence associated with idiopathic epilepsy in 2021 and percentage change in the age-standardised metrics for 1990–2021 by seven GBD super-regions, 21 GBD regions, and 204 countries/territories

Region, country	Incidence		Deaths		DALYs	
	Counts	% change in age-standardised rates, 1990–2021	Counts	% change in age-standardised rates, 1990–2021	Counts	% change in age-standardised rates, 1990–2021
Global	3,272,734 (2,403,802 to 4,125,119)	12.3% (-4.8 to 32.6)	139,851 (116,953 to 153,370)	-15.8% (-22.8 to -8.8)	13,877,827 (10,732,569 to 17,619,993)	-14.5% (-24.2 to -4.2)
High income region	521,937 (347,791 to 693,196)	9.1% (-13.2 to 28.7)	18,152 (16,351 to 19,399)	18.1% (9.3 to 23.8)	1,402,064 (941,460 to 2,073,856)	-3.2% (-18.4 to 13.3)
High income Asia Pacific	71,299 (44,656 to 98,720)	7.7% (-26.0 to 49.7)	2,303 (2,011 to 2,517)	13.4% (-6.2 to 25.1)	181,526 (116,478 to 288,640)	-12.0% (-38.5 to 23.8)
High income North America	143,834 (90,670 to 199,908)	15.5% (-10.7 to 38.8)	3,822 (3,582 to 3,979)	21.4% (17.3 to 24.8)	423,104 (271,625 to 643,343)	6.7% (-13.8 to 31.9)
Southern Latin America	32,871 (15,909 to 49,491)	10.0% (-45.5 to 124.7)	761 (714 to 811)	-12.9% (-19.2 to -5.6)	93,165 (55,654 to 147,779)	-14.9% (-49.0 to 46.0)
Western Europe	260,298 (164,172 to 344,965)	8.5% (-21.2 to 44.6)	10,905 (9,548 to 11,837)	25.9% (13.1 to 34.6)	668,962 (460,088 to 990,189)	-3.3% (-25.6 to 21.9)
Australasia	13,634 (5,442 to 21,149)	-1.7% (-60.2 to 145.7)	361 (334 to 386)	-26.5% (-31.7 to -20.9)	35,307 (19,319 to 62,512)	-22.4% (-58.9 to 48.0)
Latin America and Caribbean	366,402 (264,770 to 476,603)	-4.1% (-23.8 to 23.0)	10,545 (9,612 to 11,506)	-14.5% (-21.8 to -6.8)	1,318,898 (987,773 to 1,773,671)	-23.6% (-37.8 to -8.2)
Central Latin America	173,731 (121,135 to 229,075)	-3.7% (-28.7 to 31.0)	4,826 (4,221 to 5,499)	-22.3% (-32.1 to -11.7)	636,587 (455,770 to 857,865)	-25.4% (-41.4 to -7.0)
Tropical Latin America	121,093 (81,539 to 161,143)	-9.6% (-35.0 to 34.5)	3,795 (3,622 to 3,937)	18.3% (11.8 to 24.2)	422,868 (301,544 to 584,924)	-20.4% (-39.7 to 7.1)
Andean Latin America	47,503 (25,464 to 68,780)	2.0% (-49.9 to 120.6)	912 (755 to 1,093)	-45.1% (-55.1 to -34.0)	154,769 (96,445 to 230,916)	-34.4% (-62.9 to 15.4)
Caribbean	24,075 (15,128 to 33,912)	-0.1% (-35.6 to 54.2)	1,012 (840 to 1,221)	-19.4% (-32.0 to -6.0)	104,675 (75,798 to 143,105)	-14.6% (-35.9 to 9.9)
Sub-Saharan Africa	713,285 (484,928 to 952,443)	7.5% (-14.6 to 39.6)	38,666 (31,461 to 45,776)	-11.5% (-23.9 to 2.4)	3,672,786 (2,873,814 to 4,586,892)	-8.5% (-20.8 to 5.2)
Southern sub-Saharan Africa	46,002 (29,386 to 63,986)	1.5% (-30.7 to 51.1)	1,920 (1,668 to 2,371)	-5.3% (-22.1 to 16.1)	206,134 (155,806 to 263,097)	-7.8% (-25.9 to 18.3)
Western sub-Saharan Africa	323,994 (220,101 to 431,752)	10.9% (-13.9 to 51.5)	11,950 (7,788 to 14,810)	3.3% (-31.7 to 43.2)	1,327,545 (945,495 to 1,756,096)	1.5% (-22.3 to 28.1)
Central sub-Saharan Africa	85,155 (34,158 to 138,874)	1.3% (-58.5 to 185.8)	4,153 (3,086 to 5,731)	-13.4% (-32.9 to 10.5)	441,289 (287,627 to 628,281)	-13.2% (-42.3 to 31.2)

Eastern sub-Saharan Africa	258,133 (167,483 to 358,826)	6.9% (-21.7 to 63.8)	20,643 (17,587 to 24,914)	-20.4% (-31.1 to -7.5)	1,697,817 (1,361,673 to 2,111,472)	-14.3% (-27.2 to 1.9)
North Africa and Middle East	298,247 (202,461 to 422,106)	10.2% (-23.8 to 56.7)	7,374 (5,915 to 8,547)	-41.2% (-48.6 to -33.0)	982,282 (700,420 to 1,361,899)	-31.9% (-47.1 to -11.5)
Southeast Asia, east Asia, and Oceania	625,602 (437,540 to 811,288)	23.5% (-6.7 to 61.0)	16,320 (13,632 to 19,470)	-53.2% (-60.2 to -44.9)	2,217,008 (1,574,008 to 2,995,777)	-34.3% (-48.5 to -17.2)
Southeast Asia	248,332 (170,940 to 336,053)	16.2% (-14.7 to 58.2)	3,647 (2,597 to 4,322)	-26.2% (-35.5 to -15.4)	755,399 (512,525 to 1,060,685)	-5.1% (-28.6 to 24.2)
Oceania	4,420 (1,714 to 7,277)	-1.4% (-57.6 to 132.4)	229 (165 to 329)	10.4% (-13.0 to 41.9)	26,577 (16,444 to 39,292)	3.0% (-35.8 to 63.9)
East Asia	372,849 (259,684 to 491,425)	24.9% (-9.6 to 72.5)	12,444 (10,330 to 15,388)	-55.6% (-62.9 to -46.0)	1,435,032 (1,023,185 to 1,955,288)	-42.6% (-56.1 to -25.3)
Central Europe, eastern Europe, and central Asia	145,212 (100,228 to 193,226)	-0.7% (-19.7 to 21.1)	6,935 (6,084 to 7,586)	3.5% (-9.1 to 14.3)	672,317 (510,497 to 873,611)	-9.0% (-23.3 to 5.9)
Central Asia	45,659 (26,279 to 63,772)	6.9% (-33.9 to 69.9)	2,503 (2,203 to 2,820)	11.6% (-2.3 to 26.9)	270,937 (207,394 to 353,474)	1.7% (-22.9 to 32.9)
Eastern Europe	59,543 (39,815 to 81,362)	-10.9% (-32.0 to 15.4)	1,570 (1,385 to 1,743)	-40.1% (-46.7 to -33.7)	185,111 (125,736 to 264,284)	-35.4% (-49.8 to -18.9)
Central Europe	40,010 (26,684 to 53,769)	3.4% (-23.7 to 37.3)	2,862 (2,346 to 3,210)	15.7% (-7.1 to 31.6)	216,270 (159,252 to 295,130)	-10.6% (-30.4 to 12.3)
South Asia	602,050 (428,444 to 784,538)	7.5% (-23.3 to 57.8)	41,859 (31,308 to 47,631)	-27.7% (-38.9 to -12.2)	3,612,472 (2,845,810 to 4,472,974)	-25.2% (-38.5 to -5.4)
Countries						
Afghanistan	16,320 (3,945 to 31,363)	-8.5% (-76.2 to 458.5)	877 (641 to 1,128)	-32.8% (-47.8 to -13.9)	98,313 (61,376 to 152,314)	-33.4% (-59.7 to 14.1)
Albania	991 (255 to 1,595)	10.7% (-72.8 to 286.6)	60 (43 to 94)	-29.8% (-48.2 to -5.5)	5,560 (3,171 to 9,431)	-26.3% (-60.2 to 48.1)
Algeria	19,584 (5,214 to 33,093)	-6.0% (-78.7 to 255.2)	466 (377 to 583)	-41.6% (-53.7 to -28.0)	61,469 (32,146 to 101,649)	-38.8% (-71.7 to 26.0)
American Samoa	20 (5 to 32)	4.5% (-72.2 to 287.8)	1 (0 to 1)	49.7% (-25.6 to 155.4)	95 (50 to 153)	14.2% (-50.1 to 173.1)
Andorra	43 (12 to 65)	-3.5% (-64.3 to 153.4)	1 (1 to 1)	-36.5% (-58.3 to -5.0)	92 (42 to 180)	-24.5% (-66.0 to 75.6)
Angola	25,615 (6,738 to 45,346)	11.5% (-76.1 to 479.3)	952 (670 to 1,293)	-24.0% (-45.7 to 6.0)	121,740 (64,097 to 195,038)	-13.6% (-56.2 to 63.7)
Antigua and Barbuda	67 (18 to 106)	1.4% (-69.0 to 324.2)	3 (3 to 3)	-34.3% (-42.2 to -26.5)	300 (173 to 481)	-26.8% (-62.9 to 43.8)
Argentina	19,540 (4,859 to 32,977)	13.0% (-71.6 to 311.0)	372 (345 to 401)	-12.7% (-19.9 to -4.8)	51,394 (23,949 to 93,016)	-9.7% (-58.8 to 96.3)
Armenia	995 (331 to 1,644)	1.5% (-70.7 to 290.8)	28 (22 to 34)	-16.0% (-35.4 to 4.8)	3,558 (1,720 to 6,136)	-20.2% (-66.1 to 87.5)
Australia	11,257 (3,191 to 18,357)	0.2% (-70.7 to 239.4)	298 (275 to 320)	-24.6% (-30.3 to -18.2)	29,095 (14,924 to 56,000)	-20.2% (-63.6 to 70.0)

Austria	4,492 (1,349 to 7,044)	3.5% (-60.5 to 309.1)	158 (142 to 172)	27.1% (16.4 to 38.4)	10,936 (5,535 to 19,587)	-4.2% (-55.5 to 116.8)
Azerbaijan	4,594 (1,369 to 7,563)	10.1% (-71.0 to 331.5)	261 (187 to 376)	-11.2% (-34.4 to 20.2)	27,588 (15,667 to 43,858)	-13.0% (-54.0 to 62.7)
Bahamas	242 (77 to 393)	-3.6% (-71.0 to 232.5)	6 (5 to 8)	-30.3% (-47.2 to -8.8)	876 (415 to 1,458)	-24.8% (-69.4 to 68.1)
Bahrain	810 (241 to 1,347)	2.7% (-72.4 to 251.6)	20 (16 to 27)	-40.7% (-51.0 to -27.0)	2,587 (1,380 to 4,429)	-34.4% (-68.9 to 32.2)
Bangladesh	41,793 (11,936 to 73,953)	2.5% (-72.2 to 463.5)	1,544 (1,137 to 2,102)	-43.5% (-57.1 to -23.3)	176,492 (93,809 to 303,266)	-36.1% (-69.1 to 30.3)
Barbados	167 (52 to 265)	-6.2% (-75.7 to 240.4)	6 (5 to 8)	-36.3% (-50.5 to -18.8)	624 (334 to 1,062)	-31.0% (-66.3 to 47.4)
Belarus	2,510 (679 to 4,138)	-16.2% (-76.2 to 193.3)	103 (84 to 124)	-47.3% (-58.2 to -33.7)	9,621 (5,216 to 16,858)	-45.2% (-72.8 to 10.9)
Belgium	7,213 (2,104 to 11,074)	11.6% (-70.3 to 287.3)	365 (321 to 402)	54.0% (38.3 to 68.4)	21,537 (12,266 to 37,721)	11.4% (-49.6 to 132.7)
Belize	248 (70 to 438)	10.4% (-72.9 to 393.2)	7 (6 to 8)	-19.9% (-32.1 to -5.1)	916 (468 to 1,526)	-13.4% (-56.1 to 66.1)
Benin	8,420 (1,944 to 15,562)	6.1% (-77.6 to 563.1)	354 (226 to 480)	3.6% (-34.8 to 51.8)	38,576 (20,894 to 63,322)	-1.4% (-52.1 to 91.7)
Bermuda	34 (10 to 55)	-9.9% (-71.9 to 238.6)	1 (1 to 1)	-49.0% (-59.1 to -35.9)	96 (42 to 187)	-39.3% (-73.2 to 57.5)
Bhutan	231 (64 to 419)	9.8% (-73.7 to 497.7)	19 (13 to 27)	-20.8% (-44.9 to 24.2)	1,660 (953 to 2,604)	-13.7% (-56.1 to 65.6)
Bolivia	5,800 (1,483 to 9,715)	-9.7% (-78.3 to 276.9)	227 (160 to 312)	-42.7% (-58.7 to -19.1)	28,633 (15,075 to 46,287)	-39.3% (-69.8 to 23.4)
Bosnia and Herzegovina	1,111 (300 to 1,799)	13.3% (-70.7 to 325.0)	78 (49 to 104)	-12.5% (-45.0 to 22.2)	6,085 (3,339 to 9,948)	-12.0% (-58.0 to 74.7)
Botswana	1,526 (433 to 2,598)	31.3% (-61.5 to 400.4)	65 (47 to 84)	-21.1% (-49.0 to 19.0)	7,654 (4,330 to 11,471)	-1.0% (-47.1 to 85.9)
Brazil	117,285 (78,931 to 156,517)	-10.0% (-34.8 to 34.6)	3,693 (3,526 to 3,826)	18.8% (13.1 to 24.7)	409,015 (290,945 to 565,775)	-20.8% (-39.8 to 8.3)
Brunei	243 (75 to 386)	-11.5% (-67.5 to 225.4)	5 (4 to 6)	-29.0% (-45.1 to -8.9)	780 (387 to 1,314)	-30.7% (-69.1 to 62.0)
Bulgaria	2,346 (643 to 3,762)	4.2% (-70.8 to 247.2)	180 (135 to 228)	34.0% (0.5 to 77.9)	14,512 (8,075 to 23,745)	4.6% (-48.9 to 128.5)
Burkina Faso	13,358 (2,354 to 26,262)	8.3% (-78.6 to 450.2)	633 (393 to 889)	4.5% (-32.5 to 58.5)	63,812 (32,779 to 101,254)	2.1% (-48.7 to 91.4)
Burundi	7,238 (1,429 to 14,567)	-13.3% (-81.9 to 477.5)	642 (478 to 843)	-3.6% (-27.6 to 29.8)	50,753 (32,859 to 73,842)	-17.0% (-47.9 to 29.5)
Côte d'Ivoire	18,421 (4,398 to 33,460)	12.4% (-74.1 to 444.9)	803 (485 to 1,111)	9.8% (-32.0 to 59.9)	85,743 (46,260 to 138,935)	6.3% (-46.2 to 99.9)
Cabo Verde	369 (100 to 637)	32.0% (-70.5 to 559.4)	18 (13 to 23)	-28.6% (-47.4 to -4.0)	1,619 (871 to 2,641)	-14.6% (-56.0 to 57.0)

