Annex 4A. Global and Regional Causes of Death 2000 - 2015: Data and Methods

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1. Introduction

This Annex provides further methodological detail for Volume 9, Chapter 4 "Global and regional causes of death: patterns and trends, 2000-15". The statistics presented in this Chapter are drawn from the 2015 Global Health Estimates (GHE 2015) released by the WHO at the beginning of 2017 (1). The GHE estimates are available for years 2000, 2005, 2010 and 2015 for Member States and for selected regional groupings of countries, areas and territories, at **http://www.who.int/healthinfo/global_health_estimates/en/**. These estimates have been documented following the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) (2). Compliance with GATHER requirements is documented in a WHO Technical Paper (3).

Population and all-cause mortality estimates for years 2000-2015

WHO life tables were revised and updated for all Member States for years 1990-2015, drawing on the UN World Population Prospects 2015 revision (4), recent and unpublished analyses of all-cause and HIV mortality for countries with high HIV prevalence, vital registration data (5), and UN-IGME estimates of levels and trends for under-5 mortality (6). Annex Table D summarizes the methods used for preparing life tables. Data sources are documented in more detail in GHE Technical Paper 2016.2 (7). The WHO life tables are available in the Global Health Observatory at **http://apps.who.int/gho/data/node.main.LIFECOUNTRY?lang=en**

Grouping of countries by average income per capita

The summary results presented in Chapter 4 use World Bank classifications of national income (gross national income per capita) as of July 2014 to classify countries into four income categories: low, lower-middle, upper-middle, and high. These categories are defined in Annex Table B. Tables in Chapter 4 use a list of selected causes. The complete cause list is available in the downloadable Excel file "Annex 4A Cause of death results".

Cause of death categories

Annex Table A lists the cause of death categories and their definitions in terms of the ICD-10 codes of the International Classification of Diseases, Tenth Revision (ICD-10) (8). Note that these categories generally relate to the underlying cause of death as defined by the WHO International form for the medical certificate of cause of death and the ICD-10 definitions and coding rules.

2. Use of death registration data

Cause-of-death statistics are reported to WHO on an annual basis by country, year, cause, age and sex. These statistics can be accessed in the WHO Mortality Database (5). We used the vital

registration data recorded in the WHO Mortality Database to estimate cause-specific deaths. We analyzed the data using the following steps:

1) Application of inclusion criteria to select countries with high-quality vital registration data;
2) Extraction of deaths by cause group, with a short cause list and, if possible, a detailed cause list (depending on the cause tabulation used in each country-year);
3) Redistribution of deaths of unknown sex/age and deaths assigned to ill-defined (garbage) codes and adjustment for incomplete registration of deaths in some countries;
4) Interpolation/extrapolation of number of deaths for missing country-years;
5) Adjustments to take into account additional information for specific causes of death; and
6) Scaling of total deaths by age and sex to previously estimated WHO all-cause envelopes for years 2000-2015.

For these estimates, a total of 69 countries had data that met the inclusion criteria discussed below, of which 66 countries were reporting data coded to the third or fourth character of ICD-10 and 61 countries had data for years 2013 or later. Fourteen countries had reported data from 2015. Figure 1 provides an overview of the involved in preparing the complete dataset for GHE causes and categories for years 2000 to 2015 for the countries with death registration data reported to the WHO Mortality Database and which meet inclusion criteria. Details are provided below.

Inclusion criteria

We applied the following inclusion criteria to data in the WHO mortality database received as of end October 2016:

- The data are for a country that is currently a WHO Member State;
- The data are for a country whose population in 2015 was greater than 90,000;
- The data are available for 5-year age groups to ages 85 and over;
- At least five years of data are available during 2005-present;
- The data fulfill quality criteria pertaining to garbage codes and completeness, as described below.

Completeness of death registration data was assessed against estimated total deaths for the population as described in the WHO Technical Paper 2016.2 (7). We then calculated the proportion of deaths with underlying cause coded to a short list of so-called “garbage” codes:

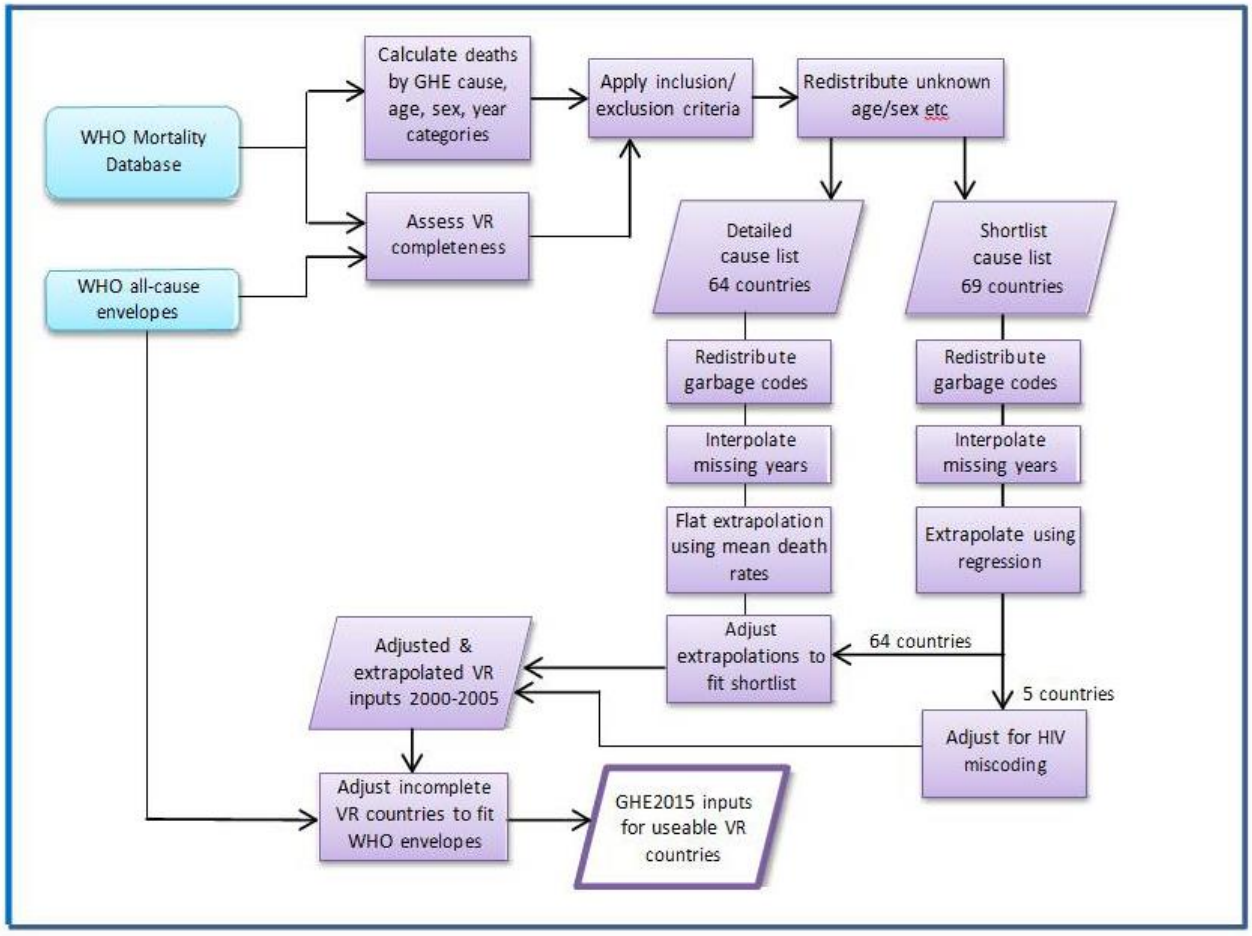
- symptoms, signs and ill-defined conditions (ICD10 codes R00-R99),
- injuries undetermined whether intentional or unintentional (ICD10 Y10-Y34, Y87.2),
- ill-defined cancers (C76, C80, and C97), and
- ill-defined cardiovascular diseases (I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9 and I70.9).

A summary usability score was calculated as follows:

(Percent Usable) = Completeness (%) * (1 - Proportion Garbage)

All countries with a mean percent usable below 65% during the period 2000 to latest available year were excluded (see Table 1). The quality of cause-of-death coding was further investigated in the remaining countries. The proportion of deaths assigned to an expanded list of ill-defined causes (3, Table 4.2) was calculated for each year in the period 2005-2014 (or latest available), and the mean proportion garbage during the period was calculated. Data from a country were excluded if the average proportion of ill-defined causes was above 25%. Based on this analysis, data from Argentina, Bulgaria, Fiji, Greece, Montenegro, Poland, and Syrian Arab Republic were excluded (Table 1).

Figure 1 Overview of the processes involved in the preparation of the GHE2015 dataset for Member States with death registration data meeting inclusion criteria.



Note: Refer also to Chapter Figure 4.1 for further steps involved in the inclusion of this dataset in the final GHE2015 estimates.

Some data were excluded despite fulfilling our inclusion criteria: from the Philippines, the years 1998-1999 and 2002 were excluded because the trends in specific causes were implausible, and data from Armenia for the years 2006 and 2008-2011 were excluded because it was not possible to map the data provided to WHO to the short cause list (Table 2). Data from South Africa were excluded because of high levels of miscoding of HIV deaths to other causes, not captured by the usability index. The estimation of HIV deaths for South Africa is described in Section 6.

For countries which did not meet the criteria for directly using death registration data to estimate causes of death, we drew on updated IHME single-cause analyses from the GBD2015 study (9-11), as described in Section 7. Note that the IHME modelling strategies do make use of the available death registration data (5) as well as other sources of information on deaths, covariate regression modelling and also draw on patterns of causes of death for similar countries.

Table 1 Characteristics[a] of Country Vital Registration Data and Inclusion/Exclusion

Country[b]	Years Available	Average usability	Range of completeness		Range of garbage		Notes
		2000- latest year					
Albania	1998-2009	60%	76%	85%	18%	28%	Excluded: low usability
Antigua and Barbuda	1998-2009, 2012-2014	78%	81%	95%	5%	18%	
Argentina	1998-2014	77%	98%	99%	19%	22%	Excluded: high proportion garbage
Armenia	1998-2003, 2012-2015	95%	91%	103%	4%	7%	Excluded: fewer than five years' data since 2005
Australia	1998-2004, 2006-2014	95%	100%	100%	5%	6%	
Austria	1998-2014	91%	100%	100%	1%	14%	
Azerbaijan	1998-2004, 2007	87%	94%	97%	2%	34%	Excluded: fewer than five data since 2005
Bahamas	1998-2013	87%	81%	103%	2%	8%	
Bahrain	2001, 2010-	61%	81%	100%	25%	33%	Excluded: low usability
Barbados	2000-2003, 2013	68%	71%	80%	8%	13%	
Belarus	1998-2003, 2007-2011, 2013-2014	80%	88%	95%	10%	15%	Summarized cause list used for all years
Belgium	1998-2013	87%	100%	100%	12%	15%	
Belize	1998-2014	76%	74%	90%	4%	13%	
Bolivia (Plurinational State of)	2000-2003	17%	35%	41%	48%	58%	Excluded: fewer than five years' data since 2005
Bosnia and Herzegovina	2011, 2014	73%	95%	95%	21%	24%	Excluded: fewer than five years' data since 2005
Brazil	1998-2014	83%	93%	100%	10%	21%	
Brunei Darussalam	1998-2014	91%	92%	103%	4%	9%	Summarized cause list used for all years
Bulgaria	1998-2013	76%	93%	98%	16%	28%	Excluded: high proportion garbage
Cabo Verde	2011	73%	95%	95%	23%	23%	Excluded: fewer than five years' data since 2005

Canada	1998-2012	94%	100%	100%	6%	8%	
Chile	1998-2014	94%	99%	100%	5%	11%	
Colombia	1998-2013	84%	80%	91%	5%	8%	
Costa Rica	1998-2014	87%	91%	98%	4%	7%	
Croatia	1998-2015	89%	100%	100%	6%	17%	
Cuba	1998-2014	92%	98%	100%	1%	9%	
Cyprus[d]	2004-2013	58%	66%	76%	10%	24%	
Czechia	1998-2015	89%	100%	100%	7%	15%	
Denmark	1998-2014	87%	100%	100%	12%	14%	
Dominican Republic	1998-2012	45%	50%	61%	8%	21%	Excluded: low usability
Ecuador	1998-2014	69%	79%	93%	14%	23%	
Egypt	2000-2011	56%	89%	94%	32%	41%	Excluded: low usability
El Salvador	1998-2013	63%	75%	84%	18%	26%	Excluded: low usability
Estonia	1998-2014	94%	100%	100%	5%	8%	
Fiji	2001-2009, 2011-2012	81%	103%	103%	9%	37%	Excluded: high proportion garbage
Finland	1998-2014	97%	100%	100%	2%	3%	
France	1998-2013	85%	100%	100%	14%	16%	
Georgia	1998-2001, 2004-2007, 2009-2014	61%	81%	100%	7%	69%	Excluded: low usability
Germany	1998-2014	88%	100%	100%	11%	14%	
Greece	1998-2013	74%	97%	100%	24%	27%	Excluded: high proportion garbage
Grenada	2001-2015	88%	87%	100%	5%	15%	
Guatemala	1998-2014	79%	90%	96%	9%	22%	
Guyana	1998-1999, 2001-2012	86%	76%	93%	6%	22%	
Haiti	1999, 2001-2004	6%	3%	15%	32%	52%	Excluded: fewer than five years' data since 2005
Honduras	2008-2013	13%	13%	15%	3%	7%	Excluded: low usability
Hungary	1998-2014	95%	100%	100%	4%	7%	
Iceland	1998-2015	94%	100%	100%	5%	10%	

