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

*GBD 2017 Causes of Death Collaborators**

Lancet 2018; 392: 1736–88

This online publication has been corrected. The corrected version first appeared at thelancet.com on November 9, 2018

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Summary

Background Global development goals increasingly rely on country-specific estimates for benchmarking a nation's progress. To meet this need, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2016 estimated global, regional, national, and, for selected locations, subnational cause-specific mortality beginning in the year 1980. Here we report an update to that study, making use of newly available data and improved methods. GBD 2017 provides a comprehensive assessment of cause-specific mortality for 282 causes in 195 countries and territories from 1980 to 2017.

Methods The causes of death database is composed of vital registration (VR), verbal autopsy (VA), registry, survey, police, and surveillance data. GBD 2017 added ten VA studies, 127 country-years of VR data, 502 cancer-registry country-years, and an additional surveillance country-year. Expansions of the GBD cause of death hierarchy resulted in 18 additional causes estimated for GBD 2017. Newly available data led to subnational estimates for five additional countries—Ethiopia, Iran, New Zealand, Norway, and Russia. Deaths assigned International Classification of Diseases (ICD) codes for non-specific, implausible, or intermediate causes of death were reassigned to underlying causes by redistribution algorithms that were incorporated into uncertainty estimation. We used statistical modelling tools developed for GBD, including the Cause of Death Ensemble model (CODEm), to generate cause fractions and cause-specific death rates for each location, year, age, and sex. Instead of using UN estimates as in previous versions, GBD 2017 independently estimated population size and fertility rate for all locations. Years of life lost (YLLs) were then calculated as the sum of each death multiplied by the standard life expectancy at each age. All rates reported here are age-standardised.

Findings At the broadest grouping of causes of death (Level 1), non-communicable diseases (NCDs) comprised the greatest fraction of deaths, contributing to 73·4% (95% uncertainty interval [UI] 72·5–74·1) of total deaths in 2017, while communicable, maternal, neonatal, and nutritional (CMNN) causes accounted for 18·6% (17·9–19·6), and injuries 8·0% (7·7–8·2). Total numbers of deaths from NCD causes increased from 2007 to 2017 by 22·7% (21·5–23·9), representing an additional 7·61 million (7·20–8·01) deaths estimated in 2017 versus 2007. The death rate from NCDs decreased globally by 7·9% (7·0–8·8). The number of deaths for CMNN causes decreased by 22·2% (20·0–24·0) and the death rate by 31·8% (30·1–33·3). Total deaths from injuries increased by 2·3% (0·5–4·0) between 2007 and 2017, and the death rate from injuries decreased by 13·7% (12·2–15·1) to 57·9 deaths (55·9–59·2) per 100 000 in 2017. Deaths from substance use disorders also increased, rising from 284 000 deaths (268 000–289 000) globally in 2007 to 352 000 (334 000–363 000) in 2017. Between 2007 and 2017, total deaths from conflict and terrorism increased by 118·0% (88·8–148·6). A greater reduction in total deaths and death rates was observed for some CMNN causes among children younger than 5 years than for older adults, such as a 36·4% (32·2–40·6) reduction in deaths from lower respiratory infections for children younger than 5 years compared with a 33·6% (31·2–36·1) increase in adults older than 70 years. Globally, the number of deaths was greater for men than for women at most ages in 2017, except at ages older than 85 years. Trends in global YLLs reflect an epidemiological transition, with decreases in total YLLs from enteric infections, respiratory infections and tuberculosis, and maternal and neonatal disorders between 1990 and 2017; these were generally greater in magnitude at the lowest levels of the Socio-demographic Index (SDI). At the same time, there were large increases in YLLs from neoplasms and cardiovascular diseases. YLL rates decreased across the five leading Level 2 causes in all SDI quintiles. The leading causes of YLLs in 1990—neonatal disorders, lower respiratory infections, and diarrhoeal diseases—were ranked second, fourth, and fifth, in 2017. Meanwhile, estimated YLLs increased for ischaemic heart disease (ranked first in 2017) and stroke (ranked third), even though YLL rates decreased. Population growth contributed to increased total deaths across the 20 leading Level 2 causes of mortality between 2007 and 2017. Decreases in the cause-specific mortality rate reduced the effect of population growth for all but three causes: substance use disorders, neurological disorders, and skin and subcutaneous diseases.

Interpretation **Improvements in global health have been unevenly distributed among populations. Deaths due to injuries, substance use disorders, armed conflict and terrorism, neoplasms, and cardiovascular disease are expanding threats to global health. For causes of death such as lower respiratory and enteric infections, more rapid progress occurred for children than for the oldest adults, and there is continuing disparity in mortality rates by sex across age groups. Reductions in the death rate of some common diseases are themselves slowing or have ceased, primarily for NCDs, and the death rate for selected causes has increased in the past decade.**

Funding **Bill & Melinda Gates Foundation.**

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Introduction

Systematic recording and analysis of causes of human death remains one of the most resilient successes for public health, beginning with routine and continuous reporting of deaths by physicians starting in the 15th century.[1] Today, hundreds of thousands of physicians evaluate and select the cause of death for millions of deaths annually, codifying the results according to the International Classification of Diseases (ICD) system.[2] These efforts form the basis of a global mortality reporting system that is widely relied upon to prioritise health system investments, track progress towards global development goals, and guide scientific research. Although there remains a need for wider adoption and improvement of these systems, continuous reporting of cause-specific mortality in many countries represents a success for global health.[3]

More mortality data are now becoming available because of broader adoption of vital registration systems and increased information-sharing made possible by digital communication. At the same time, efforts to correct, sort, analyse, and report this massive

Research in context

Evidence before this study

Previously, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2016 provided estimates for 264 causes of death for 195 countries and territories, by age and sex, from 1980 to 2016. GBD 2016 incorporated newly available data for many locations, expanded and refined the included causes of death, improved modelling techniques, and developed a star rating system for the quality of cause of death data. To better assess mortality among the oldest adults, terminal age categories for age 90–94 years and 95 years and older were added. Other organisations periodically produce estimates of cause-specific mortality, including for a wide list of causes and across multiple age groups (WHO), for selected cancers (the International Agency for Research on Cancer), and for child deaths (the Maternal and Child Epidemiology Estimation [MCEE] group). GBD continues to provide the only peer-reviewed annual estimates of cause-specific mortality available for all locations over time.

Added value of this study

GBD 2017 includes estimates for 2017 and also updates the entire series from 1980 produced for GBD 2016. The list of included causes has been expanded and study methods have been improved in multiple ways. First, inclusion of an independent estimation of population and fertility developed for GBD 2017 substantially improved estimates in selected countries. Second, additional data were identified, including 127 country-years of vital registration and ten verbal autopsy studies. Third, new subnational assessments were developed for five countries in 2017: Ethiopia, Iran, New Zealand, Norway, and Russia. Fourth, a new stratum was developed for subnational-level estimation in New Zealand to characterise populations by ethnicity as Māori or non-Māori. Fifth, we revised adjustments made for misclassified deaths due to dementia, Parkinson's disease, and atrial fibrillation. Finally, additional diseases are now estimated, including non-rheumatic calcific aortic and degenerative mitral valve disease; subarachnoid haemorrhage; myelodysplastic, myeloproliferative, and other haemopoietic disorders; diabetes mellitus as type 1 and type 2 (previously combined); poisoning by carbon monoxide; liver cancer due to non-alcoholic steatohepatitis; ectopic pregnancy; and invasive non-typhoidal salmonella.

Implications of all the available evidence

Deaths due to communicable, maternal, neonatal, and nutritional causes continue to decline, while deaths from non-communicable diseases increase and injury deaths are stable. Declines in death rates of some non-communicable diseases have slowed or ceased. GBD 2017 has increased its collaboration with governments, leading to additional data for subnational estimation. Engagement with GBD collaborators, policy makers, disease experts, and the public is guiding expansions of the cause list and resulting decreasing burden classified in residual "other" categories. Non-communicable diseases remain the leading causes of death globally, and their burden is rising. GBD 2017 is motivated by the same goals as GBD 2016, including the belief that annual updates, reflecting improvements due to improved data availability, new causes estimated, and better methods to reduce bias and improve transparency in reporting, are contributing to the formulation and tracking of new evidence-based health policy. We intend for GBD 2017 to serve as a global public good, freely available for policy makers and the public seeking to improve human health.

amount of global data are evolving to keep pace with increasing demands for timely assessment of global, regional, and local mortality patterns. In addition to shifts in mortality patterns due to an ongoing epidemiological transition, rapid spikes in mortality due to specific causes are frequently observed and require recurrent updates to global estimates. Examples of mortality spikes include opioid-associated deaths in parts of the USA,[4] suicide in eastern Europe in the 1990s,[5] and conflict-associated deaths in the eastern Mediterranean and North Africa region.[6] Causes of death are now reported digitally in many locations, allowing health authorities to improve the quality and timeliness of mortality reporting.[7,8] Global development goals increasingly rely on country-specific estimates for benchmarking a nation's progress. Global commitments, such as the UN's Sustainable Development Goals (SDGs),[9] the Moscow Declaration to End Tuberculosis,[10] WHO's First Global Conference on Air Pollution and Health[11] in October, 2018, and the UN High-level Meetings on NCDs[12] and tuberculosis,[13] both in September, 2018, will require ongoing tracking of cause-specific mortality, including in locations where mortality surveillance data remain limited.

See Online for appendix 2

The following study represents an annual update to the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), an effort to produce consistent and comparable estimates of cause-specific mortality for all locations globally. GBD 2017 includes results by age and sex, for the years 1980 through to 2017, for 195 countries and territories. A cycle of continuous quality improvement has led to substantial changes, including new data sources, new causes of death, and updated methods. For the first time, population estimates have been independently produced by GBD 2017,[14] and subnational estimates have been produced for Ethiopia, Iran, New Zealand, Norway, and Russia. The purpose of GBD 2017 is to serve as a global public good, freely available for policy makers and the public seeking to improve human health.

For the **data visualisation tool** see https://vizhub.healthdata.org/gbd-compare/

Methods

Overview

GBD cause of death estimation incorporates methods to adjust for incomplete or missing vital registration (VR) and verbal autopsy (VA) data, general heterogeneity in data completeness and quality, and the redistribution of so-called garbage codes (insufficiently specific or implausible cause of death codes). A general description of these methods is provided in this section, with further detail presented in appendix 1. GBD 2017 complied with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER)[15] statement (appendix 1 section 1.3). Analyses were completed with Python version 2.7.14, Stata version 13.1, and R version 3.3.2. Statistical code used for GBD estimation is publicly available online.

See Online for appendix 1

For the **statistical code** see https://github.com/ihmeuw/ihme-modeling

Geographical units and time periods

The locations included in GBD 2017 have been arranged into a set of hierarchical categories composed of seven super-regions and a further nested set of 21 regions containing 195 countries and territories (appendix 1). Each year, GBD includes subnational analyses for a few new countries and continues to provide subnational estimates for countries that were added in previous cycles. Subnational estimation in GBD 2017 includes five new countries (Ethiopia, Iran, New Zealand, Norway, Russia) and countries previously estimated at subnational levels (GBD 2013: China, Mexico, and the UK [regional level]; GBD 2015: Brazil, India, Japan, Kenya, South Africa, Sweden, and the USA; GBD 2016: Indonesia and the UK [local government authority level]). All analyses are at the first level of administrative organisation within each country except for New Zealand (by Māori ethnicity), Sweden (by Stockholm and non-Stockholm), and the UK (by local government authorities). All subnational estimates for these countries were incorporated into model development and evaluation as part of GBD 2017. To meet data use requirements, in this publication we present all subnational estimates excluding those pending publication (Brazil, India, Japan, Kenya, Mexico, Sweden, the UK, and the USA); because of space constraints these selected subnational results are presented in appendix 2. Subnational estimates for countries with populations larger than 200 million (measured with our most recent year of published estimates) that have not yet been published elsewhere are presented wherever estimates are illustrated with maps but are not included in data tables.

The complete cause-specific estimation results include the years 1980 through to 2017, and are available for exploration by an online data visualisation tool. To better support current health policy assessment, we include a subset of analyses in the current study featuring the most recent interval, 2007–17.

The GBD cause of death hierarchy

The GBD study attributes each death to a single underlying cause that began the series of events leading to death, in accordance with ICD principles. The GBD study organises causes of death in a hierarchical list containing four levels (appendix 1 section 7). At the highest level (Level 1), all disease burden is divided among three mutually exclusive and collectively exhaustive categories: communicable, maternal, neonatal, and nutritional (CMNN) diseases; non-communicable diseases (NCDs); and injuries. Level 2 distinguishes these Level 1 categories into 21 cause groups, such as cardiovascular diseases; diarrhoeal diseases, lower respiratory infections (LRIs), and other common infectious diseases; or transport injuries. Level 3 disaggregates these causes further; in most cases this disaggregation represents the finest level of detail by cause, such as stroke, ischaemic heart disease,

or road injuries. Where data are sufficiently available or specific policy relevance has been sought, selected causes are further disaggregated at Level 4, such as drug-susceptible tuberculosis, multidrug-resistant tuberculosis without extensive drug resistance, and extensively drug-resistant tuberculosis. For GBD 2017, the cause hierarchy was further refined to separately estimate causes with substantial policy interest or high levels of burden. Specific changes included separate estimation of non-rheumatic calcific aortic and degenerative mitral valve diseases, and myelodysplastic, myeloproliferative, and other haemopoietic neoplasms, resulting in a reduction in the estimates of some residual causes. Disaggregation of residual causes also allowed separate estimation of type 1 and type 2 diabetes, chronic kidney disease due to type 1 and type 2 diabetes, poisoning by carbon monoxide, liver cancer due to non-alcoholic steatohepatitis (NASH), subarachnoid haemorrhage, ectopic pregnancy, and invasive non-typhoidal salmonella. Maternal and neonatal disorders, previously estimated as separate cause groupings at Level 2 of the hierarchy, were estimated for GBD 2017 at Level 3 of the hierarchy, and then aggregated up to Level 2 to better capture the epidemiological connections and linked burden between them. The complete hierarchy of causes included in GBD 2017 and their corresponding ICD9 and ICD10 codes are described in appendix 1 (section 7).

Cause of death data

The GBD cause of death database consists of VR and VA data; survey and census data for injuries and maternal mortality; surveillance data for maternal mortality and child death; cancer registries; and police records for interpersonal violence and road injuries. Self-harm estimates incorporate VR data and are based on ICD categorisation as described in appendix 1 (section 7). In this iteration of GBD, ten new VA studies and 127 new country-years of VR data were added at the country level. 502 new cancer-registry country-years were added, as was one additional new surveillance country-year. Data sources comprising the GBD cause of death database can be reviewed on the Global Health Data Exchange website. Multiple factors can influence changes between GBD studies in estimates for a given cause-location-year, including the quality of a country's data system (as represented by the GBD star rating system) and the addition of more recent data. Figure 1 shows the relative stability of GBD estimates between study iterations. Variation between GBD 2016 and GBD 2017 estimates was greater in countries with both low star ratings and no new VR data updates occurring between these iterations of the study. Changes to estimates can be seen even in high star rating locations because of changes in modelling strategy or model covariates even when no new VR data were available between cycles.

Data standardisation and processing

To standardise cause of death data, we used protocols to address the minor proportion of deaths that were assigned to age groups broader than the GBD five-year age groups or were not assigned an age or sex, and to address differences in ICD codes due to national variation or revision, as described in appendix 1 (section 2). Garbage codes, deaths with non-specific codes (eg, unspecified stroke), deaths assigned to ICD codes that could not be underlying causes of death (eg, senility), or deaths assigned to intermediate but not underlying causes of death (eg, heart failure), were redistributed by age, sex, location, and year to the most likely causes of death. Methods used for this redistribution included regression models, redistribution based on fixed proportions, proportional reassignment, and fractional assignment of a death assigned to multiple causes, as developed by Naghavi and colleagues[16] and detailed in appendix 1 (section 2.7). We excluded all data sources with more than 50% of deaths assigned to major garbage codes (those at Level 1 or Level 2 of the GBD hierarchy) in any location-year to mitigate the potential for bias from these sources. The proportion of VR data assigned to major garbage code categories for each location-year is shown, with supporting detail, in appendix 1 (section 7). New to GBD 2017, the uncertainty around redistribution methods was also estimated. Additional details for this process are provided in appendix 1 (section 2.7). Because mortality due to HIV/AIDS is sometimes coded to other causes of death such as tuberculosis, meningitis, or toxoplasmosis, we also corrected the cause of death assignment to HIV/AIDS for peak epidemic times. Tuberculosis deaths can be misclassified as pneumonia deaths in children in locations with a high tuberculosis burden. Methods to adjust for this potential misclassification are described in detail in appendix 1 (section 3.3).

