The global, regional, and national burden of benign prostatic hyperplasia in 204 countries and territories from 2000 to 2019: a systematic analysis for the Global Burden of Disease Study 2019

GBD 2019 Benign Prostatic Hyperplasia Collaborators*

Summary

Background Benign prostatic hyperplasia is a common urological disease affecting older men worldwide, but comprehensive data about the global, regional, and national burden of benign prostatic hyperplasia and its trends over time are scarce. As part of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019, we estimated global trends in, and prevalence of, benign prostatic hyperplasia and disability-adjusted life-years (DALYs) due to benign prostatic hyperplasia, in 21 regions and 204 countries and territories from 2000 to 2019.

Methods This study was conducted with GBD 2019 analytical and modelling strategies. Primary prevalence data came from claims from three countries and from hospital inpatient encounters from 45 locations. A Bayesian meta-regression modelling tool, DisMod-MR version 2.1, was used to estimate the age-specific, location-specific, and year-specific prevalence of benign prostatic hyperplasia. Age-standardised prevalence was calculated by the direct method using the GBD reference population. Years lived with disability (YLDs) due to benign prostatic hyperplasia were estimated by multiplying the disability weight by the symptomatic proportion of the prevalence of benign prostatic hyperplasia. Because we did not estimate years of life lost associated with benign prostatic hyperplasia, disability-adjusted life-years (DALYs) equalled YLDs. The final estimates were compared across Socio-demographic Index (SDI) quintiles. The 95% uncertainty intervals (UIs) were estimated as the 25th and 975th of 1000 ordered draws from a bootstrap distribution.

Findings Globally, there were 94·0 million (95% UI 73·2 to 118) prevalent cases of benign prostatic hyperplasia in 2019, compared with 51·1 million (43·1 to 69·3) cases in 2000. The age-standardised prevalence of benign prostatic hyperplasia was 2480 (1940 to 3090) per 100 000 people. Although the global number of prevalent cases increased by 70·5% (68·6 to 72·7) between 2000 and 2019, the global age-standardised prevalence remained stable (−0·770% [−1·56 to 0·0912]). The age-standardised prevalence in 2019 ranged from 6480 (5130 to 8080) per 100 000 in eastern Europe to 987 (732 to 1320) per 100 000 in north Africa and the Middle East. All five SDI quintiles observed an increase in the absolute DALY burden between 2000 and 2019. The most rapid increases in the absolute DALY burden were seen in the middle SDI quintile (94·7% [91·8 to 97·6]), the low-middle SDI quintile (77·3% [74·1 to 81·2]), and the low SDI quintile (77·7% [72·9 to 83·2]). Between 2000 and 2019, age-standardised DALY rates changed less, but the three lower SDI quintiles (low, low-middle, and middle) saw small increases, and the two higher SDI quintiles (high and high-middle SDI) saw small decreases.

Interpretation The absolute burden of benign prostatic hyperplasia is rising at an alarming rate in most of the world, particularly in low-income and middle-income countries that are currently undergoing rapid demographic and epidemiological changes. As more people are living longer worldwide, the absolute burden of benign prostatic hyperplasia is expected to continue to rise in the coming years, highlighting the importance of monitoring and planning for future health system strain.

Funding Bill & Melinda Gates Foundation.

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Introduction Benign prostatic hyperplasia is a multifocal, non-malignant, hyperplastic, and progressive histopathological change in stromal and epithelial cells in the transitional zone of the prostate, resulting in discrete prostatic nodules, inflammation, fibrosis, and changes in smooth muscle activity, which can cause partial or complete obstruction of the urethra.1,2 The resulting bladder outlet obstruction, coupled with increased muscle tone of the bladder and secondary dysfunction of the detrusor, produce lower urinary tract symptoms.3 Benign prostatic hyperplasia is a common urological disease among older men. The age-specific prevalence of benign prostatic hyperplasia has been estimated from
autopsy studies to be 8% in the fourth decade of life, 50% in the sixth decade of life, and 80% in the ninth decade of life.35 The annual prostatic volume increment with age, based on Krimpen and Baltimore’s longitudinal study of ageing, is about 2.0–2.5% per year in older men.36 There is some evidence to suggest the prevalence varies by race and ethnicity.37 Other factors associated with benign prostatic hyperplasia include metabolic syndrome, obesity, increased BMI, dyslipidaemia, diabetes, cardiovascular disease, acute and chronic prostatic inflammation, functional bladder capacity, treatment for cardiac disease, post-void residual urine volume, educational level, antidepressant use, calcium antagonist use, erectile function or dysfunction, high concentrations of prostate disease-specific antigen, family history of bladder cancer, and family history of prostatic disease, whereas an inverse association has been observed with increased physical exercise, moderate alcohol consumption, and smoking.38–40

Previous studies have shown that benign prostatic hyperplasia contributes to increased health costs31 and decreased quality of life.32 It is associated with serious morbidities, including an increased risk of falls, depression, and diminished health-related quality of life based on indicators such as sleep, psychological condition, activities of daily living, and sexual wellbeing.33 The effects of benign prostatic hyperplasia are not only seen on the patient but also on the patient’s family and on society at large.34,35 Beyond its immediate effect on morbidity, benign prostatic hyperplasia is also associated with complications such as urinary tract infection, acute urinary retention, urolithiasis, and acute renal failure.35,36,39

Benign prostatic hyperplasia has been identified as a major urological health problem in older men in many countries.5 The prevalence of benign prostatic hyperplasia from descriptive epidemiology studies ranges from 12% to 42%,39,40 and one study estimated the lifetime risk of benign prostatic hyperplasia to be 29%.34 A systematic review and meta-analysis by Lee and colleagues35 in 2017 identified 30 population-based, hospital-based, and community-based epidemiological studies in different countries, and yielded a 26% point prevalence of benign prostatic hyperplasia in older men.
for the years 1990–2016. Another meta-analysis done in China indicated that the pooled overall prevalence of benign prostatic hyperplasia among men aged 40 years or older was 36–6% during 1989–2014.41

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) is the largest and most comprehensive scientific effort to produce estimates of health loss due to 369 diseases and injuries. As such, GBD overcomes some of the limitations of the epidemiological studies described above by utilising a large number of administrative datasets from around the world, processing them all in a comparable fashion, and using regional patterns and predictive covariates to provide the most precise annual estimates of disease burden possible for a large number of countries and territories, including those without primary data, over a long time series. The burden of benign prostatic hyperplasia has been estimated and included in comprehensive reports since GBD 2010,42–45 and Launer and colleagues previously reported the global benign prostatic hyperplasia burden in GBD 2017. In this report, we extended and improved upon the GBD 2017 results reported by Launer and colleagues by providing estimates for additional countries and territories and more recent estimation years, incorporating more location-years of prevalence data, applying a novel method to adjust for systematic bias in prevalence data sources, and incorporating the use of a validated instrument to estimate benign prostatic hyperplasia symptom severity. We also provided a more detailed account of the dataset and current methods for estimation of the benign prostatic hyperplasia burden to stimulate substantive engagement on data collection priorities and future directions for improvement of estimates.

With the population rapidly ageing in many parts of the world, the burden of benign prostatic hyperplasia is expected to rise. Understanding the current burden of and recent trends in benign prostatic hyperplasia, the role of demographic and other factors in driving the change, and the strengths and limitations of existing datasets is necessary to fill data gaps and help health systems prepare for the challenges associated with this rising global burden.

This manuscript was produced as part of the GBD Collaborator Network and in accordance with the GBD Protocol.

Methods

Overview

A comprehensive description of GBD study aims, data sources, methodologies, and analytical tools has been reported previously.46 The methods specific to the estimation of health loss due to benign prostatic hyperplasia are summarised below. The analysis presented here complies with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) statement. All input data and the code used to execute all data processing and modelling described below can be found on the Global Health Data Exchange (GHDx) website.

Case definition

In this study, we defined a case of benign prostatic hyperplasia on the basis of an individual receiving that diagnosis in a clinical encounter, as ascertained from administrative data, using the codes of the International Classification of Diseases, version 9 (ICD-9), and version 10 (ICD-10).47 The ICD-9 codes used were 600, 600.0, 600.1, 600.2, 600.3, and 600.9, and the ICD-10 codes used were N40, N40.0, N40.1, N40.2, N40.3, and N40.9. Ascertainment via diagnostic codes in administrative data necessarily means that not all individuals have had a histological diagnosis of benign prostatic hyperplasia, and receipt of clinical care suggests these individuals could be properly described as having lower urinary tract symptoms due to benign prostatic obstruction; for consistency with previous GBD publications and visualisations, we refer to these as cases of benign prostatic hyperplasia in this Article. Complications of benign prostatic hyperplasia that can be mapped to other GBD-defined diseases, such as urinary tract infections, kidney stones, and chronic kidney disease, were not included in the analysis. Only non-fatal health loss was estimated in this analysis, because life-threatening complications of benign prostatic hyperplasia are classified in other GBD-defined diseases and mortality due to these complications should not be double-counted.

Prevalence data sources

We used international clinical administrative data to estimate the prevalence of benign prostatic hyperplasia. Clinical administrative data included claims from three locations—the USA, Taiwan (province of China), and Poland—and hospital inpatient admissions data from 45 locations. The claims data from the USA consisted of more than 12 billion claims records from the commercially insured population in 2000 and 2010–16. Claims data from Taiwan (province of China) were from the national insurance programme covering more than 99% of the population in 2016, and claims data from Poland were from the national insurance programme covering more than 90% of the population in 2015–17.48–50 The inpatient admission records came from 297 sources, each covering 1–5 years of data between 1980 and 2018 (figure 1). A complete list of prevalence data sources is available in appendix 2 (pp 22–30) and on the GHDx website.