Cambodia	5,545 (1,707 to 10,145)	10.0% (-69.3 to 487.7)	99 (61 to 190)	-26.7% (-47.3 to -3.3)	19,343 (8,402 to 33,204)	-13.0% (-66.7 to 116.2)
Cameroon	20,248 (5,267 to 36,088)	8.2% (-73.2 to 402.0)	855 (510 to 1,198)	0.4% (-38.4 to 53.8)	90,245 (49,112 to 138,832)	-1.3% (-52.0 to 88.5)
Canada	12,188 (3,302 to 19,377)	5.8% (-65.2 to 228.0)	395 (363 to 423)	-22.9% (-28.1 to -17.4)	36,611 (18,411 to 67,325)	-12.7% (-58.8 to 80.8)
Central African Republic	2,958 (609 to 5,533)	-4.7% (-78.8 to 441.6)	249 (175 to 354)	3.6% (-23.3 to 39.5)	22,428 (14,325 to 33,082)	-0.8% (-40.4 to 69.5)
Chad	10,491 (1,871 to 20,868)	18.9% (-72.0 to 498.3)	523 (342 to 728)	35.8% (-11.8 to 110.9)	52,600 (28,779 to 83,422)	27.0% (-31.7 to 143.8)
Chile	11,551 (3,444 to 18,452)	5.1% (-72.0 to 275.2)	316 (294 to 339)	-21.3% (-27.5 to -14.1)	35,349 (17,967 to 63,167)	-24.2% (-67.8 to 77.8)
China	359,966 (248,027 to 475,661)	26.1% (-10.3 to 77.4)	11,886 (9,815 to 14,767)	-56.6% (-64.0 to -47.0)	1,374,719 (969,523 to 1,888,680)	-43.2% (-56.9 to -25.5)
Colombia	30,190 (7,624 to 51,156)	-2.2% (-75.2 to 327.2)	739 (612 to 876)	-24.2% (-37.5 to -10.6)	102,285 (49,616 to 183,088)	-28.8% (-71.7 to 67.5)
Comoros	439 (132 to 782)	4.5% (-72.4 to 514.5)	42 (31 to 59)	-13.8% (-39.6 to 29.2)	3,029 (1,963 to 4,322)	-14.3% (-49.2 to 48.6)
Congo	3,801 (1,063 to 6,520)	4.7% (-73.0 to 454.6)	163 (115 to 221)	-18.5% (-39.4 to 11.9)	18,730 (10,262 to 28,721)	-15.7% (-57.8 to 61.5)
Cook Islands	7 (2 to 11)	3.6% (-71.3 to 300.2)	0 (0 to 0)	-33.4% (-52.4 to -2.7)	24 (11 to 44)	-19.6% (-69.3 to 94.0)
Costa Rica	2,860 (838 to 4,631)	1.5% (-71.8 to 273.5)	86 (76 to 97)	-0.5% (-13.9 to 13.2)	9,906 (5,298 to 16,667)	-9.4% (-59.9 to 103.5)
Croatia	1,579 (444 to 2,489)	-8.1% (-76.6 to 280.1)	98 (70 to 122)	9.6% (-22.3 to 38.9)	7,892 (3,927 to 14,288)	-19.1% (-62.1 to 86.6)
Cuba	4,105 (1,142 to 6,896)	-5.5% (-75.2 to 276.7)	120 (103 to 138)	-29.2% (-39.5 to -18.2)	11,668 (5,783 to 20,845)	-27.4% (-68.6 to 63.4)
Cyprus	616 (170 to 987)	-1.4% (-73.1 to 286.5)	12 (10 to 14)	-51.9% (-60.8 to -41.3)	1,226 (587 to 2,275)	-34.3% (-75.3 to 52.6)
Czechia	4,163 (1,255 to 6,575)	2.5% (-70.6 to 234.4)	257 (195 to 317)	15.1% (-14.7 to 46.0)	20,234 (10,842 to 35,457)	-10.6% (-56.4 to 101.5)
North Korea	5,162 (1,382 to 9,075)	-13.0% (-77.3 to 283.8)	259 (177 to 417)	-24.7% (-46.4 to 8.1)	28,174 (15,412 to 46,236)	-34.1% (-69.2 to 38.2)
Democratic Republic of the Congo	49,843 (10,597 to 92,421)	-5.2% (-78.8 to 449.8)	2,705 (1,904 to 3,949)	-9.8% (-33.0 to 19.4)	266,322 (157,817 to 418,849)	-14.7% (-51.1 to 46.9)
Denmark	2,267 (606 to 3,531)	-3.0% (-66.7 to 200.5)	135 (119 to 151)	37.7% (16.4 to 60.6)	7,279 (4,319 to 12,653)	-5.6% (-52.1 to 86.7)
Djibouti	800 (212 to 1,429)	9.8% (-72.2 to 463.7)	59 (41 to 83)	-4.7% (-33.1 to 34.4)	4,900 (3,085 to 7,082)	-3.7% (-43.5 to 64.0)
Dominica	49 (17 to 78)	8.0% (-68.9 to 372.8)	3 (2 to 3)	-14.2% (-34.1 to 9.7)	263 (153 to 408)	-4.1% (-50.5 to 94.6)
Dominican Republic	6,379 (1,815 to 10,939)	22.4% (-65.0 to 364.0)	155 (124 to 204)	-27.6% (-42.9 to -8.0)	22,957 (11,030 to 39,726)	-7.7% (-57.6 to 93.9)

Ecuador	17,237 (5,412 to 29,200)	7.4% (-67.4 to 375.3)	391 (260 to 520)	-32.6% (-54.3 to -10.6)	57,008 (28,159 to 95,303)	-25.5% (-69.7 to 65.8)
Egypt	52,019 (13,581 to 88,282)	13.9% (-68.9 to 450.6)	707 (495 to 884)	-16.1% (-45.8 to 12.0)	141,500 (63,436 to 258,099)	-17.9% (-65.5 to 109.1)
El Salvador	3,575 (850 to 6,058)	11.2% (-72.3 to 345.4)	66 (49 to 83)	-31.6% (-47.0 to -12.0)	10,804 (4,827 to 19,130)	-22.7% (-67.5 to 71.4)
Equatorial Guinea	1,372 (342 to 2,319)	58.1% (-63.0 to 1,019.9)	35 (22 to 54)	-38.5% (-60.8 to -3.6)	5,431 (2,708 to 8,957)	-7.0% (-59.2 to 96.9)
Eritrea	4,035 (989 to 7,500)	9.2% (-74.1 to 601.4)	373 (266 to 509)	6.6% (-21.8 to 38.6)	30,121 (19,629 to 43,904)	-2.5% (-37.5 to 52.6)
Estonia	526 (164 to 808)	15.9% (-66.8 to 323.9)	30 (24 to 35)	-47.9% (-58.5 to -34.9)	2,532 (1,368 to 4,280)	-36.0% (-64.8 to 14.5)
Eswatini	689 (161 to 1,221)	21.5% (-74.5 to 581.7)	34 (22 to 46)	-6.2% (-41.1 to 44.5)	3,765 (2,243 to 5,795)	6.5% (-43.9 to 100.2)
Ethiopia	50,042 (26,329 to 75,113)	10.0% (-44.1 to 187.2)	5,212 (4,266 to 6,245)	-37.2% (-52.4 to -14.9)	378,228 (303,894 to 478,535)	-33.4% (-49.1 to -10.0)
Fiji	381 (111 to 616)	7.7% (-66.1 to 369.4)	17 (12 to 23)	-12.7% (-38.5 to 24.3)	2,220 (1,217 to 3,480)	-3.7% (-48.5 to 86.2)
Finland	2,532 (765 to 3,994)	8.4% (-70.3 to 205.2)	126 (110 to 140)	16.7% (3.5 to 31.1)	7,784 (4,342 to 14,023)	-3.8% (-56.3 to 112.4)
France	47,359 (16,632 to 74,013)	8.8% (-60.2 to 280.8)	2,011 (1,743 to 2,243)	-2.4% (-12.6 to 6.7)	116,702 (65,076 to 214,831)	-10.1% (-52.8 to 83.5)
Gabon	1,566 (334 to 2,705)	9.5% (-71.5 to 428.1)	48 (33 to 69)	-27.9% (-48.2 to 0.2)	6,638 (3,389 to 10,844)	-18.5% (-63.0 to 59.9)
Gambia	1,352 (302 to 2,437)	15.6% (-75.9 to 510.4)	76 (53 to 103)	21.2% (-20.6 to 85.7)	6,840 (4,204 to 9,853)	16.3% (-33.1 to 121.1)
Georgia	1,345 (409 to 2,187)	-4.9% (-75.0 to 258.9)	64 (50 to 76)	5.6% (-16.6 to 28.5)	6,456 (3,461 to 10,518)	-15.5% (-59.3 to 74.8)
Germany	74,433 (22,871 to 112,811)	14.9% (-62.9 to 218.6)	3,147 (2,765 to 3,455)	69.5% (52.8 to 83.7)	185,643 (98,911 to 356,086)	5.9% (-47.7 to 144.9)
Ghana	20,839 (5,733 to 35,587)	22.5% (-68.9 to 500.0)	620 (416 to 817)	11.4% (-32.4 to 66.5)	78,351 (41,633 to 127,923)	13.0% (-46.4 to 137.4)
Greece	4,020 (1,041 to 6,328)	1.7% (-73.8 to 225.6)	181 (164 to 196)	107.6% (89.2 to 127.2)	10,648 (5,776 to 19,089)	15.2% (-52.3 to 205.6)
Greenland	30 (10 to 47)	-3.0% (-70.2 to 241.2)	2 (1 to 2)	-33.4% (-47.7 to -17.4)	151 (81 to 259)	-29.3% (-64.7 to 40.6)
Grenada	62 (17 to 102)	7.8% (-66.5 to 311.2)	2 (2 to 3)	-39.5% (-49.9 to -27.8)	254 (138 to 413)	-28.1% (-64.3 to 46.0)
Guam	61 (21 to 100)	3.4% (-65.7 to 282.0)	1 (0 to 1)	42.2% (-44.6 to 133.0)	201 (76 to 378)	3.1% (-61.8 to 219.0)
Guatemala	10,197 (2,788 to 16,910)	10.3% (-69.1 to 404.5)	327 (277 to 384)	-39.3% (-48.7 to -28.9)	45,501 (24,813 to 73,550)	-23.9% (-61.9 to 52.0)
Guinea	8,030 (1,687 to 16,067)	10.3% (-75.5 to 499.5)	401 (264 to 539)	16.0% (-30.1 to 82.8)	40,224 (22,795 to 65,629)	7.4% (-42.1 to 107.7)

Guinea-Bissau	1,243 (239 to 2,341)	-0.1% (-81.8 to 547.0)	76 (53 to 102)	9.6% (-28.1 to 62.6)	7,169 (4,197 to 11,060)	0.8% (-43.1 to 82.9)
Guyana	494 (143 to 810)	14.1% (-68.3 to 291.3)	26 (20 to 34)	-10.8% (-35.8 to 16.5)	2,625 (1,518 to 3,892)	-3.4% (-47.5 to 77.5)
Haiti	6,452 (1,574 to 11,690)	-7.6% (-80.4 to 366.7)	461 (338 to 633)	-28.0% (-47.3 to -4.4)	41,456 (25,671 to 61,579)	-27.2% (-56.0 to 22.2)
Honduras	5,930 (1,308 to 10,386)	-3.7% (-78.8 to 407.7)	263 (182 to 362)	-28.2% (-50.0 to -0.5)	29,360 (16,232 to 45,500)	-27.9% (-62.2 to 45.9)
Hungary	3,177 (1,018 to 5,092)	-5.3% (-72.6 to 253.4)	174 (139 to 212)	-12.8% (-32.5 to 6.6)	15,020 (7,858 to 26,371)	-25.9% (-68.1 to 63.4)
Iceland	168 (47 to 260)	14.7% (-65.8 to 265.5)	5 (4 to 5)	43.1% (26.7 to 62.3)	396 (206 to 755)	10.6% (-51.1 to 130.0)
India	457,420 (325,186 to 602,651)	6.7% (-23.6 to 54.5)	31,176 (22,983 to 35,983)	-31.2% (-42.5 to -15.2)	2,646,968 (2,052,364 to 3,304,933)	-29.0% (-41.5 to -10.1)
Indonesia	92,528 (61,423 to 124,849)	16.3% (-20.4 to 73.3)	905 (218 to 1,422)	-10.2% (-31.6 to 20.3)	248,916 (144,392 to 364,035)	2.0% (-26.9 to 47.2)
Iran	39,827 (27,032 to 52,554)	13.4% (-19.7 to 58.6)	604 (543 to 769)	-55.1% (-61.6 to -44.3)	98,687 (67,059 to 139,669)	-40.0% (-56.1 to -17.8)
Iraq	19,238 (5,800 to 32,017)	12.8% (-68.7 to 361.3)	314 (240 to 409)	-48.9% (-61.0 to -33.5)	52,367 (25,909 to 87,928)	-32.9% (-68.9 to 28.7)
Ireland	2,888 (887 to 4,474)	12.2% (-65.1 to 288.6)	85 (74 to 95)	7.6% (-6.6 to 22.5)	6,728 (3,555 to 12,479)	-3.5% (-57.0 to 125.6)
Israel	5,001 (1,654 to 7,850)	13.0% (-60.1 to 312.0)	125 (111 to 139)	38.1% (22.6 to 54.8)	11,159 (5,713 to 21,197)	7.3% (-49.8 to 146.8)
Italy	22,897 (15,348 to 31,205)	-3.3% (-27.6 to 26.6)	1,541 (1,248 to 1,738)	113.1% (74.0 to 138.2)	69,514 (49,195 to 100,631)	8.1% (-16.8 to 36.9)
Jamaica	1,569 (444 to 2,585)	0.2% (-70.9 to 261.5)	63 (46 to 82)	-1.3% (-27.8 to 32.7)	6,090 (3,192 to 9,979)	-11.8% (-56.9 to 73.2)
Japan	47,554 (31,556 to 64,782)	11.5% (-8.4 to 33.6)	1,705 (1,452 to 1,860)	108.0% (97.8 to 117.9)	120,161 (79,423 to 190,673)	16.5% (-4.0 to 43.3)
Jordan	5,515 (1,556 to 8,939)	3.3% (-69.2 to 288.1)	77 (63 to 97)	-55.0% (-65.3 to -42.4)	13,622 (6,589 to 24,303)	-37.8% (-70.6 to 25.1)
Kazakhstan	9,430 (2,663 to 15,433)	6.9% (-73.5 to 308.4)	369 (322 to 426)	27.1% (6.7 to 49.4)	43,810 (24,202 to 73,500)	0.7% (-51.1 to 125.4)
Kenya	35,642 (25,413 to 47,859)	5.2% (-20.5 to 47.4)	2,037 (1,584 to 2,527)	-8.8% (-32.4 to 23.4)	178,110 (137,309 to 220,747)	-3.2% (-21.4 to 20.1)
Kiribati	46 (11 to 82)	-5.2% (-79.6 to 300.2)	3 (2 to 4)	-11.5% (-33.9 to 24.1)	314 (187 to 474)	-13.1% (-52.9 to 59.4)
Kuwait	2,206 (585 to 3,563)	-0.5% (-73.5 to 292.5)	23 (19 to 28)	-43.3% (-54.4 to -29.4)	4,884 (1,967 to 9,507)	-28.6% (-74.8 to 82.5)
Kyrgyzstan	3,245 (879 to 5,504)	-4.9% (-78.3 to 349.3)	204 (167 to 246)	-2.6% (-23.6 to 26.4)	19,728 (12,491 to 29,756)	-15.5% (-54.4 to 54.9)
Laos	2,532 (641 to 4,327)	14.4% (-75.3 to 711.5)	40 (24 to 81)	-32.7% (-51.8 to -11.8)	9,119 (3,591 to 16,393)	-12.0% (-68.9 to 141.9)