Mortality rates from dementia and Parkinson's disease reported in VR systems cannot be reconciled with observed trends in prevalence and excess mortality—a disparity that can be attributed to variation in death certification practices for these causes across countries and over time.[17] For GBD 2017, we sought to address this known bias by using details from multiple cause of death data. For GBD 2017, multiple cause of death data were available to investigators only for the USA, where recent years show improved use of previously underutilised codes such as dementia. Statistical models of these USA data were used to reclassify deaths from other GBD causes and garbage codes to dementia and Parkinson's disease according to the pattern of intermediate and immediate causes observed in the most recent years. Model results were applied to all countries. A similar reallocation process was used for atrial fibrillation deaths misclassified as deaths due to heart failure or thromboembolic events. A detailed

For the **Global Health Data Exchange** see http://ghdx.healthdata.org/

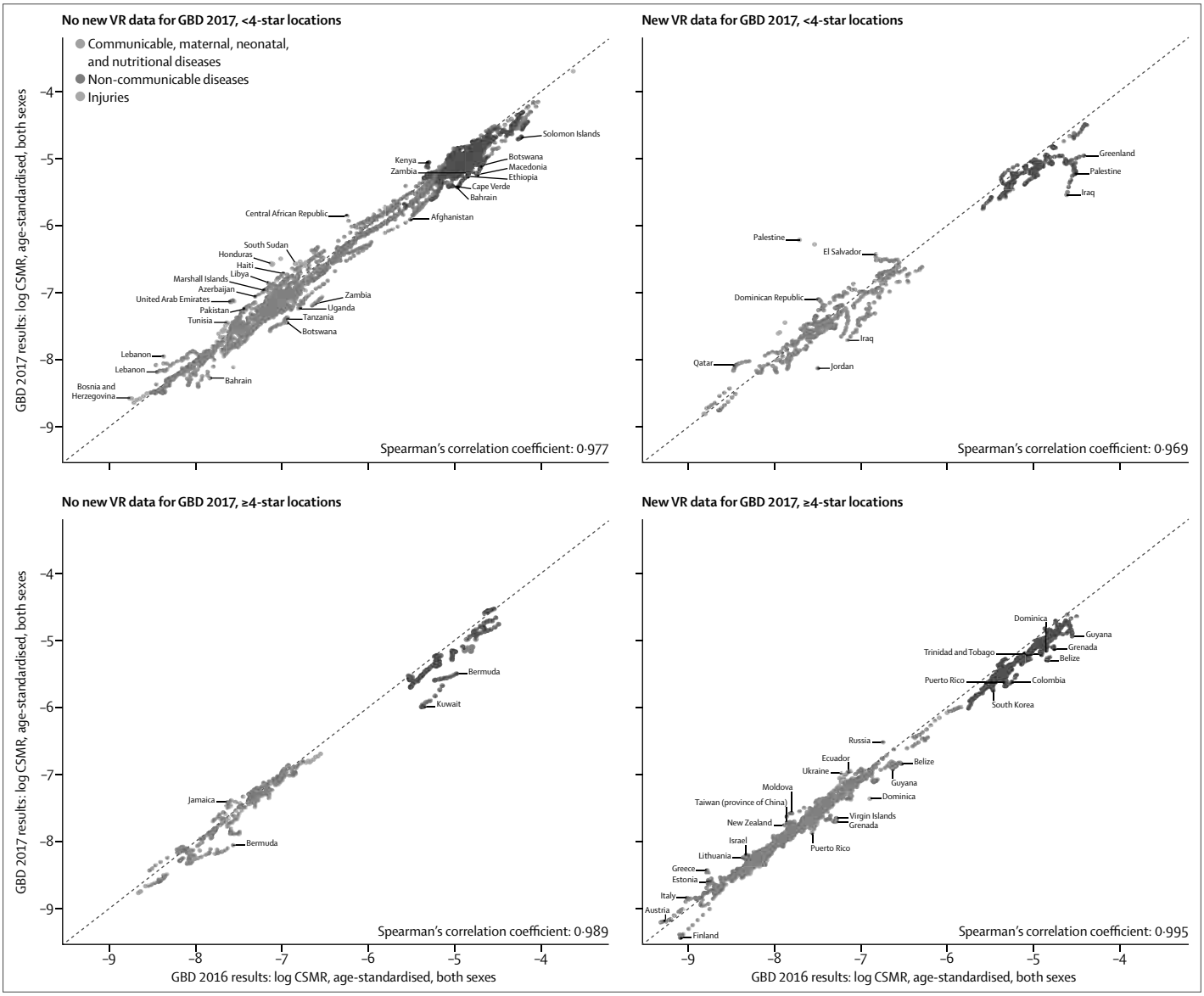

Figure 1: **Effect of new VR data on Level 1 cause estimates from GBD 2016 to GBD 2017, based on national locations with varying quality of VR data, 2008–16**
The figure shows the degree of consistency between GBD 2016 and GBD 2017 estimates for Level 1 causes at the national level from 2008 to 2016. The diagonal line represents no change from GBD 2016 to GBD 2017. Each point represents one country-year, with colours indicating the Level 1 cause grouping (communicable, maternal, neonatal, and nutritional diseases; non-communicable diseases; and injuries). Panels indicate whether or not any new VR data between 2008 and 2016 were added for that location for GBD 2017, and whether or not a location has 4-star or 5-star VR quality. Points that are outside of the standard 95% prediction interval for a linear regression of 2017 values on 2016 values are annotated (if the same location-cause had multiple points in a time series, only the furthest-most point was annotated). The Spearman's correlation coefficient is noted in the lower right-hand corner of each panel. CSMR=cause-specific mortality rate. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study. VR=vital registration.

description of these redistribution procedures and the manner in which they were applied to all countries is available in section 2 of appendix 1. This reallocation is illustrated in appendix 1 (section 7).

For the first time in GBD 2017, we separately estimated deaths from diabetes by type. Deaths due to diabetes can be reported in VR and VA data as type 1, type 2, or unspecified. Two data manipulation steps were necessary. First, we assumed all deaths reported in individuals younger than 15 years were type 1 regardless of the original code assignment. Second, we redistributed unspecified diabetes deaths on the basis of a regression in which the true proportions of type 1 and type 2 deaths by age-sex-location-year are a function of the proportion of unspecified deaths, age, the age-standardised prevalence of obesity, and an interaction term for age and obesity prevalence. These methods are described in detail in appendix 1 (section 3.3).

Data completeness assessment

Completeness of VR data was assessed by location-year, and sources with less than 50% completeness were excluded. We multiplied the estimated all-cause mortality for each age-sex-location-year by the cause fraction for the corresponding age-sex-location-year to adjust all included sources to 100% completeness. VA and VR data availability and completeness are shown for each location-year in appendix 1 (section 7). To further characterise the quality of data available in each country, the GBD study rated each location-year from 1980 to 2017 on a level of 0 to 5 stars according to methods previously described.[18] Ratings convey an overall measure of the reliability of cause of death estimates for each location-year but do not directly affect the estimation process.

Cause of death estimation with CODEm

The GBD Cause of Death Ensemble model (CODEm) systematically tested and combined results from different statistical models according to their out-of-sample predictive validity. Results are incorporated into a weighted ensemble model as detailed in appendix 1 (section 3.1) and below. For GBD 2017, CODEm was used to estimate 192 causes of death (appendix 1 section 7). To predict the level for each cause of death, we used CODEm to systematically test a large number of functional forms and permutations of covariates.[18] Each resulting model that met the predetermined requirements for regression coefficient significance and direction was fit on 70% of the data, holding out 30% for cross-validation (appendix 1 section 3.1). Out-of-sample predictive validity of these models was assessed by use of repeated cross-validation tests on the first 15% of the held-out data. Various ensemble models with different weighting parameters were created from the combination of these models, with the highest weights assigned to models with the best out-of-sample prediction error for trends and levels, as detailed in appendix 1 (section 7). Model performance of these ensembles was assessed against the root-mean squared error (RMSE) of the ensemble model predictions of the log of the age-specific death rates for a cause, assessed with the same 15% of the data. The ensemble model performing best was subsequently selected and assessed against the other 15% of the data withheld from the statistical model building. CODEm was run independently by sex for each cause of death. A separate model was run for countries with 4-star or greater VR systems to avert uncertainty inflation from more heterogeneous data. The distribution of RMSE relative to cause-specific mortality rates (CSMRs) at Level 2 of the GBD hierarchy shows that model performance was weakest for causes of death with comparatively low mortality rates (figure 2; appendix 2), while models for more common causes of death such as stroke, chronic obstructive pulmonary disease, and self-harm and interpersonal violence generally had low RMSE.

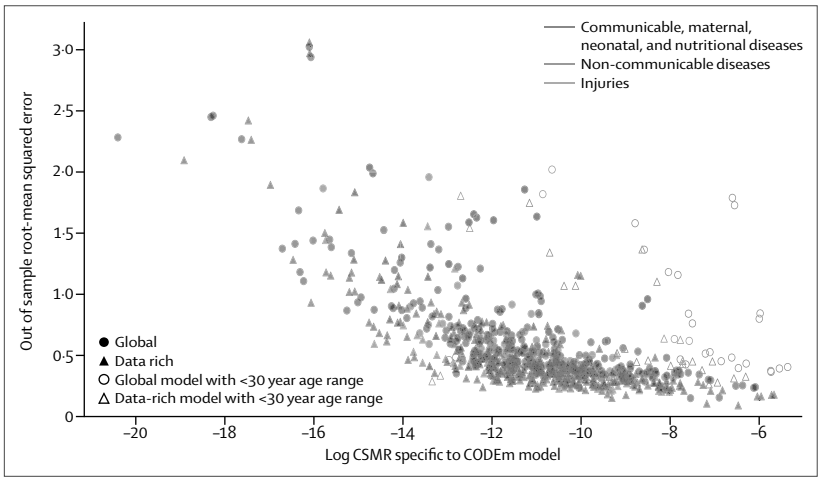

***Figure 2*: Out-of-sample model performance for CODEm models and age-standardised cause-specific mortality rate by Level 1 causes**

Model performance was defined by the root-mean squared error of the ensemble model predictions of the log of the age-specific death rates for a cause with 15% of the data held out from the statistical model building. The figure shows the association between the root-mean squared error and the log of the CSMR, aggregated over 1980–2017. Each point represents one CODEm model specific for model-specific age ranges and sex. Circles denote models run with all locations. Triangles denote models run on only data-rich locations. Colours denote the Level 1 cause categories. Open circles and triangles denote models that were run with restricted age groups of less than 30 years. CODEm=Cause of Death Ensemble model. CSMR=cause-specific mortality rate.

Cause of death estimation with alternative estimation strategies

Alternative estimation strategies were used to model a subset of causes of death with unique epidemiology, large changes in reporting over time, or particularly limited data availability, including HIV/AIDS, malaria, chronic kidney disease, cirrhosis, liver cancer, meningitis, dementia, and atrial fibrillation. Alternative strategies included prevalence-based models, incidence and case fatality models, and sub-cause proportion models as described in appendix 1 (section 7). Mortality-incidence ratio models based on registry data were used to estimate mortality from 32 cancers (appendix 1 section 3.3). Negative-binomial models were used for eight causes of death with typically low death counts or causes that typically have no deaths in countries with a high Socio-demographic Index (SDI), including ascariasis, cystic echinococcosis, cysticercosis, diphtheria, iodine deficiency, other intestinal infectious diseases, schistosomiasis, and varicella and herpes zoster virus. Once underlying cause of death estimates and accompanying uncertainty were generated, these models were combined with the cause of death correction procedure (CoDCorrect) to establish estimates consistent with all-cause mortality levels for each age-sex-year location.

Estimation of fatal discontinuities

Fatal discontinuities are large changes in deaths due to unexpected spikes in injuries or epidemics—defined by GBD as more than one per million or more than

25 deaths—in a specific location-year. We classified fatal discontinuities as conflict and terrorism, major transportation accidents, natural disasters, other forms of disaster such as large fires or the collapse of large buildings, or major outbreaks of infectious diseases. Data on fatal discontinuities came from VR data in the 75 countries with a 4-star or 5-star data quality rating for the interval of 1980–2017. For the remaining 120 countries with a rating of 3 stars or lower, we used alternative databases (appendix 1 section 7). Cholera and meningitis were estimated as fatal discontinuities to reduce the risk of underestimation for small-magnitude outbreaks caused by the smoothing of VR or VA data over time in CODEm. To address lags in reporting and publishing of data, we included news reports and other supplemental data sources when known gaps existed. Further detail about fatal discontinuity estimation is presented in appendix 1 (section 3.3).

Pathogen counterfactual analysis

Aetiology-specific mortality was estimated for LRIs and diarrhoeal diseases by use of a counterfactual approach that relates the frequency of each aetiology in a population and the association with that aetiology and either LRI or diarrhoea. LRI and diarrhoea were selected as initial candidates for this counterfactual analysis approach given the large disease burden they represent and the broad interest in interventions, mostly vaccine-based, to reduce their burden.[19] We attributed LRI deaths to four aetiologies: *Haemophilus influenzae* type B pneumonia, *Streptococcus pneumoniae* pneumococcal pneumonia, influenza, and respiratory syncytial virus pneumonia. Diarrhoeal deaths were attributed to 13 aetiologies: adenovirus, Aeromonas spp, *Campylobacter* spp, *Clostridium difficile*, cryptosporidiosis (*Cryptosporidium* spp), amoebiasis (*Entamoeba histolytica*), typical enteropathogenic *Escherichia coli*, enterotoxigenic *E coli*, norovirus, rotavirus, non-typhoidal *Salmonella* spp, shigellosis (*Shigella* spp), and cholera (*Vibrio cholerae*). The mortality attributable to each aetiology is the product of the attributable fraction and the mortality due to LRI or diarrhoea. The current counterfactual analysis is an extension of work begun in GBD 2010, based on the most common pathogens and available data. This method allows for less common aetiologies to be added in the future.

YLL computation

Years of life lost (YLLs) are a measure of premature death calculated as the sum of each death multiplied by the standard life expectancy at each age. The standard life expectancy was taken from the lowest observed risk of death for each five-year age group in all populations greater than 5 million. In 2017, GBD 2017 included a new demographic assessment of population, fertility, migration, and all-cause mortality.[14] We used these components to generate single calendar-year and single age-year estimates of the population using transparent and replicable methods.[14] This independent assessment of the population was subsequently used in the calculation of YLL rates and age-standardised mortality rates. Details of these calculations are available in appendix 1 (section 4.3).

Decomposition of change in global deaths

Using methods adapted from demographic research from Das Gupta,[20] we decomposed change in numbers of deaths by cause from 2007 to 2017, using three explanatory components: as change occurring from growth in the total population; as shifts in population structure by age; or as changes in cause-specific mortality rates. We calculated the fraction of change in deaths by cause from each component using counterfactual scenarios, changing the level of one factor from 2007 to 2017, with all other factors held constant. Since the effect depends on the order of entry of the factor, we calculated the average of all combinations of the three factors. Thus, the change in global deaths due to shifts in population age structure could be calculated by comparing the number of deaths in 2007 to the number of deaths in 2017, using the population age structure from 2017 and holding both population size and cause-specific mortality rates at 2007 levels (appendix 1 section 7).

Uncertainty analysis

Uncertainty in our estimates was attributable to cause-specific model specifications; varied availability of data by age, sex, location, or year; and variability of sample size within data sources. We quantified and propagated uncertainty into final estimates by calculating uncertainty intervals (UIs) for cause-specific estimation components based on 1000 draws from the posterior distribution of cause-specific mortality by age, sex, location, and year.[21] 95% UIs were calculated with the 2·5th and 97·5th percentiles, and point estimates were calculated from the mean of the draws. Changes over time were considered statistically significant when the uncertainty interval of the percentage change over time did not cross zero.

Socio-demographic Index and epidemiological transition analysis

The SDI is a value between 0·0 and 1·0 calculated from the geometric mean of three rescaled components: total fertility rate under 25 years (TFRU25), lag-distributed income per capita (LDI), and average educational attainment in the population older than 15 years.[22] Because the total fertility rate—used in the calculation of SDI for GBD 2016—has a U-shaped association at the highest levels of development, for GBD 2017 we recomputed the SDI using TFRU25 only, an age range for which the association with development is clearest.[14] We used a generalised additive model with a Loess smoother on SDI to estimate the association between SDI and each

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
All causes	**55 945·7 (55 356·4 to 56 516·7)**	**9·3% (8·2 to 10·2)***	**737·7 (729·9 to 745·4)**	**−14·2% (−15·0 to −13·5)***	**1 646 249·6 (1 622 870·6 to 1 673 178·4)**	**−9·0% (−10·1 to −7·6)***	**21 926·4 (21 601·1 to 22 314·9)**	**−22·2% (−23·2 to −21·0)***
Communicable, maternal, neonatal, and nutritional diseases	**10 389·9 (10 004·0 to 10 975·9)**	**−22·2% (−24·0 to −20·0)***	**143·8 (138·4 to 151·6)**	**−31·8% (−33·3 to −30·1)***	**578 416·6 (558 815·0 to 600 759·1)**	**−30·4% (−32·4 to −28·2)***	**8280·6 (8005·4 to 8602·8)**	**−35·4% (−37·3 to −33·4)***
HIV/AIDS and sexually transmitted infections	**1073·6 (983·3 to 1182·4)**	**−47·7% (−50·0 to −45·1)***	**13·9 (12·6 to 15·5)**	**−53·6% (−55·8 to −51·0)***	**60 550·2 (53 533·7 to 69 156·3)**	**−47·3% (−50·2 to −44·0)***	**806·4 (703·1 to 936·7)**	**−52·1% (−55·2 to −48·6)***
HIV/AIDS	954·5 (907·3 to 1009·7)	−50·3% (−52·1 to −48·3)*	12·1 (11·5 to 12·9)	−56·5% (−58·0 to −54·7)*	50 497·1 (47 658·0 to 53 595·8)	−51·2% (−52·9 to −49·2)*	655·1 (617·5 to 696·4)	−56·6% (−58·1 to −54·8)*
HIV/AIDS and drug-susceptible tuberculosis co-infection	194·6 (137·7 to 253·0)	−55·4% (−58·4 to −51·6)*	2·5 (1·8 to 3·2)	−61·1% (−63·7 to −57·7)*	10 664·8 (7613·4 to 13 757·1)	−55·6% (−58·7 to −51·7)*	140·0 (100·2 to 180·0)	−60·5% (−63·1 to −57·0)*
HIV/AIDS and multidrug-resistant tuberculosis without extensive drug resistance co-infection	22·6 (13·4 to 34·5)	−52·2% (−66·4 to −33·2)*	0·3 (0·2 to 0·4)	−58·1% (−70·5 to −41·5)*	1247·8 (746·6 to 1906·7)	−51·7% (−65·7 to −33·2)*	16·4 (9·8 to 25·1)	−56·8% (−69·3 to −40·4)*
HIV/AIDS and extensively drug-resistant tuberculosis co-infection	1·2 (0·8 to 1·8)	−8·3% (−26·8 to 14·7)	0·0 (0·0 to 0·0)	−20·3% (−36·4 to −0·2)*	62·7 (38·3 to 92·9)	−10·5% (−28·4 to 11·5)	0·8 (0·5 to 1·2)	−21·0% (−36·7 to −1·4)*
HIV/AIDS resulting in other diseases	736·0 (659·5 to 817·7)	−48·7% (−51·1 to −45·9)*	9·3 (8·4 to 10·4)	−55·1% (−57·2 to −52·6)*	38 521·8 (34 381·3 to 43 095·5)	−49·8% (−52·3 to −46·9)*	497·9 (444·2 to 558·4)	−55·4% (−57·6 to −52·8)*
Sexually transmitted infections excluding HIV	119·1 (50·8 to 220·4)	−10·8% (−18·4 to −2·5)*	1·8 (0·7 to 3·3)	−14·4% (−21·5 to −6·6)*	10 053·1 (4057·0 to 18 915·2)	−11·4% (−19·0 to −3·2)*	151·3 (60·6 to 285·3)	−14·4% (−21·8 to −6·6)*
Syphilis	113·5 (45·2 to 214·5)	−11·3% (−19·1 to −2·8)*	1·7 (0·7 to 3·2)	−14·3% (−21·8 to −6·4)*	9836·1 (3848·5 to 18 676·4)	−11·5% (−19·3 to −3·1)*	148·6 (58·0 to 282·3)	−14·3% (−21·8 to −6·2)*
Chlamydial infection	1·1 (0·9 to 1·2)	2·5% (−4·5 to 11·3)	0·0 (0·0 to 0·0)	−15·2% (−21·0 to −8·4)*	40·5 (32·6 to 45·0)	−5·5% (−12·2 to 2·5)	0·5 (0·4 to 0·6)	−17·9% (−23·7 to −11·0)*
Gonococcal infection	3·0 (2·4 to 3·3)	3·7% (−3·4 to 12·5)	0·0 (0·0 to 0·0)	−14·9% (−20·8 to −8·2)*	112·8 (90·2 to 124·9)	−3·8% (−10·7 to 4·3)	1·4 (1·1 to 1·6)	−17·4% (−23·5 to −10·7)*
Other sexually transmitted infections	1·5 (1·2 to 1·7)	0·2% (−6·4 to 8·3)	0·0 (0·0 to 0·0)	−15·9% (−21·6 to −9·5)*	63·6 (51·0 to 70·7)	−6·2% (−12·7 to 1·1)	0·8 (0·6 to 0·9)	−18·2% (−23·9 to −11·7)*
Respiratory infections and tuberculosis	**3752·3 (3629·4 to 3889·3)**	**−8·0% (−10·3 to −5·5)***	**50·5 (48·8 to 52·3)**	**−24·5% (−26·4 to −22·6)***	**148 233·5 (141 335·1 to 155 291·4)**	**−24·7% (−27·4 to −21·7)***	**2056·0 (1956·3 to 2160·7)**	**−32·8% (−35·4 to −30·0)***
Tuberculosis	1183·7 (1129·8 to 1245·3)	−14·9% (−18·2 to −10·3)*	14·9 (14·3 to 15·7)	−31·4% (−34·1 to −27·6)*	41 876·9 (39 972·4 to 44 120·5)	−21·2% (−24·4 to −17·4)*	533·4 (509·1 to 562·6)	−33·3% (−35·9 to −30·0)*
Drug-susceptible tuberculosis	1044·1 (951·6 to 1129·2)	−15·5% (−22·3 to −8·6)*	13·2 (12·0 to 14·2)	−31·9% (−37·3 to −26·4)*	36 932·5 (33 846·8 to 39 919·1)	−21·9% (−27·8 to −16·0)*	470·7 (431·3 to 508·4)	−33·8% (−38·7 to −29·0)*
Multidrug-resistant tuberculosis without extensive drug resistance	126·9 (70·1 to 202·2)	−11·6% (−47·4 to 38·1)	1·6 (0·9 to 2·5)	−28·6% (−57·4 to 11·4)	4505·1 (2582·5 to 6984·6)	−17·6% (−49·4 to 26·5)	57·2 (33·0 to 88·4)	−30·2% (−56·9 to 6·6)
Extensively drug-resistant tuberculosis	12·6 (8·6 to 18·0)	14·0% (−18·7 to 58·7)	0·2 (0·1 to 0·2)	−7·7% (−34·1 to 28·8)	439·2 (306·2 to 616·5)	5·5% (−23·2 to 44·9)	5·5 (3·8 to 7·7)	−11·1% (−35·2 to 22·1)
Lower respiratory infections	2558·6 (2442·2 to 2655·4)	−4·3% (−6·9 to −1·5)*	35·4 (33·8 to 36·8)	−21·1% (−23·2 to −18·9)*	105 834·5 (99 746·4 to 111 767·8)	−25·9% (−29·2 to −22·2)*	1515·1 (1424·8 to 1602·2)	−32·6% (−35·7 to −29·2)*
Upper respiratory infections	9·1 (6·1 to 12·4)	−30·5% (−41·0 to −14·5)*	0·1 (0·1 to 0·2)	−42·1% (−49·6 to −29·9)*	477·3 (247·3 to 730·5)	−33·2% (−44·1 to −12·9)*	6·9 (3·5 to 10·6)	−38·6% (−48·3 to −19·4)*
Otitis media	0·9 (0·7 to 1·5)	−41·4% (−51·6 to −28·4)*	0·0 (0·0 to 0·0)	−50·4% (−58·8 to −39·9)*	44·8 (31·2 to 72·1)	−49·4% (−59·9 to −35·5)*	0·6 (0·4 to 1·0)	−54·5% (−64·1 to −41·8)*