Iraq	2008	54%	75%	75%	28%	28%	Excluded: fewer than five years' data since 2005
Ireland	1998-2013	95%	100%	100%	4%	8%	Summarized cause list used for some years
Israel	1998-2014	91%	100%	100%	8%	14%	
Italy	1998-2003, 2006-2012	91%	100%	100%	8%	12%	
Jamaica	2000-2006, 2009-2011	73%	73%	92%	5%	25%	
Japan	1998-2014	89%	100%	100%	9%	15%	
Jordan	2008-2011	61%	59%	86%	9%	10%	Excluded: fewer than five years' data since 2005
Kazakhstan	1998-2015	81%	84%	90%	3%	22%	Summarized cause list used for all years
Kiribati	1998-2001	51%	68%	79%	25%	35%	Excluded: fewer than five years' data since 2005
Kuwait	1998-2014	65%	63%	86%	8%	16%	Excluded: low usability
Kyrgyzstan	1998-2015	90%	92%	97%	3%	8%	
Latvia	1998-2014	90%	95%	98%	5%	11%	
Lithuania	1998-2015	92%	91%	99%	2%	6%	
Luxembourg	1998-2014	86%	100%	100%	12%	16%	
Malaysia	2000-2008	40%	46%	58%	21%	24%	Excluded: fewer than five years' data since 2005
Maldives	2000-2005, 2007-2008, 2010-2011	58%	84%	102%	13%	77%	Excluded: low usability
Malta	1998-2014	92%	100%	100%	5%	12%	
Mauritius	1998-2014	88%	96%	97%	7%	15%	
Mexico	1998-2014	95%	100%	100%	4%	6%	
Montenegro	2000-2009	67%	89%	94%	23%	29%	Excluded: high proportion garbage
Morocco	2008-2012	12%	21%	24%	46%	51%	Excluded: low usability
Netherlands	1998-2015	86%	100%	100%	13%	15%	
New Zealand	1998-2012	97%	100%	100%	3%	4%	
Nicaragua	1998-2013	60%	49%	72%	4%	11%	Excluded: low usability

Norway	1998-2014	88%	100%	100%	11%	13%	
Oman	2009-2010	49%	81%	84%	34%	46%	Excluded: fewer than five years' data since 2005
Panama	1998-2014	80%	86%	93%	8%	14%	
Paraguay	1998-2014	61%	66%	83%	14%	27%	Excluded: low usability
Peru	1998-2014	57%	61%	68%	5%	24%	Excluded: low usability
Philippines	2000-2001, 2006-2011	78%	85%	90%	9%	10%	
Poland	1999-2014	72%	98%	100%	25%	31%	Excluded: high proportion garbage
Portugal	1998-2003, 2007-2014	82%	100%	100%	14%	22%	Summarized cause list used for some years
Qatar	2001, 2004-2012	60%	65%	97%	22%	35%	Excluded: low usability
Republic of Korea	1998-2013	85%	97%	100%	13%	21%	
Republic of Moldova	1998-2015	83%	80%	90%	2%	7%	
Romania	1998-2015	92%	100%	100%	0%	8%	
Russian Federation	1998-2011	89%	91%	96%	4%	6%	Summarized cause list used for all years
Saint Lucia	1998-2006, 2008-2014	75%	76%	94%	6%	27%	
Saint Vincent and the Grenadines	1998-2015	93%	92%	104%	2%	10%	
Saudi Arabia	2009, 2012	21%	39%	39%	46%	48%	Excluded: fewer than five years' data since 2005
Serbia	1998-2014	80%	93%	96%	12%	18%	
Singapore	1998-2015	71%	68%	82%	1%	4%	
Slovakia	1998-2010, 2012-2014	94%	100%	100%	4%	11%	
Slovenia	1998-2013, 2015	89%	100%	100%	9%	12%	
South Africa	1998-2014	70%	81%	97%	19%	32%	Special methods used
Spain	1998-2014	90%	100%	100%	8%	12%	
Sri Lanka	1998-2003, 2006	72%	79%	102%	23%	32%	Excluded: fewer than five years' data since 2005
Suriname	1998-2014	64%	66%	79%	12%	22%	Excluded: low usability

Sweden	1998-2015	89%	100%	100%	10%	12%	
Switzerland	1998-2013	89%	100%	100%	10%	13%	
Syrian Arab Republic	1998-2010	72%	79%	103%	10%	35%	Excluded: high Proportion garbage
Tajikistan	1998-2005	78%	78%	83%	4%	9%	Excluded: fewer than five years' data since 2005
Thailand	1998-2000, 2002-2014	52%	79%	95%	31%	54%	Excluded: low usability
The former Yugoslav Republic of Macedonia	1998-2013	87%	96%	103%	9%	16%	Summarized cause list used for some years
Trinidad and Tobago	1998-2010	84%	81%	100%	2%	5%	
Tunisia	2009, 2013	22%	28%	30%	18%	27%	Excluded: fewer than five years' data since 2005
Turkey	1999-2002, 2004-2013	58%	47%	91%	8%	15%	Excluded: low usability
Turkmenistan	1998, 2012-2013	67%	77%	94%	3%	13%	Excluded: fewer than five years' data since 2005
Ukraine[d]	1998-2012, 2014	90%	89%	97%	2%	6%	Summarized cause list used for all years
United Arab Emirates	2005-2010	56%	59%	82%	18%	26%	Excluded: low usability
United Kingdom	1998-2014	93%	100%	100%	6%	8%	
United States of America	1998-2014	93%	100%	100%	7%	10%	
Uruguay	1998-2010, 2012-2014	83%	100%	100%	16%	18%	
Uzbekistan	1998-2005, 2009-2014	85%	81%	99%	2%	6%	Summarized cause list used for some years
Venezuela (Bolivarian Republic of)	1998-2013	82%	86%	90%	7%	9%	

a. Characteristics on data sources that are common to all sources are not listed in this table. Specifically, all data sources cover the national area unless otherwise noted, are death registration data based on medical certification of death, and cover all ages and both sexes.

b. Only data fulfilling the first three inclusion criteria listed above, e.g. member state, minimum population and detailed age grouping, are included in this table.

c. ICD-10 codes included in the "garbage" category are given in the text above. Additional garbage codes discussed in the text are not considered in this column.

d. Data are for areas under government control

Mapping to GHE cause list and redistribution of ill-defined causes

Included vital registration data were coded according to ICD9, ICD10, or one of several abbreviated cause lists derived from ICD9 or ICD10. Total deaths by cause, age and sex were mapped to the GHE cause list (Annex Table A). We used the complete cause list in Annex Table A if the data were coded using 3- or 4-digit ICD-10 codes or 4-digit ICD-9 codes. For all included data, we extracted the number of deaths by cause, age and sex, using the broad cause categories listed in Table 2 (hereafter "shortlist"). In some cases, counts of deaths were not available for specific causes of death. Specifically, chlamydia deaths were not available in the 4-digit ICD-9 codes. The mean fraction of other sexually transmitted disease deaths caused by chlamydia was calculated for each country-sex group and applied to all years of data for that country. If there were no deaths coded to other sexually transmitted diseases in a given country, the mean fraction for all other countries was used. Several causes of death are not available in death registration data coded using ICD10 at the 3-digit level: hepatitis C (acute infections), lymphatic filariasis, Japanese encephalitis, panic disorder, age-related vision disorders, congenital abdominal wall defect, and congenital oesophageal atresia. Deaths for all of these causes were assumed to be zero in the countries with data coded to ICD10 at the 3-digit level.

Deaths of unknown sex were redistributed pro-rata within cause-age groups of known sexes, and then deaths of unknown age were redistributed pro-rata within cause-sex groups of known ages. We redistributed deaths coded to symptoms, signs and ill-defined conditions (ICD10 codes R00-R94,R96- R99) pro-rata to all non-injury causes of death, and injuries with undetermined intent (ICD10 codes Y10- Y34) pro-rata to all injury causes of death, following previously published methods (12). Cancers with unspecified site (ICD10 codes C76, C80, C97) were redistributed pro-rata to all sites excluding liver, pancreas, ovary, and lung. Additionally, we redistributed cancer of uterus, part unspecified (C55) pro- rata to cervix uteri (C53) and corpus uteri (C54).

Previously published analyses of heart failure (13, 14) have proposed that these deaths be reassigned mainly to to ischemic heart disease (IHD; cause 1100), chronic obstructive pulmonary disease (COPD; cause 1180) in older adults, and to IHD, COPD, cardiomyopathy, myocarditis, and endocarditis (cause 1150) and congenital heart anomalies (cause 1440) in children, adolescents and young adults (destination causes for ill-defined deaths may be called target causes). Following these analyses, we redistributed heart failure and other ill-defined cardiovascular causes of death to IHD and COPD in adults over age 50 and to the four target causes—IHD, COPD, cardiomyopathy, myocarditis, endocarditis, and congenital heart anomalies in people under age 50. As these conditions have strong age and sex patterns, redistribution fractions were calculated by age and sex. We combined available data from three epidemiologically relevant regions, the traditional high-income countries, Eastern Europe and Central Asia, and other countries with usable death registration data, and calculated fractions for each target disease based on their relative frequency in the data. The redistribution fractions are available in the WHO Technical Paper (3).

The ICD-10 code ranges mapped to hypertensive heart disease (HHD) include codes for essential hypertension (I10), secondary hypertension (I15) and hypertensive renal disease (I12). Most deaths coded to essential hypertension are likely to be due to ischaemic heart disease, and additionally it is likely that a proportion of deaths coded to HHD are actually due to ischaemic heart disease in people who also had essential hypertension.

Based on a regression analysis of the logit of the proportion of deaths in the HHD category that were coded to essential hypertension against the crude HHD death rate, the predicted fraction of HHD deaths to be redistributed to IHD was estimated. It was set to 30% for country-years with HHD death rate less than 20 per 100,000. For certain outlier countries, it was set to country-specific values derived directly from the VR data: 50% (Brazil), 40% (France) and 37% (Argentina). Based on a similar analysis, 10% of HHD deaths were redistributed to "other chronic kidney disease", with specific higher values for Japan (18%), Mexico (30%) and the USA (15%).

In a number of countries, the deaths coded to the GHE category "other infectious diseases" result in unusually high death rates for this category. The GHE category includes a number of within-infectious- disease garbage codes: A49 Bacterial infection, unspecified; A89 Unspecified viral infection of the CNS; B34 Viral infection of unspecified site; B94 Sequelae of other and unspecified infectious disease; and B99 Other and unspecified infectious diseases. However, the numbers of deaths coded to these categories are insufficient to explain the outlier levels. Based on a regression the death rate for this category against the death rate for lower respiratory infections, fractions of the "other infectious disease" deaths were shifted to lower respiratory infections for all except shortlist countries. The average fraction was 13% with 20th percentile 4% and 80th percentile 29%. Countries with average fractions of 30% or more included Antigua and Barbuda, Belgium, Barbados, Grenada, Israel, Saint Lucia, Luxembourg, Norway, Sweden, Switzerland and St. Vincent and the Grenadines.

GHE categories 950 "Alzheimer disease and other dementias" and 1010 "Other neurological conditions" contain 84% of the deaths coded to neurological causes in the death registration data for 2000-2015. "Other neurological conditions" accounted for 15% on average, but in some countries accounted for much higher proportions of deaths, for example Uzbekhistan 63%, Guatemala 59%, Singapore 52%, Colombia 52%, Philippines 46%, Mexico 44%, Brazil 30%. Based on a regression of the log of the "Other neurological conditions" death rate against the log of the death rate for dementias, excess "other neurological" deaths above the predicted rate were shifted to the dementia category.

Similar issues occurred for chronic respiratory disease categories, with high proportions of deaths coded to "other respiratory diseases" in some countries. When the proportion of chronic respiratory disease deaths in the "other respiratory diseases" category exceeded the initial average value of 0.15, it was rescaled to fall in the range 0.15 to 0.5 (one standard deviation above the mean). The excess deaths in the "other" category were shifted pro-rata by age and sex to COPD and asthma cause categories.