Prevalence data processing

The processing of these data sources has been described in detail elsewhere. Briefly, for claims data, we used the unique enrollee identification numbers to link inpatient and outpatient claims to a single individual. An enrollee

For the input data see http://ghdx.healthdata.org/
For the code used for data processing and modelling see https://ghdx.healthdata.org/ gbd-2019/code

See Online for appendix 2
was then extracted as a prevalent case if they had at least one inpatient or two outpatient medical encounters with any of the defining ICD codes for benign prostatic hyperplasia in either the primary or secondary diagnostic position. Processing of inpatient admissions data involved converting benign prostatic hyperplasia admission counts into cause fractions, which are the number of hospital admissions specifically for benign prostatic hyperplasia divided by the total number of admissions in the data year. Then, these cause fractions were multiplied by the hospital admission rate per capita and the total population size for each unique source, age, sex, and year combination to convert data to population-level inpatient admission rates. Details of the data and methods used to estimate hospital admission rates and population sizes have been previously described. Population-level benign prostatic hyperplasia admission rates were then transformed to population prevalence data by applying a ratio of total benign prostatic hyperplasia cases to inpatient benign prostatic hyperplasia admissions modelled from claims data.

We treated claims data and outpatient-adjusted inpatient admission data from Taiwan (province of China) and Poland as reference data, meeting our ICD-based case definition, and representing a general population defined only by year, age, sex and geographical location. The claims data from the USA, however, were adjusted to account for selection bias since these data come from a database of commercial insurance claims, and enrolment in commercial health insurance is generally associated with higher economic status. The adjustment coefficient...
was estimated with a Bayesian, regularised, trimmed meta-regression (MR-BRT) analysis. MR-BRT is a mixed-effects meta-regression tool that accounts for between-study heterogeneity and has been described previously.\(^\text{41,46-49}\)

Once all data were standardised to the reference standard, and the uncertainty of the adjustment process was accounted for, we applied the median absolute deviation (MAD) exclusion criterion to systematically exclude unreasonably high or low datapoints as outliers. Specifically, this was done by calculating the MAD of the age-standardised prevalence of all data and marking any data series greater than two MAD from the median as outliers and excluding them from the analysis (8-8% of processed datapoints were marked as outliers on the basis of the MAD exclusion criterion).

**Prevalence modelling**

We used DisMod-MR version 2.1 to estimate the age-specific, year-specific, and location-specific prevalence of benign prostatic hyperplasia. DisMod-MR is a Bayesian mixed-effects meta-regression tool that was designed for disease modelling by the Institute for Health Metrics and Evaluation (Seattle, WA, USA).\(^\text{41,48-49}\)

The tool uses a compartmental model with a series of age-integrated differential equations to estimate a set of epidemiological measures (prevalence, incidence, remission, excess mortality rate, relative risk, and cause-specific mortality rate) that are internally consistent with one another. Estimation occurs at each level of a geographical cascade (ie, global, seven GBD super-regions, 21 regions, and 204 countries and territories), in which each subsequent model borrows information from the previous model in the cascade via a Bayesian prior.\(^\text{41}\) A Gaussian data likelihood function is used at each step in the cascade. We provided value priors on incidence, remission, and excess mortality. First, we assumed a benign prostatic hyperplasia incidence of zero in men younger than 40 years. The maximum disease duration above the age of 40 years was set at 10 years, and the uncertainty of the adjustment process was accounted for, we applied the median absolute deviation (MAD) exclusion criterion to systematically exclude unreasonably high or low datapoints as outliers. Specifically, this was done by calculating the MAD of the age-standardised prevalence of all data and marking any data series greater than two MAD from the median as outliers and excluding them from the analysis (8-8% of processed datapoints were marked as outliers on the basis of the MAD exclusion criterion).

**Disability weight and severity distribution**

The disability weight represents the severity of health loss associated with a generic health state, described in lay language. It ranges from 0 (perfect health) to 1 (death). Disability weights for generic health states were estimated by use of nine large population-based surveys and one open-access internet survey where participants were asked to compare pairwise combinations of health states.\(^\text{56-59}\) Two health states were assigned to benign prostatic hyperplasia: asymptomatic and symptomatic. The asymptomatic health state has a disability weight of 0.067 (95% CI 0.043–0.097). The asymptomatic health state has a disability weight of zero, assuming no 95% CIs.\(^\text{55}\)

To determine what proportion of the estimated benign prostatic hyperplasia prevalence to assign to the symptomatic health state, we used data from four community-based surveys from Japan, the USA, Scotland, and France that recruited men aged 40–84 years.\(^\text{59}\) The surveys used the International Prostate Symptom Score (I-PSS), a validated questionnaire, to measure the severity of lower urinary tract symptoms among men.\(^\text{22,60,61}\) We estimated by use of nine large population-based surveys and one open-access internet survey where participants were asked to compare pairwise combinations of health states.\(^\text{56-59}\) Two health states were assigned to benign prostatic hyperplasia: asymptomatic and symptomatic. The asymptomatic health state has a disability weight of 0.067 (95% CI 0.043–0.097). The asymptomatic health state has a disability weight of zero, assuming no 95% CIs.\(^\text{55}\)

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**Years lived with disability (YLDs) and disability-adjusted life-years (DALYs)**

YLDs due to benign prostatic hyperplasia were estimated by multiplying the disability weights by the prevalence of symptomatic and asymptomatic benign prostatic hyperplasia and summing them together. Because we did not estimate mortality for benign prostatic hyperplasia, we did not produce years of life lost (YLLs) for benign prostatic hyperplasia. Therefore, DALYs equalled YLDs. Final estimates by year, age, and location, including those included in the text, figures, tables, and appendix 2 of this Article, can be viewed on the GBD Compare Viz Hub.

**Socio-demographic Index**

The Socio-demographic Index (SDI) is a summary measure that describes a country’s development. The SDI is derived from a country’s total fertility rate for women younger than 25 years, educational attainment in adults, and lag-distributed income per capita. Details of the SDI estimation methods are available elsewhere.\(^\text{12}\) We grouped all GBD countries

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For the GBD Compare Viz Hub see [http://ihmeuw.org/5u6z](http://ihmeuw.org/5u6z)

For the Epi Visualization Viz Hub see [http://ihmeuw.org/5u6w](http://ihmeuw.org/5u6w)

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## Articles

### Global

| Country               | 2000 Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | 2019 Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | Percentage change between 2000 and 2019 (%) |
|-----------------------|---------------------|-----------------------------------------------|---------------------|-----------------------------------------------|--------------------------------------------|
| **Central Europe, eastern Europe, and central Asia** |                     |                                               |                     |                                               |                                            |
| Afghanistan           | 21 040              | (14 600 to 31 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |
| Armenia               | 25 000              | (13 000 to 40 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |
| Azerbaijan            | 21 040              | (14 600 to 31 000)                            | 45 000              | (30 000 to 62 000)                            | 17·7%                                      |
| Georgia               | 25 000              | (13 000 to 40 000)                            | 43 000              | (28 000 to 61 000)                            | 18·8%                                      |
| Kazakhstan            | 21 040              | (14 600 to 31 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |
| Kyrgyzstan            | 72 000              | (35 000 to 119 000)                           | 150 000             | (76 000 to 249 000)                           | 55·7%                                      |
| Mongolia              | 27 000              | (10 000 to 60 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |
| Tajikistan            | 112 000             | (50 000 to 240 000)                           | 235 000             | (117 000 to 436 000)                          | 51·9%                                      |
| Turkmenistan          | 68 000              | (29 000 to 135 000)                           | 160 000             | (76 000 to 273 000)                           | 50·0%                                      |
| Uzbekistan            | 68 000              | (29 000 to 135 000)                           | 150 000             | (76 000 to 252 000)                           | 50·0%                                      |
| **Central Europe**    |                     |                                               |                     |                                               |                                            |
| Albania               | 37 000              | (20 000 to 52 000)                            | 75 000              | (40 000 to 130 000)                           | 27·3%                                      |
| Bosnia and Herzegovina| 65 000              | (35 000 to 105 000)                           | 150 000             | (76 000 to 252 000)                           | 50·0%                                      |
| Bulgaria              | 112 000             | (50 000 to 240 000)                           | 235 000             | (117 000 to 436 000)                          | 51·9%                                      |
| Croatia               | 17 000              | (10 000 to 26 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |
| Czechia               | 128 000             | (66 000 to 225 000)                           | 260 000             | (136 000 to 467 000)                          | 50·0%                                      |
| Hungary               | 10 000              | (5 000 to 18 000)                             | 24 000              | (12 000 to 44 000)                            | 23·8%                                      |
| Montenegro            | 128 000             | (70 000 to 228 000)                           | 260 000             | (136 000 to 467 000)                          | 50·0%                                      |
| North Macedonia       | 72 000              | (38 000 to 152 000)                           | 150 000             | (76 000 to 252 000)                           | 50·0%                                      |
| Poland                | 55 000              | (31 000 to 95 000)                            | 120 000             | (63 000 to 221 000)                           | 40·0%                                      |
| Romania               | 51 000              | (28 000 to 91 000)                            | 120 000             | (63 000 to 221 000)                           | 40·0%                                      |
| Serbia                | 21 040              | (14 600 to 31 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |
| Slovakia              | 96 000              | (55 000 to 148 000)                           | 235 000             | (117 000 to 436 000)                          | 51·9%                                      |
| Slovenia              | 28 000              | (15 000 to 45 000)                            | 42 080              | (28 000 to 63 000)                            | 20·9%                                      |