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Enteric infections	**1766·0 (1398·0 to 2386·0)**	**–17·2% (–24·6 to –8·2)***	**24·4 (19·5 to 32·4)**	**–29·9% (–34·9 to –23·1)***	**84 625·5 (73 770·6 to 100 720·2)**	**–30·6% (–36·3 to –23·7)***	**1208·6 (1064·1 to 1424·7)**	**–36·6% (–41·8 to –30·7)***
Diarrhoeal diseases	1569·6 (1176·0 to 2193·0)	–16·6% (–25·3 to –6·7)*	21·6 (16·4 to 29·7)	–30·2% (–36·1 to –22·7)*	70 574·3 (60 421·1 to 86 165·2)	–32·0% (–38·6 to –23·9)*	1009·1 (870·5 to 1211·0)	–38·1% (–43·9 to –31·3)*
Typhoid and paratyphoid	135·9 (76·9 to 218·9)	–22·3% (–27·3 to –18·1)*	1·9 (1·1 to 3·0)	–27·8% (–32·8 to –23·9)*	9686·1 (5484·9 to 15 746·2)	–23·8% (–29·3 to –19·4)*	136·3 (77·0 to 220·9)	–28·7% (–34·0 to –24·4)*
Typhoid fever	116·8 (65·4 to 187·7)	–23·7% (–29·0 to –19·3)*	1·6 (0·9 to 2·6)	–29·1% (–34·1 to –25·0)*	8331·7 (4632·5 to 13 419·2)	–25·3% (–31·0 to –20·8)*	117·3 (65·5 to 188·5)	–30·1% (–35·6 to –25·7)*
Paratyphoid fever	19·1 (8·7 to 37·3)	–12·7% (–20·1 to –4·2)*	0·3 (0·1 to 0·5)	–18·9% (–26·1 to –10·8)*	1354·4 (622·3 to 2620·2)	–13·2% (–21·3 to –3·8)*	19·0 (8·8 to 36·6)	–18·6% (–26·5 to –9·7)*
Invasive non-typhoidal salmonella	59·1 (33·3 to 98·1)	–17·9% (–25·1 to –8·7)*	0·8 (0·5 to 1·4)	–24·8% (–31·9 to –15·6)*	4260·8 (2382·0 to 7378·6)	–17·2% (–25·7 to –6·8)*	61·6 (34·7 to 107·6)	–22·6% (–30·7 to –12·5)*
Other intestinal infectious diseases	1·4 (1·0 to 2·2)	–39·7% (–67·1 to 9·7)	0·0 (0·0 to 0·0)	–44·7% (–70·1 to 2·3)	104·4 (67·8 to 170·7)	–43·6% (–71·6 to 11·9)	1·5 (1·0 to 2·5)	–46·9% (–73·7 to 6·3)
Neglected tropical diseases and malaria	**720·1 (530·7 to 938·8)**	**–29·0% (–37·3 to –19·3)***	**10·1 (7·5 to 13·2)**	**–36·1% (–43·7 to –27·3)***	**48 656·2 (35 574·6 to 64 934·2)**	**–33·7% (–42·4 to –23·7)***	**699·9 (508·0 to 933·6)**	**–38·6% (–46·7 to –29·2)***
Malaria	619·8 (440·1 to 839·5)	–30·8% (–39·4 to –20·8)*	8·7 (6·1 to 11·9)	–37·3% (–45·4 to –27·9)*	43 546·6 (29 966·3 to 59 772·4)	–34·5% (–43·8 to –23·6)*	629·4 (432·6 to 858·7)	–39·2% (–48·2 to –28·8)*
Chagas disease	7·9 (7·5 to 8·6)	3·8% (–1·6 to 12·9)	0·1 (0·1 to 0·1)	–21·1% (–25·2 to –14·3)*	174·9 (166·1 to 193·5)	–4·2% (–9·0 to 4·8)	2·2 (2·0 to 2·4)	–25·1% (–28·9 to –18·1)*
Leishmaniasis	7·5 (0·0 to 34·5)	–64·8% (–96·8 to –44·5)*	0·1 (0·0 to 0·5)	–67·8% (–97·5 to –50·3)*	509·8 (0·3 to 2440·2)	–63·8% (–92·1 to –39·7)*	7·2 (0·0 to 34·6)	–66·2% (–93·2 to –43·8)*
Visceral leishmaniasis	7·5 (0·0 to 34·5)	–64·8% (–96·8 to –44·5)*	0·1 (0·0 to 0·5)	–67·8% (–97·5 to –50·3)*	509·8 (0·3 to 2440·2)	–63·8% (–92·1 to –39·7)*	7·2 (0·0 to 34·6)	–66·2% (–93·2 to –43·8)*
African trypanosomiasis	1·4 (0·3 to 4·9)	–80·7% (–95·6 to –27·8)*	0·0 (0·0 to 0·1)	–82·8% (–96·0 to –34·3)*	77·6 (15·0 to 283·6)	–80·8% (–95·6 to –27·2)*	1·0 (0·2 to 3·8)	–82·3% (–96·0 to –33·6)*
Schistosomiasis	8·8 (8·0 to 9·8)	–12·3% (–17·6 to –6·4)*	0·1 (0·1 to 0·1)	–28·5% (–32·7 to –23·7)*	342·3 (305·3 to 384·3)	–15·6% (–21·9 to –8·8)*	4·4 (3·9 to 5·0)	–27·4% (–32·9 to –21·4)*
Cysticercosis	0·7 (0·5 to 1·0)	–15·9% (–42·7 to 23·3)	0·0 (0·0 to 0·0)	–27·3% (–50·5 to 5·3)	39·6 (26·9 to 55·0)	–20·5% (–46·9 to 18·2)	0·5 (0·4 to 0·7)	–28·9% (–52·5 to 4·8)
Cystic echinococcosis	1·2 (0·9 to 1·5)	–30·0% (–52·1 to –1·3)*	0·0 (0·0 to 0·0)	–41·9% (–59·8 to –19·0)*	52·0 (38·1 to 68·0)	–38·8% (–56·8 to –12·9)*	0·7 (0·5 to 0·9)	–46·4% (–62·0 to –24·1)*
Dengue	40·5 (17·6 to 49·8)	65·5% (21·7 to 99·7)*	0·5 (0·2 to 0·7)	40·7% (3·6 to 69·7)*	1902·9 (716·6 to 2312·9)	32·0% (–1·8 to 61·2)	26·1 (9·8 to 31·7)	18·2% (–12·0 to 45·0)
Yellow fever	4·8 (1·0 to 13·8)	–16·6% (–28·7 to –2·0)*	0·1 (0·0 to 0·2)	–23·3% (–34·4 to –9·6)*	313·9 (67·2 to 900·2)	–16·0% (–28·9 to 0·0)	4·3 (0·9 to 12·4)	–21·3% (–33·6 to –5·8)*
Rabies	11·7 (9·3 to 14·7)	–48·1% (–58·8 to –37·3)*	0·2 (0·1 to 0·2)	–54·8% (–63·8 to –45·0)*	633·7 (504·4 to 836·4)	–51·5% (–61·3 to –38·9)*	8·6 (6·8 to 11·5)	–56·2% (–65·1 to –44·3)*
Intestinal nematode infections	3·2 (2·5 to 4·1)	–43·1% (–56·1 to –25·0)*	0·0 (0·0 to 0·1)	–47·2% (–59·5 to –30·1)*	257·1 (194·1 to 336·3)	–44·1% (–57·6 to –25·0)*	3·8 (2·9 to 5·0)	–47·6% (–60·4 to –29·6)*
Ascariasis	3·2 (2·5 to 4·1)	–43·1% (–56·1 to –25·0)*	0·0 (0·0 to 0·1)	–47·2% (–59·5 to –30·1)*	257·1 (194·1 to 336·3)	–44·1% (–57·6 to –25·0)*	3·8 (2·9 to 5·0)	–47·6% (–60·4 to –29·6)*
Ebola virus disease	0·0 (0·0 to 0·0)	–98·2% (–98·4 to –98·0)*	0·0 (0·0 to 0·0)	–98·4% (–98·6 to –98·2)*	0·5 (0·5 to 0·5)	–98·1% (–98·3 to –97·9)*	0·0 (0·0 to 0·0)	–98·2% (–98·4 to –98·0)*
Zika virus disease	0·0 (0·0 to 0·1)	..	0·0 (0·0 to 0·0)	..	1·0 (0·2 to 3·4)	..	0·0 (0·0 to 0·0)	..
Other neglected tropical diseases	12·6 (8·0 to 36·3)	8·1% (–8·1 to 28·2)	0·2 (0·1 to 0·5)	–3·7% (–18·3 to 13·9)	804·3 (442·8 to 2696·6)	3·9% (–16·3 to 29·4)	11·6 (6·3 to 39·6)	–3·5% (–22·2 to 20·7)

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Other infectious diseases	**830·5 (732·2 to 947·8)**	**–25·9% (–32·4 to –18·8)***	**11·6 (10·1 to 13·3)**	**–33·8% (–39·3 to –27·4)***	**53 008·6 (44 786·0 to 63 000·4)**	**–33·0% (–39·6 to –25·1)***	**762·8 (640·5 to 911·5)**	**–37·9% (–44·0 to –30·5)***
Meningitis	288·0 (254·3 to 333·2)	–20·1% (–26·0 to –11·0)*	4·0 (3·6 to 4·6)	–27·8% (–33·1 to –19·3)*	19 436·9 (16 935·1 to 22 335·8)	–25·2% (–31·5 to –15·7)*	280·5 (243·6 to 323·2)	–30·2% (–36·3 to –21·4)*
Pneumococcal meningitis	42·1 (36·6 to 49·4)	–13·4% (–20·6 to –2·3)*	0·6 (0·5 to 0·7)	–22·4% (–28·9 to –12·4)*	2751·8 (2325·8 to 3276·5)	–18·5% (–26·8 to –6·5)*	39·6 (33·4 to 47·0)	–24·2% (–32·1 to –12·8)*
H influenzae type B meningitis	75·7 (66·7 to 92·0)	–33·7% (–39·6 to –26·0)*	1·1 (0·9 to 1·3)	–40·6% (–45·8 to –33·9)*	4907·3 (4232·2 to 5813·6)	–40·4% (–46·1 to –33·0)*	70·5 (60·6 to 83·9)	–44·7% (–50·1 to –37·7)*
Meningococcal infection	30·0 (25·7 to 35·7)	–31·5% (–37·4 to –22·8)*	0·4 (0·4 to 0·5)	–37·1% (–42·6 to –29·2)*	2180·3 (1819·8 to 2614·5)	–34·9% (–41·4 to –26·4)*	31·9 (26·5 to 38·4)	–38·8% (–45·0 to –30·5)*
Other meningitis	140·3 (121·4 to 161·8)	–8·9% (–15·4 to 1·4)	2·0 (1·7 to 2·3)	–17·3% (–23·4 to –7·5)*	9597·5 (8195·6 to 11 118·5)	–12·8% (–20·4 to –0·7)*	138·5 (118·3 to 160·5)	–18·4% (–25·7 to –7·4)*
Encephalitis	92·4 (83·1 to 107·9)	0·0% (–14·2 to 16·2)	1·2 (1·1 to 1·4)	–14·3% (–26·5 to –0·9)*	4588·2 (4059·5 to 5230·7)	–12·1% (–28·1 to 4·5)	64·1 (56·6 to 72·4)	–20·1% (–35·0 to –5·0)*
Diphtheria	3·6 (2·2 to 6·1)	–23·9% (–55·6 to 36·4)	0·1 (0·0 to 0·1)	–28·6% (–58·8 to 29·2)	298·7 (181·8 to 510·0)	–23·9% (–56·7 to 38·7)	4·4 (2·7 to 7·6)	–28·3% (–59·5 to 31·4)
Whooping cough	91·8 (45·9 to 163·2)	–23·3% (–54·8 to 35·6)	1·4 (0·7 to 2·4)	–27·1% (–57·1 to 28·8)	7879·2 (3938·1 to 14 010·3)	–23·3% (–54·8 to 35·4)	117·9 (58·9 to 209·6)	–27·1% (–57·0 to 28·8)
Tetanus	38·1 (25·9 to 48·8)	–54·9% (–65·9 to –39·1)*	0·5 (0·4 to 0·7)	–59·6% (–69·3 to –45·0)*	2447·7 (1734·9 to 3199·0)	–59·3% (–69·9 to –43·5)*	35·1 (25·0 to 46·3)	–62·1% (–72·1 to –47·0)*
Measles	95·3 (34·5 to 205·2)	–57·0% (–61·9 to –51·9)*	1·4 (0·5 to 3·1)	–59·3% (–64·0 to –54·4)*	8105·1 (2935·7 to 17 469·0)	–56·9% (–61·8 to –51·8)*	120·8 (43·7 to 260·4)	–59·2% (–63·9 to –54·3)*
Varicella and herpes zoster	15·6 (14·4 to 17·3)	–16·4% (–22·9 to –9·5)*	0·2 (0·2 to 0·2)	–29·2% (–34·7 to –23·4)*	833·0 (742·3 to 938·1)	–22·5% (–31·4 to –13·2)*	12·1 (10·7 to 13·6)	–28·4% (–36·6 to –19·4)*
Acute hepatitis	126·4 (94·5 to 143·7)	–9·8% (–15·5 to –2·3)*	1·6 (1·2 to 1·9)	–24·5% (–29·2 to –18·4)*	5478·4 (4040·3 to 6330·0)	–21·7% (–27·7 to –14·4)*	72·3 (52·9 to 83·9)	–31·2% (–36·5 to –24·9)*
Acute hepatitis A	18·6 (13·6 to 23·8)	–33·1% (–41·9 to –22·5)*	0·3 (0·2 to 0·3)	–38·7% (–46·8 to –28·6)*	1286·7 (935·2 to 1633·7)	–36·0% (–45·1 to –24·3)*	18·0 (13·0 to 22·9)	–40·7% (–49·1 to –29·0)*
Acute hepatitis B	89·6 (66·1 to 102·5)	–0·8% (–8·4 to 8·5)	1·1 (0·8 to 1·3)	–19·6% (–25·4 to –12·4)*	3262·4 (2367·8 to 3819·1)	–12·2% (–19·7 to –2·7)*	41·8 (30·1 to 49·3)	–25·6% (–31·9 to –17·5)*
Acute hepatitis C	3·5 (1·9 to 6·0)	–23·7% (–35·9 to –9·4)*	0·0 (0·0 to 0·1)	–32·1% (–42·4 to –19·6)*	219·7 (120·1 to 371·3)	–31·0% (–43·3 to –15·3)*	3·2 (1·8 to 5·4)	–35·5% (–47·2 to –20·7)*
Acute hepatitis E	14·7 (10·4 to 18·5)	–15·8% (–27·2 to –3·1)*	0·2 (0·1 to 0·2)	–25·8% (–35·3 to –15·6)*	709·6 (489·6 to 903·9)	–25·5% (–35·2 to –14·5)*	9·3 (6·4 to 11·8)	–31·9% (–40·6 to –22·0)*
Other unspecified infectious diseases	79·3 (59·9 to 85·1)	1·6% (–3·1 to 7·9)	1·1 (0·8 to 1·2)	–13·4% (–17·5 to –8·1)*	3941·3 (2831·7 to 4325·8)	–10·2% (–16·2 to –2·4)*	55·6 (39·6 to 61·3)	–17·9% (–23·6 to –10·6)*
Maternal and neonatal disorders	**1977·4 (1890·1 to 2060·6)**	**–24·1% (–26·9 to –21·0)***	**29·5 (28·2 to 30·8)**	**–26·6% (–29·3 to –23·5)***	**167 684·6 (160 060·7 to 174 918·2)**	**–24·2% (–27·1 to –20·9)***	**2518·2 (2403·8 to 2627·1)**	**–26·5% (–29·3 to –23·3)***
Maternal disorders	193·6 (179·9 to 209·6)	–24·0% (–28·4 to –19·5)*	2·5 (2·3 to 2·7)	–30·7% (–34·8 to –26·6)*	10 993·1 (10 198·9 to 11 928·5)	–25·3% (–29·7 to –20·9)*	140·9 (130·8 to 153·0)	–31·5% (–35·5 to –27·5)*
Maternal haemorrhage	38·5 (33·2 to 45·2)	–52·1% (–59·0 to –44·2)*	0·5 (0·4 to 0·6)	–56·4% (–62·7 to –49·3)*	2173·8 (1859·7 to 2552·5)	–53·0% (–60·1 to –45·0)*	27·8 (23·8 to 32·7)	–57·1% (–63·6 to –49·7)*
Maternal sepsis and other pregnancy-related infections	21·2 (18·2 to 25·0)	–27·1% (–38·8 to –15·1)*	0·3 (0·2 to 0·3)	–33·5% (–44·2 to –22·6)*	1198·0 (1022·8 to 1420·8)	–28·9% (–41·1 to –16·2)*	15·4 (13·1 to 18·3)	–34·5% (–45·4 to –22·5)*
Maternal hypertensive disorders	29·4 (25·4 to 34·5)	–5·5% (–20·7 to 11·2)	0·4 (0·3 to 0·4)	–13·0% (–27·3 to 2·6)	1729·6 (1487·6 to 2033·2)	–6·6% (–22·1 to 10·2)	22·3 (19·2 to 26·4)	–13·6% (–28·1 to 2·0)
Maternal obstructed labour and uterine rupture	13·0 (10·2 to 16·8)	–17·7% (–35·9 to 2·9)	0·2 (0·1 to 0·2)	–25·2% (–41·0 to –6·3)*	720·9 (565·5 to 946·4)	–18·9% (–37·6 to 1·9)	9·2 (7·2 to 12·1)	–25·8% (–42·9 to –6·9)*