Latvia	652 (202 to 1,035)	10.0% (-67.8 to 353.4)	36 (27 to 45)	-32.7% (-49.8 to -11.6)	3,248 (1,754 to 5,746)	-21.9% (-60.1 to 40.1)
Lebanon	2,373 (737 to 4,005)	7.9% (-69.6 to 384.7)	101 (83 to 125)	-42.3% (-56.6 to -22.9)	8,159 (4,654 to 13,262)	-37.0% (-67.6 to 15.7)
Lesotho	967 (208 to 1,740)	32.8% (-73.0 to 471.7)	51 (37 to 68)	30.1% (-18.4 to 111.6)	5,424 (3,076 to 8,094)	37.5% (-27.6 to 166.0)
Liberia	3,101 (645 to 5,819)	-4.8% (-82.1 to 457.8)	148 (91 to 215)	-19.1% (-50.5 to 24.2)	14,729 (8,273 to 22,413)	-23.9% (-62.5 to 42.6)
Libya	2,826 (810 to 4,571)	3.6% (-71.8 to 457.8)	70 (46 to 100)	-34.4% (-53.8 to -8.1)	8,771 (4,553 to 14,560)	-28.7% (-65.7 to 55.0)
Lithuania	1,005 (325 to 1,556)	5.6% (-68.7 to 280.1)	67 (54 to 80)	-29.5% (-44.0 to -13.9)	5,584 (3,236 to 9,039)	-22.2% (-56.5 to 37.8)
Luxembourg	421 (141 to 651)	7.3% (-66.1 to 259.8)	15 (13 to 18)	6.8% (-7.9 to 24.9)	1,096 (585 to 1,956)	-10.5% (-58.3 to 77.3)
Madagascar	16,688 (4,354 to 31,234)	-4.7% (-78.7 to 328.3)	1,090 (820 to 1,470)	-19.9% (-39.8 to 1.6)	99,907 (65,835 to 144,986)	-15.5% (-50.0 to 35.7)
Malawi	11,651 (2,718 to 21,237)	0.7% (-75.0 to 391.5)	1,094 (795 to 1,408)	-19.0% (-36.0 to 1.3)	86,598 (58,299 to 124,396)	-13.1% (-42.8 to 32.8)
Malaysia	13,612 (3,531 to 22,125)	14.0% (-67.4 to 282.3)	216 (186 to 261)	-31.7% (-42.1 to -17.0)	43,470 (17,072 to 78,362)	-11.9% (-67.0 to 107.9)
Maldives	202 (61 to 346)	5.0% (-66.4 to 438.5)	4 (3 to 8)	-48.0% (-60.5 to -27.9)	756 (321 to 1,374)	-33.1% (-72.3 to 78.0)
Mali	12,226 (2,788 to 23,661)	27.1% (-69.7 to 616.7)	738 (488 to 1,012)	10.0% (-25.5 to 61.2)	64,680 (37,824 to 98,313)	14.8% (-32.3 to 96.2)
Malta	195 (57 to 314)	14.8% (-64.9 to 308.5)	6 (5 to 6)	50.2% (32.1 to 71.0)	453 (227 to 852)	11.8% (-50.2 to 171.8)
Marshall Islands	19 (5 to 35)	3.7% (-79.3 to 408.1)	1 (1 to 1)	-4.0% (-33.3 to 35.4)	108 (57 to 167)	-3.4% (-54.6 to 104.9)
Mauritania	2,681 (760 to 4,600)	4.9% (-73.1 to 395.9)	103 (72 to 135)	-4.3% (-38.2 to 38.5)	10,669 (5,982 to 17,029)	-10.4% (-53.3 to 72.6)
Mauritius	706 (238 to 1,124)	20.4% (-64.9 to 476.6)	52 (47 to 57)	17.9% (4.7 to 32.2)	4,443 (2,647 to 6,998)	17.3% (-42.0 to 147.5)
Mexico	97,906 (66,968 to 130,110)	-5.4% (-28.9 to 22.7)	2,590 (2,171 to 3,010)	-24.0% (-35.9 to -12.0)	347,067 (248,049 to 468,840)	-27.2% (-42.6 to -10.5)
Micronesia (Federated States of)	36 (7 to 62)	-0.7% (-77.8 to 294.4)	1 (1 to 2)	-16.9% (-41.3 to 19.1)	193 (100 to 310)	-14.0% (-55.8 to 63.7)
Monaco	20 (6 to 31)	5.3% (-68.0 to 259.6)	0 (0 to 0)	31.0% (-22.9 to 96.8)	43 (17 to 88)	1.3% (-61.4 to 154.1)
Mongolia	1,499 (319 to 2,592)	13.0% (-74.3 to 436.7)	59 (46 to 73)	-34.3% (-49.0 to -14.0)	7,458 (3,924 to 12,135)	-20.8% (-59.5 to 53.7)
Montenegro	201 (56 to 327)	-1.4% (-72.3 to 259.8)	5 (4 to 7)	-19.6% (-36.9 to 4.2)	710 (302 to 1,357)	-16.6% (-64.8 to 88.9)
Morocco	15,675 (3,773 to 27,016)	9.9% (-71.9 to 348.6)	617 (448 to 779)	-37.7% (-50.9 to -19.9)	61,406 (35,318 to 99,584)	-27.3% (-60.6 to 31.5)

Mozambique	20,223 (3,815 to 37,370)	21.9% (-74.8 to 614.8)	1,437 (1,060 to 2,033)	-17.9% (-38.8 to 8.5)	129,022 (76,503 to 190,701)	-5.5% (-42.8 to 50.1)
Myanmar	21,074 (5,879 to 37,540)	13.2% (-70.8 to 464.1)	520 (301 to 712)	-33.4% (-51.9 to -7.1)	85,397 (37,180 to 147,646)	-11.2% (-62.3 to 109.4)
Namibia	1,347 (403 to 2,377)	13.9% (-68.7 to 375.6)	60 (43 to 85)	-9.4% (-36.7 to 28.2)	6,555 (3,787 to 10,215)	-3.7% (-52.1 to 76.5)
Nauru	5 (1 to 8)	-6.3% (-76.1 to 361.3)	0 (0 to 0)	3.7% (-25.8 to 43.6)	24 (12 to 39)	-14.5% (-61.2 to 99.9)
Nepal	11,066 (2,421 to 19,669)	14.4% (-75.3 to 555.0)	1,253 (839 to 1,676)	-19.8% (-40.4 to 11.9)	84,578 (52,279 to 128,683)	-23.7% (-55.3 to 38.0)
Netherlands	8,766 (2,585 to 13,716)	18.1% (-64.7 to 325.2)	373 (330 to 412)	32.3% (20.0 to 46.1)	23,869 (13,540 to 43,365)	7.6% (-49.3 to 144.8)
New Zealand	2,377 (936 to 3,587)	-9.9% (-62.6 to 132.7)	62 (57 to 68)	-33.9% (-39.9 to -27.9)	6,211 (3,583 to 10,253)	-31.2% (-60.1 to 17.1)
Nicaragua	3,500 (841 to 6,540)	-3.6% (-77.1 to 362.6)	80 (67 to 99)	-39.0% (-48.1 to -28.6)	11,403 (5,742 to 20,317)	-35.2% (-71.2 to 40.0)
Niger	12,533 (2,162 to 26,972)	-2.6% (-81.1 to 459.6)	683 (390 to 1,084)	9.3% (-32.5 to 68.0)	63,410 (33,606 to 101,665)	-0.7% (-47.4 to 78.7)
Nigeria	170,702 (118,786 to 224,352)	11.7% (-14.3 to 56.5)	4,878 (2,880 to 6,788)	-4.6% (-43.9 to 50.9)	608,585 (436,414 to 811,012)	-1.9% (-26.5 to 29.1)
Niue	1 (0 to 1)	7.0% (-64.0 to 326.4)	0 (0 to 0)	13.4% (-20.8 to 57.6)	3 (2 to 5)	6.2% (-44.4 to 140.1)
North Macedonia	714 (206 to 1,131)	-2.6% (-75.7 to 202.0)	42 (31 to 55)	-4.7% (-38.4 to 35.8)	3,649 (2,136 to 6,009)	-19.2% (-61.2 to 61.2)
Northern Mariana Islands	17 (4 to 29)	-7.2% (-78.0 to 291.0)	0 (0 to 0)	87.7% (-15.8 to 240.8)	62 (26 to 112)	-7.0% (-66.4 to 229.9)
Norway	3,339 (2,025 to 4,611)	-0.1% (-29.8 to 36.6)	107 (98 to 114)	-14.1% (-19.4 to -8.7)	8,411 (5,449 to 13,010)	-19.2% (-38.1 to 6.2)
Oman	2,297 (683 to 3,650)	27.3% (-61.5 to 513.2)	15 (10 to 19)	-37.6% (-55.3 to -11.4)	4,681 (1,695 to 8,985)	-11.0% (-69.0 to 161.9)
Pakistan	91,541 (44,758 to 138,269)	5.4% (-45.3 to 144.1)	7,867 (6,098 to 10,253)	-0.1% (-22.9 to 29.7)	702,774 (537,940 to 933,247)	-5.1% (-31.5 to 36.9)
Palau	7 (2 to 11)	2.6% (-72.2 to 344.4)	0 (0 to 0)	-9.1% (-32.7 to 22.2)	42 (24 to 65)	-8.3% (-50.9 to 72.3)
Palestine	2,498 (774 to 4,442)	8.6% (-72.1 to 567.9)	71 (60 to 92)	-41.9% (-53.9 to -28.2)	8,579 (4,988 to 13,509)	-32.0% (-64.5 to 25.0)
Panama	3,014 (847 to 4,866)	21.0% (-66.2 to 525.1)	63 (50 to 76)	-14.8% (-32.2 to 4.7)	9,829 (4,550 to 17,396)	-0.2% (-56.6 to 151.1)
Papua New Guinea	3,172 (775 to 5,779)	1.0% (-76.1 to 360.8)	176 (118 to 263)	17.2% (-16.2 to 70.7)	19,696 (10,732 to 30,527)	8.2% (-42.6 to 125.8)
Paraguay	3,808 (1,253 to 6,275)	9.9% (-66.7 to 312.6)	102 (72 to 134)	-0.9% (-34.9 to 39.6)	13,853 (7,143 to 23,066)	-6.6% (-54.6 to 98.4)
Peru	24,466 (6,969 to 40,938)	1.6% (-70.6 to 339.6)	294 (221 to 404)	-58.1% (-70.1 to -36.3)	69,128 (27,761 to 128,959)	-39.0% (-77.4 to 57.8)