(Table continues on next page)
| Country                  | 2000 (Cases (95% UI)) | 2019 (Cases (95% UI)) | Percentage change between 2000 and 2019 (%) |
|--------------------------|-----------------------|-----------------------|--------------------------------------------|
|                          |                       |                       |                                            |
| Eastern Europe           | 7,080,000 (5,460,000 to 9,110,000) | 6,490 (5,100 to 8,050) | -0.9% (14.5 to 23.9)                       |
| Belarus                  | 820,000 (625,000 to 1,020,000) | 620 (492 to 778) | -12.6% (5.35 to 19.4)                       |
| Estonia                  | 4,950 (3,870 to 6,160) | 6,290 (4,980 to 7,770) | 27.7% (19.7 to 35.8)                       |
| Latvia                   | 82,500 (63,800 to 96,200) | 63,000 (53,300 to 73,000) | -12.6% (5.01 to 20.3)                       |
| Lithuania                | 1,290,000 (589,000 to 7,920) | 1,680,000 (125,000 to 170,000) | -19.9% (7.75 to 20.4)                        |
| Moldova                  | 11,800 (6,290 to 47,900) | 14,700 (11,400 to 185,000) | 5.2% (17.4 to 31.5)                       |
| Russia                   | 5,900,000 (651,000 to 8,700,000) | 6,780 (5,780 to 8,590) | -11.5% (17.4 to 31.5)                       |
| Ukraine                  | 17,900 (1,380,000 to 2,270,000) | 1,830,000 (1,440,000 to 2,330,000) | -82.4% (-2.44 to 9.82)                      |

### High income

| Country                  | 2000 (Cases (95% UI)) | 2019 (Cases (95% UI)) | Percentage change between 2000 and 2019 (%) |
|--------------------------|-----------------------|-----------------------|--------------------------------------------|
| Australasia              | 2,110,000 (2,044,000 to 3,075,000) | 1,980 (1,500 to 2,600) | -4.6% (63.6 to 89.0)                       |
| Australia                | 2,233,000 (1,631,000 to 3,000,000) | 2,393,000 (2,826,000 to 3,530,000) | -2.6% (62.2 to 92.8)                       |
| New Zealand              | 5,800 (4,970 to 7,900) | 8,700 (7,800 to 9,400) | -18.7% (57.5 to 84.9)                       |
| High-income Asia Pacific | 6,290,000 (5,040,000 to 7,900,000) | 7,820 (6,110 to 8,810) | -5.9% (18.6 to 31.6)                       |
| Brunei                   | 664 (488 to 920) | 1,230 (903 to 1,620) | -20.0% (-12.4 to 5.61)                      |
| Japan                    | 1,120,000 (967,000 to 1,760,000) | 1,170 (941,000 to 1,620) | -5.1% (57.4 to 84.9)                       |
| Singapore                | 1,580,000 (1,160,000 to 2,100,000) | 2,380,000 (1,810,000 to 3,110,000) | -45.5% (48.0 to 64.6)                      |
| South Korea              | 193,000 (141,000 to 267,000) | 1,540 (1,140 to 2,090) | -1.9% (10.7 to 16.7)                       |
| High-income North America| 3,080,000 (2,730,000 to 3,520,000) | 1,800 (1,780 to 1,920) | -51.8% (65.6 to 71.9)                       |
| Canada                   | 319,000 (238,000 to 435,000) | 567,000 (421,000 to 767,000) | -49.8% (64.3 to 92.3)                      |
| Greenland                | 363 (272 to 495) | 560 (495 to 930) | -32.7% (64.6 to 96.5)                       |
| USA                      | 2,760,000 (2,460,000 to 3,120,000) | 1,800 (1,550 to 1,980) | -25.1% (67.4 to 70.9)                       |
| Southern Latin America   | 304,000 (222,000 to 410,000) | 461,000 (327,000 to 627,000) | -18.1% (43.1 to 63.2)                      |
| Argentina                | 197,000 (143,000 to 265,000) | 278,000 (204,000 to 375,000) | -41.9% (30.7 to 55.3)                      |
| Chile                    | 84,900 (61,900 to 116,000) | 140,000 (105,000 to 199,000) | -26.8% (67.8 to 101.0)                      |
| Uruguay                  | 21,700 (15,800 to 29,300) | 115,000 (84,800 to 156,000) | -78.0% (11.3 to 31.0)                      |

(Continued from previous page)
| Country       | 2000     | 2019     | Percentage change between 2000 and 2019 (%) |
|---------------|----------|----------|-------------------------------------------|
|               | Cases    | Age-standardised prevalence per 100,000 (95% UI) | Cases    | Age-standardised prevalence per 100,000 (95% UI) |         |
|               | (95% UI) | (95% UI)                                        | (95% UI) | (95% UI)                                        | (95% UI) |
| Western Europe| 6,560,000| (5,210,000 to 8,220,000)                        | 9,040,000| (7,240,000 to 11,220,000)                      | 37.8%   | (-0.97% to 7.12)                               |
| Andorra       | 712      | (529 to 952)                                    | 1,140    | (850 to 1,530)                                 | 161     | (-1.37% to 5.37)                               |
| Austria       | 246,000  | (220,000 to 273,000)                            | 363,000  | (262,000 to 401,000)                           | 4580    | (-10.4 to 6.91)                                |
| Belgium       | 286,000  | (185,000 to 363,000)                            | 359,000  | (235,000 to 478,000)                           | 3600    | (-0.42% to 6.47)                               |
| Cyprus        | 7900     | (6,340 to 9,640)                                | 15,400   | (12,300 to 18,800)                             | 1590    | (-5.64 to 6.47)                                |
| Denmark       | 64,700   | (45,500 to 85,000)                              | 94,600   | (65,300 to 126,000)                            | 1720    | (-3.91% to 6.96)                               |
| Finland       | 137,000  | (121,000 to 152,000)                            | 229,000  | (201,000 to 256,000)                           | 3970    | (-0.32% to 6.48)                               |
| France        | 666,000  | (548,000 to 894,000)                            | 948,000  | (704,000 to 1,270,000)                         | 1610    | (-0.91% to 6.81)                               |
| Germany       | 1,000,000| (715,000 to 1,370,000)                          | 1,380,000| (1,000,000 to 1,890,000)                      | 1620    | (-0.72% to 6.81)                               |
| Greece        | 139,000  | (102,000 to 187,000)                            | 165,000  | (124,000 to 218,000)                           | 1600    | (-0.73% to 6.81)                               |
| Iceland       | 2640     | (1,790 to 3,340)                                | 4100     | (2,980 to 5,530)                               | 1540    | (-0.50% to 7.14)                               |
| Ireland       | 34,700   | (25,600 to 46,100)                              | 58,600   | (43,500 to 78,600)                             | 1610    | (-1.45% to 6.64)                               |
| Israel        | 48,500   | (35,900 to 64,100)                              | 87,900   | (56,700 to 118,000)                            | 1650    | (-0.64 to 6.64)                                |
| Italy         | 1,540,000| (1,280,000 to 1,880,000)                        | 1,990,000| (1,660,000 to 2,410,000)                      | 3380    | (-0.92% to 7.57)                               |
| Luxembourg    | 4430     | (3,290 to 5,980)                                | 7520     | (5,560 to 10,100)                              | 1620    | (-0.21% to 7.86)                               |
| Malta         | 53,800   | (43,100 to 62,900)                              | 9820     | (7,850 to 11,600)                              | 2190    | (-0.97% to 7.86)                               |
| Monaco        | 571      | (44,700 to 757)                                 | 711      | (5,200 to 9,450)                               | 1610    | (-0.89% to 6.78)                               |
| Netherlands   | 167,000  | (122,000 to 225,000)                            | 268,000  | (197,000 to 352,000)                           | 1640    | (-0.84% to 7.57)                               |
| Norway        | 165,000  | (122,000 to 220,000)                            | 246,000  | (197,000 to 302,000)                           | 1640    | (-0.92% to 7.76)                               |
| Portugal      | 124,000  | (89,800 to 164,000)                             | 168,000  | (125,000 to 221,000)                           | 1630    | (-0.79% to 7.88)                               |
| San Marino    | 329      | (239 to 432)                                    | 483      | (355 to 639)                                   | 1630    | (-1.07% to 7.88)                               |
| Spain         | 495,000  | (364,000 to 662,000)                            | 671,000  | (497,000 to 894,000)                           | 1630    | (-0.87% to 6.72)                               |
| Sweden        | 139,000  | (104,000 to 184,000)                            | 193,000  | (142,000 to 258,000)                           | 1630    | (-0.87% to 7.88)                               |
| Switzerland   | 247,000  | (223,000 to 273,000)                            | 382,000  | (246,000 to 419,000)                           | 4840    | (-0.79% to 6.82)                               |
| UK            | 1,090,000| (866,000 to 1,230,000)                          | 1,390,000| (1,170,000 to 1,660,000)                      | 2380    | (-1.07% to 6.82)                               |