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Maternal abortive outcome	17·4 (14·7 to 20·8)	−7·0% (−22·3 to 10·1)	0·2 (0·2 to 0·3)	−15·7% (−29·3 to −0·4)*	963·4 (807·6 to 1161·1)	−8·9% (−24·2 to 8·7)	12·3 (10·3 to 14·9)	−16·8% (−30·7 to −0·5)*
Ectopic pregnancy	10·2 (7·1 to 15·2)	−11·6% (−41·4 to 27·9)	0·1 (0·1 to 0·2)	−19·2% (−46·2 to 16·8)	590·6 (409·0 to 881·4)	−13·3% (−43·8 to 26·9)	7·6 (5·3 to 11·4)	−20·3% (−48·1 to 17·0)
Indirect maternal deaths	34·1 (30·0 to 38·7)	−4·1% (−16·7 to 8·5)	0·4 (0·4 to 0·5)	−12·5% (−24·0 to −1·0)*	1934·4 (1694·2 to 2216·7)	−6·1% (−19·2 to 6·8)	24·8 (21·7 to 28·5)	−13·9% (−25·8 to −2·3)*
Late maternal deaths	3·4 (2·6 to 4·3)	−0·9% (−7·0 to 5·5)	0·0 (0·0 to 0·1)	−9·5% (−14·7 to −4·0)*	194·7 (152·2 to 251·4)	−2·0% (−8·2 to 4·1)	2·5 (2·0 to 3·2)	−10·1% (−15·4 to −4·5)*
Maternal deaths aggravated by HIV/AIDS	1·6 (1·0 to 2·1)	−23·9% (−31·0 to −16·0)*	0·0 (0·0 to 0·0)	−32·1% (−38·4 to −25·2)*	84·4 (53·0 to 113·8)	−26·7% (−33·6 to −19·2)*	1·1 (0·7 to 1·4)	−34·2% (−40·6 to −27·5)*
Other maternal disorders	24·8 (20·8 to 29·8)	−8·5% (−24·7 to 11·2)	0·3 (0·3 to 0·4)	−16·5% (−31·2 to 1·5)	1403·1 (1159·5 to 1690·3)	−9·8% (−26·7 to 10·8)	18·0 (14·9 to 21·7)	−17·2% (−32·9 to 1·2)
Neonatal disorders	1783·8 (1698·5 to 1864·7)	−24·1% (−27·2 to −20·6)*	27·1 (25·8 to 28·3)	−26·2% (−29·1 to −22·7)*	156 691·6 (149 207·2 to 163 802·2)	−24·1% (−27·2 to −20·6)*	2377·2 (2263·7 to 2485·1)	−26·2% (−29·1 to −22·7)*
Neonatal preterm birth	649·4 (605·4 to 721·3)	−26·2% (−31·3 to −21·5)*	9·9 (9·2 to 10·9)	−28·1% (−33·2 to −23·6)*	57 052·0 (53 182·3 to 63 367·1)	−26·2% (−31·3 to −21·5)*	865·6 (806·9 to 961·5)	−28·1% (−33·2 to −23·6)*
Neonatal encephalopathy due to birth asphyxia and trauma	533·3 (476·9 to 580·3)	−24·5% (−30·2 to −18·0)*	8·1 (7·2 to 8·8)	−26·5% (−32·0 to −20·2)*	46 845·9 (41 894·1 to 50 985·7)	−24·5% (−30·2 to −18·0)*	710·8 (635·7 to 773·7)	−26·5% (−32·0 to −20·2)*
Neonatal sepsis and other neonatal infections	203·0 (178·7 to 267·1)	−11·9% (−20·5 to −1·7)*	3·1 (2·7 to 4·1)	−14·4% (−22·7 to −4·4)*	17 830·7 (15 692·9 to 23 459·0)	−11·9% (−20·5 to −1·7)*	270·4 (238·0 to 355·8)	−14·4% (−22·7 to −4·4)*
Haemolytic disease and other neonatal jaundice	49·1 (42·9 to 55·9)	−37·5% (−45·3 to −28·2)*	0·7 (0·7 to 0·8)	−39·3% (−46·8 to −30·2)*	4309·1 (3771·2 to 4914·0)	−37·5% (−45·3 to −28·2)*	65·4 (57·2 to 74·5)	−39·3% (−46·8 to −30·2)*
Other neonatal disorders	349·0 (294·9 to 382·3)	−23·6% (−29·8 to −15·5)*	5·3 (4·5 to 5·8)	−25·7% (−31·7 to −17·8)*	30 654·0 (25 899·7 to 33 578·7)	−23·6% (−29·8 to −15·5)*	465·0 (392·9 to 509·4)	−25·7% (−31·7 to −17·8)*
Nutritional deficiencies	**270·0 (249·3 to 295·5)**	**−23·9% (−29·2 to −15·7)***	**3·8 (3·5 to 4·2)**	**−33·6% (−38·1 to −26·5)***	**15 658·0 (14 051·5 to 17 506·6)**	**−34·7% (−40·5 to −26·1)***	**228·7 (204·9 to 255·9)**	**−39·4% (−44·8 to −31·4)***
Protein-energy malnutrition	231·8 (212·4 to 254·2)	−26·1% (−31·7 to −17·9)*	3·3 (3·0 to 3·7)	−34·6% (−39·4 to −27·5)*	14 405·4 (12 873·5 to 16 128·0)	−35·1% (−41·1 to −26·7)*	211·8 (189·0 to 237·3)	−39·4% (−45·0 to −31·6)*
Other nutritional deficiencies	38·2 (33·7 to 44·6)	−7·2% (−14·6 to 3·1)	0·5 (0·4 to 0·6)	−25·8% (−31·7 to −17·5)*	1252·7 (1087·5 to 1435·2)	−29·2% (−36·9 to −19·7)*	16·9 (14·6 to 19·5)	−38·6% (−45·4 to −30·4)*
Non-communicable diseases	**41 071·1 (40 470·9 to 41 548·9)**	**22·7% (21·5 to 23·9)***	**536·1 (528·4 to 542·2)**	**−7·9% (−8·8 to −7·0)***	**872 601·8 (859 538·6 to 884 787·7)**	**13·6% (12·2 to 14·9)***	**11 097·4 (10 928·6 to 11 253·8)**	**−9·6% (−10·7 to −8·6)***
Neoplasms	**9556·2 (9395·7 to 9692·3)**	**25·4% (23·9 to 27·0)***	**121·2 (119·1 to 122·9)**	**−4·4% (−5·6 to −3·3)***	**225 738·1 (221 608·8 to 229 322·4)**	**19·6% (17·8 to 21·4)***	**2803·4 (2751·5 to 2848·8)**	**−5·6% (−7·0 to −4·1)***
Lip and oral cavity cancer	193·7 (184·7 to 201·6)	35·6% (29·5 to 40·8)*	2·4 (2·3 to 2·5)	4·0% (−0·6 to 8·0)	5090·6 (4819·5 to 5328·3)	30·5% (23·8 to 36·4)*	62·2 (58·9 to 65·1)	3·0% (−2·3 to 7·6)
Nasopharynx cancer	69·5 (66·9 to 72·3)	24·4% (20·0 to 28·8)*	0·9 (0·8 to 0·9)	−3·0% (−6·4 to 0·4)	2034·5 (1954·7 to 2117·4)	18·3% (13·9 to 23·1)*	24·8 (23·8 to 25·8)	−5·0% (−8·5 to −1·3)*
Other pharynx cancer	117·4 (102·1 to 124·5)	40·4% (29·7 to 48·4)*	1·4 (1·3 to 1·5)	7·9% (−0·3 to 14·0)	3204·2 (2766·3 to 3405·1)	36·0% (25·4 to 44·2)*	38·9 (33·5 to 41·3)	6·5% (−1·7 to 12·8)
Oesophageal cancer	436·0 (425·0 to 447·6)	13·0% (9·9 to 16·3)*	5·5 (5·3 to 5·6)	−14·5% (−16·9 to −12·0)*	9647·5 (9410·7 to 9903·5)	8·9% (5·8 to 12·2)*	118·3 (115·4 to 121·4)	−16·2% (−18·6 to −13·7)*
Stomach cancer	865·0 (848·3 to 884·7)	9·4% (7·1 to 12·1)*	11·0 (10·8 to 11·2)	−17·1% (−18·8 to −15·1)*	18 782·0 (18 409·7 to 19 207·7)	4·8% (2·4 to 7·4)*	231·6 (227·0 to 236·8)	−18·6% (−20·5 to −16·6)*
Colon and rectum cancer	896·0 (876·3 to 915·7)	27·8% (24·0 to 31·3)*	11·5 (11·3 to 11·8)	−4·3% (−7·1 to −1·8)*	18 106·7 (17 678·0 to 18 525·0)	23·8% (19·2 to 27·6)*	224·7 (219·4 to 229·9)	−4·5% (−8·0 to −1·7)*

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Liver cancer	819·4 (789·7 to 855·5)	27·0% (23·0 to 32·9)*	10·2 (9·8 to 10·7)	–2·5% (–5·6 to 2·0)	20 536·2 (19 678·7 to 21 551·9)	21·2% (17·0 to 27·4)*	250·7 (240·4 to 263·0)	–4·6% (–8·0 to 0·1)
Liver cancer due to hepatitis B	325·4 (304·6 to 348·2)	20·3% (15·3 to 28·2)*	4·0 (3·7 to 4·3)	–6·2% (–10·0 to 0·1)	9449·0 (8837·3 to 10 138·6)	14·7% (9·7 to 21·9)*	114·6 (107·3 to 123·0)	–8·4% (–12·2 to –2·6)*
Liver cancer due to hepatitis C	234·3 (219·4 to 250·6)	30·4% (26·7 to 35·0)*	3·0 (2·8 to 3·2)	–2·1% (–4·9 to 1·4)	4898·4 (4554·0 to 5259·3)	26·9% (23·3 to 31·6)*	60·3 (56·2 to 64·7)	–3·0% (–5·8 to 0·5)
Liver cancer due to alcohol use	129·3 (114·5 to 147·3)	31·7% (26·8 to 37·3)*	1·6 (1·4 to 1·8)	0·6% (–3·0 to 4·8)	3040·7 (2647·6 to 3549·8)	27·8% (22·4 to 33·9)*	37·2 (32·5 to 43·3)	–0·6% (–4·5 to 3·9)
Liver cancer due to NASH	66·9 (59·6 to 74·5)	42·3% (38·0 to 47·6)*	0·8 (0·8 to 0·9)	7·6% (4·4 to 11·7)*	1443·8 (1288·9 to 1605·9)	37·3% (32·7 to 42·8)*	17·8 (15·9 to 19·7)	6·3% (2·9 to 10·5)*
Liver cancer due to other causes	63·5 (57·4 to 70·6)	28·2% (23·6 to 34·3)*	0·8 (0·7 to 0·9)	–0·9% (–4·2 to 3·6)	1704·2 (1528·4 to 1903·8)	21·1% (16·0 to 27·4)*	20·9 (18·8 to 23·3)	–3·5% (–7·2 to 1·4)
Gallbladder and biliary tract cancer	174·0 (154·2 to 184·9)	25·0% (21·5 to 28·7)*	2·2 (2·0 to 2·4)	–6·7% (–9·4 to –4·0)*	3434·0 (3009·7 to 3660·0)	21·8% (17·8 to 26·3)*	42·6 (37·3 to 45·4)	–6·8% (–9·9 to –3·5)*
Pancreatic cancer	441·1 (432·8 to 449·0)	39·9% (36·7 to 42·6)*	5·6 (5·5 to 5·7)	4·8% (2·5 to 6·8)*	8988·1 (8806·6 to 9162·9)	35·8% (32·5 to 38·6)*	111·1 (108·9 to 113·2)	4·0% (1·5 to 6·1)*
Larynx cancer	126·5 (123·4 to 129·9)	21·1% (17·8 to 24·4)*	1·6 (1·5 to 1·6)	–7·7% (–10·1 to –5·2)*	3170·0 (3089·7 to 3260·3)	17·3% (13·9 to 20·9)*	38·5 (37·6 to 39·6)	–9·1% (–11·7 to –6·4)*
Tracheal, bronchus, and lung cancer	1883·1 (1844·2 to 1922·8)	29·6% (26·5 to 32·5)*	23·7 (23·3 to 24·2)	–2·0% (–4·3 to 0·1)	40 391·6 (39 506·7 to 41 285·6)	24·8% (21·7 to 27·6)*	496·4 (485·5 to 507·2)	–4·1% (–6·5 to –2·0)*
Malignant skin melanoma	61·7 (47·9 to 70·3)	23·6% (19·0 to 26·9)*	0·8 (0·6 to 0·9)	–5·1% (–8·5 to –2·5)*	1513·2 (1220·7 to 1774·4)	16·1% (12·7 to 20·0)*	18·7 (15·1 to 21·9)	–7·2% (–9·8 to –3·8)*
Non-melanoma skin cancer	65·1 (63·1 to 66·5)	38·6% (34·9 to 41·2)*	0·8 (0·8 to 0·9)	2·7% (0·0 to 4·5)*	1239·1 (1200·2 to 1266·6)	30·0% (26·2 to 32·7)*	15·5 (15·0 to 15·8)	0·5% (–2·3 to 2·6)
Non-melanoma skin cancer (squamous-cell carcinoma)	65·1 (63·1 to 66·5)	38·6% (34·9 to 41·2)*	0·8 (0·8 to 0·9)	2·7% (0·0 to 4·5)*	1239·1 (1200·2 to 1266·6)	30·0% (26·2 to 32·7)*	15·5 (15·0 to 15·8)	0·5% (–2·3 to 2·6)
Breast cancer	611·6 (589·2 to 640·7)	27·0% (21·3 to 31·2)*	7·6 (7·4 to 8·0)	–2·6% (–6·9 to 0·4)	16 400·7 (15 737·0 to 17 320·2)	23·9% (17·3 to 28·7)*	200·2 (192·1 to 211·4)	–1·7% (–6·8 to 2·1)
Cervical cancer	259·7 (241·1 to 269·2)	18·8% (12·9 to 22·8)*	3·2 (3·0 to 3·3)	–7·2% (–11·7 to –4·0)*	7773·5 (7227·4 to 8087·8)	15·1% (9·4 to 19·1)*	94·6 (88·1 to 98·5)	–7·2% (–11·8 to –3·9)*
Uterine cancer	85·2 (83·2 to 87·4)	18·8% (15·8 to 22·5)*	1·1 (1·0 to 1·1)	–10·4% (–12·5 to –7·7)*	1930·0 (1879·9 to 1983·0)	14·8% (11·6 to 19·0)*	23·7 (23·1 to 24·3)	–11·2% (–13·7 to –8·0)*
Ovarian cancer	176·0 (171·4 to 181·2)	30·3% (26·8 to 33·7)*	2·2 (2·1 to 2·3)	–1·0% (–3·6 to 1·6)	4496·9 (4370·7 to 4642·1)	29·1% (24·8 to 33·1)*	54·9 (53·4 to 56·7)	1·1% (–2·2 to 4·2)
Prostate cancer	415·9 (357·3 to 489·5)	32·5% (29·3 to 38·4)*	5·5 (4·7 to 6·5)	–2·5% (–4·9 to 1·9)	6214·5 (5324·2 to 7293·0)	28·3% (24·9 to 34·5)*	79·3 (68·1 to 93·0)	–3·6% (–6·2 to 1·2)
Testicular cancer	7·7 (7·4 to 8·0)	6·1% (2·3 to 10·9)*	0·1 (0·1 to 0·1)	–9·4% (–12·6 to –5·2)*	338·7 (323·8 to 357·4)	0·9% (–3·3 to 6·3)	4·3 (4·1 to 4·5)	–10·8% (–14·5 to –6·1)*
Kidney cancer	138·5 (128·7 to 142·5)	30·1% (26·2 to 34·1)*	1·8 (1·6 to 1·8)	–1·3% (–4·3 to 1·7)	3143·3 (2952·2 to 3234·1)	23·1% (18·5 to 27·3)*	39·4 (37·0 to 40·5)	–3·3% (–6·9 to 0·0)
Bladder cancer	196·5 (191·5 to 205·8)	27·8% (25·1 to 30·4)*	2·6 (2·5 to 2·7)	–5·4% (–7·3 to –3·4)*	3350·1 (3257·4 to 3511·6)	22·6% (19·9 to 25·3)*	42·2 (41·0 to 44·1)	–6·9% (–8·9 to –4·8)*
Brain and nervous system cancer	247·1 (213·0 to 265·0)	29·2% (23·2 to 33·4)*	3·1 (2·7 to 3·3)	3·8% (–1·0 to 7·0)	8577·8 (7527·0 to 9359·3)	18·4% (11·9 to 24·6)*	109·8 (96·1 to 120·0)	0·0% (–5·6 to 5·3)
Thyroid cancer	41·2 (39·9 to 44·1)	28·9% (24·3 to 33·3)*	0·5 (0·5 to 0·6)	–1·2% (–4·5 to 2·0)	1001·2 (963·6 to 1074·0)	22·1% (16·7 to 28·0)*	12·4 (12·0 to 13·4)	–2·3% (–6·6 to 2·4)
Mesothelioma	29·9 (29·1 to 30·6)	26·9% (20·1 to 32·6)*	0·4 (0·4 to 0·4)	–3·4% (–8·4 to 0·7)	655·7 (635·2 to 677·0)	21·0% (13·8 to 27·3)*	8·1 (7·9 to 8·4)	–5·4% (–10·8 to –0·8)*
Hodgkin lymphoma	32·6 (27·6 to 38·1)	0·2% (–3·5 to 3·6)	0·4 (0·4 to 0·5)	–16·8% (–19·8 to –14·0)*	1327·6 (1110·1 to 1567·7)	–5·2% (–8·6 to –1·8)*	17·1 (14·3 to 20·2)	–17·1% (–20·1 to –13·9)*