Interpolation and extrapolation for missing country-years

For many countries, data were missing for some years. In order to create a continuous time-series of data from 2000 to 2015, we interpolated mortality rates for each country and cause, and then extrapolated up to six years of data at the beginning and end of the data series as described elsewhere (3)

For five countries, only data grouped by the shortlist in Table 4.6 were used, either because too few years' (Brunei Darussalam and Kazakhstan) or no data (Russian Federation, Ukraine and Belarus) were reported by ICD code. Shortlist categories were expanded by using the cause-fraction distribution within each shortlist category by year, age, sex from the GBD2013 study results (9-11). For Russia, Belarus and Ukraine, HIV deaths recorded in the death registration data were substantially miscoded to tuberculosis (cause 30), lower respiratory infections (390), other infectious diseases (370), lymphomas and multiple myeloma (760), other malignant neoplasms (780), and endocrine, blood and immune disorders (810). Deaths in these categories falling in the characteristic HIV age pattern were recoded to HIV (100), according to the age-sex-specific HIV mortality estimates from UNAIDS (Section 6).

Adjustment of specific causes

Estimates for tuberculosis deaths were compared with the WHO estimates (also based on an analysis of death registration data and surveillance data) and where the death registration numbers were lower, an average of the two sets of estimates was used. This affected mainly small countries (Antigua and Barbuda, Barbados, Grenada, Iceland, Kuwait, and Luxembourg.

Estimates for HIV deaths were compared with UNAIDS/WHO estimates. For seven mainly small countries, an average of the two sets of estimates were used: Bahamas, Barbados, Guatemala, Jamaica, Saint Lucia, The Former Yugoslav Republic of Macedonia, and Saint Vincent and the Grenadines.

Estimates for malaria deaths were compared with WHO estimates (see Section 6) and replaced by WHO estimates for seven countries where the WHO estimates summed across all years were lower than those from the death registration data. This affected malaria deaths for Brazil, Columbia , Ecuador, Guatemala, the Republic of Korea, Panama and the Philippines.

WHO estimates for maternal deaths include an upwards adjustment for under-recording of maternal deaths in death registration data (15). Maternal deaths were adjusted using these country-specific factors, and all other causes adjusted pro-rata.

Relatively small numbers of deaths coded to depression in some countries were re-assigned to suicide.

Deaths due to alcohol and drug use disorders include alcohol and drug poisoning deaths coded to the injury chapter of ICD (see Annex Table A). These were adjusted as described in Section 6 to re- allocate unspecified drug dependence, multiple drug use, and unspecified poisoning.

Where necessary, road injury deaths were adjusted upwards to take account of additional surveillance data provided by countries (see Section 6). Homicide deaths were similarly adjusted where relevant to take account of homicide data from the police/justice sector (see Section 6).

Table 2 Short cause list used for vital registration data coded using ICD-9 or ICD-10 abbreviated cause lists

GHE Code	Shortlist Cause Category
10	I. Communicable, maternal, perinatal, and nutritional conditions
20	A. Infectious and parasitic diseases
30	A1. Tuberculosis
100	A3. HIV/AIDS
220	A9a. Malaria
380	B. Respiratory infections
390	B1. Lower respiratory infections
420	C. Maternal conditions
490	D. Neonatal conditions
540	E. Nutritional deficiencies
600	II. Noncommunicable Diseases
610	A. Malignant neoplasms
620	A1. Mouth and oropharynx cancers
630	A2. Oesophagus cancer
640	A3. Stomach cancer
650	A4. Colon and rectum cancers
660	A5. Livery cancer
680	A7. Trachea, bronchus and lung cancers
700	A9. Breast cancer
710	A10. Cervix uteri cancer
740	A13. Prostate cancer
800	C. Diabetes mellitus
820/940	E/F. Mental and neurological disorders
1100	H. Cardiovascular diseases
1130	H3. Ischaemic heart disease
1140	H4. Stroke
1170	I. Respiratory diseases
1180	I1. Chronic obstructive pulmonary disease
1190	I2. Asthma
1200	I3. Other respiratory diseases
1210	J. Digestive disorders
1230	J2. Liver disorders
1260	K. Genitourinary diseases
1400	N. Congenital anomalies
1510	III. Injuries
1520	A. Unintentional injuries
1530	A1. Road injury
1600	B. Intentional injuries
1610	B1. Self-harm
1620	B2. Interpersonal violence
1630	B3. Collective violence and legal intervention

Estimates of deaths due to conflicts (see Section 6) were compared with estimates from the death registration data year by year and added "outside-the-envelope" for country-years where they are not included in death registration data.

3. Causes of death for children under age 5 years

General estimation process

Cause-specific estimates of deaths for children under age 5 were estimated for 15 cause categories using methods described elsewhere (16, 17). The fifteen cause categories used for the WHO-MCEE estimates of under 5 deaths for years 2000-2015 (see Annex Table D) include all the major causes of neonatal (0-27 days), postneonatal (1-59 months) and 1-4 year deaths and two residual categories containing all remaining causes of death. These residual categories ("Other Group 1" and "Other Group 2"). Cause groups such as "Congenital malformations" and "Injuries" were expanded to the full GHE cause list (Annex Table A) for neonatal and under 5 deaths using sub-cause distributions derived from the GBD2015 estimates (9-11). Note that the WHO-MCEE cause estimates and the GBD2105 sub-cause distributions are derived from death registration data for those countries with useable death registration data.

Child deaths in China

Cause-specific estimates of deaths for children under age 5 in China were estimated for 15 cause categories using data obtained from China Maternal and Child Surveillance System (MCMSS) for years 2000-2015 by age-sex-residency-region strata (17). The fifteen cause categories used for the WHO-MCEE estimates of under 5 deaths for years 2000-2015 (see Annex Table D) include all the major causes of neonatal deaths (0-27 days), and deaths at ages 1-59 months and two residual categories containing all remaining causes of death. These residual categories ("Other Group 1" and "Other Group 2") and cause groups such as "Congenital malformations" and "Injuries" were expanded to the full GHE cause list (Annex Table A) for neonatal and under 5 deaths using cause distributions derived from the GBD2015 estimates for child causes estimates (9-11).

Child deaths in India

In order to estimate trends in under 5 causes of death for India, subnational analyses were used to develop national estimates for years 2000-2015. For neonates, a verbal autopsy multi-cause model (VAMCM) based on 37 sub-national Indian community- based VA studies was used to predict the cause distribution of deaths at state level. The resulting cause- specific proportions were applied to the estimated total number of neonatal deaths to obtain the estimated number of deaths by cause at state level prior to summing to obtain national estimates (17).

For children who died in the ages of 1-59 months in India, the multi-cause model (17) was run on 49 subnational datasets, including 27 new study data points of sub-national community-based VA studies, plus 22 sets of observations for the Indian states derived from the Million Death Study (18). Nine cause categories were specified, including measles plus the eight specified in the post-neonatal

VAMCM for other countries. State-level measles deaths were then normalized to fit the national measles estimates produced by the WHO IVB. State- level AIDS and malaria estimates were provided by UNAIDS and WHO malaria program, respectively. All cause fractions were adjusted to sum to one. The state-level estimates were collapsed to obtain national estimates at the end.

4. Causes of death for China 2000-2015

Cause-specific mortality data for China were available from three sources – the sample vital registration (VR) system data for years 1987 to 2012 (19), summary deaths tabulations from the Diseases Surveillance Points (DSP) system for years 1995-1998 and 2004-2012 (20, 21) and the newly merged and expanded VR and DSP system for 2013, referred to as the Death Registration (DR) system (22). The Death Registration system also includes larger numbers of in-hospital deaths so that the total deaths recorded in the system reached 4 million deaths in 2012 (23). The numbers of deaths recorded in the sample representative sites for DSP, VR and DR systems is summarized in Table 3 below.

Table 3. Total deaths and population covered by the Chinese vital registration system (VR), the Disease Surveillance Points system (DSP) and the newly merged Death Registration system (DR)

	Number of Deaths			Population		
Year	VR	DSP	DR	VR	DSP	DR
2000	711,946	…	…	117,183,678	…	…
2001	…	…	…	…	…	…
2002	…	…	…	…	…	…
2003	626,392	…	…	102,889,945	…	…
2004	295,906	430,994	…	55,288,841	71,173,205	…
2005	310,826	437,490	…	57,272,144	71,487,277	…
2006	379,057	347,057	…	72,240,261	66,012,299	…
2007	475,289	401,008	…	79,101,646	71,476,477	…
2008	471,219	424,683	…	…	73,928,499	…
2009	505,021	437,550	…	…	75,020,489	…
2010	558,915	453,211	…	90,158,748	78,766,626	…
2011	775,458	437,490	…	124,960,668	77,396,478	…
2012	929,249	459,836	…	147,969,227	77,215,997	…
2013	…	…	1,463,851	…	…	227,236,284

Note: … data not available.

These sets of data were assessed and compared for suitability in estimating 2000-2015 cause-specific mortality for China at the national level. The VR and DSP datasets gave quite similar cause distributions at major cause group level by age, across the period 2000-2010. Additionally, comparison for more detailed major causes of death did not give any clear indication that one data set was of systematically higher quality than the other. With the merger of the two systems in 2013, and the expansion of urban sample sites, the urban-rural composition of the sampled populations changed to be more nationally representative. For earlier years, WHO analyses had re-weighted urban and rural samples from DSP and VR to give approximate national representativeness. However, the DR dataset for 2013 also uses a different set of cause categories, not entirely consistent with the earlier datasets. We mapped cause categories from the three datasets to GHE cause categories and examined the resulting cause-specific time trends. There were inconsistencies between the DSP+VR based results and the 2013 results which were not resolvable given the available cause-specific information.

We also compared these results with the GBD2015 national cause-specific trends for China and found reasonable consistency for the 2015 results for most but not all causes. For causes for which WHO has specific estimates as described in Section 6, these estimates were used. For other causes, cause fractions from the GBD2015 estimates were used, adjusted to the WHO envelope for these causes. The GBD2015 estimates were derived from available Chinese data on causes of death at national and sub-national levels, with major inputs coming from the DSP and VR sample systems for years 2000-2012, with additional data on deaths in Chinese hospitals (23).

Estimates for road injury deaths were revised based on analysis of the DR 2013 data. The estimated total road injury deaths for China in 2013 was revised upwards from 261,000 to 272,000, which is still somewhat lower than the 310,000 estimated by GBD2015.

The following GBD2015 cause fractions were adjusted based on comparisons with 2013 data: 17% increase for diabetes, 17% increase for epilepsy, 53% increase for “other neurological”, increase in 2000 of 6% dropping to 0% in 2010 and beyond for COPD (based on trend in VR/DSP data for 2000-2010), increase in 2000 of 20% dropping to 0% in 2010 and beyond for “other respiratory” (based on trend in VR/DSP data for 2000-2010, and approximately 5% increase across all years for suicide.

5. Causes of death for India 2000-2015

Analysis of causes of death for India was based on data from the Sample Registration system (SRS) for the periods 2001-2003 (24, 25) and 2010-2013 (26, 27). These data were derived from representative samples of deaths in the SRS sampling areas, for which verbal autopsy methods were used to assign cause of death. The Sample Registration System monitors a representative sample population of over 6 million people in over 1 million homes in India. In 2013, a total of 7,597 sample units covered a total population of 7.5 million people, of whom 2.0 million were in urban areas and 5.5 million in rural areas.

In 2001 the Indian Registrar General Surveyor introduced an enhanced form of verbal autopsy for assessing the cause of death. Verbal autopsy is a method of ascertaining the cause of death by interviewing a family member or caretaker of the deceased to obtain information on the clinical signs, symptoms and general

circumstances that preceded the death. Details of methods and validation have been reported elsewhere (25, 26). Verbal autopsy reports were independently coded to ICD-10 categories by at least two of a total of 130 physicians trained in ICD-10 coding. In case of disagreement on the ICD-10 codes at the chapter level, reconciliation between reports was conducted, followed by a third senior physician's adjudication.

A total of 122,848 deaths between January 2001 and December 2003, and a total of 182,827 deaths for 2010-2013 were assigned causes of death by verbal autopsy. Verbal autopsies could not be conducted for around 10% of the deaths for reasons such as family migration or change of residence. National estimates for deaths and mortality rates were based on reweighted urban and rural estimates for India, by age, sex and area.

The GHE analysis is based on the resulting national-level cause-specific mortality proportions derived for GHE cause categories from the SRS data. GBD2015 cause fractions were used to redistribute deaths to detailed sub-cause categories in cases where the SRS cause categories were broader than the GHE cause categories.

For causes for which full time series estimates for years 2000-2015 were not available from WHO technical programs and UNAIDS (see Section 6), the trends for the full period 2000-2015 were estimated as follows. We made use of the trends estimated in the GBD2015 study (9). The GBD2015 estimates for years 2000-2015 were rescaled for consistency with the total deaths across all such causes estimated from WHO life tables and cause-specific estimates. Age-sex-cause specific ratios of SRS-based deaths to rescaled GBD2015 deaths were calculated from the SRS data for period 2002 (2001-2003) and 2011.5 (2010-2013). The scale factors were linearly interpolated for years 2003-2011 and extrapolated to year 2000 and 2015. They were then applied to the GBD2015 estimates to generate full time series for these causes consistent with the WHO analyses of the SRS data for 2001-2003 and 2010-2013. The remaining cause-specific estimates were based on information from WHO technical programs and UNAIDS on specific causes as described in Section 6.