Philippines	41,855 (29,016 to 56,497)	4.0% (-16.4 to 31.0)	383 (287 to 455)	-8.2% (-28.1 to 9.7)	116,068 (78,784 to 164,451)	-3.5% (-20.3 to 19.0)
Poland	12,308 (8,037 to 16,538)	13.0% (-17.3 to 51.0)	1,161 (941 to 1,326)	83.4% (48.6 to 108.7)	74,691 (55,929 to 98,330)	18.0% (-6.6 to 47.2)
Portugal	4,592 (1,220 to 7,126)	17.4% (-68.2 to 359.6)	326 (281 to 360)	29.5% (14.5 to 43.5)	14,936 (9,267 to 24,385)	-4.0% (-48.4 to 97.3)
Puerto Rico	1,818 (531 to 2,911)	-6.6% (-72.1 to 202.3)	57 (47 to 69)	-53.4% (-62.1 to -43.6)	5,878 (2,724 to 10,579)	-39.6% (-73.9 to 19.6)
Qatar	1,477 (485 to 2,385)	-6.7% (-74.4 to 201.3)	13 (10 to 19)	-59.2% (-70.6 to -35.8)	3,127 (1,242 to 6,046)	-45.2% (-81.5 to 28.4)
South Korea	21,404 (5,486 to 32,888)	0.1% (-72.5 to 219.4)	564 (422 to 642)	-45.6% (-62.5 to -34.8)	56,166 (26,890 to 106,019)	-40.7% (-73.2 to 29.6)
Republic of Moldova	977 (291 to 1,613)	-13.2% (-75.8 to 218.1)	72 (59 to 87)	-38.1% (-50.4 to -24.2)	5,543 (3,542 to 8,420)	-39.2% (-65.0 to 5.3)
Romania	6,526 (1,925 to 10,401)	-0.5% (-69.7 to 258.1)	416 (322 to 496)	-3.2% (-25.1 to 18.2)	35,052 (19,816 to 56,062)	-20.5% (-60.5 to 56.5)
Russian	41,005 (27,958 to 54,875)	-10.7% (-26.0 to 3.0)	838 (754 to 919)	-41.6% (-47.0 to -36.6)	108,613 (71,621 to 162,868)	-36.9% (-49.4 to -24.9)
Rwanda	7,911 (1,724 to 14,528)	-3.6% (-80.4 to 383.3)	636 (467 to 904)	-29.1% (-47.8 to -2.9)	51,636 (34,412 to 75,020)	-28.5% (-56.4 to 13.3)
Saint Kitts and Nevis	39 (12 to 63)	-9.4% (-72.5 to 271.4)	1 (1 to 2)	-53.0% (-62.4 to -41.6)	163 (88 to 270)	-44.5% (-73.1 to 13.9)
Saint Lucia	107 (29 to 178)	-2.6% (-76.2 to 280.8)	6 (5 to 7)	-40.2% (-51.7 to -27.9)	520 (299 to 853)	-31.7% (-66.0 to 39.8)
Saint Vincent and the Grenadines	69 (17 to 113)	10.2% (-70.1 to 441.0)	4 (3 to 5)	-18.9% (-32.8 to -3.0)	352 (211 to 524)	-13.3% (-53.9 to 55.1)
Samoa	80 (24 to 136)	5.2% (-72.1 to 401.4)	2 (2 to 3)	-14.1% (-39.1 to 26.6)	341 (175 to 566)	-8.0% (-56.3 to 90.1)
San Marino	13 (4 to 20)	0.2% (-70.3 to 236.2)	0 (0 to 0)	-45.7% (-63.5 to -23.9)	22 (7 to 47)	-11.7% (-75.0 to 189.1)
São Tomé and Príncipe	141 (41 to 243)	25.1% (-68.8 to 533.5)	6 (4 to 8)	9.5% (-24.9 to 71.1)	604 (303 to 953)	10.8% (-42.8 to 128.2)
Saudi Arabia	24,102 (6,271 to 39,558)	25.9% (-65.0 to 419.3)	543 (329 to 731)	-39.1% (-57.1 to -15.5)	80,462 (37,741 to 144,059)	-19.4% (-63.1 to 73.9)
Senegal	9,736 (2,078 to 18,156)	11.4% (-77.0 to 682.6)	539 (376 to 726)	16.1% (-20.8 to 68.1)	50,423 (29,474 to 77,321)	11.2% (-42.6 to 121.5)
Serbia	3,444 (980 to 5,513)	-6.4% (-72.3 to 251.1)	170 (123 to 209)	-32.9% (-49.8 to -14.2)	14,775 (7,750 to 26,085)	-32.6% (-68.8 to 32.4)
Seychelles	41 (12 to 70)	10.5% (-65.6 to 293.1)	1 (1 to 1)	-40.0% (-50.8 to -26.7)	156 (73 to 265)	-18.5% (-65.6 to 66.0)
Sierra Leone	4,916 (974 to 9,070)	4.5% (-78.0 to 468.7)	254 (156 to 360)	11.0% (-29.7 to 67.2)	24,982 (13,071 to 38,676)	3.6% (-43.7 to 88.1)
Singapore	2,099 (603 to 3,370)	13.7% (-71.2 to 324.3)	29 (25 to 32)	8.8% (-4.3 to 22.6)	4,420 (1,834 to 9,156)	-7.1% (-66.6 to 145.7)

Slovakia	2,148 (623 to 3,532)	6.7% (-69.6 to 233.2)	136 (103 to 167)	-13.7% (-34.8 to 12.1)	11,740 (6,646 to 19,713)	-13.9% (-56.8 to 81.3)
Slovenia	718 (221 to 1,132)	-9.9% (-74.4 to 195.8)	44 (31 to 56)	-2.2% (-31.4 to 25.7)	3,202 (1,765 to 5,439)	-26.3% (-67.0 to 64.9)
Solomon Islands	225 (51 to 410)	4.1% (-76.7 to 396.3)	11 (8 to 16)	6.4% (-23.5 to 54.4)	1,322 (743 to 2,091)	1.6% (-46.0 to 116.3)
Somalia	9,108 (1,372 to 19,866)	-6.9% (-83.8 to 585.8)	1,291 (796 to 2,109)	-0.9% (-23.6 to 30.6)	94,814 (56,205 to 146,348)	-1.9% (-35.3 to 39.5)
South Africa	33,214 (20,311 to 46,183)	-1.3% (-35.7 to 53.6)	1,179 (1,006 to 1,356)	-11.9% (-23.5 to 1.8)	132,325 (96,364 to 178,256)	-16.4% (-36.9 to 10.9)
South Sudan	5,622 (1,248 to 10,953)	-10.3% (-83.2 to 302.7)	563 (395 to 772)	0.8% (-23.7 to 40.2)	44,306 (30,068 to 63,012)	2.1% (-37.5 to 60.7)
Spain	17,767 (5,790 to 28,706)	5.4% (-66.2 to 322.0)	818 (691 to 915)	45.4% (27.1 to 62.3)	46,938 (25,478 to 86,310)	-2.6% (-54.8 to 123.3)
Sri Lanka	11,228 (2,760 to 18,557)	5.5% (-76.4 to 333.5)	347 (234 to 486)	-54.2% (-69.2 to -34.4)	44,289 (19,810 to 77,271)	-33.9% (-72.6 to 39.7)
Sudan	19,218 (5,103 to 33,204)	12.3% (-71.6 to 455.5)	623 (421 to 853)	-37.9% (-56.7 to -10.5)	79,238 (48,142 to 122,131)	-27.5% (-60.8 to 30.9)
Suriname	376 (122 to 606)	10.3% (-64.8 to 439.2)	16 (12 to 20)	-26.7% (-43.5 to -2.7)	1,760 (1,025 to 2,766)	-15.8% (-56.3 to 70.4)
Sweden	3,689 (1,573 to 5,654)	-11.2% (-60.0 to 110.0)	118 (103 to 134)	-25.2% (-34.9 to -13.6)	9,557 (5,508 to 16,370)	-26.5% (-59.4 to 34.6)
Switzerland	4,415 (1,266 to 6,831)	-2.8% (-70.4 to 246.5)	175 (147 to 203)	3.7% (-20.2 to 25.4)	11,013 (5,994 to 19,564)	-14.4% (-61.7 to 94.2)
Syrian Arab Republic	5,147 (1,473 to 8,531)	9.3% (-71.0 to 416.0)	145 (100 to 201)	-15.6% (-43.6 to 24.4)	17,116 (9,951 to 28,228)	-12.4% (-53.7 to 88.5)
Türkiye	43,973 (13,647 to 72,076)	15.7% (-67.1 to 350.2)	1,479 (1,183 to 1,818)	-52.1% (-61.9 to -39.0)	153,904 (87,880 to 251,337)	-45.5% (-70.7 to 0.1)
Taiwan (province of China)	7,721 (2,127 to 11,774)	11.6% (-67.9 to 312.4)	299 (271 to 326)	19.5% (7.6 to 31.1)	32,140 (15,708 to 57,965)	-3.6% (-56.4 to 143.2)
Tajikistan	4,869 (1,338 to 8,428)	-10.0% (-74.9 to 257.0)	467 (344 to 621)	-4.1% (-28.8 to 30.9)	42,944 (28,869 to 60,112)	-10.5% (-46.7 to 44.6)
Thailand	25,162 (7,863 to 40,960)	31.2% (-60.0 to 483.8)	989 (755 to 1,241)	-18.0% (-42.8 to 10.6)	103,216 (51,404 to 180,179)	5.5% (-47.4 to 134.3)
Timor-Leste	522 (145 to 918)	16.4% (-67.2 to 567.4)	7 (5 to 14)	-23.8% (-43.6 to 1.0)	1,734 (668 to 3,199)	-5.2% (-62.4 to 145.5)
Togo	5,184 (1,166 to 9,782)	-10.8% (-78.8 to 343.0)	241 (153 to 335)	11.6% (-29.4 to 65.1)	24,271 (13,213 to 38,099)	-11.9% (-53.2 to 88.2)
Tokelau	0 (0 to 1)	5.6% (-77.2 to 384.7)	0 (0 to 0)	32.3% (-4.4 to 82.5)	3 (2 to 4)	19.7% (-34.8 to 124.9)
Tonga	37 (11 to 60)	6.7% (-72.6 to 333.4)	1 (1 to 1)	-13.5% (-35.8 to 22.3)	147 (78 to 240)	-4.0% (-51.2 to 104.7)
Trinidad and Tobago	933 (265 to 1,537)	3.5% (-68.7 to 296.9)	38 (28 to 48)	-35.6% (-52.0 to -17.2)	4,140 (2,231 to 7,015)	-22.3% (-60.9 to 60.4)

Tunisia	4,598 (1,332 to 7,796)	17.8% (-70.6 to 373.4)	113 (82 to 161)	-42.0% (-57.3 to -22.2)	13,331 (6,992 to 23,207)	-31.4% (-66.7 to 35.5)
Turkmenistan	2,504 (598 to 4,328)	11.9% (-73.6 to 278.1)	148 (100 to 206)	47.3% (-2.8 to 114.8)	16,092 (9,040 to 25,360)	22.5% (-38.7 to 139.8)
Tuvalu	4 (1 to 7)	3.4% (-73.1 to 297.4)	0 (0 to 0)	-18.5% (-36.8 to 4.4)	21 (11 to 33)	-14.2% (-57.2 to 76.8)
Uganda	32,443 (6,989 to 58,736)	10.3% (-76.3 to 595.5)	1,553 (1,163 to 2,046)	-13.4% (-38.5 to 21.9)	156,048 (98,147 to 235,170)	-1.6% (-45.0 to 78.0)
Ukraine	12,868 (4,047 to 20,913)	-11.2% (-72.0 to 199.8)	425 (303 to 553)	-30.3% (-49.4 to -8.5)	49,970 (26,971 to 82,168)	-26.6% (-66.1 to 46.6)
United Arab Emirates	5,335 (1,735 to 8,863)	-3.0% (-68.4 to 228.4)	48 (38 to 60)	-60.2% (-68.7 to -43.6)	15,054 (5,805 to 28,385)	-41.8% (-76.3 to 31.5)
UK	42,922 (29,133 to 57,869)	5.5% (-10.0 to 20.0)	1,067 (972 to 1,131)	-24.3% (-30.8 to -20.0)	102,392 (70,294 to 151,734)	-17.3% (-30.3 to -4.9)
Tanzania	40,002 (9,568 to 72,527)	13.6% (-67.2 to 520.9)	2,890 (2,209 to 3,715)	-24.9% (-46.0 to -3.1)	254,132 (164,749 to 371,644)	-12.2% (-44.9 to 42.4)
USA	131,613 (82,178 to 180,640)	16.5% (-10.0 to 39.9)	3,426 (3,214 to 3,570)	29.3% (24.7 to 33.0)	386,335 (245,396 to 600,739)	9.0% (-11.8 to 34.8)
Virgin Islands	50 (16 to 78)	0.0% (-69.5 to 306.4)	1 (1 to 2)	-18.5% (-40.2 to 8.9)	193 (90 to 330)	-10.7% (-59.8 to 95.4)
Uruguay	1,779 (421 to 2,893)	14.5% (-72.9 to 309.8)	73 (67 to 79)	18.5% (6.4 to 30.4)	6,417 (3,532 to 10,629)	2.1% (-52.4 to 115.5)
Uzbekistan	17,179 (4,639 to 27,932)	14.9% (-65.8 to 391.2)	902 (761 to 1,067)	0.0% (-18.2 to 21.9)	103,303 (65,442 to 160,865)	3.2% (-41.1 to 91.0)
Vanuatu	104 (23 to 181)	4.0% (-75.5 to 419.2)	5 (3 to 6)	8.4% (-22.1 to 57.8)	570 (299 to 892)	4.6% (-47.9 to 112.0)
Venezuela	16,559 (5,129 to 28,253)	-5.0% (-73.1 to 326.6)	611 (452 to 776)	-4.5% (-29.9 to 20.1)	70,432 (36,755 to 122,188)	-16.4% (-60.1 to 93.4)
Viet Nam	32,978 (7,580 to 56,040)	28.1% (-72.0 to 526.6)	79 (15 to 326)	-20.6% (-34.2 to 10.2)	77,438 (17,792 to 164,318)	11.3% (-76.6 to 352.6)
Yemen	12,930 (2,526 to 24,018)	7.7% (-79.8 to 641.9)	441 (274 to 612)	-26.0% (-46.2 to 3.7)	54,109 (28,194 to 85,439)	-21.6% (-57.1 to 61.3)
Zambia	16,067 (4,093 to 28,828)	10.1% (-68.8 to 411.1)	1,706 (1,215 to 2,358)	45.1% (3.4 to 99.3)	134,735 (88,958 to 188,670)	34.5% (-15.7 to 133.5)
Zimbabwe	8,260 (1,964 to 15,310)	3.4% (-75.9 to 407.9)	530 (341 to 773)	13.8% (-24.9 to 61.2)	50,411 (29,431 to 75,589)	15.1% (-37.6 to 101.8)

Table 2. Age-standardised incidence, prevalence, death, and DALY rates of idiopathic epilepsy per 100,000 people by seven GBD super-regions, 21 GBD regions, and 204 countries/territories, both sexes, 2021

Region, country	Incidence rate (95% UI)	Prevalence rate (95% UI)	Death rate (95% UI)	DALYs rate (95% UI)
Global	42.8 (31.2 to 53.7)	307.4 (234.7 to 389.0)	1.7 (1.5 to 1.9)	177.8 (137.7 to 225.9)
High income region	52.5 (34.8 to 71.7)	343.7 (233.4 to 454.9)	1.1 (1.0 to 1.1)	119.1 (79.4 to 179.9)
High income Asia Pacific	45.0 (27.4 to 62.6)	276.7 (168.6 to 384.4)	0.7 (0.7 to 0.7)	92.9 (59.1 to 144.3)
High income North America	42.2 (27.0 to 59.6)	334.7 (218.9 to 460.7)	0.8 (0.7 to 0.8)	109.4 (69.2 to 168.0)
Southern Latin America	51.8 (25.0 to 78.4)	339.7 (161.0 to 515.6)	1.0 (0.9 to 1.1)	136.7 (80.7 to 216.4)
Western Europe	65.3 (41.3 to 89.1)	381.1 (238.1 to 502.5)	1.4 (1.3 to 1.5)	135.0 (91.1 to 204.0)
Australasia	48.9 (19.8 to 75.9)	316.1 (123.3 to 491.0)	0.9 (0.9 to 1.0)	111.6 (60.8 to 199.7)
Latin America and Caribbean	63.2 (45.4 to 82.4)	470.6 (346.3 to 607.6)	1.7 (1.6 to 1.9)	220.7 (164.8 to 296.9)
Central Latin America	69.7 (48.4 to 92.2)	537.4 (384.2 to 714.3)	1.9 (1.7 to 2.2)	250.7 (179.2 to 337.2)
Tropical Latin America	55.2 (37.1 to 73.7)	389.5 (262.4 to 529.0)	1.5 (1.5 to 1.6)	183.1 (130.2 to 256.0)
Andean Latin America	71.7 (38.7 to 103.6)	561.9 (309.6 to 821.7)	1.4 (1.2 to 1.7)	232.5 (144.5 to 347.5)
Caribbean	52.5 (32.9 to 73.7)	371.1 (236.3 to 507.4)	2.0 (1.7 to 2.5)	220.7 (159.6 to 303.9)
Sub-Saharan Africa	56.8 (40.1 to 74.0)	386.3 (286.7 to 491.3)	4.9 (4.1 to 5.7)	345.3 (274.3 to 426.0)
Southern sub-Saharan Africa	56.6 (36.8 to 78.6)	403.7 (271.2 to 545.3)	2.5 (2.2 to 3.1)	257.2 (195.2 to 330.5)