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	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Non-Hodgkin lymphoma	248·6 (243·5 to 253·1)	29·4% (25·5 to 32·4)*	3·2 (3·1 to 3·2)	0·1% (–2·7 to 2·4)	6828·8 (6611·8 to 7020·0)	22·1% (15·6 to 26·9)*	86·8 (84·0 to 89·5)	0·2% (–5·2 to 4·3)
Multiple myeloma	107·1 (98·5 to 118·9)	32·7% (28·4 to 36·4)*	1·4 (1·3 to 1·5)	–0·4% (–3·5 to 2·4)	2234·7 (2091·4 to 2493·2)	30·4% (25·6 to 34·4)*	27·7 (25·9 to 30·8)	0·3% (–3·3 to 3·4)
Leukaemia	347·6 (317·3 to 364·9)	12·8% (9·5 to 15·6)*	4·5 (4·1 to 4·7)	–9·6% (–12·2 to –7·4)*	11 712·0 (10 531·4 to 12 523·3)	2·3% (–3·7 to 6·2)	153·4 (137·9 to 164·5)	–12·0% (–17·3 to –8·5)*
Acute lymphoid leukaemia	52·2 (46·0 to 56·7)	14·1% (2·6 to 23·2)*	0·7 (0·6 to 0·7)	–1·5% (–11·6 to 6·2)	2661·7 (2341·7 to 2941·1)	5·3% (–8·6 to 15·4)	36·1 (31·7 to 40·0)	–4·7% (–17·6 to 4·7)
Chronic lymphoid leukaemia	35·2 (33·5 to 36·9)	21·4% (17·7 to 25·0)*	0·5 (0·4 to 0·5)	–10·3% (–13·0 to –7·6)*	634·1 (595·7 to 674·2)	18·3% (14·2 to 22·4)*	8·0 (7·5 to 8·5)	–9·2% (–12·3 to –6·1)*
Acute myeloid leukaemia	99·9 (91·3 to 104·6)	24·6% (17·1 to 29·8)*	1·3 (1·2 to 1·3)	–1·0% (–6·6 to 3·0)	3192·6 (2868·8 to 3405·6)	16·2% (4·4 to 24·6)*	41·3 (37·0 to 44·1)	–1·4% (–11·3 to 5·8)
Chronic myeloid leukaemia	24·1 (22·2 to 26·1)	3·3% (0·4 to 6·4)*	0·3 (0·3 to 0·3)	–19·9% (–22·2 to –17·6)*	643·3 (583·4 to 699·1)	–1·7% (–5·2 to 1·5)	8·0 (7·3 to 8·7)	–19·7% (–22·4 to –17·1)*
Other leukaemia	136·2 (121·0 to 146·8)	4·9% (0·9 to 9·7)*	1·8 (1·6 to 1·9)	–15·6% (–18·7 to –12·1)*	4580·2 (3955·1 to 5013·3)	–8·1% (–14·6 to –1·8)*	60·0 (51·9 to 65·7)	–20·8% (–26·5 to –15·4)*
Other malignant cancers	359·5 (331·4 to 370·8)	26·8% (23·3 to 29·5)*	4·6 (4·2 to 4·8)	0·1% (–2·6 to 2·2)	11 189·0 (10 386·5 to 11 664·8)	18·4% (12·8 to 22·8)*	144·4 (133·8 to 150·9)	–0·3% (–5·1 to 3·5)
Other neoplasms	102·9 (80·2 to 122·4)	42·0% (35·6 to 51·7)*	1·3 (1·0 to 1·6)	7·4% (2·1 to 15·8)*	2425·8 (2024·4 to 2932·1)	32·9% (25·9 to 42·7)*	31·1 (25·9 to 37·4)	7·9% (2·0 to 16·5)*
Myelodysplastic, myeloproliferative, and other haemopoietic neoplasms	98·8 (76·7 to 118·1)	42·6% (36·2 to 52·2)*	1·3 (1·0 to 1·5)	7·1% (1·8 to 15·3)*	2189·1 (1820·8 to 2665·5)	33·9% (26·6 to 43·3)*	27·9 (23·2 to 33·8)	7·2% (1·2 to 15·6)*
Other benign and in-situ neoplasms	4·1 (3·2 to 4·8)	29·6% (17·2 to 44·5)*	0·1 (0·0 to 0·1)	15·5% (4·1 to 29·2)*	236·8 (186·4 to 277·7)	25·0% (12·7 to 38·6)*	3·2 (2·5 to 3·7)	14·3% (3·0 to 27·0)*
Cardiovascular diseases	**17 790·9 (17 527·1 to 18 042·7)**	**21·1% (19·7 to 22·6)***	**233·1 (229·7 to 236·4)**	**–10·3% (–11·4 to –9·3)***	**330 172·6 (324 899·3 to 335 159·9)**	**14·7% (13·3 to 16·2)***	**4148·0 (4082·0 to 4210·8)**	**–11·3% (–12·4 to –10·1)***
Rheumatic heart disease	285·5 (266·2 to 303·3)	1·3% (–3·9 to 6·0)	3·7 (3·4 to 3·9)	–21·3% (–25·2 to –17·8)*	7492·6 (6926·7 to 8046·7)	–10·2% (–15·4 to –6·2)*	94·5 (87·5 to 101·4)	–25·9% (–30·0 to –22·7)*
Ischaemic heart disease	8930·4 (8790·7 to 9138·7)	22·3% (20·6 to 23·8)*	116·9 (115·1 to 119·7)	–9·7% (–11·0 to –8·7)*	164 983·4 (162 168·9 to 168 584·2)	17·3% (15·4 to 19·0)*	2065·9 (2030·6 to 2111·7)	–9·8% (–11·2 to –8·5)*
Stroke	6167·3 (6044·3 to 6327·6)	16·6% (14·7 to 18·6)*	80·5 (78·9 to 82·6)	–13·6% (–15·0 to –12·1)*	113 355·9 (110 957·8 to 116 180·6)	12·1% (9·9 to 14·1)*	1422·2 (1392·0 to 1457·7)	–13·8% (–15·5 to –12·3)*
Ischaemic stroke	2747·4 (2657·1 to 2857·6)	21·2% (19·0 to 23·3)*	36·6 (35·5 to 38·0)	–11·8% (–13·4 to –10·3)*	40 834·1 (39 133·3 to 43 140·9)	16·9% (14·3 to 19·3)*	521·8 (500·5 to 550·2)	–12·0% (–13·9 to –10·3)*
Intracerebral haemorrhage	2974·9 (2880·8 to 3072·8)	12·5% (9·6 to 15·1)*	38·2 (37·0 to 39·4)	–15·7% (–17·8 to –13·8)*	61 562·6 (59 598·2 to 63 531·4)	9·3% (6·5 to 11·8)*	764·1 (739·7 to 788·4)	–15·4% (–17·6 to –13·5)*
Subarachnoid haemorrhage	445·0 (417·2 to 492·3)	18·4% (13·4 to 24·6)*	5·7 (5·3 to 6·3)	–9·4% (–13·1 to –4·9)*	10 959·3 (10 294·3 to 12 264·1)	10·7% (6·8 to 16·5)*	136·4 (128·2 to 152·5)	–11·4% (–14·5 to –7·0)*
Hypertensive heart disease	925·7 (681·4 to 994·9)	46·6% (26·3 to 59·3)*	12·3 (9·0 to 13·2)	7·5% (–7·3 to 16·3)	15 135·2 (11 349·8 to 16 311·7)	35·7% (19·1 to 47·9)*	191·5 (143·3 to 206·2)	3·8% (–8·8 to 12·9)
Non-rheumatic valvular heart disease	144·9 (121·8 to 150·4)	31·8% (27·7 to 34·7)*	2·0 (1·6 to 2·0)	–5·3% (–7·9 to –3·2)*	2168·4 (1980·3 to 2322·7)	21·8% (18·6 to 25·0)*	27·9 (25·4 to 29·6)	–6·2% (–8·5 to –3·8)*
Non-rheumatic calcific aortic valve disease	102·7 (82·7 to 108·0)	40·0% (33·0 to 44·9)*	1·4 (1·1 to 1·5)	–1·0% (–5·6 to 2·2)	1345·1 (1185·5 to 1432·5)	30·4% (25·1 to 35·3)*	17·5 (15·3 to 18·6)	–1·7% (–5·3 to 1·6)

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Non-rheumatic degenerative mitral valve disease	35·7 (30·5 to 42·5)	16·4% (11·0 to 23·4)*	0·5 (0·4 to 0·6)	−14·0% (−18·1 to −8·6)*	683·6 (592·6 to 787·0)	10·3% (4·9 to 16·2)*	8·7 (7·5 to 10·0)	−13·0% (−16·9 to −8·3)*
Other non-rheumatic valve diseases	6·4 (4·9 to 8·7)	9·7% (−4·1 to 42·2)	0·1 (0·1 to 0·1)	−17·8% (−28·5 to 8·0)	139·7 (105·8 to 187·5)	8·1% (−2·4 to 27·6)	1·8 (1·4 to 2·4)	−12·4% (−21·3 to 4·7)
Cardiomyopathy and myocarditis	368·5 (341·9 to 386·9)	8·1% (3·8 to 18·2)*	4·8 (4·5 to 5·0)	−16·6% (−19·8 to −9·4)*	9623·3 (8867·5 to 10 208·8)	−5·1% (−9·6 to 5·5)	122·4 (113·0 to 129·7)	−21·5% (−25·1 to −13·0)*
Myocarditis	46·5 (39·7 to 51·8)	14·4% (5·6 to 29·7)*	0·6 (0·5 to 0·7)	−13·3% (−20·4 to −0·1)*	1259·3 (1100·1 to 1415·5)	−0·3% (−6·9 to 7·6)	16·6 (14·5 to 18·5)	−15·2% (−21·1 to −7·7)*
Alcoholic cardiomyopathy	88·9 (80·9 to 96·3)	−25·3% (−29·5 to −8·3)*	1·1 (1·0 to 1·2)	−40·5% (−43·7 to −27·6)*	2849·2 (2599·0 to 3073·1)	−30·7% (−34·7 to −12·1)*	34·7 (31·7 to 37·5)	−43·2% (−46·5 to −28·2)*
Other cardiomyopathy	233·2 (213·7 to 248·3)	28·5% (24·5 to 32·4)*	3·1 (2·8 to 3·3)	−3·6% (−6·7 to −0·7)*	5514·8 (4946·7 to 5992·9)	15·7% (10·9 to 19·9)*	71·1 (64·0 to 77·0)	−5·4% (−9·3 to −2·0)*
Atrial fibrillation and flutter	287·2 (276·4 to 304·8)	47·8% (45·4 to 50·6)*	4·0 (3·9 to 4·2)	2·6% (0·9 to 4·6)*	3054·5 (2923·0 to 3235·4)	40·5% (37·9 to 43·4)*	40·6 (38·9 to 43·1)	2·2% (0·3 to 4·2)*
Aortic aneurysm	167·2 (159·8 to 174·1)	23·7% (19·9 to 27·6)*	2·2 (2·1 to 2·3)	−8·5% (−11·2 to −5·8)*	3039·9 (2877·2 to 3186·4)	19·0% (14·5 to 23·6)*	38·2 (36·2 to 40·0)	−8·5% (−11·9 to −5·1)*
Peripheral vascular disease	70·2 (43·2 to 123·3)	55·7% (31·0 to 74·2)*	1·0 (0·6 to 1·7)	10·5% (−6·8 to 24·1)	916·9 (576·9 to 1540·0)	48·3% (25·0 to 65·6)*	11·8 (7·4 to 20·0)	9·7% (−7·5 to 22·6)
Endocarditis	83·4 (74·3 to 94·3)	32·2% (25·2 to 36·8)*	1·1 (1·0 to 1·2)	1·0% (−4·0 to 5·0)	2174·5 (2033·2 to 2373·0)	16·9% (8·9 to 22·2)*	28·3 (26·4 to 30·9)	−2·3% (−8·8 to 2·1)
Other cardiovascular and circulatory diseases	360·7 (338·1 to 392·9)	21·9% (17·9 to 24·8)*	4·7 (4·4 to 5·1)	−7·9% (−10·9 to −5·9)*	8228·0 (7681·4 to 9061·9)	12·6% (9·5 to 15·7)*	104·7 (97·8 to 115·2)	−9·4% (−12·0 to −7·1)*
Chronic respiratory diseases	**3914·2 (3790·6 to 4044·8)**	**15·8% (12·7 to 19·3)***	**51·4 (49·7 to 53·1)**	**−14·2% (−16·5 to −11·5)***	**68 004·9 (65 869·4 to 70 592·2)**	**9·7% (7·0 to 13·2)***	**861·9 (835·4 to 895·0)**	**−15·7% (−17·7 to −13·0)***
Chronic obstructive pulmonary disease	3197·8 (3029·0 to 3358·9)	17·5% (13·3 to 21·1)*	42·2 (40·0 to 44·2)	−13·6% (−16·5 to −11·0)*	50 990·0 (47 678·7 to 54 146·9)	13·2% (8·8 to 16·9)*	647·3 (605·9 to 686·4)	−14·3% (−17·5 to −11·6)*
Pneumoconiosis	21·6 (20·5 to 22·7)	10·7% (5·1 to 16·6)*	0·3 (0·3 to 0·3)	−16·7% (−20·8 to −12·4)*	426·9 (403·6 to 452·9)	7·9% (1·8 to 14·6)*	5·3 (5·0 to 5·6)	−16·4% (−21·1 to −11·3)*
Silicosis	11·3 (10·4 to 12·5)	12·0% (1·2 to 22·8)*	0·1 (0·1 to 0·2)	−15·5% (−23·6 to −7·4)*	235·7 (210·3 to 258·2)	11·8% (−0·7 to 23·6)	2·9 (2·6 to 3·2)	−13·4% (−23·1 to −4·3)*
Asbestosis	3·4 (2·3 to 3·9)	23·3% (15·1 to 33·9)*	0·0 (0·0 to 0·1)	−8·3% (−14·1 to −0·4)*	54·6 (38·6 to 65·6)	15·6% (7·4 to 28·5)*	0·7 (0·5 to 0·8)	−11·4% (−17·5 to −1·3)*
Coal worker pneumoconiosis	3·2 (2·9 to 4·0)	−2·2% (−12·0 to 11·7)	0·0 (0·0 to 0·1)	−26·6% (−33·8 to −16·7)*	58·9 (52·2 to 76·4)	−6·4% (−16·3 to 8·3)	0·7 (0·7 to 1·0)	−27·9% (−35·4 to −16·9)*
Other pneumoconiosis	3·6 (3·1 to 4·5)	8·9% (0·0 to 25·4)*	0·0 (0·0 to 0·1)	−17·5% (−24·1 to −5·0)*	77·6 (66·1 to 96·4)	4·2% (−3·8 to 19·5)	1·0 (0·8 to 1·2)	−18·3% (−24·7 to −5·9)*
Asthma	495·1 (338·2 to 641·2)	−0·7% (−6·2 to 8·1)	6·3 (4·3 to 8·2)	−23·9% (−28·1 to −17·2)*	12 139·9 (8538·5 to 15 576·3)	−7·5% (−11·4 to −1·6)*	152·8 (108·3 to 195·8)	−25·8% (−28·9 to −20·4)*
Interstitial lung disease and pulmonary sarcoidosis	147·6 (114·9 to 181·3)	49·8% (39·0 to 58·6)*	1·9 (1·5 to 2·4)	11·4% (4·0 to 17·9)*	2716·7 (2156·9 to 3371·3)	43·0% (32·1 to 53·4)*	34·2 (27·1 to 42·4)	10·4% (2·3 to 18·6)*
Other chronic respiratory diseases	52·1 (45·9 to 59·6)	21·3% (14·1 to 34·2)*	0·7 (0·6 to 0·8)	−3·2% (−8·7 to 6·7)	1731·4 (1504·5 to 1998·9)	10·8% (3·2 to 24·3)*	22·1 (19·3 to 25·5)	−6·3% (−12·6 to 5·3)
Digestive diseases	**2377·7 (2295·1 to 2518·0)**	**15·3% (12·1 to 19·7)***	**30·3 (29·2 to 32·1)**	**−10·7% (−13·1 to −7·3)***	**65 348·4 (62 343·9 to 69 371·3)**	**7·5% (4·2 to 11·9)***	**819·8 (781·7 to 869·7)**	**−12·2% (−14·9 to −8·5)***
Cirrhosis and other chronic liver diseases	1322·9 (1268·2 to 1449·1)	15·0% (8·7 to 21·5)*	16·5 (15·8 to 18·1)	−9·7% (−14·7 to −4·6)*	39 652·4 (37 985·2 to 43 624·9)	8·9% (3·4 to 14·4)*	488·9 (468·0 to 537·5)	−11·3% (−15·8 to −6·9)*
Cirrhosis and other chronic liver diseases due to hepatitis B	384·0 (349·1 to 441·7)	8·6% (1·1 to 17·3)*	4·8 (4·3 to 5·5)	−14·3% (−20·2 to −7·3)*	11 721·5 (10 648·0 to 13 431·7)	3·4% (−3·3 to 10·7)	144·1 (130·8 to 165·3)	−15·5% (−20·9 to −9·5)*