6. Methods for specific causes with additional information

Tuberculosis

For countries with death registration data, tuberculosis mortality estimates were generally based on the most recently available vital registration data. For other countries, total tuberculosis deaths were derived from published WHO estimates (28), together with more detailed unpublished age distributions based on the VR data and notifications data.

HIV/AIDS

For 43 countries with significant HIV epidemics, explicit efforts were made to ensure consistency of all- cause and HIV mortality estimates across the period 2000-2015 in the 2016 revision of WHO life tables and all-cause mortality "envelopes" (7). These countries are identified in Annex Table C. For

these countries, HIV mortality estimates from either UN Population Division (4) or UNAIDS (29) were revised using updated Spectrum models for 1985-2015. These models took into account the WPP 2015 revisions to demographic data and all-cause mortality, as well as 2015 UNAIDS files with a range of 2016 updates to the Spectrum/AIM software including new patterns of adult mortality on ART and age at ART initiation among pediatric patients and the re-fitting of all the EPP curves (7, 30).

For South Africa, there were inconsistencies between the HIV mortality estimates of UNAIDS and UN Population Division, all-cause mortality estimates and implied completeness of death registration. We decided to maximise consistency with previous WHO estimates of HIV and non-HIV mortality for years 2000-2012 released in 2014, and which had taken explicit account of an analysis of miscoded HIV deaths in the death registration data. A more detailed summary of the adjustments for South Africa are given in a WHO Technical Paper (3).

For countries with death registration data, HIV/AIDS mortality estimates were generally based on the most recently available vital registration data except where there was evidence of misclassification of HIV/AIDS deaths. In such cases, a time series analysis of causes where there was likely misclassified HIV/AIDS deaths was carried out to identify and re-assign such deaths.

For other countries, estimates were based on UNAIDS estimated HIV/AIDS mortality (29). UNAIDS does not estimate HIV deaths for the following countries: Comoros, Libya, Micronesia, Samoa, Seychelles, Solomon Islands, Tonga and Vanuatu. HIV estimates for these countries were based on previous WHO GHE2013 estimates with projections. It was assumed based on advice from UNAIDS that 1% of HIV deaths under age 5 occurred in the neonatal period.

Malaria

For countries in which death reporting was estimated to capture > 50% of all deaths and a high proportion of malaria cases were parasitologically confirmed, reported malaria deaths were adjusted for completeness of death reporting. For countries in elimination program phase, reported malaria deaths were adjusted for completeness of case reporting.

For countries (i) outside the African Region in which death reporting is estimated to capture ≤ 50% of all deaths or a high proportion of malaria cases are *not* parasitologically confirmed, or (ii) in the African Region where estimates of case incidence were derived from routine reporting systems and where malaria comprises less than 5% of all deaths in children under 5,[1] case fatality rates were used to derive number of deaths from case estimates. A case fatality rate of 0·256% was applied to the estimated number of *P. falciparum* cases, being the average of case fatality rates reported in the literature (31-33) and unpublished data from Indonesia, 2004-2009 (*correspondence with Dr. Ric Price, Menzies School of Health Research*). A case fatality rate of 0.0375% was applied to the estimated number of *P. vivax* cases, representing the mid-point of the range of reported case fatality rates (34). The number of cases reported by a Ministry of Health was adjusted to take into account (i) incompleteness in reporting systems (ii) patients seeking treatment in the private sector, self-medicating or not seeking treatment at all, and (iii) potential over-diagnosis through the lack of

[1] Algeria, Botswana, Cape Verde, Comoros, Eritrea, Ethiopia, Madagascar, Namibia, Sao Tome and Principe, South Africa, Swaziland, and Zimbabwe

laboratory confirmation of cases.

For countries in the African Region where malaria comprises 5% or more of all deaths in children under 5, malaria deaths were estimated using a multinomial logistic regression model fitted to available verbal autopsy data sets as part of the analysis of under 5 causes of death (Section 5). The regression model included as a key covariate the geospatial estimates of parasite prevalence rates produced by the Malaria Atlas Project at Oxford University in close collaboration with WHO (35).

The estimated malaria mortality rate in children under 5 years for a country was used to determine malaria transmission intensity and the corresponding malaria-specific mortality rates in older age groups (36).

Whooping cough and measles

Estimates of pertussis mortality were based on a model using pertussis immunization coverage (37). Age-, country-, and immunization history- specific estimates of the probability of initial infection, probability that an infected individual develops typical symptoms of a case of pertussis and the probability that a case of pertussis will die were estimated using structured expert judgment (38). Annual deaths attributable to pertussis infection during the infant period and 12-59 months of age were estimated for each country for the years 2000 – 2012. The pertussis cause fraction was assumed to be constant to extrapolate forwards to 2015.

Measles cases were estimated using surveillance data together with a dynamic model to to take into account trends in case notifications and vaccine coverage up to and including the year 2015 (39, 40). The cases are then stratified by age classes based on a model fitted to data stratified by national GDP and vaccine coverage. Deaths were then estimated by applying to age- and country-specific case fatality ratios (41-43). Pertussis and measles deaths at ages 5 and over were estimated from useable death registration data or GBD2015 analyses.

Hepatitis-attributable deaths

For liver cancer and cirrhosis of the liver, the GBD2015 estimated deaths for four aetiological categories: hepatitis B virus (HBV) infection, hepatitis C virus (HCV) infection, alcohol, and "other causes". DisMod- MR 2.1 was used to model the proportions of liver cancers and liver cirrhosis due to these four sub- causes using data derived from systematic reviews of literature on the aetiology of liver cancers and liver cirrhosis (10).

IARC has also carried out an analysis of the hepatitis B and hepatitis C fractions of total liver cancer cases. Estimates for 50 countries have been published (44) and regional and global estimates are in preparation (45). Since there is considerable time lag between hepatitis infection and death from liver cancer, the proportions attributable to HBV and HCV infection relate to hepatitis seroprevalence distributions in the past, when hepatitis C was less prevalent than in recent years. The time series used in the IARC paper vary from country to country depending on available data, but typically contain data ranging from the early 1990s to the early 2000s, in some cases out to 2010. The data for China are for the range 1954-2010. Details of the time periods for the data used in the IHME analyses were not available. On the other hand, the IHME analyses included a complete set of subcause categories as they also estimated alcohol and other causes as well as hepatitis infection (ensuring that all cause fractions add to 100%). The IARC analyses address only hepatitis B and C with the

potential for over- estimation of causal fractions.

In estimating the sub-causes of liver cancer and cirrhosis for GHE2015, we drew on the GBD2015, GBD2013 and IARC analyses as follows. The GBD2015 cause fractions for liver cancer were revised pro- rata to adjust the HBC fraction of HBV+HCV caused liver cancer by country/region group to the IARC estimates. We also revised the "other" category downwards to the proportions estimated in GBD2013, shifting the excess deaths to HBV and HCV. This resulted in an overall estimate of the fraction of liver cancer attributable to hepatitis (HBV or HCV) similar to the IARC estimates (3). Cirrhosis death attributions were similarly adjusted drawing on the HCV/HBV proportions estimated for liver cancer.

Schistosomiasis

For the WHO update of burden of disease for year 2004 (46), very limited available data was used to conservatively estimate annual case fatality rates for prevalent cases at 0.01% for *S. mansoni*, 0.02% for *S. haematobium*, and 0.03% for *S. japonicum* and *S. mekongi*. There were estimated to be 261 million prevalent cases of schistosomiasis infection in 2004. The GBD2015 study estimated that there 252 million prevalent cases of schistosomiasis infection in 2015, and 4,365 deaths due to schistosomias, giving an implied average case fatality rate of 0.002%, an order of magnitude lower than earlier WHO estimates. The GBD2015 implied case fatality rates for the Middle East and North Africa, for Latin America, and for Southeast Asia, East Asia and the Pacific were 0.009%, 0.017% and 0.08% respectively. These were substantially higher than the implied African case fatality rate of 0.001%. Revised case fatality rates of 0.0075% for *S. mansoni*, 0.015% for *S. haematobium* were applied to the prevalence rates estimated by GBD2015 (47) to revise the estimates of schistosomiasis deaths for GHE. This resulted in an estimate of 21,170 deaths in sub-Saharan Africa and 24,067 deaths globally in 2015.

Cycsticercosis, echinococcosis and food-borne trematodes

In 2015, the WHO Foodborne Disease Burden Epidemiology Reference Group (FERG) published regional and global estimates of deaths and DALYs for cysticercosis, echinococcis, and food-borne trematodosis for the year 2010 (48, 49). The GBD2015 time series estimates of deaths for these three diseases were scaled to match the underlying FERG estimates of deaths by country in 2010.

Rabies

Previous WHO estimates of rabies deaths for years 2000-2012 (50) were updated as follows. Total rabies deaths for China for years 2011-2015 were based on more recent data on reported human rabies deaths from the Chinese Center for Disease Control and Prevention (51, 52). Rabies deaths for India were revised based on the reported deaths in the Indian SRS data for years 2001-2003 and 2010-2013 (see Section 5). For other countries with more than 10 estimated rabies deaths per year, years 2013 to 2015 were projected assuming an average annual rate of decline of 4% based on the trend in the GBD2013 estimates.

Leprosy

The GBD2015 estimated that there were 514,200 prevalent cases of leprosy in 2015, with 35% of these in India. Although cause of death data for both India and China contained leprosy deaths, the GBD2015 estimated zero deaths globally. The implied case fatality rate for India of 2% was applied to GBD2015 estimates of leprosy cases across all countries. Resulting global deaths for leprosy in 2015 were just over 15,900.

Ebola

Deaths directly resulting from Ebola virus infection in 2014 and 2015 in Liberia, Sierra Leone and Guinea were estimated using the "medium" scenario estimates of Helleringer and Noymer (53). They estimated Ebola deaths for three scenarios as follows: a "low" scenario where they consider that no cases went unrecorded, and a high scenario where they consider that there 2.5 times more cases than recorded. The medium scenario considers 70% more cases than recorded.

The Ebola outbreak overwhelmed the healthcare systems of Guinea, Liberia, and Sierra Leone, reducing access to health services for diagnosis and treatment for the major diseases that are endemic to the region: malaria, HIV/AIDS, and tuberculosis. Parpia et al. (54) modelled the impact of reduced access to health services on the mortality rates for these three diseases. We took their modelled impact of a 50% reduction in treatment coverage to estimate the additional deaths for malaria (under 5), HIV(ages 15 +) and tuberculosis (all ages). Their estimates related to March 2014 to March 2015, and we assumed the coverage collapse would have covered half a year in 2014 and half a year in 2015. For Liberia, there were very few Ebola deaths in 2015 compared to 2014, so we reduced the coverage collapse to 1/3 of 2015.

Takashi et al (55) estimated the likely increase in measles deaths resulting from disruption of childhood vaccinations during the Ebola outbreak. They projected that after 6 to 18 months of disruptions, a large cluster of children unvaccinated for measles would have accumulated across the three countries, increasing the expected sizes of regional measles outbreaks and resulting in an additional 5,200 deaths (range 2,000 – 16,000). Data reported to WHO from the case-based measles surveillance systems for all three countries to 31 March 2016 confirmed that there were outbreaks of measles in 2015 in all three countries, although it is likely that reported cases do not accurately reflect the magnitude of the outbreaks. We conservatively adjusted the 2015 measles deaths to include outbreaks of the same magnitude as those estimated for 2014 for deaths under age 5, and to increase the 2015 deaths over age 5 so they were 10% higher than those in 2014.

We explored options for estimating other impacts of health system collapse during the Ebola epidemic, but decided to limit the estimates to those outlined above, for two reasons. First, the impact on HIV, TB, malaria and measles may be higher because of the direct impact on interventions with a big effect on mortality (ART, DOTs, antimalarials, vaccination) and second, it's not clear that there would have been much pre-Ebola health system impact on other causes (particularly for adults).

The estimated direct and indirect mortality impacts of the Ebola epidemic, included in GHE2015, are summarized in Table 4 on the following page.