Western sub-Saharan Africa	59.3 (42.2 to 77.3)	404.5 (293.9 to 526.1)	3.6 (2.4 to 4.5)	299.7 (216.0 to 386.8)
Central sub-Saharan Africa	55.6 (22.4 to 88.9)	394.3 (177.8 to 625.8)	3.9 (2.9 to 5.4)	334.5 (220.9 to 477.2)
Eastern sub-Saharan Africa	54.0 (36.0 to 73.2)	355.2 (242.0 to 477.8)	7.5 (6.4 to 8.9)	423.5 (345.1 to 519.7)
North Africa and Middle East	47.4 (32.3 to 66.7)	316.2 (217.5 to 430.7)	1.3 (1.1 to 1.5)	158.6 (113.9 to 219.8)
Southeast Asia, east Asia, and Oceania	31.5 (22.0 to 40.9)	232.2 (168.0 to 298.2)	0.7 (0.6 to 0.8)	104.6 (74.9 to 142.6)
Southeast Asia	37.1 (25.4 to 50.8)	263.0 (186.3 to 349.7)	0.6 (0.4 to 0.7)	110.5 (75.1 to 155.6)
Oceania	29.7 (11.9 to 48.4)	248.8 (111.2 to 390.5)	1.7 (1.3 to 2.5)	187.9 (116.0 to 276.4)
East Asia	28.2 (19.2 to 37.4)	216.1 (149.9 to 279.2)	0.8 (0.7 to 1.0)	102.0 (74.1 to 138.7)
Central Europe, eastern Europe, and central Asia	39.4 (27.1 to 52.7)	326.3 (228.0 to 425.3)	1.5 (1.3 to 1.6)	163.0 (125.0 to 213.4)
Central Asia	47.4 (27.5 to 66.2)	449.7 (262.4 to 619.7)	2.6 (2.3 to 2.9)	280.7 (214.2 to 367.4)
Eastern Europe	33.2 (22.0 to 45.3)	226.5 (152.2 to 303.9)	0.6 (0.5 to 0.7)	87.1 (58.1 to 124.7)
Central Europe	41.9 (28.0 to 59.0)	387.9 (266.4 to 516.7)	1.8 (1.5 to 2.0)	174.6 (127.6 to 239.8)
South Asia	33.1 (23.4 to 42.5)	259.7 (190.7 to 329.9)	2.6 (1.9 to 2.9)	199.2 (156.4 to 246.2)
Countries				
Afghanistan	43.9 (10.2 to 83.9)	317.9 (70.6 to 594.2)	3.3 (2.5 to 4.3)	293.1 (182.3 to 448.9)
Albania	43.6 (11.1 to 70.7)	437.1 (113.6 to 705.2)	2.0 (1.5 to 2.9)	215.2 (123.5 to 367.3)

Algeria	43.9 (11.8 to 74.7)	284.4 (72.0 to 471.3)	1.1 (0.9 to 1.5)	139.9 (73.0 to 230.3)
American Samoa	40.3 (10.5 to 65.5)	366.2 (92.7 to 594.3)	1.4 (1.0 to 1.7)	195.8 (104.3 to 317.1)
Andorra	59.6 (17.2 to 92.1)	348.7 (100.7 to 530.1)	0.7 (0.4 to 0.9)	103.6 (46.1 to 201.8)
Angola	69.3 (18.7 to 119.9)	542.0 (142.7 to 917.0)	3.9 (2.8 to 5.1)	388.6 (208.2 to 604.8)
Antigua and Barbuda	79.1 (21.1 to 126.7)	662.3 (195.6 to 1,027.4)	3.2 (3.0 to 3.5)	322.8 (184.9 to 523.2)
Argentina	45.6 (11.4 to 77.2)	277.7 (71.5 to 454.7)	0.8 (0.7 to 0.8)	113.5 (53.0 to 205.4)
Armenia	38.0 (12.3 to 64.0)	296.5 (95.5 to 496.2)	0.8 (0.6 to 1.0)	120.5 (57.7 to 211.4)
Australia	48.3 (13.7 to 79.7)	316.5 (100.8 to 512.0)	0.9 (0.8 to 1.0)	109.4 (55.7 to 209.2)
Austria	57.4 (16.7 to 90.4)	332.7 (99.5 to 511.7)	1.1 (1.0 to 1.1)	112.0 (53.4 to 207.7)
Azerbaijan	47.1 (14.0 to 76.8)	449.6 (133.3 to 745.2)	2.4 (1.7 to 3.3)	263.8 (150.0 to 417.9)
Bahamas	65.5 (20.6 to 105.0)	493.1 (155.9 to 765.5)	1.5 (1.2 to 1.9)	219.1 (101.5 to 367.3)
Bahrain	59.1 (17.2 to 97.8)	417.2 (115.7 to 663.3)	1.6 (1.3 to 2.0)	178.6 (92.2 to 310.9)
Bangladesh	25.7 (7.4 to 45.5)	199.3 (59.0 to 356.3)	1.1 (0.8 to 1.4)	108.0 (57.9 to 184.0)
Barbados	63.1 (19.1 to 102.5)	463.0 (148.0 to 739.6)	1.7 (1.3 to 2.1)	199.8 (105.0 to 335.7)
Belarus	31.1 (8.6 to 51.6)	234.2 (65.1 to 384.3)	0.9 (0.7 to 1.1)	99.0 (52.2 to 175.6)
Belgium	66.7 (19.5 to 102.2)	425.6 (125.9 to 656.7)	1.9 (1.7 to 2.1)	164.6 (90.4 to 293.7)
Belize	55.8 (15.7 to 97.3)	401.3 (116.3 to 686.1)	1.8 (1.5 to 2.1)	210.0 (107.5 to 348.7)

Benin	55.0 (13.0 to 100.6)	391.2 (96.6 to 719.4)	4.0 (2.6 to 5.5)	316.6 (180.3 to 492.2)
Bermuda	62.6 (19.6 to 102.6)	452.6 (139.4 to 709.8)	0.9 (0.8 to 1.1)	144.5 (60.9 to 281.6)
Bhutan	31.8 (8.5 to 57.8)	297.6 (78.9 to 525.4)	2.7 (1.8 to 3.9)	222.5 (127.0 to 348.0)
Bolivia	48.6 (12.5 to 82.0)	421.1 (105.8 to 704.0)	2.0 (1.4 to 2.8)	242.8 (126.1 to 392.9)
Bosnia and Herzegovina	41.0 (11.2 to 69.1)	379.1 (107.0 to 617.1)	1.8 (1.2 to 2.3)	176.7 (97.1 to 293.3)
Botswana	63.4 (18.2 to 106.3)	513.1 (142.2 to 844.8)	2.9 (2.1 to 3.7)	318.3 (176.7 to 482.5)
Brazil	55.3 (37.3 to 74.2)	388.9 (262.2 to 526.5)	1.5 (1.5 to 1.6)	182.6 (129.9 to 254.6)
Brunei	56.4 (17.5 to 88.9)	418.3 (132.5 to 644.5)	1.2 (1.0 to 1.4)	174.6 (85.5 to 292.4)
Bulgaria	43.5 (12.0 to 71.1)	429.1 (118.8 to 682.0)	2.0 (1.5 to 2.6)	209.0 (115.4 to 339.5)
Burkina Faso	50.8 (9.2 to 99.0)	362.1 (66.6 to 692.2)	4.4 (2.7 to 6.1)	315.9 (165.2 to 491.8)
Burundi	47.7 (9.2 to 93.7)	306.8 (57.7 to 602.2)	8.5 (6.4 to 11.4)	427.1 (289.8 to 607.8)
Côte d'Ivoire	60.7 (14.5 to 109.1)	446.6 (109.5 to 797.9)	4.1 (2.5 to 5.6)	336.5 (187.6 to 530.1)
Cabo Verde	66.9 (18.0 to 115.6)	500.8 (125.8 to 858.8)	3.3 (2.5 to 4.2)	287.7 (153.5 to 471.7)
Cambodia	32.1 (10.0 to 58.7)	233.4 (73.5 to 429.0)	0.7 (0.4 to 1.2)	114.4 (50.0 to 195.9)
Cameroon	57.8 (14.9 to 102.3)	402.8 (99.8 to 694.6)	3.9 (2.3 to 5.5)	313.9 (176.3 to 472.1)
Canada	35.3 (9.0 to 57.5)	272.3 (76.4 to 430.2)	0.8 (0.7 to 0.8)	93.1 (46.6 to 173.7)
Central African Republic	47.9 (9.9 to 89.4)	325.7 (65.0 to 600.6)	5.6 (4.0 to 7.8)	414.5 (267.6 to 602.2)

Chad	49.3 (8.7 to 97.3)	342.1 (60.3 to 649.1)	5.1 (3.4 to 7.0)	350.9 (206.9 to 522.6)
Chile	66.3 (19.9 to 107.2)	478.8 (148.1 to 773.6)	1.4 (1.3 to 1.6)	183.6 (92.4 to 331.9)
China	28.2 (19.0 to 37.9)	214.7 (150.1 to 278.6)	0.8 (0.7 to 1.0)	101.4 (72.5 to 139.4)
Colombia	64.4 (16.2 to 110.3)	504.4 (135.2 to 858.9)	1.4 (1.2 to 1.7)	206.3 (98.7 to 371.2)
Comoros	57.1 (17.1 to 101.0)	378.8 (108.6 to 661.6)	7.2 (5.3 to 10.2)	419.9 (273.3 to 596.3)
Congo	67.6 (18.9 to 115.0)	515.4 (144.1 to 887.6)	3.6 (2.5 to 4.8)	356.2 (194.6 to 544.2)
Cook Islands	41.0 (12.9 to 66.5)	364.6 (115.3 to 578.1)	0.6 (0.5 to 0.9)	136.0 (62.4 to 247.2)
Costa Rica	63.5 (18.8 to 104.7)	495.7 (150.0 to 804.0)	1.7 (1.5 to 1.9)	203.7 (107.1 to 344.6)
Croatia	45.3 (11.9 to 73.5)	443.8 (122.6 to 705.1)	1.6 (1.1 to 2.0)	172.1 (83.8 to 318.5)
Cuba	44.0 (12.2 to 75.4)	270.1 (78.5 to 445.2)	0.8 (0.7 to 0.9)	103.6 (47.7 to 190.5)
Cyprus	51.1 (14.0 to 82.3)	287.6 (81.0 to 450.5)	0.7 (0.6 to 0.8)	87.6 (39.4 to 164.6)
Czechia	46.1 (13.6 to 75.7)	450.3 (126.9 to 694.6)	1.7 (1.3 to 2.1)	175.1 (90.6 to 312.6)
North Korea	21.7 (5.9 to 38.7)	177.8 (47.7 to 304.9)	0.9 (0.7 to 1.5)	110.0 (60.7 to 183.0)
Democratic Republic of the Congo	49.3 (10.4 to 91.1)	327.0 (73.1 to 584.1)	3.9 (2.7 to 5.7)	307.6 (184.2 to 474.2)
Denmark	42.6 (11.1 to 66.9)	266.1 (74.9 to 413.4)	1.4 (1.2 to 1.5)	107.0 (60.6 to 189.6)
Djibouti	61.9 (16.5 to 110.3)	429.9 (113.8 to 738.0)	6.8 (5.0 to 9.5)	415.5 (266.6 to 596.9)
Dominica	77.6 (27.2 to 123.4)	665.6 (224.1 to 1,029.3)	3.6 (2.8 to 4.7)	386.8 (225.0 to 604.4)

Dominican Republic	58.0 (16.4 to 98.5)	423.0 (129.2 to 696.3)	1.4 (1.1 to 1.9)	207.0 (99.5 to 358.3)
Ecuador	94.9 (29.9 to 160.5)	710.8 (226.2 to 1,140.8)	2.2 (1.5 to 2.9)	313.9 (155.0 to 524.7)
Egypt	46.3 (12.0 to 77.7)	303.1 (81.0 to 484.3)	0.8 (0.6 to 1.0)	132.7 (59.7 to 240.4)
El Salvador	55.0 (13.2 to 92.6)	401.8 (98.6 to 658.9)	1.0 (0.8 to 1.3)	165.9 (74.2 to 292.8)
Equatorial Guinea	84.9 (20.6 to 140.9)	706.0 (172.0 to 1,150.4)	2.9 (1.9 to 4.4)	370.1 (185.0 to 625.8)
Eritrea	55.8 (13.9 to 102.5)	380.1 (98.2 to 676.6)	8.6 (6.4 to 11.4)	486.4 (329.2 to 688.8)
Estonia	44.9 (13.7 to 69.5)	420.7 (126.8 to 632.4)	1.7 (1.4 to 2.1)	177.5 (97.6 to 298.5)
Eswatini	56.6 (13.6 to 98.5)	449.0 (107.6 to 751.3)	3.4 (2.3 to 4.6)	329.0 (195.4 to 508.7)
Ethiopia	41.4 (21.9 to 62.3)	257.5 (139.1 to 372.4)	7.6 (6.2 to 9.2)	372.6 (302.9 to 464.0)
Fiji	41.2 (12.1 to 66.5)	381.3 (111.3 to 598.0)	1.9 (1.4 to 2.6)	239.8 (130.8 to 376.7)
Finland	52.4 (15.7 to 84.1)	336.3 (91.5 to 529.4)	1.3 (1.2 to 1.5)	126.4 (67.9 to 229.2)
France	76.2 (26.3 to 120.9)	426.9 (155.3 to 661.3)	1.7 (1.5 to 1.8)	152.6 (83.6 to 292.8)
Gabon	82.8 (17.7 to 140.9)	688.2 (146.3 to 1,158.0)	3.1 (2.2 to 4.3)	374.9 (194.3 to 615.7)
Gambia	51.0 (11.7 to 90.3)	334.6 (77.4 to 578.0)	4.5 (3.1 to 6.1)	316.9 (201.2 to 452.6)
Georgia	41.5 (12.5 to 68.4)	357.5 (110.3 to 573.4)	1.5 (1.2 to 1.8)	177.8 (96.1 to 291.4)
Germany	91.8 (27.5 to 140.5)	538.6 (163.0 to 815.6)	1.9 (1.7 to 2.0)	178.8 (88.8 to 355.0)
Ghana	56.4 (15.1 to 95.6)	387.6 (104.4 to 634.9)	2.4 (1.6 to 3.1)	239.2 (129.5 to 383.3)