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Cirrhosis and other chronic liver diseases due to hepatitis C	342·2 (312·6 to 381·1)	17·4% (11·3 to 23·0)*	4·2 (3·9 to 4·7)	−8·4% (−13·0 to −3·9)*	9980·1 (9074·7 to 11 116·9)	12·2% (6·8 to 17·3)*	121·9 (111·0 to 135·8)	−9·6% (−13·9 to −5·5)*
Cirrhosis and other chronic liver diseases due to alcohol use	332·3 (303·0 to 373·3)	16·9% (11·2 to 23·7)*	4·1 (3·7 to 4·6)	−8·8% (−13·2 to −3·4)*	9785·4 (8919·3 to 10 962·1)	12·3% (7·1 to 18·3)*	119·0 (108·6 to 133·5)	−10·0% (−14·2 to −5·2)*
Cirrhosis due to NASH	118·0 (108·6 to 128·6)	27·6% (21·2 to 33·3)*	1·5 (1·3 to 1·6)	−1·4% (−6·3 to 3·1)	3285·5 (3011·9 to 3586·8)	22·2% (16·6 to 27·2)*	40·0 (36·6 to 43·6)	−3·0% (−7·4 to 1·0)
Cirrhosis and other chronic liver diseases due to other causes	146·4 (130·9 to 164·6)	14·2% (8·2 to 20·2)*	1·9 (1·7 to 2·1)	−8·6% (−13·4 to −3·8)*	4880·0 (4392·5 to 5457·1)	2·1% (−4·3 to 10·7)	63·9 (57·5 to 71·4)	−12·0% (−17·5 to −4·5)*
Upper digestive system diseases	292·1 (279·7 to 312·3)	2·9% (−1·3 to 8·6)	3·8 (3·6 to 4·0)	−21·6% (−24·8 to −17·3)*	6789·9 (6413·1 to 7259·0)	−4·5% (−9·5 to 1·8)	85·2 (80·4 to 91·2)	−23·3% (−27·3 to −18·4)*
Peptic ulcer disease	240·3 (229·4 to 258·8)	0·6% (−3·6 to 5·6)	3·1 (3·0 to 3·3)	−23·5% (−26·6 to −19·7)*	5513·3 (5202·4 to 5947·8)	−6·8% (−11·4 to −1·5)*	69·1 (65·1 to 74·7)	−25·4% (−29·0 to −21·0)*
Gastritis and duodenitis	51·8 (43·0 to 56·9)	15·5% (7·5 to 28·9)*	0·7 (0·6 to 0·7)	−11·7% (−17·6 to −2·2)*	1276·6 (1047·1 to 1419·7)	6·8% (−3·1 to 22·4)	16·1 (13·2 to 17·9)	−13·2% (−21·1 to −1·3)*
Appendicitis	43·9 (40·2 to 47·5)	1·8% (−4·0 to 9·6)	0·6 (0·5 to 0·6)	−17·0% (−21·5 to −10·7)*	1633·2 (1473·2 to 1772·7)	−8·7% (−16·7 to 0·6)	21·4 (19·3 to 23·3)	−20·1% (−27·2 to −12·1)*
Paralytic ileus and intestinal obstruction	240·5 (198·7 to 261·6)	21·1% (14·4 to 29·0)*	3·2 (2·7 to 3·5)	−5·8% (−11·0 to 0·3)	7245·9 (5866·8 to 7980·6)	6·5% (−3·1 to 15·5)	97·0 (78·9 to 106·8)	−8·7% (−16·8 to −0·8)*
Inguinal, femoral, and abdominal hernia	44·2 (38·6 to 50·0)	21·7% (16·2 to 28·4)*	0·6 (0·5 to 0·7)	−8·9% (−12·9 to −4·2)*	914·3 (792·8 to 1021·9)	12·1% (4·5 to 20·4)*	11·7 (10·1 to 13·1)	−10·6% (−16·5 to −3·9)*
Inflammatory bowel disease	38·6 (31·6 to 41·2)	20·4% (11·5 to 27·2)*	0·5 (0·4 to 0·5)	−10·5% (−16·0 to −5·9)*	829·7 (711·4 to 900·7)	10·3% (−2·7 to 19·5)	10·7 (9·1 to 11·7)	−11·3% (−20·7 to −4·5)*
Vascular intestinal disorders	96·1 (89·0 to 100·8)	22·6% (17·0 to 28·1)*	1·3 (1·2 to 1·3)	−10·2% (−14·2 to −6·2)*	1570·1 (1433·3 to 1667·3)	17·6% (10·7 to 24·8)*	20·0 (18·3 to 21·3)	−10·0% (−15·3 to −5·0)*
Gallbladder and biliary diseases	110·5 (105·5 to 116·6)	28·8% (25·3 to 33·8)*	1·5 (1·4 to 1·6)	−5·0% (−7·5 to −1·7)*	1983·2 (1863·2 to 2092·0)	18·5% (13·4 to 25·3)*	25·4 (23·8 to 26·8)	−6·9% (−10·9 to −1·8)*
Pancreatitis	101·6 (89·5 to 108·3)	20·6% (16·4 to 25·7)*	1·3 (1·1 to 1·4)	−5·7% (−9·0 to −1·7)*	2890·0 (2537·1 to 3102·9)	13·8% (8·7 to 19·5)*	35·8 (31·4 to 38·4)	−6·8% (−10·9 to −2·1)*
Other digestive diseases	87·3 (81·9 to 93·3)	25·4% (18·1 to 32·3)*	1·2 (1·1 to 1·2)	−7·1% (−12·1 to −2·4)*	1839·7 (1663·9 to 2038·5)	16·4% (5·8 to 27·4)*	23·7 (21·5 to 26·3)	−6·5% (−14·9 to 1·8)
Neurological disorders	**3094·2 (3039·6 to 3142·6)**	**42·1% (40·2 to 43·9)***	**43·1 (42·3 to 43·7)**	**0·1% (−1·2 to 1·3)**	**38 004·5 (37 134·8 to 39 174·6)**	**26·2% (23·9 to 30·2)***	**507·6 (496·1 to 523·4)**	**−3·1% (−4·8 to −0·1)***
Alzheimer's disease and other dementias	2514·6 (2470·5 to 2550·3)	46·2% (43·9 to 48·0)*	35·4 (34·8 to 35·9)	0·6% (−0·9 to 1·8)	23 951·1 (23 523·6 to 24 326·8)	38·6% (35·7 to 40·9)*	323·7 (317·9 to 328·7)	−0·3% (−2·3 to 1·2)
Parkinson's disease	340·6 (324·4 to 355·1)	38·3% (33·3 to 41·4)*	4·6 (4·4 to 4·8)	0·8% (−2·8 to 3·0)	4361·2 (4182·8 to 4578·7)	33·8% (28·5 to 37·0)*	56·9 (54·5 to 59·8)	0·3% (−3·6 to 2·6)
Epilepsy	130·2 (117·0 to 150·8)	3·8% (−1·6 to 15·7)	1·7 (1·5 to 2·0)	−10·7% (−15·4 to −0·5)*	6232·1 (5709·8 to 7289·7)	−5·5% (−11·6 to 8·3)	82·6 (75·5 to 96·6)	−14·9% (−20·6 to −2·1)*
Multiple sclerosis	20·7 (17·7 to 22·2)	22·4% (8·0 to 27·8)*	0·3 (0·2 to 0·3)	−3·9% (−14·5 to 0·4)	628·2 (563·0 to 682·4)	17·1% (4·1 to 24·5)*	7·7 (6·9 to 8·3)	−5·5% (−15·1 to 0·6)
Motor neuron disease	34·1 (32·8 to 37·1)	32·7% (28·0 to 37·0)*	0·4 (0·4 to 0·5)	1·2% (−2·4 to 4·5)	828·1 (796·7 to 917·1)	27·2% (22·6 to 31·3)*	10·3 (9·9 to 11·4)	0·1% (−3·5 to 3·3)
Other neurological disorders	53·9 (51·6 to 59·0)	25·4% (17·8 to 32·3)*	0·7 (0·7 to 0·8)	2·0% (−3·9 to 6·8)	2003·8 (1856·8 to 2269·5)	11·4% (3·6 to 21·1)*	26·5 (24·3 to 30·1)	−2·8% (−9·3 to 5·1)
Mental disorders	**0·3 (0·3 to 0·4)**	**19·9% (10·0 to 29·2)***	**0·0 (0·0 to 0·0)**	**7·5% (−1·4 to 15·9)**	**17·5 (15·9 to 19·2)**	**18·5% (8·8 to 27·5)***	**0·2 (0·2 to 0·2)**	**7·2% (−1·6 to 15·3)**
Eating disorders	0·3 (0·3 to 0·4)	19·9% (10·0 to 29·2)*	0·0 (0·0 to 0·0)	7·5% (−1·4 to 15·9)	17·5 (15·9 to 19·2)	18·5% (8·8 to 27·5)*	0·2 (0·2 to 0·2)	7·2% (−1·6 to 15·3)
Anorexia nervosa	0·2 (0·2 to 0·3)	17·6% (7·0 to 27·6)*	0·0 (0·0 to 0·0)	5·5% (−4·1 to 14·4)	12·7 (10·9 to 14·1)	15·9% (5·6 to 25·6)*	0·2 (0·1 to 0·2)	5·0% (−4·4 to 13·7)

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Bulimia nervosa	0·1 (0·1 to 0·1)	26·4% (12·9 to 40·5)*	0·0 (0·0 to 0·0)	13·5% (1·0 to 26·2)*	4·8 (4·0 to 6·7)	25·9% (12·0 to 40·0)*	0·1 (0·1 to 0·1)	13·6% (1·1 to 26·3)*
Substance use disorders	**351·5 (334·1 to 362·7)**	**23·8% (20·2 to 27·3)***	**4·3 (4·1 to 4·5)**	**2·0% (–1·0 to 5·0)**	**13 597·6 (12 979·5 to 14 033·3)**	**18·8% (15·3 to 22·4)***	**168·0 (160·4 to 173·3)**	**0·8% (–2·2 to 3·9)**
Alcohol use disorders	184·9 (166·7 to 193·0)	2·7% (–2·2 to 7·7)	2·3 (2·0 to 2·4)	–16·5% (–20·4 to –12·4)*	6750·4 (6113·2 to 7082·7)	–2·1% (–7·2 to 3·3)	82·4 (74·7 to 86·5)	–18·4% (–22·7 to –13·9)*
Drug use disorders	166·6 (163·4 to 170·3)	60·2% (56·9 to 63·6)*	2·1 (2·0 to 2·1)	34·1% (31·4 to 36·9)*	6847·2 (6704·5 to 7004·4)	50·4% (47·0 to 54·0)*	85·5 (83·7 to 87·5)	30·5% (27·6 to 33·5)*
Opioid use disorders	109·5 (105·7 to 113·6)	77·0% (68·8 to 88·5)*	1·4 (1·3 to 1·4)	49·4% (42·5 to 59·2)*	4641·2 (4480·6 to 4818·9)	65·0% (57·3 to 75·0)*	58·0 (56·1 to 60·3)	43·9% (37·1 to 52·6)*
Cocaine use disorders	7·3 (6·6 to 8·1)	42·2% (30·1 to 58·3)*	0·1 (0·1 to 0·1)	19·6% (9·2 to 33·0)*	311·5 (281·5 to 344·1)	35·6% (24·0 to 51·2)*	3·9 (3·5 to 4·3)	16·7% (6·5 to 30·0)*
Amphetamine use disorders	4·5 (3·3 to 5·0)	27·2% (0·8 to 41·0)*	0·1 (0·0 to 0·1)	8·7% (–14·0 to 20·7)	206·9 (151·6 to 227·8)	21·0% (–3·6 to 34·4)	2·6 (1·9 to 2·8)	5·6% (–15·5 to 17·4)
Other drug use disorders	45·3 (42·9 to 48·2)	35·2% (22·8 to 46·1)*	0·6 (0·5 to 0·6)	11·3% (1·2 to 19·9)*	1687·6 (1589·4 to 1805·9)	25·9% (14·0 to 37·3)*	21·0 (19·8 to 22·5)	8·2% (–2·0 to 17·8)
Diabetes and kidney diseases	**2611·2 (2557·8 to 2667·2)**	**34·2% (32·0 to 36·2)***	**33·6 (32·9 to 34·3)**	**1·3% (–0·3 to 2·7)**	**58 116·9 (56 801·5 to 59 525·7)**	**25·1% (23·0 to 27·2)***	**726·4 (710·0 to 744·4)**	**–1·1% (–2·8 to 0·6)**
Diabetes mellitus	1369·8 (1340·3 to 1401·9)	34·7% (32·2 to 37·3)*	17·5 (17·1 to 17·9)	1·2% (–0·7 to 3·1)	29 300·2 (28 711·5 to 29 950·1)	29·9% (27·2 to 32·4)*	363·1 (355·7 to 371·2)	0·7% (–1·4 to 2·6)
Type 1 diabetes mellitus	345·5 (319·3 to 371·1)	15·1% (10·5 to 19·0)*	4·3 (4·0 to 4·7)	–11·0% (–14·6 to –7·8)*	9477·3 (8944·6 to 10 079·9)	11·1% (7·2 to 14·3)*	117·3 (110·8 to 124·6)	–10·6% (–13·9 to –7·9)*
Type 2 diabetes mellitus	1024·3 (985·5 to 1066·8)	43·0% (40·4 to 45·8)*	13·2 (12·7 to 13·7)	5·9% (4·1 to 8·0)*	19 822·9 (19 013·8 to 20 687·8)	41·3% (38·3 to 44·4)*	245·8 (235·8 to 256·5)	7·1% (5·0 to 9·4)*
Chronic kidney disease	1230·2 (1195·1 to 1258·8)	33·7% (30·5 to 36·1)*	15·9 (15·5 to 16·3)	1·5% (–0·9 to 3·2)	28 508·5 (27 610·2 to 29 314·0)	21·0% (18·2 to 23·5)*	359·4 (348·2 to 369·6)	–2·5% (–4·7 to –0·6)*
Chronic kidney disease due to type 1 diabetes mellitus	77·3 (62·4 to 95·2)	23·2% (19·0 to 27·4)*	0·9 (0·8 to 1·2)	–1·2% (–4·0 to 1·2)	2622·0 (2121·7 to 3205·5)	17·8% (13·6 to 22·3)*	31·9 (25·9 to 38·9)	–2·9% (–5·6 to –0·3)*
Chronic kidney disease due to type 2 diabetes mellitus	349·0 (306·8 to 395·9)	40·5% (36·4 to 43·6)*	4·5 (4·0 to 5·1)	4·2% (1·4 to 6·2)*	6671·9 (5825·5 to 7625·9)	35·4% (31·0 to 38·7)*	82·8 (72·4 to 94·5)	2·9% (–0·2 to 5·2)
Chronic kidney disease due to hypertension	347·4 (304·6 to 391·5)	41·4% (37·4 to 44·2)*	4·6 (4·0 to 5·2)	3·2% (0·4 to 5·2)*	5954·8 (5175·1 to 6741·9)	33·4% (29·3 to 36·5)*	75·2 (65·4 to 84·9)	2·3% (–0·7 to 4·5)
Chronic kidney disease due to glomerulonephritis	189·7 (165·2 to 217·3)	25·5% (22·1 to 28·8)*	2·4 (2·1 to 2·8)	–1·3% (–3·2 to 0·7)	5554·9 (4929·1 to 6250·8)	12·7% (9·6 to 16·1)*	70·6 (62·8 to 79·4)	–5·5% (–7·5 to –3·3)*
Chronic kidney disease due to other and unspecified causes	266·8 (232·8 to 304·0)	25·9% (22·4 to 29·4)*	3·4 (3·0 to 3·9)	–1·4% (–3·7 to 0·6)	7704·8 (6794·9 to 8614·8)	10·0% (6·8 to 13·4)*	98·9 (87·4 to 110·0)	–7·7% (–9·9 to –5·4)*
Acute glomerulonephritis	11·2 (10·5 to 12·1)	14·7% (8·7 to 22·3)*	0·1 (0·1 to 0·2)	–9·5% (–14·5 to –3·5)*	308·2 (282·4 to 336·8)	–5·5% (–10·4 to 2·2)	3·9 (3·6 to 4·3)	–20·9% (–25·1 to –15·1)*
Skin and subcutaneous diseases	**100·3 (65·3 to 131·7)**	**42·3% (34·9 to 52·0)***	**1·3 (0·9 to 1·7)**	**8·1% (2·7 to 16·5)***	**2517·9 (1703·3 to 3283·8)**	**26·1% (18·6 to 35·7)***	**33·1 (22·4 to 43·2)**	**5·0% (–1·2 to 13·8)**
Bacterial skin diseases	76·0 (48·7 to 95·6)	45·5% (36·8 to 54·9)*	1·0 (0·6 to 1·3)	12·7% (6·0 to 20·7)*	2096·6 (1378·0 to 2691·9)	26·4% (18·0 to 36·9)*	27·6 (18·2 to 35·6)	6·4% (–0·6 to 15·9)
Cellulitis	18·9 (10·3 to 26·0)	57·0% (45·8 to 67·1)*	0·2 (0·1 to 0·3)	19·6% (9·8 to 28·2)*	480·1 (264·6 to 640·2)	38·3% (30·8 to 50·4)*	6·2 (3·4 to 8·3)	13·7% (7·3 to 23·9)*
Pyoderma	57·1 (35·8 to 70·8)	42·1% (32·4 to 52·4)*	0·8 (0·5 to 0·9)	10·5% (3·2 to 19·0)*	1616·4 (1051·6 to 2136·7)	23·3% (14·3 to 35·0)*	21·5 (14·1 to 28·8)	4·5% (–3·2 to 15·0)
Decubitus ulcer	20·3 (13·2 to 30·6)	32·4% (22·9 to 51·0)*	0·3 (0·2 to 0·4)	–5·1% (–12·2 to 9·2)	321·7 (211·2 to 471·5)	26·2% (17·9 to 42·5)*	4·2 (2·7 to 6·1)	–2·3% (–8·8 to 11·5)