Table 4 Estimated direct and indirect additional deaths associated with the West African Ebola outbreak of 2014-2015

	2014	2015	Under 5	Over 5	Total
Guinea					
Ebola	2,635	1,105	324	3,416	3,740
TB	849	847	336	1,361	1,697
HIV	339	288	-	627	627
Measles	-	550	450	100	550
Malaria	2,197	2,082	4,199	80	4,279
Total	**6,021**	**4,872**	**5,309**	**5,583**	**10,892**
Liberia					
Ebola	5,412	155	307	5,260	5,567
TB	830	560	215	1,175	1,390
HIV	112	73	-	186	186
Measles	-	145	119	25	145
Malaria	420	253	627	46	673
Total	**6,774**	**1,186**	**1,268**	**6,693**	**7,961**
Sierra Leone					
Ebola	9,025	1,580	952	9,653	10,605
TB	787	803	324	1,267	1,590
HIV	106	94	-	199	199
Measles	-	4,533	4,532	1	4,533
Malaria	1,576	1,347	2,844	78	2,923
Total	**11,493**	**8,357**	**8,652**	**11,198**	**19,851**
Total					
Ebola	17,072	2,840	1,583	18,329	19,912
TB	2,466	2,211	875	3,802	4,677
HIV	557	455	-	1,012	1,012
Measles	-	5,228	5,101	127	5,228
Malaria	4,193	3,682	7,670	204	7,875
Total	**24,288**	**14,415**	**15,229**	**23,474**	**38,703**

Maternal causes of death

Country-specific estimates for maternal mortality were based on the Interagency estimates for years 2000-2015 (56). A multilevel regression model for the proportion of total female deaths in the age range 15-49 that were due to maternal causes (PM) was developed using available national-level data from surveys, censuses, surveillance systems and death registration. This regression model included national income per capita, the general fertility rate and the presence of a skilled attendant at birth (as a proportion of total births) as covariates to predict trends in maternal mortality.

Because the WHO life tables, and hence the total female deaths in the maternal age range, were revised

in 2016, the interagency PM estimates have been applied to the new envelopes to estimate numbers of maternal deaths. This has resulted in changes in the estimates of maternal deaths for some countries with substantial revisions to all-cause mortality, and small changes to regional and global total maternal deaths.

Note that the maternal mortality estimates include those HIV deaths occurring in pregnant women or within 42 days of end of pregnancy which were considered to be indirect maternal deaths rather than incidental. These HIV maternal deaths were subtracted from total HIV deaths as estimated by UNAIDS.

Cancers

Cause-specific estimates for cancer deaths in 2012 were derived from Globocan 2012 (57). For countries without useable death registration data, site-specific deaths were projected back to year 2000 using trend estimates from the GBD2015. For countries with useable death registration data, cancer deaths by site were estimated from the death registration data directly with the various adjustments and redistributions described in Section 4. Karposi sarcoma was excluded from the Globocan estimates as this is almost entirely a manifestation of HIV/AIDS, already included in the estimates for HIV/AIDS deaths.

Alcohol use and drug use disorders

The injury codes for accidental poisoning by alcohol and by opioids are now used to code acute intoxication deaths from alcohol and acute overdose deaths by opioids. These deaths have been remapped to alcohol use disorders and drug use disorders respectively (see Annex Table A). The GBD2015 attributed deaths coded to the ICD-10 code X49 "Accidental poisoning due to other and unspecified chemicals" pro-rata to the GBD drug-type cause categories for drug use disorders, based on the similarity of the age patterns for unspecified poisoning to those for drug overdose. This resulted in a relatively large proportion of drug use disorder deaths for the "other drug use disorders" category. Based on a literature review that identified opioid-dependency as a large contributor to the deaths in the "other drug use disorders" category, particularly where multiple drug use was involved (10, page 150), the GBD2015 redistributed a large (but undocumented) proportion of the "other drug use" deaths to the "opioid use disorder" category.

An analysis of the age pattern of "Other drug use disorders" for Australia and the USA and comparison with the age patterns for "Opioid drug use disorders" and for accidental poisoning by prescription drugs, also confirmed that the resulting GBD2015 "Other drug use disorders" should be re-attributed in part to opioid use disorders. Analysis of detailed Australian data for deaths coded to ICD-10 code F19 "Multiple drug use, other and unknown drug use" has shown that around 77% of these deaths involve opioid drugs (58). Based on the adjustment needed to match this result, 24.3% of "other drug use" deaths were re-attributed to opioid use disorders.

The resulting global deaths for opioid use disorders of 127,373 in 2015 were thus somewhat higher than the 122,048 estimated by the GBD2015 for the year 2015. Note that these are deaths directly caused by opioid use, and exclude suicides or homicides involving opioids. Total attributable deaths for opioid use would be much higher as they include deaths due to infectious diseases transmitted

via re-use of injecting equipment, as well as deaths due to road injury and suicide. The UNODC's World Drug Report 2015 estimated there were 187,100 (98,300-231,400) drug-related deaths globally in 2013, based on reports from its Member States (59). This is surprisingly close to the WHO estimate of 160,946 for drug use disorder deaths in 2013, but less than half of WHO draft estimates for total deaths from all causes attributable to drug use.

Road injuries

For the third WHO Global status report on road safety (60), updated estimates of road injury deaths were prepared for 182 Member States for the years 2000-2013. These estimates drew on death registration data, on reported road traffic deaths from official road traffic surveillance systems (collected in a WHO survey of Member States for the report), and on a revised regression model for countries without useable death registration data. Road injury deaths were projected forward to 2015 using recent trends in death registration data where available, or the trend for recent years to 2015 from the GBD2015. Road injury deaths for Libya reported in the third WHO Global status report on road safety were considerably higher than for any other country (based on country-reported surveillance data) and were revised downwards using the road injury regression model estimates predicted for Libya from relevant covariates such as vehicle ownership.

Homicide

Updated estimates of homicide deaths for WHO Member States were published by WHO for years 2000-2012 in the Global status report on violence prevention 2014 (61), drawing on data from vital registration and criminal justice systems. These were projected forward to 2015 using recent trends in death registration data where available, or the trend for recent years to 2015 from the GBD2015.

Conflict and natural disasters

Estimated deaths for major natural disasters were obtained from the EM-DAT/CRED International Disaster Database (63). Country-specific estimates of war and conflict deaths were updated for the entire period 1990-2015 using estimates of direct deaths from three datasets: *Battle-Related Deaths (version 5), Non-State* Conflict *Dataset (UCDP version 5),* and *One-sided Violence Dataset (UCDP version 5)* from 1989 to 2014 (64-66). Using these three datasets, instead of focusing solely on battle-related deaths, reduces the likelihood that overall direct conflict deaths are underestimated. However, it is likely that a degree of undercounting still occurs in the count-based datasets, and an adjustment factor of 1.91 was applied to the annual battle death main estimates for state-state conflicts (7, Annex 4B). No adjustments were applied to estimated conflict deaths (main estimates) for non-state conflict deaths, and one-sided violence. Note that the application of a single adjustment factor for all state-state conflicts may result in deaths for specific conflicts being over- or under-estimated.

For several conflicts where more specific sources of information are available, these were used to revise estimated deaths:

Iraq	Latest counts of reported deaths in Iraq by the Iraq Body Count (67) were compared with conflict deaths for the period 2003-2006 estimated from the Iraq Family Health Survey 2006 (68). Calendar year adjustment factors for under-reporting in the Iraq Body Count data ranged from 3.3 (2003) and 3.4 (2004) to 2.3 (2006) and 2.2 (2007). An average adjustment factor of 2.17 was applied to Iraq Body Count data for more recent years to derive a time series of estimated total conflict deaths in Iraq.
Syria	For Syria, excess mortality in 2011 and 2012 due to the conflict was taken into account based on UN estimates of overall conflict deaths by month and age distribution of deaths (69, 70), as well as estimates by various human rights organizations (71, 72).
West Bank and Gaza Strip.	Estimates of Israeli and Palestinian deaths were derived from statistics published by the Office for the Coordination of Humanitarian Affairs (OCHA) - Occupied Palestinian Territory (OPT) (73) and the Israeli Center for Human Rights in the Occupied Territories (74).

Deaths due to landmines and unexploded ordinance, terrorist events and legal execution were estimated as described in a WHO Technical Paper (7). Legal execution deaths are included in this cause category for GHE2015. Estimated execution deaths were added for the main countries using capital punishment regularly (China, Iran, Iraq, DPR Korea, Saudi Arabia, USA and Yemen), from UN Human Rights Reports, with additional information from Amnesty International reports, Human Rights Watch reports and Wikipedia.

7. Other causes of death for countries without useable data

Cause of death estimates from the GBD2015 study

The IHME uses covariate based estimation models for a large number of single causes as inputs to its overall estimation of numbers of deaths by country, cause, age and sex in the GBD2015 study (9, 10). The IHME modelling strategies make use of available death registration data as well as other sources of information on deaths, covariate regression modelling and also draw on patterns of causes of death for similar countries. Results from these models were used as inputs to our estimates for years 2000-2015 for causes of death not addressed by WHO and UN Interagency estimation processes and where death registration data did not provide sufficient detail or did not meet quality criteria for direct use for estimating deaths by cause.

To ensure that the results of all the single-cause models summed to the all-cause mortality estimate for each age-sex-country-year group, IHME applied a final step called CoDCorrect to rescale the cause-specific estimates (9). The overall effect is to “squeeze” or “expand” causes with wider uncertainty ranges more than those with narrower uncertainty ranges.

The overall process of preparing the “prior” set of estimates for all countries for years 2000-2015 for

the complete GHE cause list ensuring that inputs from WHO/UN sources and GBD2015 were consistent with the WHO all-cause envelopes is summarized in Figure 2. These "prior" estimates were used "as is" for causes of death at ages 5 and over for countries without death registration data meeting inclusion criteria, and also provided inputs to the preparation of GHE2015 estimates for India, under 5 deaths and inputs for specific detailed cause breakdowns for certain cause groups for countries with death registration data.

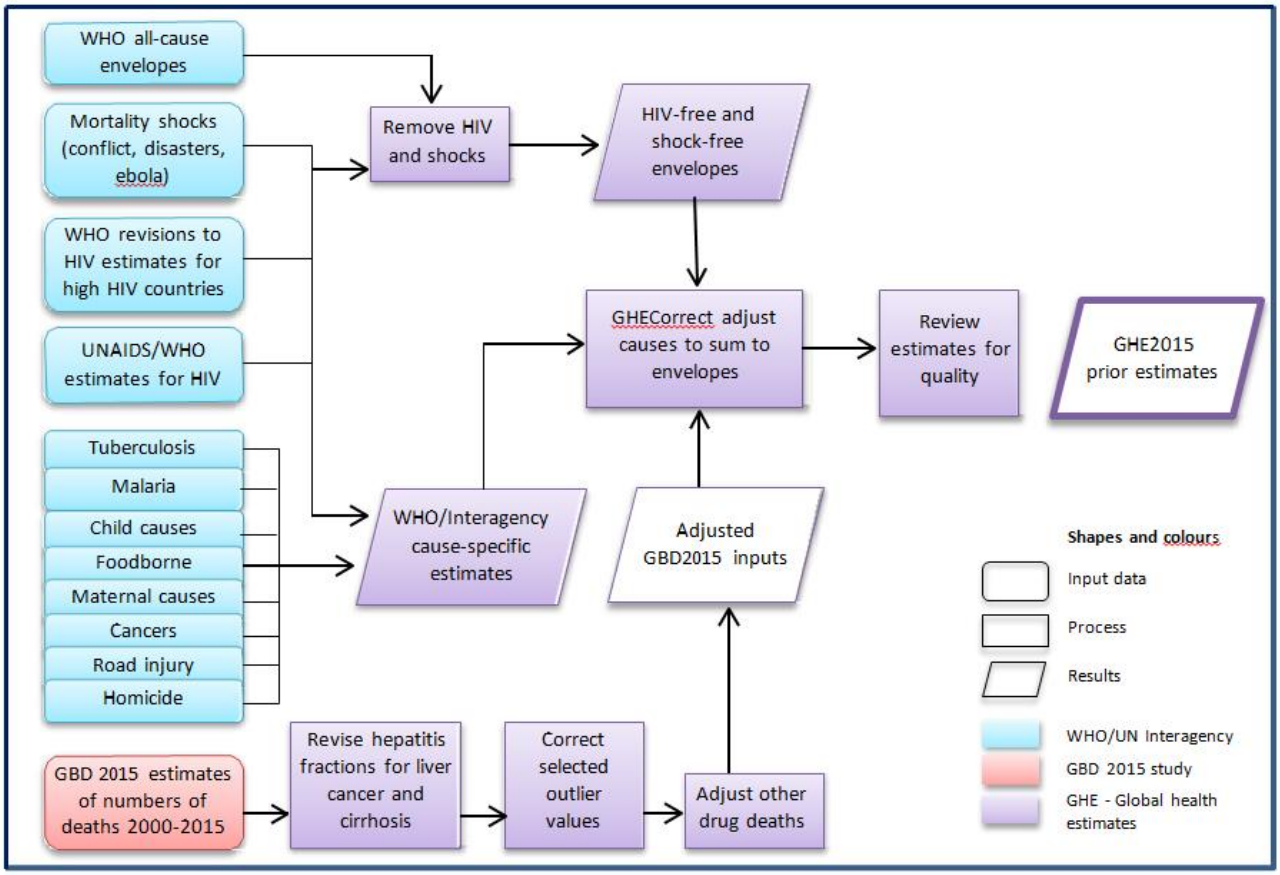
GHECorrect process

GBD2015 results, post-CoDCorrect, were used as inputs to estimate cause fractions by country, age, sex and year for causes of death at ages five years and above for which death registration data and/or WHO and UN Interagency analyses (described in Sections 4 to 8) were not available. IHME results for priority causes such as HIV, TB, malaria, cancers, maternal mortality, child mortality differ to varying degrees from those of WHO and UN agency partners. In part, this reflects differences in modelling strategies, but also the inclusion by IHME of data from verbal autopsy (VA) studies which has been mapped to ICD categories using IHME-developed computer algorithms. As was done for GBD2015, we carried out a "GHECorrect process to ensure that cause fractions across all causes added to 1 by age, sex, country and year, so that estimated numbers of deaths added across causes to the estimated total deaths by age, sex, country and year.