Greece	47.9 (12.4 to 76.1)	267.3 (68.7 to 422.8)	0.9 (0.9 to 1.0)	95.4 (48.2 to 179.7)
Greenland	53.8 (17.9 to 86.2)	554.6 (167.4 to 870.9)	2.4 (1.6 to 3.1)	250.9 (135.4 to 429.7)
Grenada	63.1 (17.4 to 104.4)	477.2 (131.8 to 790.3)	2.2 (1.9 to 2.5)	240.1 (128.5 to 393.0)
Guam	39.9 (13.6 to 65.1)	351.4 (123.2 to 567.2)	0.4 (0.2 to 0.5)	125.5 (47.9 to 237.0)
Guatemala	61.5 (17.0 to 101.7)	505.2 (140.3 to 844.9)	2.2 (1.9 to 2.6)	284.5 (156.4 to 453.6)
Guinea	52.7 (11.5 to 103.7)	374.1 (81.7 to 702.2)	4.5 (3.0 to 6.1)	335.4 (201.5 to 527.5)
Guinea-Bissau	54.3 (10.4 to 100.7)	385.9 (71.8 to 712.7)	5.5 (3.8 to 7.2)	392.5 (240.0 to 587.9)
Guyana	63.8 (18.5 to 104.9)	502.4 (138.6 to 804.2)	3.6 (2.7 to 4.6)	340.8 (197.2 to 506.7)
Haiti	47.1 (11.6 to 85.2)	324.3 (80.6 to 567.8)	4.2 (3.1 to 5.8)	323.5 (202.6 to 482.0)
Honduras	56.6 (12.4 to 97.7)	437.9 (96.9 to 757.0)	3.0 (2.1 to 4.0)	292.5 (164.0 to 456.7)
Hungary	41.1 (12.8 to 68.0)	375.0 (118.2 to 588.8)	1.3 (1.0 to 1.6)	148.5 (74.7 to 266.4)
Iceland	51.4 (14.7 to 80.3)	308.1 (88.0 to 484.8)	1.0 (0.9 to 1.1)	106.2 (53.8 to 205.1)
India	33.2 (23.6 to 43.2)	256.2 (185.6 to 325.7)	2.5 (1.8 to 2.8)	191.6 (146.9 to 237.7)
Indonesia	34.9 (22.9 to 46.8)	219.0 (147.8 to 294.1)	0.4 (0.1 to 0.6)	92.7 (54.1 to 136.0)
Iran	50.0 (33.8 to 65.7)	305.4 (211.4 to 392.6)	0.7 (0.7 to 1.0)	121.5 (81.7 to 172.7)
Iraq	44.2 (13.3 to 73.4)	278.9 (83.4 to 449.8)	0.9 (0.7 to 1.1)	124.7 (62.6 to 208.7)
Ireland	63.8 (19.4 to 100.7)	382.9 (113.0 to 589.7)	1.3 (1.1 to 1.4)	129.3 (66.8 to 242.3)

Israel	52.9 (17.4 to 83.2)	307.6 (105.5 to 466.1)	1.1 (1.0 to 1.2)	113.4 (57.5 to 216.4)
Italy	43.1 (28.7 to 59.7)	253.4 (174.1 to 344.3)	1.2 (1.0 to 1.4)	97.1 (65.6 to 148.3)
Jamaica	58.5 (17.0 to 95.4)	426.3 (124.7 to 693.1)	2.1 (1.5 to 2.7)	211.9 (109.3 to 348.6)
Japan	44.0 (28.3 to 61.0)	261.6 (169.0 to 352.3)	0.7 (0.6 to 0.7)	87.0 (56.7 to 135.8)
Jordan	43.5 (12.3 to 70.0)	268.8 (74.0 to 436.0)	0.7 (0.6 to 0.9)	109.2 (53.4 to 193.0)
Kazakhstan	49.8 (14.1 to 82.0)	475.8 (136.7 to 769.9)	1.9 (1.7 to 2.2)	230.3 (126.4 to 386.6)
Kenya	66.2 (48.5 to 87.0)	411.9 (308.0 to 527.6)	6.1 (4.7 to 7.5)	377.9 (295.6 to 465.8)
Kiribati	35.6 (8.8 to 63.9)	317.8 (79.1 to 551.9)	2.3 (1.7 to 3.1)	253.8 (151.0 to 385.7)
Kuwait	53.9 (14.7 to 86.6)	358.1 (95.0 to 569.3)	0.6 (0.5 to 0.7)	117.9 (46.4 to 231.6)
Kyrgyzstan	45.0 (12.2 to 76.1)	416.9 (112.5 to 660.2)	3.1 (2.5 to 3.7)	284.3 (179.2 to 428.9)
Laos	33.4 (8.5 to 56.8)	252.3 (60.5 to 427.9)	0.6 (0.4 to 1.3)	124.1 (48.5 to 221.7)
Latvia	40.9 (12.4 to 65.2)	362.8 (117.0 to 571.2)	1.5 (1.1 to 1.9)	161.8 (86.2 to 286.3)
Lebanon	45.6 (14.3 to 76.6)	289.8 (93.5 to 476.6)	1.7 (1.4 to 2.0)	149.2 (83.7 to 244.1)
Lesotho	49.1 (10.3 to 86.5)	360.1 (79.7 to 602.7)	3.2 (2.2 to 4.2)	290.4 (165.7 to 427.6)
Liberia	52.0 (10.5 to 97.4)	365.3 (72.6 to 657.7)	3.8 (2.3 to 5.5)	290.5 (165.4 to 431.6)
Libya	43.5 (12.8 to 69.9)	266.7 (80.2 to 428.6)	1.1 (0.7 to 1.5)	131.7 (66.9 to 218.5)
Lithuania	42.8 (13.8 to 67.3)	389.2 (123.9 to 586.2)	1.9 (1.5 to 2.3)	190.1 (110.8 to 303.0)

Luxembourg	70.2 (23.9 to 109.7)	439.9 (139.5 to 663.0)	1.6 (1.4 to 1.9)	153.5 (78.4 to 278.8)
Madagascar	52.1 (13.4 to 96.6)	337.3 (88.4 to 620.0)	5.7 (4.4 to 7.7)	363.1 (241.6 to 514.9)
Malawi	52.1 (12.3 to 94.2)	338.2 (75.6 to 610.6)	8.5 (6.4 to 10.7)	468.8 (329.8 to 652.8)
Malaysia	44.6 (11.8 to 72.7)	353.4 (94.8 to 559.1)	0.7 (0.6 to 0.9)	138.7 (54.2 to 247.8)
Maldives	43.6 (13.0 to 75.8)	376.5 (120.1 to 631.7)	1.0 (0.8 to 1.4)	154.0 (67.0 to 275.2)
Mali	43.6 (10.2 to 84.1)	288.3 (64.0 to 547.2)	5.0 (3.3 to 6.9)	321.2 (194.4 to 462.6)
Malta	51.4 (15.2 to 84.2)	290.5 (82.7 to 458.4)	0.8 (0.7 to 0.9)	96.5 (46.9 to 187.8)
Marshall Islands	32.8 (8.3 to 60.2)	278.6 (67.4 to 492.3)	1.5 (1.2 to 2.0)	186.3 (97.2 to 290.2)
Mauritania	55.8 (15.7 to 95.1)	384.2 (106.1 to 649.1)	3.3 (2.3 to 4.3)	269.7 (159.3 to 421.7)
Mauritius	61.4 (21.2 to 99.5)	630.3 (207.5 to 981.0)	3.5 (3.1 to 3.8)	339.8 (202.7 to 542.7)
Mexico	77.0 (52.8 to 101.6)	582.8 (400.6 to 753.8)	2.0 (1.7 to 2.3)	268.5 (192.0 to 360.9)
Micronesia (Federated States of)	34.1 (7.2 to 58.6)	289.1 (62.6 to 488.8)	1.5 (1.1 to 1.9)	184.8 (96.1 to 298.9)
Monaco	60.0 (18.9 to 96.1)	356.4 (121.8 to 564.0)	0.6 (0.4 to 0.8)	103.8 (42.2 to 209.9)
Mongolia	43.2 (9.2 to 74.0)	403.0 (82.2 to 672.8)	1.8 (1.4 to 2.3)	223.4 (116.4 to 364.4)
Montenegro	38.2 (10.4 to 62.6)	333.3 (89.4 to 532.7)	0.7 (0.6 to 0.9)	113.9 (46.1 to 221.3)
Morocco	43.2 (10.5 to 74.4)	281.1 (69.5 to 485.0)	1.8 (1.3 to 2.2)	168.5 (97.3 to 273.8)
Mozambique	57.0 (11.1 to 104.6)	409.6 (77.4 to 763.8)	7.9 (5.9 to 10.6)	455.7 (293.1 to 651.5)

Myanmar	37.5 (10.5 to 66.7)	292.2 (84.4 to 518.6)	1.0 (0.6 to 1.3)	150.7 (65.5 to 260.5)
Namibia	53.4 (15.7 to 92.2)	405.5 (123.2 to 688.0)	2.9 (2.1 to 3.9)	274.7 (159.1 to 429.9)
Nauru	39.4 (10.4 to 65.5)	376.9 (99.3 to 611.3)	1.7 (1.3 to 2.2)	217.3 (111.1 to 348.7)
Nepal	35.8 (7.8 to 63.6)	339.5 (68.8 to 609.1)	5.5 (3.1 to 7.6)	290.5 (185.4 to 435.2)
Netherlands	56.4 (16.1 to 91.4)	347.3 (99.4 to 537.7)	1.4 (1.2 to 1.5)	126.6 (70.1 to 231.5)
New Zealand	51.5 (20.6 to 77.9)	312.9 (122.1 to 471.4)	1.0 (1.0 to 1.1)	121.5 (70.5 to 199.0)
Nicaragua	51.3 (12.6 to 95.6)	364.8 (85.9 to 645.8)	1.3 (1.1 to 1.6)	170.5 (85.6 to 302.2)
Niger	41.0 (7.1 to 85.1)	264.6 (48.4 to 540.1)	4.8 (2.8 to 7.6)	305.8 (174.6 to 484.5)
Nigeria	66.4 (47.6 to 86.1)	443.4 (326.7 to 580.9)	3.2 (1.9 to 4.3)	288.5 (205.5 to 374.5)
Niue	39.8 (11.9 to 64.7)	347.9 (108.6 to 551.5)	1.4 (1.1 to 1.7)	198.0 (120.5 to 310.1)
North Macedonia	38.7 (11.3 to 62.8)	341.9 (96.4 to 539.1)	1.6 (1.1 to 2.1)	158.7 (89.2 to 267.0)
Northern Mariana Islands	38.2 (9.0 to 62.7)	326.8 (80.8 to 516.1)	0.6 (0.4 to 0.7)	129.3 (53.0 to 234.5)
Norway	67.4 (40.5 to 93.2)	413.3 (247.4 to 567.6)	1.4 (1.3 to 1.4)	142.9 (91.5 to 227.9)
Oman	49.9 (14.8 to 79.5)	321.8 (89.0 to 497.8)	0.4 (0.3 to 0.5)	106.0 (39.3 to 202.5)
Pakistan	36.1 (18.0 to 54.0)	308.5 (157.1 to 447.3)	4.4 (3.1 to 5.8)	298.4 (227.7 to 395.6)
Palau	43.0 (11.8 to 69.7)	403.1 (115.7 to 631.4)	1.9 (1.5 to 2.5)	237.9 (134.2 to 361.8)
Palestine	44.2 (13.9 to 77.6)	279.0 (87.4 to 468.9)	1.7 (1.5 to 2.2)	161.7 (95.1 to 252.5)

Panama	70.8 (19.9 to 114.0)	571.5 (170.7 to 897.7)	1.5 (1.2 to 1.7)	228.3 (105.9 to 403.1)
Papua New Guinea	27.9 (6.6 to 50.8)	227.3 (54.7 to 402.6)	1.8 (1.2 to 2.7)	183.7 (98.5 to 286.2)
Paraguay	52.4 (17.3 to 86.1)	399.9 (124.0 to 668.6)	1.5 (1.1 to 2.0)	192.5 (99.5 to 319.1)
Peru	67.8 (18.9 to 113.0)	534.4 (155.1 to 856.1)	0.8 (0.6 to 1.1)	189.3 (75.8 to 353.7)
Philippines	36.4 (25.5 to 48.6)	243.5 (175.2 to 319.5)	0.4 (0.3 to 0.5)	103.3 (70.5 to 144.9)
Poland	39.1 (26.1 to 53.7)	350.7 (236.8 to 458.2)	2.2 (1.7 to 2.5)	174.3 (126.5 to 233.6)
Portugal	47.7 (12.7 to 76.4)	269.2 (73.8 to 420.7)	1.6 (1.4 to 1.8)	119.2 (71.0 to 197.1)
Puerto Rico	63.0 (18.4 to 100.1)	460.9 (129.5 to 727.0)	1.2 (1.0 to 1.4)	164.6 (74.3 to 304.3)
Qatar	55.4 (17.9 to 87.5)	381.3 (122.2 to 587.3)	0.6 (0.5 to 0.8)	119.1 (48.4 to 232.5)
South Korea	47.7 (12.1 to 74.3)	315.4 (84.6 to 484.7)	0.8 (0.7 to 1.0)	108.7 (51.9 to 201.4)
Republic of Moldova	32.2 (9.4 to 54.4)	247.5 (76.3 to 407.6)	1.7 (1.3 to 2.0)	149.3 (93.5 to 228.1)
Romania	42.1 (12.6 to 68.1)	398.1 (121.7 to 617.6)	1.7 (1.3 to 2.0)	180.1 (100.7 to 290.7)
Russia	32.0 (21.6 to 43.9)	211.2 (143.6 to 281.8)	0.5 (0.4 to 0.5)	72.8 (48.2 to 110.6)
Rwanda	54.7 (11.9 to 98.7)	360.5 (77.4 to 634.1)	6.8 (5.1 to 9.7)	405.8 (276.0 to 585.1)
Saint Kitts and Nevis	71.6 (22.5 to 116.3)	564.3 (166.3 to 909.6)	2.3 (1.9 to 2.8)	269.3 (142.6 to 448.3)
Saint Lucia	65.7 (17.1 to 111.3)	519.3 (139.4 to 852.3)	2.8 (2.3 to 3.3)	279.8 (158.3 to 458.5)
Saint Vincent and the Grenadines	63.9 (15.7 to 104.4)	494.2 (132.8 to 812.4)	3.2 (2.7 to 3.6)	301.5 (179.4 to 451.7)