(Continued from previous page)
| Country | 2000 Cases (95% UI) | 2019 Cases (95% UI) | Percentage change between 2000 and 2019 (%) |
|---------|---------------------|---------------------|----------------------------------------------|
| Latin America and Caribbean | 4,040,000 (3,210,000 to 5,030,000) | 7,830,000 (6,270,000 to 9,740,000) | 93.9% (90.9 to 96.9) |
| Andean Latin America | 501,000 (382,000 to 647,000) | 936,000 (706,000 to 1,210,000) | 88.1% (78.6 to 98.3) |
| Bolivia | 71,200 (52,900 to 93,800) | 136,000 (101,000 to 180,000) | 91.5% (77.2 to 109) |
| Ecuador | 170,000 (125,000 to 212,000) | 315,000 (231,000 to 398,000) | 85.8% (72.7 to 102) |
| Peru | 261,000 (193,000 to 342,000) | 492,000 (363,000 to 639,000) | 88.7% (75.2 to 105) |
| Caribbean | 472,000 (325,000 to 573,000) | 671,000 (500,000 to 891,000) | 55.1% (48.7 to 61.2) |
| Antigua and Barbuda | 734 (546 to 972) | 1,350 (986 to 1,810) | 83.9% (67.8 to 101) |
| The Bahamas | 2,410 (1,790 to 3,180) | 4,710 (3,480 to 6,260) | 95.9% (81.3 to 112) |
| Barbados | 389 (290 to 510) | 664 (4860 to 8850) | 70.6% (56.7 to 88.9) |
| Belize | 1,680 (1,250 to 2,230) | 3,730 (2,750 to 4,930) | 121% (103 to 141) |
| Bermuda | 924 (683 to 1,220) | 1,640 (1,210 to 2,160) | 77.3% (62.2 to 93.9) |
| Cuba | 166,000 (124,000 to 222,000) | 2,420,000 (1,810,000 to 3,220,000) | 46.3% (33.0 to 58.1) |
| Dominica | 953 (700 to 1,270) | 1,280 (944 to 1,680) | 34.6% (23.7 to 46.4) |
| Dominican Republic | 68,800 (51,000 to 95,500) | 116,000 (86,200 to 154,000) | 68.7% (56.4 to 82.7) |
| Grenada | 865 (644 to 1,140) | 1,530 (1,140 to 2,020) | 77.0% (63.4 to 92.5) |
| Guyana | 5,360 (3,990 to 7,070) | 8,020 (6,010 to 10,700) | 49.8% (37.0 to 60.0) |
| Haiti | 53,300 (39,400 to 71,800) | 8,360 (6,130 to 112,000) | 56.5% (45.0 to 68.8) |
| Jamaica | 29,000 (21,400 to 37,900) | 41,300 (30,700 to 54,400) | 42.2% (31.8 to 55.5) |
| Puerto Rico | 61,800 (45,500 to 81,300) | 95,000 (70,000 to 125,000) | 53.8% (41.7 to 65.9) |
| Saint Kitts and Nevis | 480 (356 to 630) | 881 (643 to 1,210) | 83.5% (59.6 to 10.7) |
| Saint Lucia | 1,530 (1,130 to 2,040) | 2,840 (2,100 to 3,740) | 85.8% (71.0 to 106) |
| Saint Vincent and the Grenadines | 1,120 (826 to 1,470) | 2,080 (1,550 to 2,740) | 86.6% (70.1 to 104) |
| Suriname | 4,280 (3,130 to 5,730) | 7,630 (5,630 to 10,100) | 78.3% (65.8 to 92.6) |
| Trinidad and Tobago | 13,700 (10,100 to 17,900) | 25,200 (18,400 to 33,500) | 84.2% (70.0 to 101) |
| Virgin Islands | 1,500 (1,110 to 2,030) | 2,570 (1,910 to 3,410) | 71.2% (53.6 to 89.4) |

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| Region                  | 2000 Cases (95% UI) | 2000 Age-standardised prevalence per 100 000 (95% UI) | 2019 Cases (95% UI) | 2019 Age-standardised prevalence per 100 000 (95% UI) | Percentage change between 2000 and 2019 (%) |
|------------------------|--------------------|------------------------------------------------------|--------------------|------------------------------------------------------|------------------------------------------|
| **North Africa and Middle East** |                    |                                                      |                    |                                                      |                                          |
| Afghanistan            | 39 300 (28 900 to 53 700) | 987 (735 to 1330) | 48 500 (36 000 to 65 600) | 1010 (736 to 1360) | 174% (117 to 244) |
| Algeria                | 76 500 (55 300 to 105 000) | 969 (705 to 1230) | 161 000 (119 000 to 222 000) | 979 (721 to 1330) | 111% (95 100 to 128) |
| Bahrain                | 1 240 (914 to 1 680) | 1080 (789 to 1 450) | 633 (452 to 875) | 1070 (81 000 to 1 460) | 109% (80 600 to 1 230) |
| Egypt                  | 1 750 000 (1 270 000 to 2 410 000) | 970 (730 to 1 230) | 324 000 (228 000 to 440 000) | 985 (716 to 1 230) | 104% (92 000 to 1 210) |
| Iran                   | 18 900 (13 800 to 25 900) | 1010 (748 to 1 390) | 35 400 (26 500 to 48 200) | 1030 (76 100 to 1 460) | 107% (76 100 to 1 460) |
| Iraq                   | 49 300 (36 100 to 66 800) | 1020 (745 to 1 430) | 106 000 (78 700 to 1 450) | 1150 (76 900 to 1 410) | 116% (101 000 to 1 360) |
| Jordan                 | 10 800 (7 830 to 14 500) | 1160 (8 510 to 1 570) | 36 400 (26 600 to 48 500) | 1150 (8 440 to 1 540) | 116% (101 000 to 1 360) |
| Kuwait                 | 10 500 (7 410 to 16 820) | 1010 (7 390 to 1 360) | 13 300 (8 990 to 18 100) | 993 (7 390 to 1 330) | 116% (128 000 to 1 900) |
| Lebanon                | 15 900 (11 500 to 21 900) | 967 (7 050 to 1 310) | 22 400 (16 500 to 30 600) | 959 (7 060 to 1 310) | 116% (27 4 00 to 53 3) |
| Libya                  | 11 700 (8 640 to 15 800) | 976 (7 200 to 1 310) | 22 700 (16 900 to 30 600) | 972 (7 170 to 1 300) | 104% (7 5 000 to 1 120) |
| Morocco                | 81 900 (60 500 to 111 000) | 969 (7 070 to 1 310) | 147 000 (107 000 to 197 000) | 972 (7 22 000 to 1 310) | 97% (64 7 00 to 96 6) |
| Oman                   | 4200 (3 060 to 5840) | 1010 (7 360 to 1 370) | 8890 (6 590 to 12 400) | 1030 (7 600 to 1 400) | 112% (94 2 01 to 1 311) |
| Palestine              | 4840 (35 40 to 65 80) | 976 (7 210 to 1 320) | 10 500 (7 700 to 14 300) | 996 (7 730 to 1 340) | 116% (9 7 01 to 1 36) |

(Continued from previous page)
|                | Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | Percentage change between 2000 and 2019 (%) | Age-standardised prevalence (95% UI) |
|----------------|---------------|-----------------------------------------------|---------------|-----------------------------------------------|---------------------------------------------|--------------------------------------|
|                | 2000          |                                               | 2019          |                                               |                                             |                                     |
| Qatar          | 1200 (864 to 1680) | 600 (485 to 842) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Saudi Arabia   | 45600         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Sudan          | 57000         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Syria          | 32500         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Tunisia        | 33100         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Turkey         | 213000        | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| United Arab Emirates | 3850          | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Yemen          | 29600         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| South Asia     | 112000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Bangladesh     | 68600         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Bhutan         | 36900         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| India          | 95500000      | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Nepal          | 120000        | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Pakistan       | 80000         | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Southeast Asia, east Asia, and Oceania | 159000000 | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| East Asia      | 108000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| China          | 102000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| North Korea    | 387000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Taiwan        | 724000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Oceania        | 514000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| American Samoa | 410000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Cook Islands   | 260000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Federated States of Micrones | 648000000 | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Fiji           | 640000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Guam           | 148000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Kiribati       | 509000000     | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |
| Marshall Islands | 232000000 | 2700 (2400 to 3000) | 5700 (930 to 8200) | 2700 (1700 to 4600) | 5000 (447 to 559) | -1.64% (-8.76 to 7.96) |

(Table continues on next page)
| Country                  | 2020 Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | 2019 Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | Percentage change between 2020 and 2019 (%) |
|-------------------------|---------------------|-----------------------------------------------|---------------------|-----------------------------------------------|--------------------------------------------|
| Nauru                   | 42.1 (31.7 to 56.3) | 3190 (2400 to 4110)                          | 39.7 (29.6 to 53.9) | 3330 (2500 to 4320)                          | -5.69% (-13.1 to 2.22)                     |
| Niue                    | 32.0 (21.9 to 41.9) | 3250 (2450 to 4210)                          | 32.0 (24.0 to 41.7) | 3380 (2540 to 4380)                          | -0.203% (-7.6 to 7.87)                     |
| Northern Mariana Islands| 306 (235 to 404)   | 3090 (2230 to 4010)                          | 749 (595 to 1000)   | 3180 (2400 to 4130)                          | 145% (124 to 167)                          |
| Palau                   | 189 (143 to 252)   | 3250 (2470 to 4260)                          | 307 (229 to 410)    | 3370 (2510 to 4340)                          | 62.8% (49.9 to 77.6)                       |
| Papua New Guinea        | 31.70 (21.90 to 42.30) | 3110 (2360 to 4120)                        | 64.00 (48.20 to 84.100) | 3220 (2440 to 4160)                          | 102% (87.3 to 119)                        |
| Samoa                   | 1470 (1100 to 1940) | 3150 (2370 to 4010)                          | 2030 (1540 to 2650) | 3240 (2450 to 4200)                          | 38.2% (27.0 to 49.7)                       |
| Solomon Islands         | 104 (76.5 to 136)  | 3180 (2370 to 4230)                          | 1170 (878 to 1510)  | 3380 (2540 to 4330)                          | 20.7% (13.0 to 28.2)                       |
| Tonga                   | 966 (719 to 1270)  | 3240 (2430 to 4210)                          | 1590 (1200 to 2150) | 3380 (2540 to 4330)                          | 122% (106 to 141)                         |
| Tuvalu                  | 1160 (862 to 1520) | 3290 (2440 to 3880)                          | 258 (1920 to 3410)  | 3250 (2370 to 4140)                          | -173% (133 to 136)                        |
| Southeast Asia          | 4'970'000 (3'850'000 to 6'380'000) | 3470 (2690 to 4420)                       | 9'230'000 (7'200'000 to 11'390'000) | 3520 (2700 to 4460)                          | 85.8% (81.4 to 90.4)                      |
| Cambodia                | 71'300 (52'500 to 94'200) | 3180 (2370 to 4340)                       | 1470 (1100 to 195'000) | 3260 (2460 to 4210)                          | 106.6% (92.2 to 124)                      |
| Indonesia               | 2'010'000 (1'560'000 to 2'540'000) | 3620 (2850 to 4520)                       | 3'500'000 (2'720'000 to 4'450'000) | 3700 (2890 to 4650)                          | 74.5% (69.3 to 79.8)                      |
| Laos                    | 36'200 (27'000 to 48'200) | 3730 (2930 to 4420)                       | 67'000 (47'700 to 83'400) | 3310 (2510 to 4310)                          | 73.0% (59.9 to 88.0)                      |
| Malaysia                | 187'000 (141'000 to 250'000) | 3290 (2500 to 4320)                       | 430'000 (221'000 to 667'000) | 3350 (2510 to 4340)                          | 130% (114 to 149)                         |
| Maldives                | 2290 (1590 to 3400) | 3210 (2400 to 4180)                          | 462 (3490 to 6080)  | 3270 (2460 to 4220)                          | 302% (85.0 to 121)                        |
| Mauritius               | 13'300 (10'100 to 17'600) | 3370 (2550 to 4400)                       | 29'700 (22'300 to 39'300) | 3700 (2810 to 4790)                          | 123% (105.0 to 141)                      |
| Myanmar                 | 386'000 (289'000 to 507'000) | 3170 (2390 to 4110)                       | 613'000 (462'000 to 808'000) | 3270 (2450 to 4250)                          | 58.8% (47.0 to 71.5)                      |
| Philippines             | 516'000 (390'000 to 692'000) | 2980 (2240 to 3900)                       | 983'000 (736'000 to 1'320'000) | 3010 (2270 to 3950)                          | 90.7% (86.8 to 94.8)                      |
| Seychelles              | 875 (655 to 1150)   | 3200 (2420 to 4200)                          | 1630 (1230 to 2170) | 3300 (2470 to 4310)                          | 85.9% (69.6 to 105)                       |
| Sri Lanka               | 204'000 (153'000 to 272'000) | 3230 (2420 to 4250)                       | 387'000 (289'000 to 516'000) | 3380 (2540 to 4450)                          | 89.5% (75.7 to 105)                      |
| Thailand                | 691'000 (521'000 to 919'000) | 3240 (2450 to 4260)                       | 1'500'000 (1'130'000 to 1'960'000) | 3220 (2430 to 4170)                          | 127% (101 to 134)                        |
| Timor-Leste             | 5960 (4410 to 8200)  | 3160 (2380 to 4120)                          | 12'700 (9390 to 17'000) | 3220 (2470 to 4280)                          | 112% (95.6 to 132)                       |
| Viet Nam                | 842'000 (659'000 to 1'060'000) | 4090 (3220 to 5130)                       | 1'550'000 (1'210'000 to 1'960'000) | 4200 (3310 to 5230)                          | 83.9% (69.0 to 99.4)                      |