Since WHO and IHME all-cause envelopes (death rates, life tables) differed significantly for some age groups and countries, the first step was to rescale estimated deaths for all cause categories excluding disasters and conflict (referred to as mortality shocks) in the GBD2015 to match the estimated WHO all- cause deaths excluding shocks:

$$CG_{lysac} = G_{lysac}(E_{lysa}) \Big/ \sum_{c \notin shock} G_{lysac}$$

Figure 2. Overview of the processes involved in the preparation of the GHE2015 "prior" estimates for all countries.



Note: Refer also to Figure 4.1 in Chapter 4 for further steps involved in the inclusion of this dataset in the final GHE2015 estimates

where CGl*ysac* is the corrected number of GBD2015 deaths for location l, year y, sex s, age a, cause c, Gl*ysac* is the corresponding uncorrected number of GBD2015 deaths, and El*ysa* is the estimated GHE total deaths excluding shocks for location l, year y, sex s, and age a.

Causes were divided into three groups:

W WHO/interagency causes with estimates (tuberculosis, HIV, malaria, rabies, maternal causes, cancers, road injuries and homicide)
S mortality shocks (natural disasters and conflicts)
R other causes

The adjustment factor required for corrected GBD estimates for group R is:

$$\alpha_{lysa} = \left(E_{lysa} - \sum_{c \in W} D_{lysac}\right) \Big/ \sum_{cc \in R} CG_{lysac}$$

The adjustment factor α was less than 0.5 for 3.4% of location-year-sex-age-specific estimates and between 0.5 and 0.75 for another 5.7%. To reduce the need for substantial squeezing of GBD2015 inputs, adjustments were made to the age distribution of deaths for causes in group W' (apart from HIV and maternal causes) as follows. Where α*l*ysa was <0.5, deaths D*l*ysac for causes c in cause group W' were adjusted downwards by the factor 0.5*(D*l*ysaW' + CG*l*ysaW')/ (D*l*ysaW') and the excess deaths redistributed pro-rata across other ages for that location l, year y, and sex s. After these adjustments to age distributions of causes in W', the adjustment factor α was less than 0.5 for 1.7% of location-year- sex-age-specific estimates and between 0.5 and 0.75 for another 3.3%.

GBD2015-derived estimates for causes in group R were squeezed up to 25% using an alpha value

$$\alpha'_{lysa} = \max(\alpha_{min}, \alpha_{lysa})$$

where αmin =0.75. Where further squeezing was required to match the WHO envelope, estimates were squeezed in both groups R and W', with a differential squeezing factor δ = 1.5 (causes in group R squeezed by factor δxβ and those in group W' by factor β) where β was calculated as:

$$\beta_{lysa} = \left[\left(\sum_{cc \in R} \alpha'_{lysa} CG_{lysac}\right) - \left(E_{lysa} - \sum_{c \in W} D_{lysac}\right)\right] \Big/ \left(\delta \sum_{cc \in R} \alpha'_{lysa} CG_{lysac} + \sum_{c \in W} D_{lysac}\right)$$

Some additional adjustments were carried out for age distributions of group W' causes for Zimbabwe, due to large differences between GBD2015 and GHE non-HIV envelopes. For Zimbabwe, αmin was set to 0.9 and δ to 1. The squeeze factor β was capped at a maximum value of 0.5/ δ (0.5 for Zimbabwe, 0.333 for other countries). There were 10 countries where β initially exceeded 0.5/ δ for some age-sex categories, seven of these were high HIV countries, and the others were small islands. This mostly occurred at younger adult ages and for years before 2010. In these cases, a further pro-rata squeeze was applied to groups W (including and maternal now) and R to match the WHO envelope for 161 country-year-sex-age categories (an average of 1 age-sex category in each year for each of 10 countries). For these cases, the average additional adjustment was 16% downwards.

Other adjustments for specific causes in certain countries

HIV mortality rates and non-HIV mortality rates were explicitly estimated for 43 high HIV prevalence countries as described in Section 6. The resulting non-HIV mortality envelopes differed substantially from those in GBD2015 for 4 countries, resulting in Group I (infectious, maternal, neonatal and nutritional causes) and Group II (non-communicable diseases) fractions and age patterns substantially different in GHE2015 from those of neighboring countries with similar non-HIV mortality levels. For

this reason, the GBD2015 Group I and Group II inputs were further adjusted for Côte d'Ivoire, Nigeria, Sierra Leone and Zimbabwe, based on group fractions for other countries in the region with similar non-HIV mortality levels.

Based on the GBD2015 inputs, there were also a number of extreme outliers for specific causes in some countries. These were adjusted as follows:

- Deaths due to meningitis and encephalitis in Nepal and Bhutan were revised downwards by a factor based on the ratio of GBD2015 estimated death rate to that for India applied to the GHE2015 revised meningitis and encephalitis deaths derived from the Indian SRS data.
- Chronic respiratory disease deaths for Papua New Guinea (the highest in the world in GBD2015) were revised downwards to a level 20% above the average for Vanuatu, Micronesia and Fiji.
- Accidental poisoning deaths in Somalia were revised downward by 60% based on the difference between GBD2013 and GBD2015 estimates.
- Skin disease deaths were revised downwards in Bahrein based on the average of the death rates for United Arab Emirates, Kuwait, Oman, Qatar and Saudi Arabia.
- Endocrine disease death rates were adjusted downwards in Tajikistan using GBD2013-based rates, which are similar to those for Afghanistan and Pakistan in GBD2015.
- GBD2015 death rates for chronic respiratory diseases in Montenegro were extremely low, unlike those in the surrounding countries (Serbia, Bosnia and Herzegovina, Croatia, Albania, and the Former Yugoslav Republic of Macedonia). In contrast, both smoking rates and air pollution levels were similar for Montenegro and these countries. The CRD death rates for Montenegro were adjusted to match those of Serbia.

8. Limitations and uncertainty of the cause of death estimates

Quantitative uncertainty ranges are available as part of the comprehensive GHE2015 estimates dataset on the WHO website (1). Methods for these uncertainty ranges, as well as an overview of the quality of the uncertainty analysis, are documented in a WHO Technical Paper (3). In addition, the IARC Globocan database provides information on data sources and quality of inputs for seven categories of incidence data and six categories of mortality data, as well as six estimation methods for mortality (57). Most methods for estimation of uncertainty rely on statistical techniques to assess variations across observations and/or take into account sampling error but are less successful in dealing with unknown systematic bias in observations, such as systematic misspecification of cause of death. Uncertainty around model specification and data pre-processing steps are also frequently omitted when uncertainty intervals are quantified. For these reasons, the quantitative uncertainty ranges really should be treated as indicative of likely relative uncertainty across regions and causes.

Finally, we highlight some broad cross-cutting limitations to the GHE mortality and cause of death analysis.

- All-cause mortality estimates in countries without well-functioning death registration systems rely heavily on census and survey data sources (particularly sibling survival data) and the use of model life tables. There is not yet consensus on the methods for analyzing sibling survival data or assessing levels of under-reporting of deaths in surveys or censuses.

- Demographic methods for the assessment of completeness of death registration all involve strong assumptions or information about migration and are prone to error resulting from age mis-statement in registration or census data, and to differential completeness of successive censuses.
- Estimation of HIV mortality relies on imputation of deaths from seroprevalence data using limited information on survival curves for HIV-positive persons not receiving or receiving anti-retroviral treatment (ART), and on the coverage of ART in populations. This results in large uncertainty for countries with high prevalence of HIV, as disease progression rates may well vary across countries.
- Although death registration data is generally the best form of information available on causes of death, it has considerable limitations, even in well-functioning systems with medical certification of cause of death. The so-called garbage codes represent a substantial proportion of deaths in some countries, and methods for re-assigning these deaths to valid causes are highly uncertain and generally are not based on empirical data. The assignment of underlying cause of death is limited by the information provided on the death certificate and quite sensitive to the order in which diagnoses are written. For most causes of death, variability (due to differences in physician practice when certifying a death) in assignment of valid causes of underlying death has not been addressed to date. Additionally, some diseases and injuries have specific problems associated with difficulty in making causal judgments of underlying cause (eg. diabetes and heart disease, or Alzheimer's disease and heart disease, drug or alcohol overdose). Finally, HIV and other stigmatized causes of death, such as suicide, are routinely miscoded; the miscoding rate varies by setting.
- For many countries without functioning death registration systems, particularly in Africa, there is strong reliance on verbal autopsy studies, most of which are not nationally representative samples. Until recently there has been considerable variation in verbal autopsy instruments, and in analysis and cause assignment methods. Validation studies are challenging, and difficult to generalize to other settings. The Indian SRS data included in the Million Death Study use a form of physician-assignment of underlying cause that may be subject to different biases and limitations than the statistical algorithms used in InterVA or Tariff analyses.
- The WHO GHE estimates bring together single cause analyses from a number of WHO departments, interagency collaborations, and other sources, together with estimates drawn from the IHME GBD2015 study. These estimates are updated on differing time tables, and using different methods and assumptions in some cases, and it is more difficult to ensure consistency across causes, than is the case for large comprehensive estimates such as GBD2015 prepared by a single study group. In addition, separate preparation of estimates of total mortality and cause-specific mortality can lead to incompatible cause-specific and total mortality estimates. In some cases, WHO/UN estimates are prepared only for all-age deaths, and age patterns imputed from available sometimes limited evidence.
- Estimates of deaths associated with mortality shocks (mainly conflict and disasters, but also some epidemics) are highly uncertain, and age patterns are generally imputed from limited data for other shocks. Additionally, in countries without functioning death registration systems or high quality censuses, it is very difficult to take account of, and to estimate, indirect mortality associated with mortality shocks, with increases in non-injury mortality rates associated with disruption to health and other social systems.

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Annex Table A. GHE cause categories and ICD-10 codes

GHE code	GHE cause name	ICD-10 codes
10	**I. Communicable, maternal, perinatal and nutritional conditions**[a]	A00-B99, D50-D53, D64.9, E00-E02, E40-E46, E50-E64,
20	**A. Infectious and parasitic diseases**	A00-B99, G00-G04, G14, N70-N73, P37.3, P37.4
30	1. Tuberculosis	A15-A19, B90
40	2. STDs excluding HIV	A50-A64, N70-N73
50	a. Syphilis	A50-A53
60	b. Chlamydia	A55-A56
70	c. Gonorrhoea	A54
80	d. Trichomoniasis	A59
85	e. Genital herpes	A60
90	f. Other STDs	A57-A58, A61-A64, N70-N73
100	3. HIV/AIDS	B20-B24
101	a. HIV resulting in TB	B20.0
102	b. HIV resulting in other	B20-B24 (minus B20.0)
110	4. Diarrhoeal diseases[b]	A00, A01, A03, A04, A06-A09
120	5. Childhood-cluster diseases	A33-A37, B05
130	a. Whooping cough	A37
140	b. Diphtheria	A36
150	c. Measles	B05
160	d. Tetanus	A33-A35
170	6. Meningitis[b]	A39, G00, G03
180	7. Encephalitis[b]	A83-A86, B94.1, G04
185	8. Hepatitis	B15-B19 (minus B17.8)
186	a. Acute hepatitis A	B15
190	b. Acute hepatitis B	B16-B19 (minus B17.1, B17.2, B18.2, B18.8)
200	c. Acute hepatitis C	B17.1, B18.2
205	d. Acute hepatitis E	B17.2, B18.8
210	9. Parasitic and vector diseases	A71, A82, A90-A91, A95, B50-B57, B65, B67, B69, B73, B74.0-B74.2, P37.3-P37.4
220	a. Malaria	B50-B54, P37.3, P37.4
230	b. African trypanosomiasis	B56
240	c. Chagas disease	B57
250	d. Schistosomiasis	B65
260	e. Leishmaniasis	B55
270	f. Lymphatic filariasis	B74.0-B74.2
280	g. Onchocerciasis	B73
285	h. Cysticercosis	B69
295	i. Echinococcosis	B67
300	j. Dengue	A90-A91
310	k. Trachoma	A71
315	l. Yellow fever	A95