Samoa	35.2 (11.0 to 59.4)	295.3 (90.6 to 476.0)	1.2 (0.9 to 1.6)	163.7 (85.1 to 268.3)
San Marino	50.9 (14.5 to 78.5)	284.9 (78.7 to 448.8)	0.1 (0.1 to 0.2)	67.0 (20.3 to 146.5)
São Tomé and Príncipe	61.3 (17.8 to 104.1)	439.0 (133.7 to 723.0)	3.4 (2.4 to 4.5)	292.2 (152.3 to 457.6)
Saudi Arabia	67.1 (17.6 to 107.4)	518.0 (145.1 to 805.9)	1.5 (1.1 to 1.9)	211.7 (99.0 to 386.4)
Senegal	56.3 (12.0 to 104.7)	400.8 (89.7 to 717.9)	4.6 (3.2 to 6.2)	347.6 (211.6 to 520.4)
Serbia	45.0 (12.5 to 73.0)	371.2 (109.1 to 567.6)	1.4 (1.1 to 1.7)	153.2 (81.0 to 270.2)
Seychelles	42.0 (12.3 to 72.0)	331.8 (94.3 to 560.3)	1.0 (0.8 to 1.2)	146.4 (65.4 to 254.5)
Sierra Leone	49.8 (10.0 to 92.5)	346.4 (73.4 to 636.3)	4.0 (2.5 to 5.7)	304.2 (166.8 to 454.2)
Singapore	43.0 (12.2 to 69.1)	271.3 (78.8 to 431.8)	0.5 (0.4 to 0.5)	82.0 (34.9 to 166.2)
Slovakia	46.0 (13.5 to 76.6)	458.3 (136.9 to 727.4)	1.9 (1.5 to 2.4)	199.8 (110.2 to 338.9)
Slovenia	41.9 (13.0 to 68.1)	376.7 (120.6 to 590.9)	1.4 (1.0 to 1.8)	140.9 (74.9 to 247.0)
Solomon Islands	30.4 (7.0 to 55.0)	256.7 (61.9 to 458.6)	1.8 (1.2 to 2.6)	193.8 (108.0 to 306.8)
Somalia	35.5 (5.5 to 76.2)	211.5 (34.2 to 459.8)	10.3 (6.7 to 16.9)	505.5 (305.5 to 770.1)
South Africa	58.7 (35.8 to 81.5)	407.3 (266.3 to 544.6)	2.1 (1.8 to 2.4)	231.0 (168.2 to 311.5)
South Sudan	50.6 (11.3 to 97.9)	334.8 (76.4 to 623.4)	9.0 (6.5 to 12.5)	490.1 (339.6 to 688.2)
Spain	44.0 (13.7 to 71.8)	269.3 (85.1 to 429.5)	1.0 (0.8 to 1.1)	92.3 (47.3 to 176.5)
Sri Lanka	52.8 (12.8 to 86.9)	476.5 (117.2 to 777.7)	1.5 (1.0 to 2.1)	197.1 (87.7 to 345.7)

Sudan	39.1 (10.3 to 67.1)	242.3 (64.5 to 411.8)	1.6 (1.1 to 2.1)	167.7 (101.5 to 256.7)
Suriname	66.6 (21.6 to 107.7)	542.9 (184.4 to 868.1)	2.6 (2.0 to 3.3)	301.8 (175.6 to 474.2)
Sweden	39.9 (16.9 to 62.9)	245.2 (105.3 to 363.5)	0.8 (0.7 to 0.9)	87.4 (49.7 to 149.7)
Switzerland	54.1 (14.9 to 85.3)	314.1 (92.6 to 495.1)	1.2 (1.0 to 1.3)	109.8 (57.3 to 204.0)
Syria	38.0 (10.6 to 62.4)	229.3 (61.2 to 381.0)	1.2 (0.8 to 1.6)	127.8 (76.3 to 205.8)
Turkey	57.0 (17.8 to 93.3)	405.8 (127.1 to 642.6)	1.8 (1.4 to 2.2)	193.5 (111.2 to 316.2)
Taiwan (province of China)	35.0 (9.3 to 55.4)	334.2 (84.6 to 509.7)	1.0 (0.9 to 1.1)	126.7 (61.9 to 232.0)
Tajikistan	45.0 (12.2 to 77.2)	417.8 (113.0 to 698.8)	4.6 (3.4 to 6.1)	406.9 (269.1 to 572.0)
Thailand	43.0 (13.9 to 71.2)	344.2 (111.1 to 559.4)	1.2 (0.9 to 1.5)	152.3 (74.8 to 270.9)
Timor-Leste	34.2 (9.7 to 60.3)	251.7 (69.0 to 428.9)	0.6 (0.4 to 1.3)	121.1 (45.6 to 221.0)
Togo	57.0 (12.8 to 105.2)	399.6 (86.9 to 733.2)	3.9 (2.5 to 5.4)	312.9 (177.8 to 479.9)
Tokelau	33.1 (7.7 to 59.4)	268.2 (64.5 to 454.5)	2.0 (1.7 to 2.6)	216.8 (140.8 to 311.5)
Tonga	32.9 (10.2 to 52.8)	261.6 (79.9 to 422.3)	1.0 (0.7 to 1.4)	141.7 (75.7 to 229.2)
Trinidad and Tobago	72.3 (20.5 to 119.0)	593.4 (168.6 to 955.2)	2.4 (1.8 to 3.0)	287.4 (153.6 to 486.5)
Tunisia	42.1 (12.1 to 71.3)	257.9 (75.8 to 429.9)	1.0 (0.7 to 1.4)	118.1 (61.6 to 205.2)
Turkmenistan	47.5 (11.3 to 81.9)	459.8 (115.9 to 748.7)	2.8 (1.9 to 3.9)	305.2 (170.1 to 480.8)
Tuvalu	33.2 (9.5 to 56.6)	272.2 (74.7 to 438.5)	1.3 (1.0 to 1.7)	168.3 (91.6 to 261.9)

Uganda	64.1 (13.4 to 115.2)	404.7 (85.8 to 722.6)	5.7 (4.4 to 7.4)	375.7 (247.1 to 555.6)
Ukraine	36.5 (11.2 to 59.4)	253.1 (77.6 to 403.7)	0.9 (0.6 to 1.1)	115.8 (62.0 to 194.0)
United Arab Emirates	64.4 (22.0 to 105.6)	482.4 (148.1 to 748.3)	0.9 (0.6 to 1.1)	177.4 (74.6 to 330.1)
UK	72.0 (49.0 to 97.8)	413.6 (276.6 to 554.0)	1.2 (1.1 to 1.3)	148.2 (101.8 to 221.1)
Tanzania	60.7 (14.6 to 108.5)	425.8 (103.0 to 749.0)	7.0 (5.5 to 9.2)	445.3 (294.8 to 641.6)
USA	42.9 (27.1 to 60.7)	341.6 (217.9 to 466.9)	0.8 (0.7 to 0.8)	111.2 (70.0 to 173.7)
Virgin Islands	66.4 (20.2 to 107.6)	500.4 (152.1 to 777.4)	1.6 (1.1 to 2.2)	231.8 (118.4 to 389.8)
Uruguay	56.3 (13.4 to 91.5)	394.4 (95.3 to 636.9)	1.8 (1.6 to 1.9)	183.7 (100.5 to 305.5)
Uzbekistan	49.4 (13.6 to 79.9)	479.2 (142.1 to 765.4)	2.6 (2.2 to 3.1)	297.9 (186.3 to 466.5)
Vanuatu	30.8 (7.0 to 53.4)	254.8 (56.8 to 433.2)	1.6 (1.2 to 2.1)	182.2 (96.2 to 284.9)
Venezuela	64.6 (20.0 to 110.9)	520.8 (149.0 to 889.5)	2.2 (1.6 to 2.8)	265.1 (138.8 to 462.2)
Viet Nam	34.6 (8.0 to 58.9)	246.7 (56.2 to 409.7)	0.1 (0.0 to 0.3)	79.1 (18.1 to 169.2)
Yemen	33.3 (6.5 to 61.4)	197.4 (36.9 to 352.4)	1.5 (1.0 to 2.0)	148.2 (79.9 to 235.6)
Zambia	73.1 (18.7 to 129.0)	547.3 (147.9 to 944.1)	12.9 (9.5 to 17.1)	746.4 (505.8 to 1,031.4)
Zimbabwe	50.2 (11.8 to 91.6)	380.2 (89.8 to 677.6)	4.5 (3.0 to 6.3)	346.5 (205.5 to 517.0)

Table 3. Age-standardised incidence, deaths, and DALYs of idiopathic epilepsy per 100,000 people (with 95% UI) in 2021 by sex and World Bank country income level

	Incidence			Death			DALYs		
	Males	**Females**	**Both sexes**	**Males**	**Females**	**Both sexes**	**Males**	**Females**	**Both sexes**
Global	45.1 (33.1 to 56.4)	40.5 (29.4 to 51.0)	42.8 (31.2 to 53.7)	2.1 (1.8 to 2.4)	1.4 (1.0 to 1.5)	1.7 (1.5 to 1.9)	201.3 (157.9 to 252.7)	154.2 (114.7 to 201.8)	177.8 (137.7 to 225.9)
World Bank country income level									
HICs	55.5 (37.5 to 74.1)	49.5 (33.1 to 67.3)	52.5 (35.4 to 70.7)	1.4 (1.3 to 1.4)	1.0 (0.9 to 1.0)	1.2 (1.1 to 1.2)	142.5 (98.1 to 205.8)	115.9 (77.5 to 173.1)	129.2 (87.7 to 189.7)
UMICs	42.0 (29.6 to 54.6)	39.4 (27.5 to 51.1)	40.7 (28.6 to 52.9)	1.3 (1.1 to 1.5)	0.8 (0.6 to 0.9)	1.0 (0.9 to 1.1)	152.5 (113.1 to 200.6)	119.3 (82.8 to 163.9)	136.1 (97.8 to 182.2)
LMICs	42.2 (30.5 to 53.3)	37.9 (27.5 to 48.4)	40.1 (29.0 to 50.6)	2.6 (2.0 to 3.0)	1.9 (1.1 to 2.2)	2.2 (1.7 to 2.5)	218.5 (170.1 to 269.5)	175.0 (129.5 to 224.0)	196.9 (153.4 to 245.5)
LICs	50.4 (34.0 to 68.0)	42.8 (28.6 to 58.9)	46.5 (31.1 to 63.5)	7.0 (5.6 to 8.6)	2.6 (1.9 to 3.5)	4.6 (3.9 to 5.6)	402.9 (321.9 to 501.7)	230.9 (166.9 to 302.7)	313.6 (248.0 to 392.3)

Figures

Appendix Figure 1. Age-standardised prevalence of epilepsy from idiopathic and secondary epilepsy combined per 100,000 people (with 95% UI) by World Bank country income level and Socio-demographic Index (SDI) quintiles, both sexes, 1990–2021

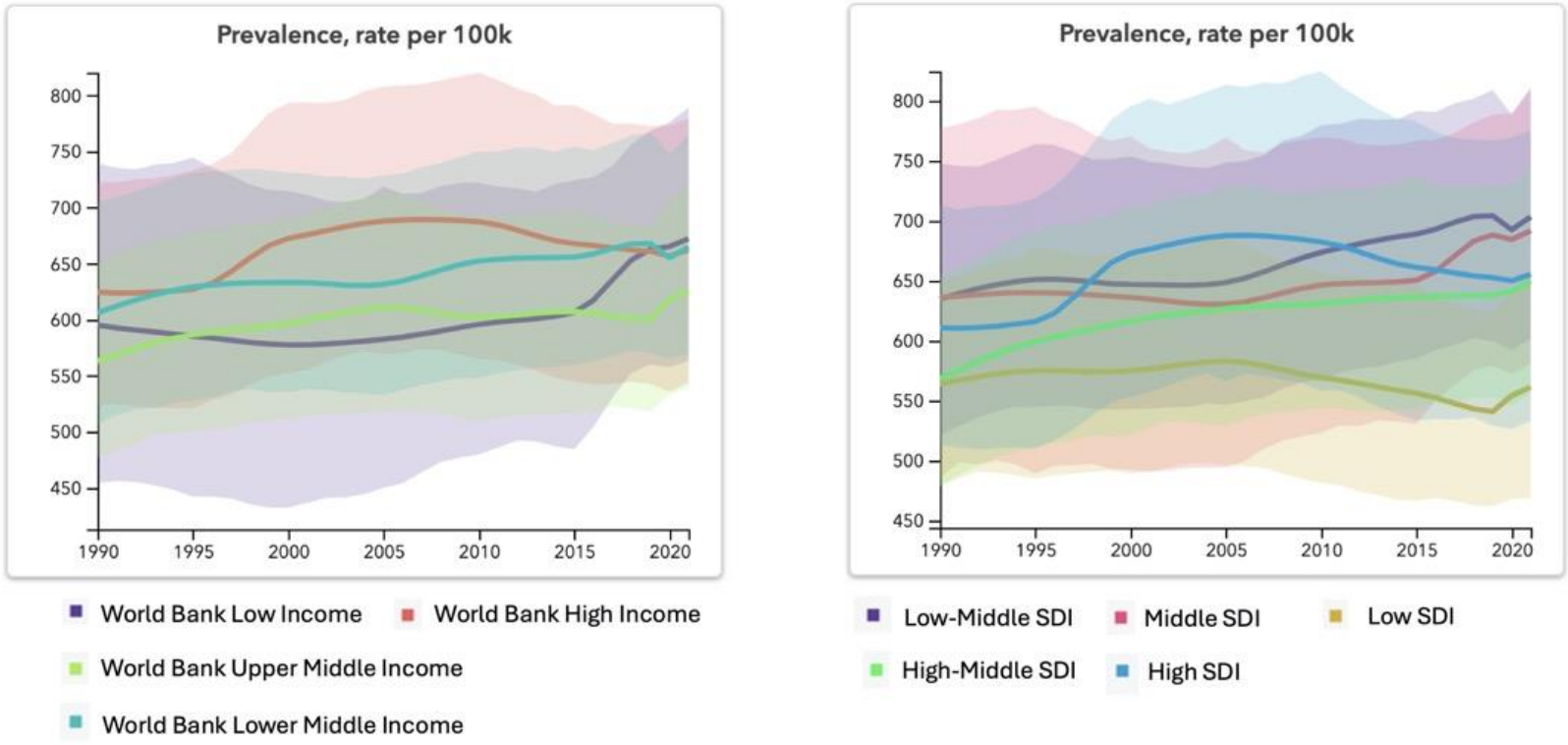


Figure 2. Age-standardised incidence, prevalence, death, and DALY rates of idiopathic epilepsy per 100,000 people in the world by sex, 1990–2021