(Continued from previous page)
### Sub-Saharan Africa

| Country | Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) | Percentage change between 2000 and 2019 (%) | Cases (95% UI) | Age-standardised prevalence per 100 000 (95% UI) |
|---------|----------------|-----------------------------------------------|----------------|-----------------------------------------------|------------------------------------------|----------------|-----------------------------------------------|
|        |                |                                              |                |                                              |                                          |                |                                              |
| Central sub-Saharan Africa |                |                                              |                |                                              |                                          |                |                                              |
| Djibouti | 1 240 000(1 050 000 to 1 330 000) | 1200 (888 to 1610) | 2 310 000 (1 710 000 to 3 130 000) | 1200 (888 to 1600) | 62.4% (59.6 to 65.1) | -0.0283% (-1.25 to 8.21) |
| Angola  | 23 000 (16 800 to 31 200) | 1200 (812 to 1470) | 1200 (812 to 1480) | 1200 (812 to 1480) | 79.9% (69.1 to 92.0) | -0.25% (-5.28 to 5.94) |
| Central African Republic | 5760 (4190 to 7940) | 1100 (804 to 1490) | 1100 (796 to 1480) | 1100 (796 to 1480) | 107% (89.5 to 129) | 1.20% (-5.9 to 10.6) |
| Congo (Brazzaville) | 5 820 (4 250 to 7 950) | 1200 (825 to 1520) | 1200 (807 to 1470) | 1200 (807 to 1470) | 50.6% (36.5 to 65.9) | -0.119% (-7.98 to 7.99) |
| Democratic Republic of the Congo | 87 300 (62 900 to 119 000) | 1100 (809 to 1480) | 1100 (797 to 1470) | 1100 (797 to 1470) | 107% (90.2 to 123) | -0.901% (-7.61 to 6.27) |
| Equatorial Guinea | 1 000 (722 to 1 370) | 1200 (831 to 1510) | 1200 (835 to 1540) | 1200 (835 to 1540) | 73.2% (58.1 to 89.8) | -0.602% (-8.38 to 7.86) |
| Gabon | 3 030 (2 200 to 4 110) | 1100 (823 to 1510) | 1100 (836 to 1530) | 1100 (836 to 1530) | 95.0% (63.3 to 65.1) | 0.830% (-7.78 to 10.7) |
| Gabon | 1100 (799 to 1 530) | 1200 (823 to 1510) | 1100 (797 to 1470) | 1100 (828 to 1188) | 68.7% (46.1 to 73.7) | 0.552% (-2.98 to 0.35) |
| Eritrea | 4880 (3550 to 6 750) | 1100 (823 to 1490) | 1100 (819 to 1470) | 1100 (819 to 1470) | 98.7% (62.8 to 71.9) | 0.857% (-1.68 to 0.08) |
| Ethiopia | 144 000 (105 000 to 195 000) | 1100 (864 to 1600) | 1100 (851 to 1570) | 1100 (851 to 1570) | 61.2% (46.1 to 74.9) | -0.668% (-3.15 to 7.74) |
| Kenya | 64 600 (47 300 to 87 400) | 1200 (813 to 1510) | 1100 (811 to 1500) | 1100 (811 to 1500) | 18.7% (15.6 to 21.1) | -0.0154% (-7.56 to 8.21) |
| Madagascar | 28 500 (21 000 to 38 600) | 1200 (831 to 1500) | 1100 (816 to 1490) | 1100 (816 to 1490) | 108% (52.2 to 79.8) | -0.368% (-4.67 to 4.75) |
| Malawi | 20 400 (15 000 to 27 700) | 1200 (832 to 1510) | 1100 (819 to 1470) | 1100 (819 to 1470) | 108% (81.9 to 139.8) | -0.704% (-9.59 to 6.69) |
| Mozambique | 32 600 (23 800 to 44 200) | 1200 (827 to 1490) | 1100 (819 to 1470) | 1100 (819 to 1470) | 108% (51.9 to 98.6) | -0.704% (-9.59 to 6.69) |
| Rwanda | 11 600 (8 600 to 15 600) | 1200 (832 to 1490) | 1100 (819 to 1470) | 1100 (819 to 1470) | 108% (51.9 to 98.6) | -0.704% (-9.59 to 6.69) |
| Somalia | 13 800 (9 830 to 18 900) | 1200 (831 to 1510) | 1100 (819 to 1470) | 1100 (819 to 1470) | 108% (51.9 to 98.6) | -0.704% (-9.59 to 6.69) |
| South Sudan | 14 800 (10 900 to 20 300) | 1200 (821 to 1500) | 1100 (818 to 1510) | 1100 (818 to 1510) | 87.8% (75.2 to 102) | -0.191% (-7.66 to 6.82) |
| Tanzania | 68 700 (50 200 to 92 900) | 1200 (821 to 1500) | 1100 (808 to 1480) | 1100 (808 to 1480) | 71.2% (58.5 to 86.1) | -0.300% (-7.63 to 8.44) |
| Uganda | 38 900 (26 900 to 50 800) | 1200 (823 to 1510) | 1100 (819 to 1520) | 1100 (819 to 1520) | 110% (50.4 to 76.3) | -0.853% (-8.93 to 7.18) |
| Zambia | 17 900 (12 100 to 24 300) | 1200 (831 to 1510) | 1100 (824 to 1500) | 1100 (824 to 1500) | 71.0% (57.3 to 84.9) | -0.824% (-9.34 to 6.94) |
| Southern sub-Saharan Africa | 226 000 (175 000 to 318 000) | 1200 (828 to 1510) | 1100 (820 to 1500) | 1100 (820 to 1500) | 110% (58.5 to 86.1) | -0.300% (-7.63 to 8.44) |
| Botswana | 6 300 (4 620 to 8 450) | 1200 (823 to 1510) | 1100 (820 to 1500) | 1100 (820 to 1500) | 78.6% (65.5 to 93.0) | 0.736% (-6.35 to 8.57) |
| Eswatini | 24 500 (18 500 to 34 800) | 1200 (828 to 1510) | 1100 (820 to 1500) | 1100 (820 to 1500) | 41.4% (29.0 to 54.5) | 2.29% (-5.26 to 11.4) |

(Continued from previous page)
Global, GBD super-region, and country-level prevalence of benign prostatic hyperplasia, and percentage change between 2000 and 2019