320		m. Rabies	A82
330	10.	Intestinal nematode infections	B76-B81
340		a. Ascariasis	B77
350		b. Trichuriasis	B79
360		c. Hookworm disease	B76
362		d. Food-bourne trematodes	B78, B80, B81
365	11.	Leprosy	A30
370	12.	Other infectious diseases	A02, A05, A20-A28, A31, A32, A38, A40-A49, A65-A70, A74- A79, A80-A81, A87-A89, A92-A99, B00-B04, B06-B09, B17.8, B25-B49, B58-B60, B64, B66, B68, B70-B72, B74.3- B74.9, B75, B82-B89, B91-B99 (minus B94.1), G14
380	**B.**	**Respiratory Infections**[b]	H65 – H66, J00-J22, P23, U044
390		1. Lower respiratory infections	J09-J22, P23, U04
400		2. Upper respiratory infections	J00-J06
410		3. Otitis media	H65-H66
420	**C.**	**Maternal conditions**	O00-O99
490	**D.**	**Neonatal conditions**	P00-P96 (minus P23, P37.3, P37.4)
500		1. Preterm birth complications[b]	P05, P07, P22, P27-P28
510		2. Birth asphyxia and birth trauma[b]	P03, P10-P15, P20-P21, P24-P26, P29
520		3. Neonatal sepsis and infections	P35-P39 (minus P37.3, P37.4)
530		4. Other neonatal conditions	P00-P02, P04, P08, P50-P96
540	**E.**	**Nutritional deficiencies**	D50-D53, D64.9, E00-E02, E40-E46, E50-E64
550		1. Protein-energy malnutrition	E40-E46
560		2. Iodine deficiency	E00-E02
570		3. Vitamin A deficiency	E50
580		4. Iron-deficiency anaemia	D50, D64.9
590		5. Other nutritional deficiencies	D51-D53, E51-E64
600	**II.**	**Noncommunicable diseases**[a]	C00-C97, D00-D48, D55-D64 (minus D 64.9), D65-D89, E03- E07, E10-E34, E65-E88, F01-F99, G06-G98 (minus G14), H00-H61, H68-H93, I00-I99, J30-J98, K00-K92, L00-L98, M00-M99, N00-N64, N75-N98, Q00-
610	**A.**	**Malignant neoplasms**	C00-C97
620		1. Mouth and oropharynx cancers	C00-C14
621		a. Lip and oral cavity	C00-C08
622		b. Nasopharynx	C11
623		c. Other pharynx	C09-C10, C12-C14

630		2. Oesophagus cancer	C15
640		3. Stomach cancer	C16
650		4. Colon and rectum cancers	C18-C21
660		5. Liver cancer[c]	C22
670		6. Pancreas cancer	C25
680		7. Trachea, bronchus, lung cancers	C33-C34
690		8. Melanoma and other skin cancers	C43-C44
691		a. Malignant skin melanoma	C43
692		b. Non-melanoma skin cancer	C44
700		9. Breast cancer	C50
710		10. Cervix uteri cancer	C53
720		11. Corpus uteri cancer	C54-C55
730		12. Ovary cancer	C56
740		13. Prostate cancer	C61
742		14. Testicular cancer	C62
745		15. Kidney, renal pelvis and ureter	C64-C66
750		16.. Bladder cancer	C67
751		17.. Brain and nervous system cancers	C70-C72
752		18.. Gallbladder and biliary tract	C23-C24
753		19.. Larynx cancer	C32
754		20.. Thyroid cancer	C73
755		21.. Mesothelioma	C45
760		22.. Lymphomas, multiple myeloma	C81-C90, C96
761		a. Hodgkin lymphoma	C81
762		b. Non-Hodgkin lymphoma	C82-C86, C96
763		c. Multiple myeloma	C88, C90
770		23.. Leukaemia	C91-C95
780		24.. Other malignant neoplasms[d]	C17, C26-C31, C37-C41, C46-C49, C51, C52, C57-C60, C63, C68, C69, C74-C80, C97
790	**B.**	**Other neoplasms**	D00-D48
800	**C.**	**Diabetes mellitus**	E10-E14 (minus E10.2-E10.29, E11.2-E11.29, E12.2, E13.2- E13.29, E14.2)
810	**D.**	**Endocrine, blood, immune disorders**	D55-D64 (minus D64.9), D65-D89, E03-E07, E15-E34, E65- E88
811		1. Thalassaemias	D56
812		2. Sickle cell disorders and trait	D57
813		3. Other haemoglobinopathies and haemolytic anaemias	D55, D58-59

814		4. Other enocrine, blood, and immune disorders	D60-D64 (minus D6 4,9),
820	**E.**	**Mental and substance use disorders**	F04-F99, G72.1, Q86.0, X41-X42, X
			F32-F33, F34.1
830		1. Depressive disorders	
831		a. Major depressive disorder	F32-F33
832		b. Dysthymia	F34.1
840		2. Bipolar disorder	F30-F31
850		3. Schizophrenia	F20-F29
860		4. Alcohol use disorders	F10, G72.1, Q86.0, X45
870		5. Drug use disorders	F11-F16, F18-F19e, X41-X42, X44e
871		a. Opioid use disorders	F11, X42, X44e
872		b. Cocaine use disorders	F14
873		c. Amphetamine use disorders	F15
874		d. Cannabis use disorders	F12
875		e. Other drug use disorders	F13, F16, F18, F19e, X41
880		6.. Anxiety disorders	F40-F44
890		7.. Eating disorders	F50
900		8.. Autism and Asperger syndrome	F84
910		9.. Childhood behavioural disorders	F90-F92
911		a. Attention deficit/ hyperactivity syndrome	F90
912		b. Conduct disorder	F91-F92
920		10.. Idiopathic intellectual disability	F70-F79
930		11.. Other mental and behavioural disorders	F04-F09, F17, F34-F39 (minus F34.1), F45-F48, F51-F69, F80-F83, F88-F89, F93-F99
940	**F.**	**Neurological conditions**	F01-F03, G06-G98 (minus G13, G72,1)
950		1. Alzheimer disease and other	F01-F03, G30-G31
960		2. Parkinson disease	G20-G21
970		3. Epilepsy	G40-G41
980		4. Multiple sclerosis	G35
990		5. Migraine	G43
1000		6. Non-migraine headache	G44
1010		7. Other neurological conditions	G06-G12, G23-G25, G36-G37, G45-G98
1020	**G.**	**Sense organ diseases**	H00-H61, H68-H93
1030		1. Glaucoma	H40
1040		2. Cataracts	H25-H26
1050		3. Uncorrected refractive errors	H49-H52

1060		4. Macular degeneration	H35.3
1070		5. Other vision loss	H30-H35 (minus H35.3), H53-H54
1080		6. Other hearing loss	H90-H91
1090		7. Other sense organ disorders	H00-H21, H27, H43-H47, H55-H61, H68-H83, H92-H93
1100	**H.**	**Cardiovascular diseases**	I00-I99
1110		1. Rheumatic heart disease	I01-I09
1120		2. Hypertensive heart disease	I10-I15
1130		3. Ischaemic heart disease[f]	I20-I25
1140		4. Stroke[g]	I60-I69
1150		5. Cardiomyopathy, myocarditis,	I30-I33, I38, I40, I42
1160		6. Other circulatory diseases	I00, I26-I28, I34-I37, I44-I51, I70-I99
1170	**I.**	**Respiratory diseases**	J30-J98
1180		1. Chronic obstructive pulmonary	J40-J44
1190		2. Asthma	I45-I46
1200		3. Other respiratory diseases	J30-J39, J47-J98
1210	**J.**	**Digestive diseases**	K20-K92
1220		1. Peptic ulcer disease	K25-K27
1230		2. Cirrhosis of the liver[h]	K70, K74
1240		3. Appendicitis	K35-K37
1241		4. Gastritis and duodenitis	K29
1242		5. Paralytic ileus and intestinal	K56
1244		6. Inflammatory bowel disease	K50-K52, K58.0
1246		7. Gallbladder and biliary diseases	K80-K83
1248		8. Pancreatitis	K85-K86
1250		9. Other digestive diseases	K20-K22, K28, K30-K31, K38, K40-K46, K55, K57, K58.9, K59-K66, K71-K73, K75-K76, K90-K92
1260	**K.**	**Genitourinary diseases**	E10.2-E10.29,E11.2-E11.29,E12.2,E13.2-E13.29,E14.2, N00-N64, N75-N76, N80-N98
1270		1. Kidney diseases	N00-N19, E10.2-E10.29,E11.2 - E11.29,E12.2,E13.2-E13.29, E14.2
1271		a. Acute glomerulonephritis	N00-N01
1272		b. Chronic kidney disease due to diabetes	E10.2-E10.29, E11.2-E11.29, E12.2, E13.2-E13.29, E14.2
1273		c. Other chronic kidney disease	N02-N19
1280		2. Benign prostatic hyperplasia	N40
1290		3. Urolithiasis	N20-N23
1300		4. Other urinary diseases	N25-N39, N41-N45, N47-N51

1310		5. Infertility	N46, N97
1320		6. Gynecological diseases	N60-N64, N75-N76, N80-N96, N98
1330	**L.**	**Skin diseases**	L00-L98
1340	**M.**	**Musculoskeletal diseases**	M00-M99
1350		1. Rheumatoid arthritis	M05-M06
1360		2. Osteoarthritis	M15-M19
1370		3. Gout	M10
1380		4. Back and neck pain	M45-M48, M50-M54
1390		5. Other musculoskeletal disorders	M00, M02, M08, M11-M13, M20-M43, M60-M99
1400	**N.**	**Congenital anomalies**	O00-O99 (minus O86.0)
1410		1. Neural tube defects	Q00, Q05
1420		2. Cleft lip and cleft palate	Q35-Q37
1430		3. Down syndrome	Q90
1440		4. Congenital heart anomalies	Q20-Q28
1450		5. Other chromosomal anomalies	Q91-Q99
1460		6. Other congenital anomalies	Q01-Q04, Q06-Q18, Q30-Q34, Q38-Q89
1470	**O.**	**Oral conditions**	K00-K14
1480		1. Dental caries	K02
1490		2. Periodontal disease	K05
1500		3. Edentulism	-
1502		4. Other oral disorders	K00, K01, K03, K04, K06-K14
1505	**P.**	**Sudden infant death syndrome**	R95
1510	**III.**	**Injuries**[i]	V01-Y89 (minus X41-X42, X44, X45)
1520	**A.**	**Unintentional injuries**	V01-X40, X43, X46-59, Y40-Y86, Y88, Y89
1530		1. Road injury[j]	V01-V04, V06, V09-V80, V87, V89, V99
1540		2. Poisonings[e]	X40, X43, X46-X48, X49[e]
1550		3. Falls	W00-W19
1560		4. Fire, heat and hot substances	X00-X19
1570		5. Drowning	W65-W74
1575		6. Exposure to mechanical forces	W20-W38, W40-W43, W45, W46, W49-W52,
1580		7. Natural disasters	X30-X39
1590		8. Other unintentional injuries	Rest of V, W39, W44, W53-W64, W77-W99,
1600	**B.**	**Intentional injuries**	X60-Y09, Y35-Y36, Y870, Y871
1610		1. Self-harm	X60-X84, Y870
1620		2. Interpersonal violence	X85-Y09, Y871
1630		3. Collective violence and legal	Y35-Y36

Notes: —, not available

[a] Deaths coded to "Symptoms, signs and ill-defined conditions" (R00-R94. R96-R99) are distributed proportionately to all causes within
Group I and Group II.

[b] For deaths under age 5, refer to classification in Annex Table D.

[c] For liver cancer secondary to hepatitis B, hepatitis C, and alcohol use, proportions derived from GBD2015 analyses.

[d] Cancer deaths coded to ICD categories for malignant neoplasms of other and unspecified sites including those whose point of origin cannot be determined, and secondary and unspecified neoplasms (C76, C80, C97) were redistributed pro-rata across malignant neoplasm categories within each age–sex group, so that the category "Other malignant neoplasms" includes only malignant neoplasms of other specified sites.

[e] Deaths coded to F19 (Multiple and other drug use) and X44 (Accidental poisoning by other and unspecified drugs and medicines) have been redistributed to the GHE drug categories as described in Section 6. Deaths coded to X49 (Accidental poisoning by other and unspecified chemicals) have been redistributed to GHE accidental poisoning and GHE opioid use disorders categories as described in Section 6.

[f] Ischaemic heart disease deaths may be miscoded to a number of so-called cardiovascular "garbage" codes. These include heart failure, ventricular dysrhythmias, generalized atherosclerosis and ill-defined descriptions and complications of heart disease. Proportions of deaths coded to these causes were redistributed to ischaemic heart disease as described in Section 3.

[g] For ischaemic stroke and haemorrhagic stroke, proportions derived from GBD2015 analyses.

[h] For cirrhosis due to hepatitis B, hepatitis C, and alcohol use, proportions derived as described in Section 6.