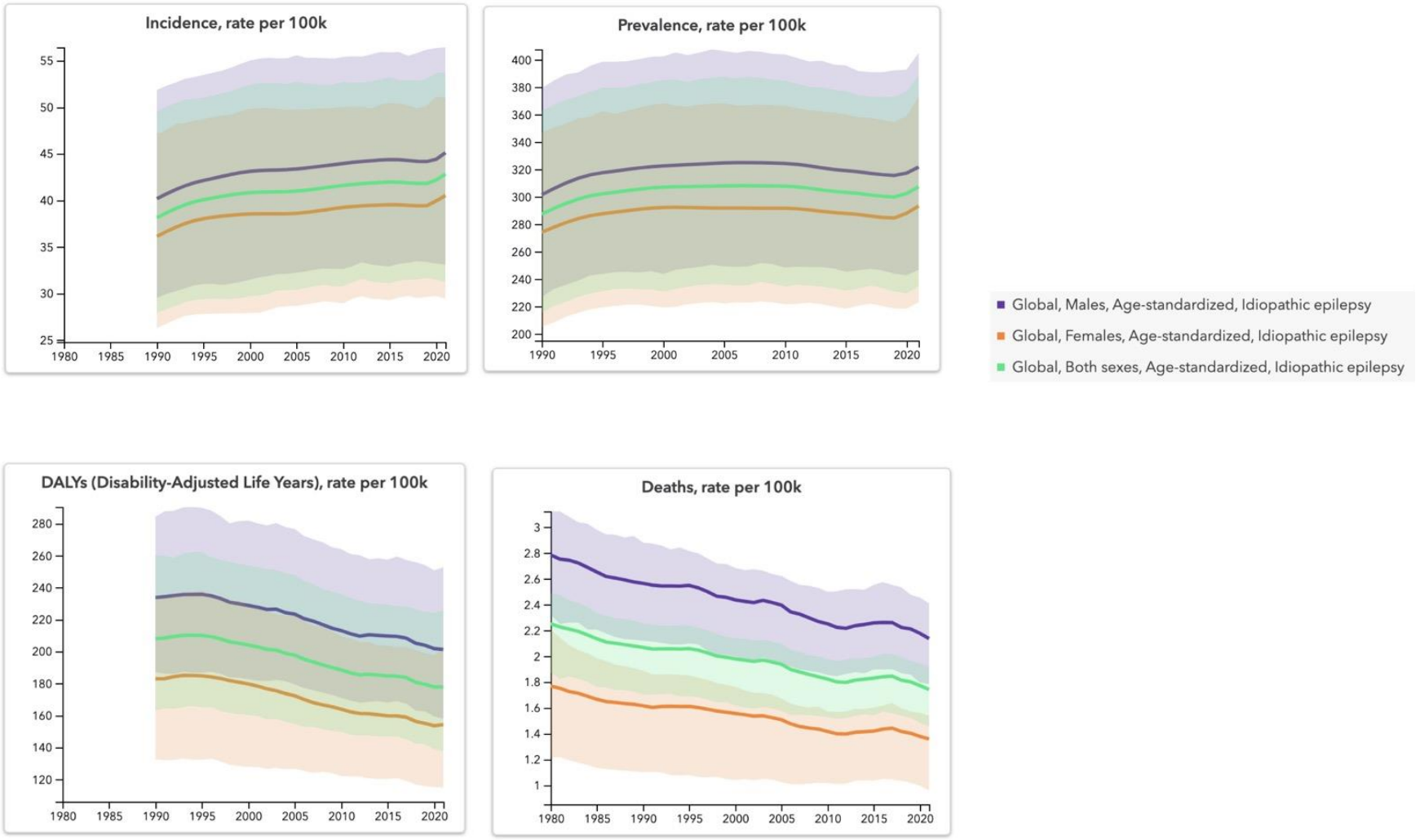


Figure 3. Age-standardised idiopathic epilepsy incidence, death, and DALY rates per 100,000 people (with 95% UI) by World Bank country income level from 1990 to 2021, both sexes

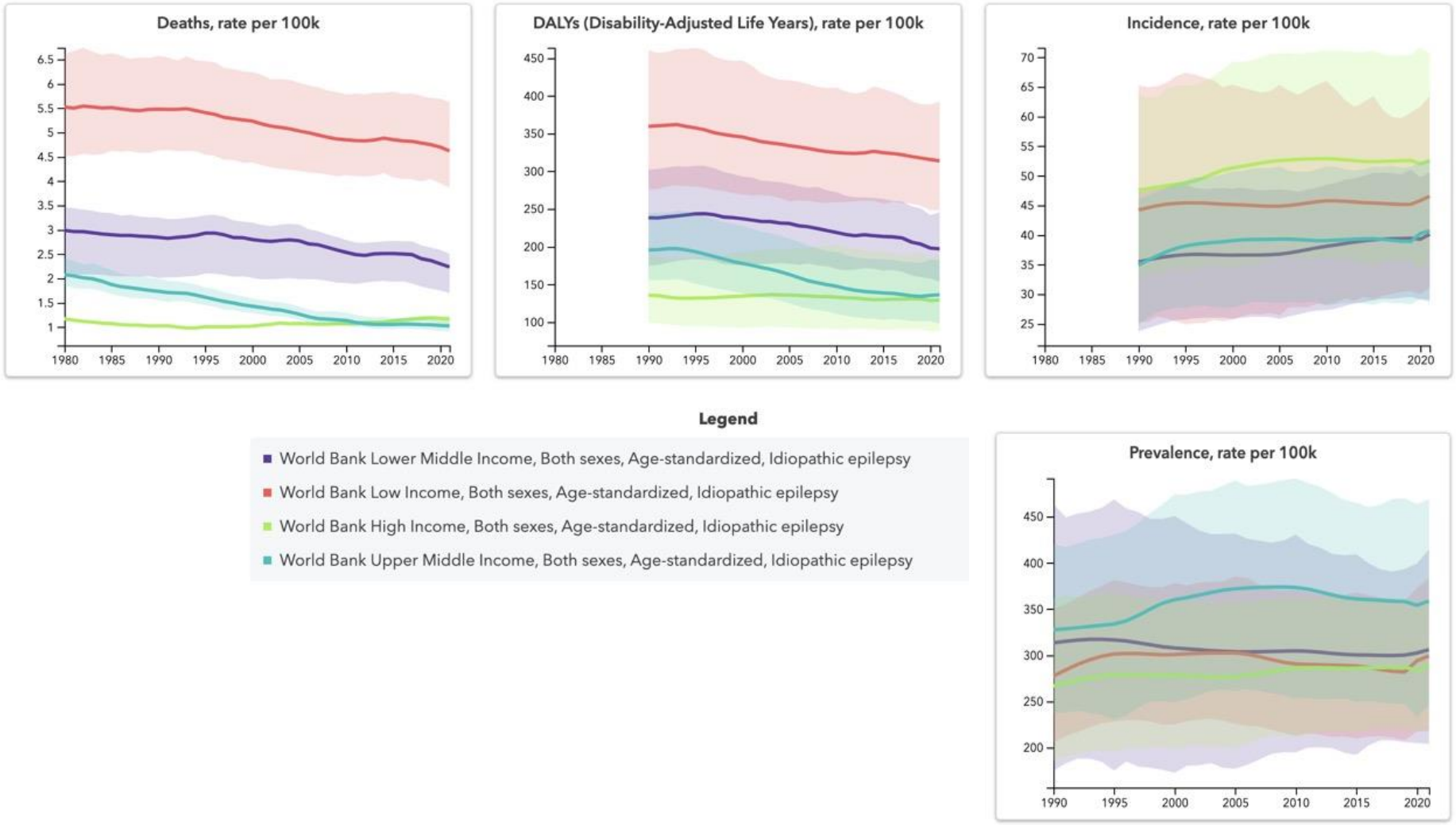
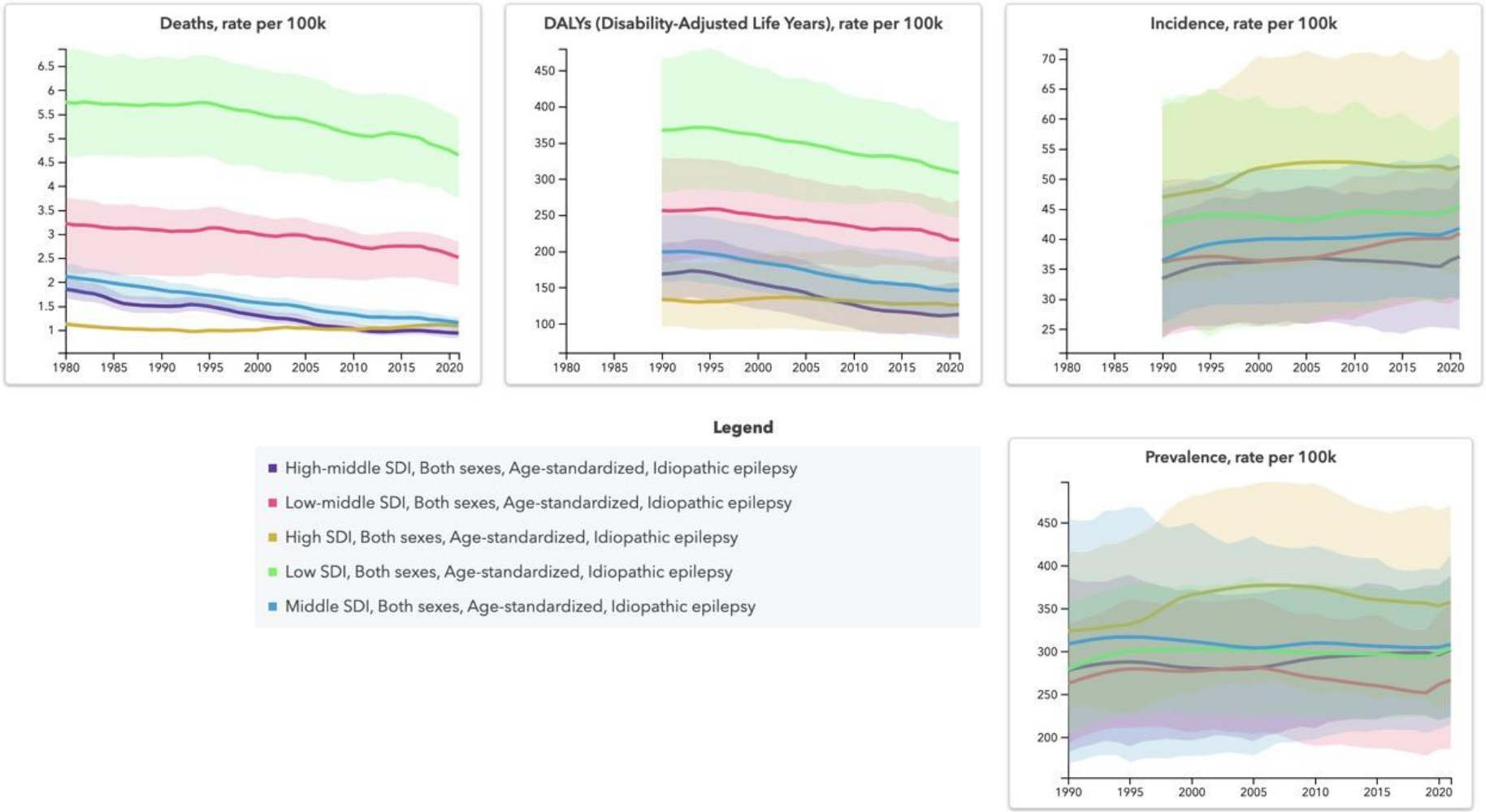


Figure 4. Age-standardised idiopathic epilepsy incidence, death, and DALY rates per 100,000 people (with 95% UI) by Socio-demographic Index quintile from 1990 to 2021, both sexes



References

1. Murray CJL, Aravkin AY, Zheng P, Abbafati C, Abbas KM, Abbasi-Kangevari M, . . . Lim SS. Global burden of 87 risk factors in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*. 2020;396:1223-1249. doi: 10.1016/S0140-6736(20)30752-2
2. Steinmetz JD, Seeher KM, Schiess N, Nichols E, Cao B, Servili C, . . . Dua T. Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *The Lancet Neurology*. 2024;23:344-381. doi: https://doi.org/10.1016/S1474-4422(24)00038-3
3. Stanaway JD, Afshin A, Gakidou E, Lim SS, Abate D, Abate KH, . . . Collaborators GBDRF. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2018;392:1923-1994. doi: 10.1016/S0140-6736(18)32225-6
4. Roth GA, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, . . . Murray CJL. 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. *The Lancet*. 2018;392:1736-1788. doi: 10.1016/S0140-6736(18)32203-7
5. United Nations Department of Economics and Social Affairs Population Division. World Population Prospects: The 2012 Revision. https://population.un.org/wpp/ Accessed 5 April 2024.
6. Collaborators GBDM. Global, regional, and national under-5 mortality, adult mortality, age-specific mortality, and life expectancy, 1970–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet (London, England)*. 2017;390:1084-1150. doi: 10.1016/S0140-6736(17)31833-0
7. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, . . . Wiebe S. ILAE Official Report: A practical clinical definition of epilepsy. *Epilepsia*. 2014;55:475-482. doi: https://doi.org/10.1111/epi.12550
8. Guidelines for epidemiologic studies on epilepsy. Commission on Epidemiology and Prognosis, International League Against Epilepsy. *Epilepsia*. 1993;34:592-596. doi: 10.1111/j.1528-1157.1993.tb00433.x
9. Zheng P, Barber R, Sorensen RJD, Murray CJL, Aravkin AY. Trimmed Constrained Mixed Effects Models: Formulations and Algorithms. *Journal of Computational and Graphical Statistics*. 2021;30:544-556. doi: 10.1080/10618600.2020.1868303
10. Ferrari AJ, Santomauro DF, Aali A, Abate YH, Abbafati C, Abbastabar H, . . . Murray CJL. 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. *The Lancet*. 2024;403:2133-2161. doi: 10.1016/S0140-6736(24)00757-8
11. Biolková V, Kolka Z, Biolek D. Algorithmic utilization of LDI transform for discrete-time filter design. Paper/Poster presented at: 2008 Proceedings of the Mosharaka International Conference on Communications, Signals and Coding, MIC-CSC 2008; 2008; https://www.scopus.com/inward/record.uri?eid=2-s2.0-70349812104&partnerID=40&md5=b356c608ef67cf4516e8bec4682ed951 [link].
12. Naghavi M, Ong KL, Aali A, Ababneh HS, Abate YH, Abbafati C, . . . Murray CJL. 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. *The Lancet*. 2024;403:2100-2132. doi: 10.1016/S0140-6736(24)00367-2

13. Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet*. 2024;403:2162-2203. doi: 10.1016/s0140-6736(24)00933-4