| Location           | 2000 Cases (95% UI) | 2019 Cases (95% UI) | Percentage change between 2000 and 2019 (%) |
|--------------------|---------------------|---------------------|-------------------------------------------|
| Lesotho            | 7010 (5120 to 9580) | 1570 (1220 to 2230) | 12% (4·17 to 21·3)                         |
| Namibia            | 6530 (4780 to 8750) | 1600 (1220 to 2220) | 36% (2·2 to 79·9)                          |
| South Africa       | 179 000 (133 000 to 243 000) | 1740 (1290 to 2350) | 74% (69·0 to 80·8)                         |
| Zimbabwe           | 34 600 (25 400 to 47 400) | 1640 (1210 to 2210) | 22·6% (12·9 to 33·1)                       |
| Western sub-Saharan Africa | 589 000 (431 000 to 798 000) | 1120 (858 to 1490) | 53·0% (50·1 to 56·5)                       |
| Benin              | 12 000 (8780 to 16 400) | 22 300 (16 500 to 39 500) | 84·6% (69·4 to 102)                       |
| Burkina Faso       | 25 900 (18 800 to 35 100) | 40 500 (29 600 to 51 000) | 56·4% (44·0 to 69·4)                       |
| Cameroon           | 29 900 (21 600 to 40 200) | 1100 (805 to 1470) | 90·4% (73·8 to 107)                        |
| Cape Verde         | 1 210 (878 to 16 20) | 1840 (1350 to 2490) | 52·0% (36·6 to 70·6)                       |
| Chad               | 17 100 (12 500 to 23 000) | 30 400 (22 000 to 41 600) | 77·8% (63·3 to 91·8)                       |
| Côte d’Ivoire      | 29 600 (21 300 to 41 100) | 53 100 (39 100 to 71 700) | 79·5% (66·5 to 95·8)                       |
| The Gambia         | 27 200 (19 70 to 37 10) | 45 900 (33 900 to 63 30) | 67·9% (53·9 to 81·1)                       |
| Ghana              | 42 000 (30 400 to 57 100) | 70 700 (51 800 to 96 30) | 68·3% (54·7 to 84·9)                       |
| Guinea             | 22 400 (16 300 to 30 100) | 28 500 (20 900 to 38 800) | 72·7% (36·3 to 106·2)                      |
| Guinea-Bissau      | 20 900 (15 400 to 28 20) | 31 200 (22 800 to 42 80) | 49·4% (36·7 to 67·1)                       |
| Liberia            | 6 880 (5 020 to 9 520) | 9 950 (7 250 to 13 400) | 44·6% (31·4 to 57·8)                       |
| Mali               | 26 500 (19 300 to 36 100) | 44 500 (32 400 to 64 00) | 67·8% (52·9 to 84·0)                       |
| Mauritania         | 6 200 (4 510 to 8 350) | 10 900 (7 930 to 14 800) | 74·6% (61·7 to 89·3)                       |
| Niger              | 18 700 (13 800 to 25 300) | 37 700 (27 500 to 51 50) | 76·4% (61·7 to 93·6)                       |
| Nigeria            | 305 000 (224 000 to 413 000) | 415 000 (308 000 to 566 00) | 36·3% (33·3 to 40·4)                       |
| São Tomé and Príncipe | 363 (263 to 496) | 488 (355 to 656) | 34·4% (21·9 to 49·7)                       |
| Senegal            | 22 100 (16 600 to 29 800) | 37 100 (26 800 to 50 000) | 67·8% (52·2 to 83·0)                       |
| Sierra Leone       | 10 900 (7 920 to 14 600) | 17 800 (12 800 to 24 200) | 63·2% (50·5 to 79·9)                       |
| Togo               | 7 420 (5 430 to 10 200) | 14 800 (10 700 to 20 400) | 98·8% (83·3 to 116)                        |

Data in parentheses are 95% uncertainty intervals (UI). Data are presented to three significant figures. GBD=Global Burden of Diseases, Injuries and Risk Factors Study

Table: Global, GBD super-region, and country-level prevalence of benign prostatic hyperplasia, and percentage change between 2000 and 2019

and territories in five SDI quintiles on the basis of their SDI values in 2019. For this analysis, we used the most recent year’s SDI groupings when describing trends between 2000 and 2019. The list of locations and their assigned SDI quintile can be found in appendix 2 (pp 8–13).
The 95% uncertainty intervals (UIs) were estimated by taking 1000 draws of the distribution of every modelling and computation process. The final mean estimate was calculated by taking the mean value of the 1000 draws, and the 95% UI was set by finding the 25th and 975th of their ordered values. Data are presented to three significant figures.

**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 2019, there were 94·0 million (95% UI 73·2 to 118) prevalent cases of benign prostatic hyperplasia globally among men aged 40 years and older, corresponding to an age-standardised prevalence of 2480 (1940 to 3090) per 100 000 (table). This was a 70·5% (95% UI 68·6 to 72·7) increase from 51·1 million (43·1 to 69·3) cases in 2000. The global age-standardised prevalence, however, remained largely unchanged during this period (−0·770% [−0·0912 to 1·56] difference).

Globally, men aged 65–74 years shared the greatest absolute burden of benign prostatic hyperplasia (figure 2), accounting for 42% of the total prevalent cases among men aged 40 years and older. The age-specific prevalence was highest in men aged 75–79 years, at 24 300 (95% UI 18 600–31 500) per 100 000, followed by the those aged 80–84 years, at 23 500 (17 800–30 400) per 100 000, and those aged 70–74 years, at 22 200 (16 100–29 400) per 100 000. Between 2000 and 2019, the number of prevalent cases of benign prostatic hyperplasia increased rapidly in all age groups (appendix 2 p 31). In men aged 40–44 years, the percentage increase was 22·6% (16·7–26·8). For men aged 80 years and older, the percentage increase was 173% (166–179).

There was substantial geographical variation in the prevalence of benign prostatic hyperplasia in 2019 (figure 3A). The highest age-standardised prevalence was observed in eastern Europe (6480 [95% UI 5130–8080] per 100 000), followed by central Latin America (4140 [3340–5090] per 100 000) and Andean Latin America (3610 [2700–4610] per 100 000). The lowest age-standardised prevalence was recorded in north Africa and the Middle East (987 [732–1320] per 100 000) and three sub-Saharan African regions: eastern sub-Saharan Africa (1160 [852–1540] per 100 000), western sub-Saharan Africa (1120 [817–1490] per 100 000), and central sub-Saharan Africa (1110 [812–1480] per 100 000). The age-standardised prevalence in five high-income regions (western Europe, high-income North America, high-income Asia Pacific, Australasia, and southern Latin America) ranged from 2250 (1800–2790) per 100 000 in western Europe to 1180 (906–1550) per 100 000 in the high-income Asia Pacific in 2019 (table).

Prevalent cases of benign prostatic hyperplasia increased in all 21 GBD regions between 2000 and 2019, with the percentage change ranging from 19·3% to 101%. The greatest increase was noted in central Latin America, with a 101% change (95% UI 96·5–105), followed by tropical Latin America (98·4% [93·5–104]), east Asia (97·5% [93·3–102]), and south Asia (91·4% [87·4–96·3]). The smallest increase was noted in three European regions (eastern, central, and western Europe). Despite this steady increase in the number of prevalent cases, 17 regions had a less than 2% change in age-standardised prevalence during the same period (figure 4). Of the remaining four regions, only two had change estimates that excluded zero in their uncertainty intervals: the high-income Asia Pacific, which saw a 3·92% (1·48–6·37) decrease, and high-income North America, which saw a 2·93% (1·42–4·44) increase (table).

The global distribution of the benign prostatic hyperplasia burden, as represented by age-standardised DALY rates, was the same as that for prevalence (figure 3A, B). In 2019, benign prostatic hyperplasia was responsible for 1·86 million (95% UI 1·13–2·78) DALYs globally, equating to an age-standardised DALY rate of 48·9 (29·7–72·6) per 100 000. Consistent with the findings for prevalence, the majority of the disease burden was concentrated in countries in eastern Europe, central Latin America, Andean Latin America, and southeast Asia. In 2019, the age-standardised DALY rate was 128 (76·5–190) per 100 000 in eastern Europe, 81·8 (50·2–121) per 100 000 in central Latin America,
71.9 (43.1–109) per 100 000 in Andean Latin America, and 69.7 (41.8–104) per 100 000 in southeast Asia (appendix pp 32–48). The temporal variation of DALYs was the same as that for prevalence.

At the national level, the age-standardised prevalence ranged from 949 per 100 000 to 6910 per 100 000 across countries and territories in 2019 (table). The highest age-standardised prevalences of benign prostatic hyperplasia were observed in Lithuania (6910 [95% UI 5830 to 7940] per 100 000), Russia (6510 [5110 to 8110] per 100 000), and Ukraine (6450 [5030 to 8050] per 100 000), whereas the lowest age-standardised prevalences were observed in Yemen (949 [702 to 1280] per 100 000), Syria (949 [694 to 1290] per 100 000), Sudan (958 [703 to 1300] per 100 000), and Lebanon (959 [706 to 1310] per 100 000). As noted for many regional estimates above, the percentage change in the age-standardised prevalence of individual countries during the 2000–19 period was small and often non-significant; the highest percentage increases in age-standardised prevalence were noted in Mauritius (9.81% [1.51 to 18.1]), Vanuatu (5.53% [–1.73 to 13.6]), and the Solomon Islands (5.35% [–1.68 to 15.1]), whereas the greatest decreases were recorded in Brunei (4.00% [–5.61 to 12.4]), Belgium (3.91% [–6.96 to 20.1]), and the Caribbean (4.91% [–2.93 to 13.5]). The temporal variation of age-standardised prevalence of individual countries during the 2000–19 period was small and often non-significant; the highest percentage increases in age-standardised prevalence were noted in Mauritius (9.81% [1.51 to 18.1]), Vanuatu (5.53% [–1.73 to 13.6]), and the Solomon Islands (5.35% [–1.68 to 15.1]), whereas the greatest decreases were recorded in Brunei (4.00% [–5.61 to 12.4]), Belgium (3.91% [–6.96 to 20.1]), and the Caribbean (4.91% [–2.93 to 13.5]).

We also assessed the disease burden in five SDI quintiles (figure 5). Between 2000 and 2019, the majority of the absolute DALY burden of benign prostatic hyperplasia was concentrated in the high-middle and middle SDI quintiles, with the fewest DALYs in the low SDI quintile. All five SDI quintiles observed an increase in the absolute DALY burden between 2000 and 2019. The most rapid increases were seen in the middle SDI quintile (94.7% [95% UI 91.8–97.6]), the low-middle SDI quintile (77.3% [74.1–81.2]), and the low SDI quintile (77.7% [72.9–83.2]). The high SDI quintile saw a 55.2% (52.6–58.2) increase and the high-middle SDI quintile saw a 52.8% (49.4–56.3) increase. During the same period, the high and high-middle SDI quintiles saw a small decrease in the age-standardised DALY rate, whereas the middle, low-middle, and low SDI quintiles saw small increases. The greatest increase in the age-standardised DALY rate was seen in the low SDI quintile (5.28% [2.41–8.36]). In contrast to the patterns we observed in the absolute DALY burden, the low-middle SDI quintile had the highest age-standardised DALY rate in 2019, surpassing that of the high-middle SDI quintile in 2016.