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Other skin and subcutaneous diseases	3·9 (2·6 to 7·2)	35·8% (26·6 to 49·6)*	0·1 (0·0 to 0·1)	3·3% (–3·5 to 14·4)	99·6 (69·4 to 165·8)	19·1% (10·8 to 34·1)*	1·3 (0·9 to 2·2)	0·7% (–6·1 to 13·1)
Musculoskeletal disorders	**121·3 (105·6 to 126·2)**	**30·9% (25·1 to 35·1)***	**1·6 (1·4 to 1·6)**	**–0·1% (–4·4 to 3·2)**	**2842·7 (2440·7 to 2953·1)**	**19·6% (13·7 to 23·2)***	**35·9 (30·8 to 37·3)**	**–2·5% (–7·1 to 0·4)**
Rheumatoid arthritis	47·3 (39·0 to 51·2)	25·8% (16·2 to 31·9)*	0·6 (0·5 to 0·7)	–5·9% (–12·9 to –1·2)*	866·0 (707·8 to 941·4)	17·9% (8·6 to 23·3)*	10·9 (8·9 to 11·8)	–9·1% (–16·1 to –5·0)*
Other musculoskeletal disorders	74·0 (66·1 to 78·7)	34·4% (30·2 to 38·8)*	1·0 (0·9 to 1·0)	3·9% (0·9 to 7·5)*	1976·6 (1730·3 to 2089·1)	20·3% (15·6 to 24·0)*	25·0 (21·9 to 26·4)	0·8% (–3·0 to 3·8)
Other non-communicable diseases	**1153·3 (1101·8 to 1208·3)**	**0·8% (–3·9 to 4·0)**	**16·3 (15·5 to 17·1)**	**–11·2% (–15·3 to –8·5)***	**68 240·8 (64 835·4 to 72 452·1)**	**–10·6% (–15·8 to –6·9)***	**993·0 (941·3 to 1054·3)**	**–16·4% (–21·3 to –12·8)***
Congenital anomalies	584·9 (556·3 to 618·3)	–14·3% (–21·1 to –10·1)*	8·7 (8·2 to 9·2)	–18·2% (–24·7 to –14·1)*	48 860·4 (46 405·7 to 51 687·3)	–15·3% (–22·0 to –11·0)*	729·4 (692·5 to 771·7)	–18·8% (–25·2 to –14·6)*
Neural tube defects	61·7 (46·7 to 83·7)	–13·1% (–24·5 to –1·0)*	0·9 (0·7 to 1·3)	–16·5% (–27·6 to –4·8)*	5317·5 (4017·1 to 7217·5)	–13·4% (–24·8 to –1·4)*	80·0 (60·4 to 108·6)	–16·7% (–27·7 to –5·0)*
Congenital heart anomalies	261·2 (216·6 to 308·2)	–17·9% (–24·6 to –9·8)*	3·9 (3·2 to 4·6)	–21·8% (–28·1 to –14·1)*	21 634·4 (17 770·6 to 25 604·8)	–18·9% (–25·5 to –10·8)*	321·7 (263·6 to 381·4)	–22·4% (–28·7 to –14·6)*
Orofacial clefts	3·8 (1·5 to 8·8)	–40·0% (–54·5 to –22·5)*	0·1 (0·0 to 0·1)	–41·9% (–55·9 to –25·1)*	331·3 (130·1 to 770·5)	–40·0% (–54·5 to –22·7)*	5·0 (2·0 to 11·7)	–41·9% (–56·0 to –25·2)*
Down syndrome	26·1 (21·3 to 35·1)	3·1% (–7·4 to 17·4)	0·4 (0·3 to 0·5)	–5·2% (–14·2 to 7·0)	1906·1 (1481·7 to 2707·9)	–1·4% (–11·5 to 13·9)	27·7 (21·3 to 39·8)	–7·3% (–16·7 to 7·1)
Other chromosomal abnormalities	17·9 (12·0 to 26·3)	4·6% (–6·3 to 18·2)	0·3 (0·2 to 0·4)	0·3% (–10·1 to 13·2)	1507·9 (1012·2 to 2233·3)	3·9% (–6·9 to 17·4)	22·6 (15·1 to 33·5)	0·0% (–10·4 to 13·0)
Congenital musculoskeletal and limb anomalies	11·0 (8·6 to 14·0)	–8·7% (–17·3 to 0·0)	0·2 (0·1 to 0·2)	–12·8% (–20·9 to –4·5)*	912·2 (708·9 to 1172·9)	–9·8% (–18·2 to –1·0)*	13·6 (10·6 to 17·5)	–13·3% (–21·5 to –4·9)*
Urogenital congenital anomalies	14·1 (10·3 to 16·9)	–2·5% (–11·8 to 9·2)	0·2 (0·1 to 0·2)	–8·5% (–17·1 to 2·1)	1105·8 (781·3 to 1347·8)	–5·5% (–14·6 to 6·3)	16·4 (11·5 to 20·0)	–9·7% (–18·3 to 1·3)
Digestive congenital anomalies	50·8 (37·7 to 71·8)	–16·2% (–27·1 to –6·4)*	0·8 (0·6 to 1·1)	–19·3% (–29·8 to –9·8)*	4398·7 (3253·9 to 6229·0)	–16·5% (–27·3 to –6·7)*	66·3 (49·0 to 93·9)	–19·4% (–29·9 to –9·9)*
Other congenital anomalies	138·3 (102·3 to 175·6)	–12·4% (–20·1 to –0·5)*	2·1 (1·5 to 2·6)	–15·9% (–23·3 to –4·5)*	11 746·6 (8613·3 to 14 951·0)	–13·0% (–20·7 to –1·1)*	176·1 (128·8 to 224·2)	–16·3% (–23·7 to –4·8)*
Urinary diseases and male infertility	271·2 (263·9 to 282·2)	39·6% (34·9 to 43·4)*	3·6 (3·5 to 3·7)	5·7% (2·2 to 8·5)*	6255·2 (6044·8 to 6542·1)	20·8% (15·5 to 24·9)*	81·1 (78·3 to 84·8)	–0·7% (–5·1 to 2·7)
Urinary tract infections	206·4 (197·9 to 223·2)	48·3% (42·9 to 53·5)*	2·7 (2·6 to 3·0)	10·9% (7·2 to 14·5)*	4522·3 (4285·2 to 5016·3)	31·4% (24·4 to 38·8)*	58·4 (55·2 to 65·0)	7·2% (1·7 to 13·0)*
Urolithiasis	12·3 (10·5 to 15·7)	30·4% (19·0 to 49·4)*	0·2 (0·1 to 0·2)	–1·2% (–9·7 to 12·9)	255·1 (216·0 to 323·5)	19·6% (9·7 to 36·9)*	3·2 (2·7 to 4·0)	–5·9% (–13·6 to 7·7)
Other urinary diseases	52·5 (42·3 to 58·0)	15·0% (8·0 to 25·5)*	0·7 (0·6 to 0·8)	–9·9% (–15·3 to –2·2)*	1477·8 (1172·2 to 1660·2)	–3·0% (–9·6 to 6·4)	19·4 (15·4 to 21·9)	–18·2% (–23·3 to –10·6)*
Gynaecological diseases	8·2 (7·4 to 8·7)	19·1% (5·1 to 30·0)*	0·1 (0·1 to 0·1)	–2·6% (–13·6 to 6·0)	292·9 (272·6 to 318·7)	9·2% (–2·8 to 20·6)	3·7 (3·4 to 4·0)	–6·0% (–15·4 to 3·6)
Uterine fibroids	2·4 (1·6 to 3·0)	33·3% (6·7 to 54·6)*	0·0 (0·0 to 0·0)	8·1% (–14·9 to 24·7)	74·2 (52·7 to 95·5)	13·0% (–4·2 to 31·6)	0·9 (0·6 to 1·2)	–4·8% (–20·0 to 10·5)
Polycystic ovarian syndrome	0·0 (0·0 to 0·0)	12·9% (–12·8 to 50·4)	0·0 (0·0 to 0·0)	1·0% (–22·5 to 34·8)	0·7 (0·1 to 1·5)	10·1% (–15·8 to 51·2)	0·0 (0·0 to 0·0)	–0·1% (–24·3 to 37·2)
Endometriosis	0·2 (0·1 to 0·2)	11·8% (–12·4 to 45·5)	0·0 (0·0 to 0·0)	–3·2% (–23·8 to 25·5)	7·7 (3·2 to 12·0)	10·4% (–12·9 to 41·7)	0·1 (0·0 to 0·1)	–3·2% (–23·2 to 24·3)
Genital prolapse	0·6 (0·3 to 0·9)	0·6% (–15·4 to 16·1)	0·0 (0·0 to 0·0)	–24·1% (–36·0 to –13·0)*	14·5 (6·8 to 20·1)	–4·4% (–18·4 to 10·4)	0·2 (0·1 to 0·2)	–24·0% (–35·2 to –11·9)*
Other gynaecological diseases	5·0 (4·1 to 5·6)	16·0% (4·1 to 27·9)*	0·1 (0·1 to 0·1)	–3·6% (–12·2 to 5·9)	195·8 (163·0 to 228·9)	8·9% (–2·9 to 20·6)	2·5 (2·1 to 2·9)	–4·8% (–14·2 to 5·1)

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Haemoglobinopathies and haemolytic anaemias	104·6 (82·0 to 132·2)	5·8% (–1·4 to 13·4)	1·4 (1·1 to 1·8)	–11·3% (–17·6 to –4·8)*	4831·6 (3643·1 to 6268·9)	–1·8% (–13·1 to 9·4)	66·6 (50·0 to 86·2)	–11·1% (–21·6 to –0·5)*
Thalassaemias	7·2 (6·0 to 8·4)	–23·7% (–32·6 to –12·7)*	0·1 (0·1 to 0·1)	–27·9% (–36·5 to –17·2)*	564·7 (474·8 to 667·6)	–24·6% (–33·9 to –13·2)*	8·2 (6·9 to 9·7)	–28·6% (–37·6 to –17·6)*
Sickle cell disorders	38·4 (24·0 to 54·8)	3·7% (–11·6 to 17·7)	0·5 (0·3 to 0·8)	–3·1% (–17·6 to 10·3)	2796·4 (1747·3 to 3913·6)	2·1% (–13·7 to 17·3)	39·7 (24·8 to 55·3)	–3·9% (–19·1 to 11·0)
G6PD deficiency	16·7 (12·1 to 22·5)	11·8% (4·7 to 19·6)*	0·2 (0·2 to 0·3)	–7·1% (–12·1 to –1·0)*	692·6 (522·0 to 896·1)	4·4% (–2·5 to 12·3)	8·8 (6·7 to 11·4)	–9·6% (–15·0 to –3·3)*
Other haemoglobinopathies and haemolytic anaemias	42·2 (35·1 to 49·2)	13·0% (9·3 to 16·5)*	0·6 (0·5 to 0·6)	–16·1% (–18·7 to –13·4)*	777·8 (634·5 to 917·2)	1·3% (–2·2 to 4·8)	9·9 (8·1 to 11·7)	–19·9% (–22·3 to –17·4)*
Endocrine, metabolic, blood, and immune disorders	144·5 (115·1 to 152·3)	28·2% (19·7 to 33·3)*	1·9 (1·5 to 2·0)	0·8% (–5·0 to 4·4)	4506·4 (3762·3 to 4919·9)	10·4% (2·7 to 16·9)*	59·7 (50·0 to 65·5)	–5·5% (–11·2 to –0·2)*
Sudden infant death syndrome	40·0 (18·0 to 77·0)	–17·3% (–28·6 to –1·4)*	0·6 (0·3 to 1·2)	–20·2% (–31·2 to –4·9)*	3494·3 (1570·1 to 6734·0)	–17·3% (–28·6 to –1·4)*	52·7 (23·7 to 101·5)	–20·2% (–31·2 to –4·9)*
Injuries	**4484·7 (4332·0 to 4585·6)**	**2·3% (0·5 to 4·0)***	**57·9 (55·9 to 59·2)**	**–13·7% (–15·1 to –12·2)***	**195 231·1 (188 807·7 to 199 825·5)**	**–6·4% (–7·8 to –4·8)***	**2548·3 (2461·9 to 2609·6)**	**–16·9% (–18·2 to –15·3)***
Transport injuries	**1335·0 (1289·1 to 1369·5)**	**–3·1% (–6·0 to –0·6)***	**17·0 (16·4 to 17·4)**	**–17·0% (–19·5 to –14·9)***	**61 937·8 (60 031·2 to 63 736·5)**	**–9·6% (–11·8 to –7·3)***	**800·5 (775·9 to 823·3)**	**–19·5% (–21·4 to –17·5)***
Road injuries	1243·1 (1191·9 to 1276·9)	–3·2% (–6·3 to –0·5)*	15·8 (15·2 to 16·3)	–17·1% (–19·7 to –14·9)*	57 638·4 (55 500·8 to 59 369·2)	–9·7% (–12·0 to –7·3)*	745·0 (718·1 to 767·4)	–19·6% (–21·6 to –17·5)*
Pedestrian road injuries	486·2 (459·7 to 535·0)	–6·4% (–11·7 to –2·1)*	6·2 (5·9 to 6·8)	–21·4% (–25·5 to –17·9)*	20 850·8 (19 596·0 to 23 164·4)	–14·8% (–18·7 to –11·0)*	270·4 (253·9 to 300·8)	–25·1% (–28·3 to –21·9)*
Cyclist road injuries	68·9 (59·2 to 76·2)	9·1% (1·8 to 16·4)*	0·9 (0·7 to 1·0)	–8·8% (–14·8 to –2·5)*	2853·5 (2471·6 to 3209·0)	1·0% (–5·7 to 8·3)	36·3 (31·5 to 41·0)	–11·8% (–17·8 to –5·3)*
Motorcyclist road injuries	225·7 (196·1 to 238·6)	–0·6% (–8·9 to 5·2)	2·9 (2·5 to 3·0)	–12·4% (–19·5 to –7·3)*	11 416·3 (9969·6 to 12 098·0)	–5·7% (–12·5 to –0·5)*	146·2 (127·5 to 154·9)	–14·8% (–20·7 to –10·1)*
Motor vehicle road injuries	451·1 (423·4 to 472·9)	–2·5% (–6·2 to 1·3)	5·8 (5·4 to 6·0)	–15·6% (–18·6 to –12·2)*	22 004·1 (20 639·8 to 23 130·9)	–7·8% (–10·4 to –3·0)*	285·3 (267·6 to 299·7)	–17·2% (–19·6 to –12·8)*
Other road injuries	11·2 (9·9 to 12·8)	–5·5% (–11·0 to 16·1)	0·1 (0·1 to 0·2)	–19·4% (–24·1 to –1·3)*	513·8 (454·1 to 583·4)	–11·7% (–17·3 to 10·6)	6·7 (5·9 to 7·6)	–21·4% (–26·5 to –1·7)*
Other transport injuries	91·9 (84·5 to 107·2)	–1·5% (–6·2 to 3·7)	1·2 (1·1 to 1·4)	–15·5% (–19·5 to –10·9)*	4299·4 (3919·6 to 5048·3)	–7·8% (–12·6 to –2·4)*	55·4 (50·5 to 65·0)	–17·9% (–22·2 to –13·2)*
Unintentional injuries	**1804·9 (1695·7 to 1872·0)**	**2·9% (0·5 to 6·0)***	**23·8 (22·4 to 24·7)**	**–15·3% (–17·3 to –12·8)***	**69 430·5 (64 685·1 to 72 366·8)**	**–12·8% (–15·0 to –9·6)***	**928·8 (865·6 to 969·3)**	**–23·0% (–25·0 to –20·0)***
Falls	695·8 (644·9 to 741·7)	27·4% (21·2 to 35·6)*	9·2 (8·5 to 9·8)	–2·8% (–7·4 to 3·4)	16 688·1 (15 101·9 to 17 636·8)	10·1% (4·8 to 17·2)*	216·6 (196·4 to 228·6)	–8·4% (–12·7 to –2·5)*
Drowning	295·2 (284·5 to 306·2)	–17·2% (–19·8 to –14·1)*	4·0 (3·8 to 4·1)	–27·3% (–29·6 to –24·5)*	16 563·3 (15 784·2 to 17 350·0)	–26·1% (–29·0 to –22·4)*	228·3 (217·2 to 239·7)	–32·8% (–35·5 to –29·3)*
Fire heat and hot substances	120·6 (101·6 to 129·4)	–7·9% (–10·9 to –1·2)*	1·6 (1·3 to 1·7)	–22·9% (–25·4 to –17·3)*	5286·3 (4308·9 to 5836·4)	–16·5% (–21·0 to –7·3)*	71·0 (57·8 to 78·6)	–25·5% (–29·6 to –17·1)*
Poisonings	72·4 (52·7 to 79·4)	–6·8% (–16·1 to 2·9)	0·9 (0·7 to 1·0)	–20·8% (–28·4 to –12·5)*	3321·7 (2454·1 to 3669·2)	–14·6% (–22·7 to –3·8)*	44·1 (32·7 to 48·8)	–23·9% (–31·0 to –14·1)*
Poisoning by carbon monoxide	35·5 (25·7 to 38·8)	–12·5% (–22·4 to –5·0)*	0·5 (0·3 to 0·5)	–26·6% (–34·8 to –20·3)*	1462·4 (1073·0 to 1613·6)	–19·1% (–27·2 to –11·8)*	18·9 (13·8 to 20·9)	–29·0% (–36·2 to –22·4)*
Poisoning by other means	36·9 (26·8 to 41·0)	–0·5% (–10·1 to 11·9)	0·5 (0·4 to 0·5)	–14·4% (–22·4 to –3·9)*	1859·3 (1385·8 to 2072·9)	–10·7% (–19·6 to 3·3)	25·2 (19·0 to 28·1)	–19·6% (–27·7 to –6·8)*

(Table 1 continues on next page)