Discussion

We present a comprehensive assessment of the temporal and geographical patterns of the benign prostatic hyperplasia burden from GBD 2019. Our findings are consistent with previous reports, showing that the absolute disease burden is rising in many parts of the world. The global number of prevalent cases almost doubled in the past 20 years. Despite the increase in the absolute benign prostatic hyperplasia burden, the global age-standardised prevalence and DALY rates remained largely unchanged during the study period, suggesting that population growth and ageing have a greater impact on driving the increased prevalence of, and DALYs associated with, benign prostatic hyperplasia at the global level than other risk factors for benign prostatic hyperplasia do.

Our study shows that the peak absolute benign prostatic hyperplasia burden occurred in men aged 65–69 years and the age-specific prevalence was highest in men aged 75–79 years. This trend contrasts with the age trend found in autopsy studies, where the histological prevalence continues to rise with advancing age, but was similar to the age trend found in community-based studies, where the diagnosis of benign prostatic hyperplasia was made on the basis of lower urinary tract symptoms and prostatic enlargement in clinical practice. Geographically, the age-standardised prevalence and DALY rates were lowest in countries in north Africa and the Middle East and sub-Saharan Africa, and highest in...
countries in eastern Europe. Although this geographical variation could be attributable to the varying stages at which each country is undergoing demographic and epidemiological transitions, it could also partially be explained by differences in the underlying risk factors in these populations.

Our study suggests a close and nuanced link between the benign prostatic hyperplasia burden and national sociodemographic status, and the potential for intervention to make an impact. As noted, the absolute benign prostatic hyperplasia burden has increased globally between 2000 and 2019, but age-standardised prevalence and DALY rates were more stable. This pattern of rising absolute burden with stability or only small changes in age-standardised rates was seen in most regions and many countries, reflecting the major role of widespread population growth and ageing in the substantial increase in benign prostatic hyperplasia cases. A rising absolute burden of benign prostatic hyperplasia was seen across all SDI quintiles, and the middle SDI quintile in particular carried the greatest absolute DALY burden by 2019. Notably, however, countries in the lowest three SDI quintiles (low, low-middle, and middle) had the largest percentage change in absolute DALYs between 2000 and 2019, and also had age-standardised DALY rates that overall trended upwards over the study period. Countries in the highest two SDI quintiles (high-middle and high) had somewhat smaller relative increases in absolute DALY counts and had age-standardised rates that overall trended downwards. Although population growth and ageing are the two most important factors contributing to the rising burden of benign prostatic hyperplasia worldwide, divergent trends in age-standardised rates suggest some influence from other risk factors for benign prostatic hyperplasia, such as metabolic syndrome, obesity, diabetes, and acute and chronic prostatic inflammation.5–15 Rising age-standardised DALY rates in the bottom three SDI quintiles could reflect increased detection and diagnosis, or a true increase in disease frequency driven by rising levels of upstream risk factors. Downward trends in age-standardised DALY rates could reflect increased treatment initiation, advancement in surgical care and access, or improved control of upstream risk factors. Although the age-standardised prevalence and DALY rates declined in many high-income countries during the study period, we saw increasing age-standardised rates in the USA. This finding was consistent with the rising prevalence of major comorbidities associated with benign prostatic hyperplasia, such as diabetes, hypertension, cardiac disease, and hyperlipidaemia in the USA compared with other high-income countries.47,68 This observation indicates that even high-income countries with similar advancement in economic development and similar age structures could have varying levels of benign prostatic hyperplasia depending on the prevalence of the underlying causes of benign prostatic hyperplasia in the population. This finding emphasises the broader relevance of benign prostatic hyperplasia to other non-communicable diseases and their control measures and serves as an urgent call for countries to strengthen efforts to address these public health challenges together.

With medical, social, and economic advances, people are living longer worldwide. Many countries are undergoing rapid changes in their population size, as well as the proportion of older people in their population. Consequently, addressing the burden of ageing-related diseases, such as benign prostatic hyperplasia, has to become one of the top global health priorities. In addition to...
to imposing a substantial health burden, as shown in the present analysis, benign prostatic hyperplasia imposes substantial economic costs on societies. An analysis of the National Health and Nutrition Examination Survey-III done in the USA revealed that there were close to 8 million clinic visits for a primary or secondary diagnosis of benign prostatic hyperplasia in 2000, resulting in a direct cost of US$1·1 billion for treatment, excluding outpatient medication costs.\textsuperscript{64} The estimated economic burden of benign prostatic hyperplasia in the global population of men older than 65 years was $73·8 billion per year.\textsuperscript{25} Thus, our study findings have important implications for health service structure, human resource capacity building, and economic burden prediction. Although well documented, evidence-based prevention of benign prostatic hyperplasia is limited, disability and complications related to benign prostatic hyperplasia can be mitigated. In particular, there are several medical and surgical therapy options to reduce disability due to benign prostatic hyperplasia. Medical therapy involves the use of alpha blockers, 5-alpha reductase inhibitors, phosphodiesterase-5 inhibitors, anticholinergic agents, beta-3-agonists, or therapy with a combination of the above.\textsuperscript{69} Surgical therapy can be used for selected patients, such as those with renal insufficiency associated with benign prostatic hyperplasia, refractory urinary retention, recurrent urinary tract infection, recurrent bladder stone, gross haematuria, or failed medical therapy.\textsuperscript{70,71} With the rising number of benign prostatic hyperplasia cases, the demand for diagnostic tools, medications, and hospital care will increase enormously. Therefore, the health structure and human resource capacity-building of a nation should be organised to meet these increasing demands. Despite its burden and increasing trends, efforts from the global community to design prevention strategies for benign prostatic hyperplasia are inadequate. Global, regional, and national efforts should begin and be integrated into broader non-communicable disease control efforts to prevent health loss due to benign prostatic hyperplasia.

This study has several limitations, which can be broadly organised into limitations of prevalence inputs, limitations of severity inputs, and analytical considerations. First, data to estimate the prevalence of benign prostatic hyperplasia are sparse and heterogeneous, and they carry with them the inherent biases of administrative records from medical facilities and claims. With regard to scarcity, despite the international administrative data we used in our analyses, we did not have prevalence data for many countries, especially in sub-Saharan Africa, Australasia, south Asia, Andean Latin America, and eastern Europe. We partially overcame prevalence data scarcity by using regional estimates and predictive covariates to produce estimates of the prevalence of benign prostatic hyperplasia in locations without local data. Our predictive covariates are, themselves, estimated for all year, age, and location combinations, generally with much stronger input databases than are available for benign prostatic hyperplasia, but with some uncertainty in estimation. Although the uncertainty intervals we report with our final prevalence estimates include uncertainty due to sampling and bias adjustment of input data, and uncertainty in the model fitting itself, the uncertainties in the covariate estimation processes are not reflected; future rounds of GBD should better account for covariate uncertainty. With regard to heterogeneity, the data we do have might differ on the basis of health-care-seeking behaviours and access to quality health care, rather than differences in underlying disease. This is partially addressed by processing hospital data as admission cause fractions, applying the fractions to estimates of health-care utilisation modelled from large household surveys,\textsuperscript{26} and then applying estimates of outpatient cases to inpatient admissions modelled from individual-level data using the Healthcare Access and Quality (HAQ) index as a predictor. Heterogeneity related to access was further accounted for in the USA by adjusting commercial claims data towards a general population reference standard through MR-BRT methods. Nonetheless, our ratios of outpatient cases to inpatient admissions were modelled from US data and might reflect a relationship between inpatient and outpatient care that is unique to the USA, and we did not have sufficient data to identify, quantify, and develop MR-BRT adjustments to account for all instances of heterogeneity due to access worldwide. We attempted to account for the most egregious heterogeneity by excluding outliers more than 2 MAD above or below the median, but this approach does not distinguish heterogeneity in the sources from heterogeneity in underlying disease. Regarding the general level of benign prostatic hyperplasia ascertainment in administrative data, these data sources might miss undiagnosed cases of benign prostatic hyperplasia that have not been seen by a medical provider. According to the Multinational Survey of Aging Male (MSAM-7) study conducted in the UK, the USA, France, Germany, the Netherlands, Italy, and Spain, only 19% of men with lower urinary tract symptoms sought care for urinary problems and only 10·2% had been medically treated.\textsuperscript{26} Another community-based study done in Singapore found that more than 70% of study participants with moderate-to-severe lower urinary tract symptoms did not seek care from a health-care provider.\textsuperscript{72} These studies suggest that we could be underestimating the prevalence of benign prostatic hyperplasia by relying on administrative data from clinical care encounters. In future rounds of GBD, we should augment our prevalence input data set via a systematic review of population-based studies, both to close gaps in countries without data and to facilitate nuanced quantification of the association between provider-diagnosed and overall benign prostatic hyperplasia prevalence and more accurately correct administrative data sources from diverse settings.

Second, data used for estimating the symptomatic proportion of benign prostatic hyperplasia prevalence and
for estimating disability weights were more limited than prevalence data. Disability weights associated with health state descriptions used in GBD are derived from a series of face-to-face, telephone, and internet surveys conducted over several years and in nine countries, and reported in a series of publications.56–58 If these nine countries are poorly representative of the values surrounding health in other countries, this would misrepresent the disability globally. Estimation of the proportion of doctor-diagnosed symptomatic versus asymptomatic benign prostatic hyperplasia cases rests on an even smaller database; we made use of four community-based surveys of I-PSS scores to calculate the pooled proportion of symptomatic cases of benign prostatic hyperplasia. This approach makes two important assumptions: that the distribution of I-PSS scores in community-based samples is similar to the distribution of I-PSS scores among cases ascertained from administrative data, and that the distribution of I-PSS scores from these four surveys done in Japan, the USA, Scotland, and France is reflective of the global distribution.

Third, we acknowledge a pair of analytical limitations. Because of the GBD principle of assigning every death in our estimation framework to a single underlying cause of death, we elected to assign deaths related to benign prostatic hyperplasia to other diseases in the cascade of events that lead to death, and mortality related to benign prostatic hyperplasia was thus accounted for in various complications (e.g., urinary tract infection or uro lithiasis) and not included in the estimates for benign prostatic hyperplasia. Additionally, GBD estimation to date has largely focused on producing estimates for general populations defined only by year, age, sex, and location. We acknowledge the important matter of the disparate burden by race and ethnicity within these geographically defined populations. Future rounds of GBD should attempt to estimate the proportion of other deaths due to uro logical diseases that can be reasonably attributed to benign prostatic hyperplasia as an upstream risk factor and should disaggregate estimates of burden by race and ethnicity within populations.

The burden of benign prostatic hyperplasia is rising throughout the world, primarily due to population growth and ageing. Consequently, the male burden on the existing health-care system is expected to grow substantially in the coming years. This growth could be modified by control of upstream risk factors, and technologies exist to treat and mitigate the symptoms of benign prostatic hyperplasia. Coordinated and collaborative efforts from global, regional, and national policy makers, researchers, and advocates are needed to tackle this challenge.
Articles

(N S Butt PhD), Rabigh Faculty of Medicine (A A Malik PhD), King Abdulaziz University, Jeddah, Saudi Arabia; Institute of Microengineering (F Caetano dos Santos PhD), Federal Polytechnic University of Lausanne, Lausanne, Switzerland; Section Global Health and Rehabilitation (O Dadras DrPH), Western Norway University of Applied Sciences, Bergen, Norway; Department of Global Public Health and Primary Care (O Dadras DrPH), University of Bergen, Bergen, Norway; Institute for Global Health Innovations (L P Doan MSc, L G Vu MSc), Faculty of Medicine (L P Doan MSc, L G Vu MSc), Institute of Research and Development (M Hosseinizadeh PhD), Duy Tan University, Da Nang, Viet Nam; Division of Urology (S Efekharzadeh MD), Children’s Hospital of Philadelphia, Philadelphia, PA, USA; Department of Environmental Health Engineering (A Fatemi PhD), Isfahan University of Medical Sciences, Isfahan, Iran; Department of Radiology (T G MBBS), King Edward Memorial Hospital, Mumbai, India; Reproductive and Family Health (T G Gbekresmelik MPH), Aksum University, Asmara, Ethiopia; Department of Public Health (M E Getachew MPH), Wollega University, Nekemte, Ethiopia; Social Determinants of Health Research Center (S Ghantam MD), Department of Community Medicine (N Malih MD), Urology and Nephrology Research Center (M Zahir MD), Shahid Beheshti University of Medical Sciences, Tehran, Iran; Faculty of Allied Health Sciences (Prof S Gili PhD), Institute of Public Health (A A Malik PhD), The University of Lahore, Lahore, Pakistan; Afro-Asian Institute, Lahore, Pakistan (Prof Veterans Affairs (VA), Baltimore, MD, USA; Department of Surgery (K Tan PhD), National University of Singapore, Singapore, Singapore; Department of Pediatrics and Child Health Nusing (M S Sibhat MSc), Dilla University, Dilla, Ethiopia; School of Medicine (Prof A I Singhal PhD), University of Alabama at Birmingham, Birmingham, AL, USA; Medicine Service (Prof A J Singh MD), US Department of Defense (Prof A J Singh MD), US Army Research Laboratory (Prof A J Singh MD), Clinical Research Center (A Sahelkar PhD), Mashhad University of Medical Sciences, Mashhad, Iran; Department of Biomedical Sciences (I Yunusa PhD), University of South Carolina, Columbia, SC, USA; Institute of Advanced Manufacturing Technologies (Prof N S Butt PhD), Rabigh Faculty of Medicine (A A Malik PhD), King Abdulaziz University, Jeddah, Saudi Arabia; Institute of Microengineering (F Caetano dos Santos PhD), Federal Polytechnic University of Lausanne, Lausanne, Switzerland; Section Global Health and Rehabilitation (O Dadras DrPH), Western Norway University of Applied Sciences, Bergen, Norway; Department of Global Public Health and Primary Care (O Dadras DrPH), University of Bergen, Bergen, Norway; Institute for Global Health Innovations (L P Doan MSc, L G Vu MSc), Faculty of Medicine (L P Doan MSc, L G Vu MSc), Institute of Research and Development (M Hosseinizadeh PhD), Duy Tan University, Da Nang, Viet Nam; Division of Urology (S Efekharzadeh MD), Children’s Hospital of Philadelphia, Philadelphia, PA, USA; Department of Environmental Health Engineering (A Fatemi PhD), Isfahan University of Medical Sciences, Isfahan, Iran; Department of Radiology (T G MBBS), King Edward Memorial Hospital, Mumbai, India; Reproductive and Family Health (T G Gbekresmelik MPH), Aksum University, Asmara, Ethiopia; Department of Public Health (M E Getachew MPH), Wollega University, Nekemte, Ethiopia; Social Determinants of Health Research Center (S Ghantam MD), Department of Community Medicine (N Malih MD), Urology and Nephrology Research Center (M Zahir MD), Shahid Beheshti University of Medical Sciences, Tehran, Iran; Faculty of Allied Health Sciences (Prof S Gili PhD), Institute of Public Health (A A Malik PhD), The University of Lahore, Lahore, Pakistan; Afro-Asian Institute, Lahore, Pakistan (Prof Veterans Affairs (VA), Baltimore, MD, USA; Department of Surgery (K Tan PhD), National University of Singapore, Singapore, Singapore; Department of Pediatrics and Child Health Nusing (M S Sibhat MSc), Dilla University, Dilla, Ethiopia; School of Medicine (Prof A I Singhal PhD), University of Alabama at Birmingham, Birmingham, AL, USA; Medicine Service (Prof A J Singh MD), US Department of Defense (Prof A J Singh MD), US Army Research Laboratory (Prof A J Singh MD), Clinical Research Center (A Sahelkar PhD), Mashhad University of Medical Sciences, Mashhad, Iran; Department of Biomedical Sciences (I Yunusa PhD), University of South Carolina, Columbia, SC, USA; Institute of Advanced Manufacturing Technologies (Prof N S Butt PhD), Rabigh Faculty of Medicine (A A Malik PhD), King Abdulaziz University, Jeddah, Saudi Arabia; Institute of Microengineering (F Caetano dos Santos PhD), Federal Polytechnic University of Lausanne, Lausanne, Switzerland; Section Global Health and Rehabilitation (O Dadras DrPH), Western Norway University of Applied Sciences, Bergen, Norway; Department of Global Public Health and Primary Care (O Dadras DrPH), University of Bergen, Bergen, Norway; Institute for Global Health Innovations (L P Doan MSc, L G Vu MSc), Faculty of Medicine (L P Doan MSc, L G Vu MSc), Institute of Research and Development (M Hosseinizadeh PhD), Duy Tan University, Da Nang, Viet Nam; Division of Urology (S Efekharzadeh MD), Children’s Hospital of Philadelphia, Philadelphia, PA, USA; Department of Environmental Health Engineering (A Fatemi PhD), Isfahan University of Medical Sciences, Isfahan, Iran; Department of Radiology (T G MBBS), King Edward Memorial Hospital, Mumbai, India; Reproductive and Family Health (T G Gbekresmelik MPH), Aksum University, Asmara, Ethiopia; Department of Public Health (M E Getachew MPH), Wollega University, Nekemte, Ethiopia; Social Determinants of Health Research Center (S Ghantam MD), Department of Community Medicine (N Malih MD), Urology and Nephrology Research Center (M Zahir MD), Shahid Beheshti University of Medical Sciences, Tehran, Iran; Faculty of Allied Health Sciences (Prof S Gili PhD), Institute of Public Health (A A Malik PhD), The University of Lahore, Lahore, Pakistan; Afro-Asian Institute, Lahore, Pakistan (Prof Veterans Affairs (VA), Baltimore, MD, USA; Department of Surgery (K Tan PhD), National University of Singapore, Singapore, Singapore; Department of Pediatrics and Child Health Nusing (M S Sibhat MSc), Dilla University, Dilla, Ethiopia; School of Medicine (Prof A I Singhal PhD), University of Alabama at Birmingham, Birmingham, AL, USA; Medicine Service (Prof A J Singh MD), US Department of Defense (Prof A J Singh MD), US Army Research Laboratory (Prof A J Singh MD), Clinical Research Center (A Sahelkar PhD), Mashhad University of Medical Sciences, Mashhad, Iran; Department of Biomedical Sciences (I Yunusa PhD), University of South Carolina, Columbia, SC, USA; Institute of Advanced Manufacturing Technologies (Prof N S Butt PhD), Rabigh Faculty of Medicine (A A Malik PhD), King Abdulaziz University, Jeddah, Saudi Arabia; Institute of Microengineering (F Caetano dos Santos PhD), Federal Polytechnic University of Lausanne, Lausanne, Switzerland; Section Global Health and Rehabilitation (O Dadras DrPH), Western Norway University of Applied Sciences, Berg...
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Data sharing
To download the source data and analytic code used in these analyses, please visit the Global Health Data Exchange GBD 2019 website.

Acknowledgments
This study was funded by the Bill & Melinda Gates Foundation. A Fatehizadeh acknowledges support from the Department of Environmental Health Engineering, Isfahan University of Medical Sciences, Isfahan, Iran. V B Gupta acknowledges funding support from the National Health and Medical Research Council (NHMRC) of Australia. V K Gupta acknowledges funding support from the NHMRC, Australia. M Jakovljevic acknowledges the Serbian part of this GBD-related contribution was co-financed through Grant OI 175 014 of the Ministry of Education, Science and Technological Development of Serbia. I Landires is a member of the Sistema Nacional de Investigación, which is supported by Panama’s Secretaría Nacional de Ciencia, Tecnología e Innovación. M Molokhia is supported by the National Institute for Health Research Biomedical Research Centre at Guy’s and St Thomas’ National Health Service Foundation Trust and King’s College London. V Nuñez-Samudio is a member of the Sistema Nacional de Investigación, which is supported by Panama’s Secretaría Nacional de Ciencia, Tecnología e Innovación.

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