	All-age deaths (thousands)		Age-standardised death rate (per 100 000)		All-age YLLs (thousands)		Age-standardised YLL rate (per 100 000)	
	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17	2017	Percentage change, 2007–17
(Continued from previous page)								
Exposure to mechanical forces	136·5 (117·6 to 143·2)	−6·7% (−9·8 to −3·7)*	1·8 (1·5 to 1·8)	−20·3% (−22·9 to −17·8)*	6385·5 (5500·4 to 6710·8)	−13·8% (−16·6 to −10·8)*	84·0 (72·3 to 88·3)	−23·0% (−25·5 to −20·3)*
Unintentional firearm injuries	22·6 (21·1 to 25·8)	−2·9% (−7·5 to 2·8)	0·3 (0·3 to 0·3)	−16·4% (−20·3 to −11·5)*	1094·5 (1013·5 to 1275·4)	−7·4% (−12·2 to −1·3)*	14·4 (13·3 to 16·9)	−16·5% (−20·9 to −11·1)*
Other exposure to mechanical forces	113·9 (94·7 to 120·8)	−7·4% (−10·6 to −4·1)*	1·5 (1·2 to 1·6)	−21·0% (−23·7 to −18·3)*	5291·0 (4401·1 to 5626·1)	−15·0% (−18·0 to −11·7)*	69·6 (57·8 to 74·0)	−24·3% (−26·9 to −21·2)*
Adverse effects of medical treatment	121·6 (103·6 to 137·6)	16·6% (12·0 to 20·9)*	1·6 (1·4 to 1·8)	−6·2% (−10·0 to −2·5)*	4363·9 (3619·9 to 5234·0)	4·0% (−1·2 to 11·0)	58·1 (48·0 to 70·7)	−9·5% (−13·9 to −3·6)*
Animal contact	81·1 (44·9 to 94·0)	−1·4% (−6·8 to 6·2)	1·1 (0·6 to 1·2)	−16·0% (−20·5 to −9·6)*	3911·9 (2167·6 to 4585·6)	−9·5% (−15·8 to 0·2)	52·4 (29·0 to 61·8)	−19·2% (−25·2 to −10·2)*
Venomous animal contact	70·9 (37·0 to 83·8)	−1·3% (−7·5 to 6·2)	0·9 (0·5 to 1·1)	−16·0% (−21·0 to −9·7)*	3407·7 (1758·4 to 4087·5)	−9·7% (−16·4 to −0·7)*	45·5 (23·4 to 54·9)	−19·4% (−25·8 to −11·3)*
Non-venomous animal contact	10·1 (7·1 to 14·4)	−1·6% (−15·3 to 10·2)	0·1 (0·1 to 0·2)	−16·1% (−27·4 to −6·2)*	504·2 (335·8 to 750·1)	−7·9% (−26·1 to 6·5)	6·9 (4·5 to 10·3)	−17·2% (−33·6 to −4·3)*
Foreign body	124·1 (119·3 to 130·0)	1·7% (−1·9 to 4·8)	1·7 (1·6 to 1·8)	−14·1% (−17·0 to −11·6)*	5907·0 (5566·3 to 6301·2)	−12·4% (−16·4 to −8·3)*	83·3 (78·3 to 88·9)	−20·1% (−23·8 to −16·3)*
Pulmonary aspiration and foreign body in airway	115·7 (111·4 to 121·3)	1·9% (−1·9 to 5·0)	1·6 (1·5 to 1·7)	−13·9% (−17·0 to −11·4)*	5526·1 (5212·6 to 5910·0)	−12·2% (−16·6 to −8·0)*	78·1 (73·5 to 83·7)	−19·9% (−23·8 to −16·0)*
Foreign body in other body part	8·4 (7·5 to 10·3)	−0·5% (−6·9 to 7·1)	0·1 (0·1 to 0·1)	−15·8% (−20·8 to −10·0)*	381·0 (326·2 to 474·4)	−14·4% (−21·1 to −6·2)*	5·2 (4·4 to 6·5)	−23·3% (−29·2 to −16·1)*
Environmental heat and cold exposure	53·3 (36·8 to 59·2)	−13·2% (−22·4 to −8·4)*	0·7 (0·5 to 0·8)	−29·4% (−37·1 to −25·4)*	1845·6 (1246·6 to 2066·2)	−21·4% (−28·8 to −17·5)*	23·7 (15·8 to 26·7)	−32·7% (−39·5 to −29·1)*
Exposure to forces of nature	9·6 (8·7 to 11·0)	−38·0% (−43·9 to −28·9)*	0·1 (0·1 to 0·1)	−45·8% (−50·8 to −37·9)*	477·6 (438·4 to 544·3)	−45·0% (−49·4 to −37·3)*	6·3 (5·8 to 7·2)	−50·2% (−54·2 to −43·2)*
Other unintentional injuries	94·7 (91·9 to 98·3)	−14·5% (−16·7 to −12·1)*	1·2 (1·2 to 1·3)	−25·8% (−27·6 to −23·8)*	4679·6 (4519·4 to 4888·2)	−20·7% (−22·9 to −18·1)*	60·9 (58·8 to 63·7)	−28·9% (−30·9 to −26·6)*
Self-harm and interpersonal violence	**1344·8 (1283·1 to 1380·4)**	**7·3% (4·6 to 9·7)***	**17·1 (16·3 to 17·5)**	**−7·6% (−9·9 to −5·5)***	**63 862·9 (61 029·9 to 65 755·7)**	**5·4% (2·8 to 7·7)***	**819·0 (782·2 to 843·4)**	**−5·7% (−7·9 to −3·7)***
Self-harm	793·8 (743·5 to 819·7)	1·1% (−2·6 to 3·7)	10·0 (9·4 to 10·3)	−14·8% (−18·0 to −12·6)*	33 577·2 (31 449·3 to 34 719·1)	−3·4% (−7·0 to −0·9)*	423·6 (396·9 to 438·2)	−15·1% (−18·4 to −12·9)*
Self-harm by firearm	63·8 (54·6 to 78·6)	6·8% (2·3 to 10·8)*	0·8 (0·7 to 1·0)	−10·3% (−13·9 to −7·2)*	2653·6 (2241·9 to 3288·1)	0·9% (−3·5 to 5·5)	33·5 (28·2 to 41·6)	−11·5% (−15·2 to −7·6)*
Self-harm by other specified means	730·0 (678·5 to 754·9)	0·6% (−3·2 to 3·4)	9·2 (8·5 to 9·5)	−15·2% (−18·4 to −12·8)*	30 923·6 (28 832·4 to 32 098·2)	−3·7% (−7·5 to −1·1)*	390·1 (363·6 to 405·1)	−15·4% (−18·8 to −13·1)*
Interpersonal violence	405·3 (365·2 to 431·7)	0·5% (−2·0 to 3·2)	5·2 (4·7 to 5·5)	−11·1% (−13·3 to −8·7)*	21 439·8 (19 275·8 to 22 799·8)	−1·6% (−4·4 to 1·3)	276·8 (248·4 to 294·2)	−10·9% (−13·4 to −8·2)*
Assault by firearm	174·4 (147·9 to 188·9)	7·5% (4·3 to 10·8)*	2·2 (1·9 to 2·4)	−3·6% (−6·5 to −0·5)*	9541·2 (8106·2 to 10 291·7)	5·4% (2·1 to 9·0)*	122·9 (104·3 to 132·4)	−3·7% (−6·7 to −0·4)*
Assault by sharp object	91·4 (74·4 to 111·2)	−11·5% (−15·3 to −6·0)*	1·2 (0·9 to 1·4)	−22·3% (−25·6 to −17·6)*	4634·5 (3747·0 to 5648·9)	−13·9% (−17·6 to −8·5)*	59·2 (47·8 to 72·1)	−22·6% (−25·9 to −17·8)*
Assault by other means	139·5 (123·6 to 164·4)	1·3% (−3·4 to 5·6)	1·8 (1·6 to 2·1)	−11·5% (−15·4 to −7·6)*	7264·1 (6400·8 to 8583·0)	−1·3% (−5·4 to 3·6)	94·7 (83·3 to 111·5)	−11·2% (−14·9 to −6·8)*
Conflict and terrorism	129·7 (118·1 to 143·2)	118·0% (88·8 to 148·6)*	1·7 (1·6 to 1·9)	98·4% (72·4 to 126·1)*	7966·6 (7244·5 to 8855·9)	113·5% (84·5 to 146·8)*	107·3 (97·6 to 119·1)	97·9% (71·0 to 128·8)*
Executions and police conflict	16·0 (15·7 to 16·3)	203·9% (186·9 to 220·9)*	0·2 (0·2 to 0·2)	172·4% (156·8 to 187·6)*	879·3 (862·3 to 898·1)	202·1% (184·8 to 219·8)*	11·4 (11·2 to 11·7)	176·4% (160·5 to 192·9)*

Data in parentheses are 95% uncertainty intervals. G6PD=glucose-6-phosphate dehydrogenase. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study. *H* influenzae=*Haemophilus influenzae*. NASH=non-alcoholic steatohepatitis. YLL=years of life lost. *Percentage changes that are statistically significant.

Table 1: **Global death and YLL numbers, age-standardised rates per 100 000, and percentage change between 2007 and 2017 for both sexes combined for all GBD causes and Levels 1 through 4 of the cause hierarchy**

age-sex-cause death rate using GBD estimates from all national locations across all years from 1980 to 2017 (appendix 1 section 7). Expected cause-specific death rates were scaled to the expected all-cause death rate to ensure internal consistency. We then computed the number of YLLs and deaths expected for each age-sex-location-year based on SDI alone and compared these estimates to observed rates. Additional details of the development and calculation of SDI for GBD 2017 are described in appendix 1 (section 5).

Role of the funding source

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

Results

Global causes of death

Mortality estimates by cause for the years 1990, 2007, and 2017 are available by age and sex through the GBD results tool and for each year in the GBD estimation period 1980–2017 through the online data visualisation tool. All reported rates are age-standardised.

In 2017, at the broadest level of cause of death classification in the GBD cause list (Level 1), CMNN causes accounted for 18·6% (95% UI 17·9–19·6) of total deaths or 10·4 million (10·0–11·0) deaths in 2017, while non-communicable causes (NCDs) accounted for 73·4% (72·5–74·1) or 41·1 million (40·5–41·5) deaths, and injuries accounted for 8·0% (7·7–8·2) of deaths or 4·48 million (4·33–4·59) deaths (table 1). Of the 1·65 billion (1·62–1·67) global YLLs in 2017, 35·1% (34·2–36·2) were from CMNN causes, 53·0% (52·2–53·8) were from NCDs, and the remaining 11·9% (11·5–12·1) were from injuries. Both the number of deaths and death rates from CMNN causes decreased from 2007 to 2017, by 22·2% (20·0–24·0) in terms of total deaths and by 31·8% (30·1–33·3) in terms of mortality rate. Decreases in the number and rate of YLLs from CMNN causes were similar in magnitude (30·4% [28·2–32·4] decrease in YLLs; 35·4% [33·4–37·3] decrease in YLL rate) over the same time period. By contrast, total deaths from NCD causes increased between 2007 and 2017 by 22·7% (21·5–23·9) and total YLLs from NCD causes increased by 13·6% (12·2–14·9), representing an additional 7·61 million (7·20–8·01) deaths and 105 million (94·3–114·0) YLLs estimated in 2017. Rates of both deaths and YLLs from NCD causes decreased over the same time period, by 7·9% (7·0–8·8) to 536·1 deaths (528·4–542·2) per 100 000, with a 9·6% (8·6–10·7) decrease in the YLL rate to 11 100 YLLs (10 900–11 300) per 100 000 in 2017. Total deaths from injuries varied little between 2007 and 2017, with an increase of 2·3% (0·5–4·0) to 4·48 million (4·33–4·59) deaths, while death rates from injury decreased by 13·7% (12·2–15·1) to 57·9 deaths (55·9–59·2) per 100 000 in 2017. Decreases in the number of YLLs (by 6·4% [4·8–7·8] to 195 million [189–200] YLLs in 2017) and YLL rate (by 16·9% [15·3–18·2] to 2550 [2460–2610] YLLs per 100 000 in 2017) for injuries were estimated during the same period.

Communicable, maternal, neonatal, and nutritional diseases

The overall decrease in communicable causes of death included reductions in some of the largest contributors to global mortality, including HIV/AIDS, tuberculosis, diarrhoeal diseases, and malaria (table 1). The peak in HIV/AIDS mortality occurred in 2006 with 1·95 million deaths (95% UI 1·87–2·04) and a rate of 28·8 deaths (27·7–30·1) per 100 000, but between 2007 and 2017, total mortality from HIV/AIDS decreased from 1·92 million (1·84–2·00) deaths to 0·954 million (0·907–1·01) deaths with a commensurate decrease (56·5% [54·7–58·0]) in the mortality rate from 27·9 deaths (26·8–29·1) per 100 000 in 2007 to 12·1 deaths (11·5–12·9) per 100 000 in 2017. Although tuberculosis caused an estimated 1·18 million (1·13–1·25) deaths in 2017, this was nonetheless a decrease of 14·9% (10·3–18·2) from levels in 2007, when tuberculosis caused 1·39 million (1·34–1·46) deaths. Drug-susceptible tuberculosis deaths were the largest component of tuberculosis deaths in 2017 (88·2% [81·4–93·3]) and decreased the most since 2007 (15·5% [8·6–22·3]) in comparison with other tuberculosis sub-causes. All HIV/AIDS and tuberculosis co-infections also decreased, with declines occurring for deaths from HIV/AIDS and drug-resistant tuberculosis co-infection (8·3% [–26·8 to 14·7]), HIV/AIDS and multidrug-resistant tuberculosis co-infection (52·2% [33·2–66·4]), and HIV/AIDS and drug-susceptible tuberculosis co-infection (55·4% [51·6–58·4]). The total number of deaths from diarrhoeal diseases decreased by 16·6% (6·7–25·3) between 2007 and 2017, from 1·88 million (1·53–2·47) deaths in 2007 to 1·57 million (1·18–2·19) deaths in 2017. There was a parallel decrease in the death rate (30·2% [22·7–36·1]) from diarrhoeal diseases, from 31·0 deaths (25·0–40·9) per 100 000 in 2007 to 21·6 deaths (16·4–29·7) per 100 000 in 2017. There were 620 000 deaths (440 000–840 000) from malaria in 2017, a decrease of 30·8% (20·8–39·4) from 2007 when 896 000 deaths (664 000–1 180 000) were estimated. Deaths due to measles decreased by 57·0% (51·9–61·9) from 222 000 deaths (82 300–457 000) in 2007 to 95 300 (34 500–205 000) in 2017. Invasive non-typhoidal salmonella deaths were estimated to have decreased from 71 900 deaths (42 200–116 000) in 2007 to 59 100 deaths (33 300–98 100) in 2017. A notable exception to the estimated improvements for communicable diseases occurred for dengue, where deaths increased by 65·5% (21·7–99·7) from 24 500 (11 500–29 600) in 2007 to 40 500 (17 600–49 800) in 2017, with a similar increase in mortality rate (40·7% [3·6–69·7], from 0·4 deaths [0·2–0·5] per 100 000 in 2007 to 0·5 deaths [0·2–0·7] per 100 000 in 2017).

At Level 2 of the GBD cause hierarchy, there were 1·98 million (95% UI 1·89–2·06) deaths from maternal

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Please see appendix 1 for more detailed information about individual authors' contributions to the research, divided into the following categories: managing the estimation process; writing the first draft of the manuscript; providing data or critical feedback on data sources; developing methods or computational machinery; applying analytical methods to produce estimates; providing critical feedback on methods or results; drafting the work or revising it critically for important intellectual content; extracting, cleaning, or cataloguing data; designing or coding figures and tables; and managing the overall research enterprise.

Declaration of interests

Ettore Beghi reports personal fees from MA-Provider and grants from the Italian Ministry of Health, UCB-PHARMA, American ALS Association, EISAI, and Shire. Yannick Bejot reports grants and personal fees from AstraZeneca and Boehringer Ingelheim and personal fees from Daiichi-Sankyo, Bristol-Myers Squibb (BMS), Pfizer, Medtronic, Bayer, Novex pharma, and Merck Sharpe & Dohme (MSD). Adam Berman reports personal fees from Philips. Louisa Degenhardt reports grants from Indivior, Mundipharma, and Seqirus. Panniyammakal Jeemon reports a Clinical and Public Health Intermediate Fellowship from the Wellcome Trust–DBT India Alliance (2015–20). Jacek Jóźwiak reports a grant from Valeant, personal fees from Valeant, ALAB Laboratoria and Amgen, and non-financial support from Microlife and Servier. Nicholas Kassebaum reports personal fees and other support from Vifor Pharmaceuticals. Srinivasa Vittal Katikireddi reports grants from NHS Research Scotland, the Medical Research Council, and the Scottish Government Chief Scientist Office. Jeffrey Lazarus reports personal fees from Janssen and CEPHEID and grants and personal fees from AbbVie, Gilead Sciences, and MSD. Stefan Lorkowski reports personal fees from Amgen, Berlin-Chemie, MSD, Novo Nordisk, Sanofi-Aventis, Synlab, Unilever, and non-financial support from Preventicus. Winfried März reports grants and personal fees from Siemens Diagnostics, Aegerion Pharmaceuticals, Amgen, AstraZeneca, Danone Research, Pfizer, BASF, Numares, and Berline-Chemie; personal fees from Hoffmann LaRoche, MSD, Sanofi, and Synageva; grants from Abbott Diagnostics; and other support from Synlab. Walter Mendoza is currently a Program Analyst for Population and Development at the Peru Country Office of the United Nations Population Fund. Ted Miller reports an evaluation contract from AB InBev Foundation. Frédéric Piel reports personal fees from Novartis. Postma Maarten reports grants from Mundipharma, Bayer, BMS, AstraZeneca, ARTEG, and AscA; grants and personal fees from Sigma Tau, MSD, GlaxoSmithKline, Pfizer, Boehringer-Ingelheim, Novavax, Ingress Health, AbbVie, and Sanofi; personal fees from Quintiles, Astellas, Mapi, OptumInsight, Novartis, Swedish Orphan, Innoval, Jansen, Intercept, and Pharmerit, and stock ownership in Ingress Health and Pharmacoeconomics Advice Groningen. Kazem Rahimi reports grants from the National Insitute for Health Research Biomedical Research Centre, Economic and Social Research Council, and Oxford Martin School. Mark Shrime reports grants from Mercy Ships and Damon Runyon Cancer Research Foundation. Jasvinder Singh reports consulting for Horizon, Fidia, UBM, Medscape, WebMD, the National Institutes of Health, and the American College of Rheumatology; they serve as the principal investigator for an investigator-initiated study funded by Horizon pharmaceuticals through a grant to DINORA, a 501c3 entity; they are on the steering committee of OMERACT, an international organization that develops measures for clinical trials and receives arms-length funding from 36 pharmaceutical companies. Jeffrey Stanaway reports a grant from Merck & Co. Cassandra Szoeke reports a grant from the National Medical Health Research Council, Lundbeck, Alzheimer's Association, and the Royal Australasian College of Practicioners; she holds patent PCT/AU2008/001556. Amanda Thrift reports grants from National Health and Medical Research Council, Australia. Muthiah Vaduganathan

receives research support from the NIH/National Heart, Lung, and Blood Institute and serves as a consultant for Bayer and Baxter Healthcare. Marcel Yotebieng reports grants from the US National Institutes of Health. All other authors declare no competing interests.

Data sharing

To download the data used in these analyses, please visit the Global Health Data Exchange at http://ghdx.healthdata.org/gbd–2017.

Acknowledgments

Research reported in this publication was supported by the Bill & Melinda Gates Foundation, the University of Melbourne, Public Health England, the Norwegian Institute of Public Health, St Jude Children's Research Hospital, the National Institute on Ageing of the National Institutes of Health (award P30AG047845), and the National Institute of Mental Health of the National Institutes of Health (award R01MH110163). The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders. Data for this research was provided by MEASURE Evaluation, funded by the United States Agency for International Development (USAID). Views expressed do not necessarily reflect those of USAID, the US Government, or MEASURE Evaluation. Collection of these data was made possible by USAID under the terms of cooperative agreement GPO-A-00-08-000_D3-00. The opinions expressed are those of the authors and do not necessarily reflect the views of USAID or the US Government. The data reported here have been supplied by the US Renal Data System. The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as an official policy or interpretation of the US Government.

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