[i] Injury deaths where the intent is not determined (Y10-Y34, Y872) are distributed proportionately to all causes below the group level for injuries.

[j] For countries with 3-digit ICD10 data, for "Road injury" use: V01-V04, V06, V09-V80, V87, V89 and V99. For countries with 4-digit ICD10 data, for "Road injury" use:

V01.1-V01.9, V02.1-V02.9, V03.1-V03.9, V04.1-V04.9, V06.1-V06.9, V09.2, V09.3, V10.3-V10.9, V11.3-V11.9, V12.3-V12.9, V13.3-V13.9, V14.3-V14.9, V15.4-V15.9, V16.4-V16.9, V17.4-V17.9, V18.4-V18.9, V19.4-V19.9, V20.3-V20.9, V21.3-V21.9, V22.3-V22.9, V23.3-V23.9, V24.3-V24.9, V25.3-V25.9, V26.3-V26.9, V27.3-V27.9, V28.3-V28.9, V29.4-V29.9, V30.4-V30.9, V31.4-V31.9, V32.4-V32.9, V33.4-V33.9, V34.4-V34.9, V35.4-V35.9, V36.4-V36.9, V37.4-V37.9, V38.4-V38.9, V39.4-V39.9, V40.4-V40.9, V41.4-V41.9, V42.4-V42.9, V43.4-V43.9, V44.4-V44.9, V45.4-V45.9, V46.4-V46.9, V47.4-V47.9, V48.4-V48.9, V49.4-V49.9, V50.4-V50.9, V51.4-V51.9, V52.4-V52.9, V53.4-V53.9, V54.4-V54.9, V55.4-V55.9, V56.4-V56.9, V57.4-V57.9, V58.4-V58.9, V59.4-V59.9, V60.4-V60.9, V61.4-V61.9, V62.4-V62.9, V63.4-V63.9, V64.4-V64.9, V65.4-V65.9, V66.4-V66.9, V67.4-V67.9, V68.4-V68.9, V69.4-V69.9, V70.4-V70.9, V71.4-V71.9, V72.4-V72.9, V73.4-V73.9, V74.4-V74.9, V75.4-V75.9, V76.4-V76.9, V77.4-V77.9, V78.4-V78.9, V79.4-V79.9, V80.3-V80.5, V81.1, V82.1, V82.8-V82.9, V83.0-V83.3, V84.0-V84.3, V85.0-V85.3, V86.0-V86.3, V87.0-V87.9, V89.2-V89.3, V89.9, V99 and Y850.

Annex Table B. Classification of countries by income level

Classification	Countries
Low income	Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic People's Republic of Korea, Democratic Republic of the Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sierra Leone, Somalia, Tajikistan, Togo, Uganda, United Republic of Tanzania, Zimbabwe
Lower middle income	Armenia, Bhutan, Bolivia (Plurinational State of), Cabo Verde, Cameroon, Congo, Côte d'Ivoire, Djibouti, Egypt, El Salvador, Georgia, Ghana, Guatemala, Guyana, Honduras, India, Indonesia, Kiribati, Kyrgyzstan, Lao People's Democratic Republic, Lesotho, Mauritania, Micronesia (Federated States of), Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Republic of Moldova, Samoa, Sao Tome and Principe, Senegal, Solomon Islands, South Sudan, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Timor-Leste, Ukraine, Uzbekistan, Vanuatu, Viet Nam, West Bank and Gaza Strip, Yemen, Zambia
Upper middle income	Albania, Algeria, Angola, Argentina, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Fiji, Gabon, Grenada, Hungary, Iran (Islamic Republic of), Iraq, Jamaica, Jordan, Kazakhstan, Lebanon, Libya, Malaysia, Maldives, Mauritius, Mexico, Montenegro, Namibia, Panama, Peru, Romania, Saint Lucia, Saint Vincent and the Grenadines, Serbia, Seychelles, South Africa, Suriname, Thailand, The former Yugoslav Republic of Macedonia, Tonga, Tunisia, Turkey, Turkmenistan, Venezuela (Bolivarian Republic of)
High income	Antigua and Barbuda, Australia, Austria, Bahamas, Bahrain, Barbados, Belgium, Brunei Darussalam, Canada, Chile; Taiwan, China; Croatia, Cyprus, Czechia, Denmark, Equatorial Guinea, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Oman, Poland, Portugal, Puerto Rico, Qatar, Republic of Korea, Russian Federation, Saudi Arabia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States of America, Uruguay

Notes: World Bank classifications of national income (gross national income per capita) as of July 2014 are used to classify countries into four income categories: low, lower-middle, upper-middle, and high. These are defined in terms of gross national income (GNI) per capita for 2013 as follows:

Low-income countries (LICs): US$1,045 or less

Middle-income countries (MICs) are subdivided:

Lower-middle-income: US$1,046 to US$4,125

Upper-middle-income: US$4,126 to US$12,745

High-income countries (HICs): US$12,746 or more

Annex Table C. Methods used for estimation of mortality levels and causes of death, by country, 2000-2015

Country	All-cause mortalit	Under 5 child cause of death method	Cause of death methods for ages 5+	Latest available year VR	Average usability 2000 - latest
Afghanistan	B	VA MCM	GBD2015 plus (a)		
Albania	A	VR MCM	GBD2015	2009	60%
Algeria	B	VA MCM	GBD2015 plus (a)		
Angola	C	VA MCM	High HIV		
Antigua and Barbuda	B	VR data	VR data	2014	78%
Argentina	A	VR data	GBD2015	2014	77%
Armenia	A	VR MCM	GBD2015	2015	95%
Australia	A	VR data	VR data	2014	95%
Austria	A	VR data	VR data	2014	91%
Azerbaijan	A	VA MCM	GBD2015	2007	87%
Bahamas	D	VR data	VR data & High	2013	87%
Bahrain	B	VR data	GBD2015	2014	61%
Bangladesh	B	VA MCM	GBD2015 plus (a)		
Barbados	A	VR data	VR data	2013	68%
Belarus	A	VR MCM	VR data	2014	80%
Belgium	A	VR data	VR data	2013	87%
Belize	D	VR data	VR data & High	2014	76%
Benin	D	VA MCM	High HIV		
Bhutan	B	VA MCM	GBD2015 plus (a)		
Bolivia (Plurinational State of)	A	VA MCM	GBD2015	2003	17%
Bosnia and Herzegovina	A	VR MCM	GBD2015	2014	73%
Botswana	C	VA MCM	High HIV		
Brazil	A	VR data	VR data	2014	83%
Brunei Darussalam	A	VR data	VR data	2014	91%
Bulgaria	A	VR data	GBD2015	2013	76%
Burkina Faso	D	VA MCM	High HIV		
Burundi	C	VA MCM	High HIV		
Cabo Verde	B	VR MCM	GBD2015	2011	73%
Cambodia	B	VA MCM	GBD2015 plus (a)		
Cameroon	C	VA MCM	High HIV		
Canada	A	VR MCM (0-27d), VR data (1-59m)	VR data	2012	94%
Central African Republic	C	VA MCM	High HIV		
Chad	D	VA MCM	High HIV		

Chile	A	VR data	VR data	2014	94%
China	B	Sample VR	VA/VR data	2013	n.a.
Colombia	A	VR data	VR data	2013	84%
Comoros	B	VA MCM	GBD2015 plus (a)		
Congo	C	VA MCM	High HIV		
Costa Rica	A	VR data	VR data	2014	87%
Côte d'Ivoire	D	VA MCM	High HIV		
Croatia	A	VR data	VR data	2015	89%
Cuba	A	VR data	VR data	2014	92%
Cyprus	B	VR MCM	VR data	2013	58%
Czechia	A	VR data	VR data	2015	89%
Democratic People's Republic of	B	VA MCM	GBD2015 plus (a)		
Democratic Republic of the Congo	D	VA MCM	High HIV		
Denmark	A	VR data	VR data	2014	87%
Djibouti	D	VA MCM	High HIV		
Dominican Republic	A	VA MCM	GBD2015	2012	45%
Ecuador	A	VR MCM	VR data	2014	69%
El Salvador	A	VR MCM	GBD2015	2013	63%
Equatorial Guinea	C	VA MCM	High HIV		
Eritrea	D	VA MCM	High HIV		
Estonia	A	VR data	VR data	2014	94%
Ethiopia	C	VA MCM	High HIV		
Fiji	B	VR MCM	GBD2015	2012	81%
Finland	A	VR data	VR data	2014	97%
France	A	VR data	VR data	2013	85%
Gabon	C	VA MCM	High HIV		
Gambia	D	VA MCM	High HIV		
Georgia	A	VR MCM	GBD2015	2014	61%
Germany	A	VR data	VR data	2014	88%
Ghana	D	VA MCM	High HIV	2014	n.a.
Greece	A	VR data	GBD2015	2013	74%
Grenada	B	VR data	VR data	2015	88%
Guatemala	A	VA MCM	VR data	2014	79%
Guinea	D	VA MCM	High HIV		
Guinea-Bissau	D	VA MCM	High HIV		
Guyana	A	VR data	VR data	2012	86%
Haiti	D	VA MCM	High HIV	2004	6%
Honduras	B	VR MCM	GBD2015	2013	13%
Hungary	A	VR data	VR data	2014	95%
Iceland	A	VR data	VR data	2015	94%
India	B	State level	VA/VR data	2007	n.a.

Indonesia	B	VA MCM	GBD2015 plus (a)		
Iran (Islamic Republic of)	B	VA MCM	GBD2015 plus (a)	2014	n.a.
Iraq	B	VA MCM	GBD2015	2008	54%
Ireland	A	VR data	VR data	2013	95%
Israel	A	VR data	VR data	2014	91%
Italy	A	VR data	VR data	2012	91%
Jamaica	D	VR MCM	VR data & High	2011	73%
Japan	A	VR data	VR data	2014	89%
Jordan	B	VR MCM	GBD2015	2011	61%
Kazakhstan	A	VA MCM	VR data	2015	81%
Kenya	C	VA MCM	High HIV	2015	n.a.
Kiribati	B	VA MCM	GBD2015	2001	51%
Kuwait	B	VR data	GBD2015	2014	65%
Kyrgyzstan	A	VA MCM	VR data	2015	90%
Lao People's Democratic Republic	B	VA MCM	GBD2015 plus (a)		
Latvia	A	VR data	VR data	2014	90%
Lebanon	B	VR MCM	GBD2015 plus (a)	1999	n.a.
Lesotho	C	VA MCM	High HIV		
Liberia	D	VA MCM	High HIV		
Libya	B	VR MCM	GBD2015 plus (a)		
Lithuania	A	VR data	VR data	2015	92%
Luxembourg	A	VR data	VR data	2014	86%
Madagascar	B	VA MCM	GBD2015 plus (a)	2010	n.a.
Malawi	C	VA MCM	High HIV		
Malaysia	B	VR MCM	GBD2015	2008	40%
Maldives	A	VR MCM	GBD2015	2011	58%
Mali	D	VA MCM	High HIV		
Malta	A	VR data	VR data	2014	92%
Mauritania	B	VA MCM	GBD2015 plus (a)		
Mauritius	A	VR data	VR data	2014	88%
Mexico	A	VR data	VR data	2014	95%
Micronesia (Federated States of)	B	VA MCM	GBD2015 plus (a)		
Mongolia	A	VA MCM	GBD2015 plus (a)	2012	n.a.
Montenegro	A	VR data	GBD2015	2009	67%
Morocco	B	VA MCM	GBD2015	2012	12%
Mozambique	C	VA MCM	High HIV	2014	n.a.
Myanmar	B	VA MCM	GBD2015 plus (a)	2014	n.a.
Namibia	C	VA MCM	High HIV		
Nepal	B	VA MCM	GBD2015 plus (a)		
Netherlands	A	VR data	VR data	2015	86%

New Zealand	A	VR data	VR data	2012	97%
Nicaragua	A	VR MCM	GBD2015	2013	60%
Niger	B	VA MCM	GBD2015 plus (a)		
Nigeria	D	VA MCM	High HIV		
Norway	A	VR data	VR data	2014	88%
Oman	B	VR MCM	GBD2015	2010	49%
Pakistan	B	VA MCM	GBD2015 plus (a)		
Panama	A	VR data	VR data	2014	80%
Papua New Guinea	B	VA MCM	GBD2015 plus (a)		
Paraguay	B	VR MCM	GBD2015	2014	61%
Peru	A	VR MCM	GBD2015	2014	57%
Philippines	A	VA MCM	VR data	2011	78%
Poland	A	VR data	GBD2015	2014	72%
Portugal	A	VR MCM (0-27d), VR data (1-59m)	VR data	2014	82%
Qatar	B	VR MCM	GBD2015	2012	60%
Republic of Korea	A	VR data	VR data	2013	85%
Republic of Moldova	A	VR data	VR data	2015	83%
Romania	A	VR data	VR data	2015	92%
Russian Federation	A	VR MCM	VR data	2011	89%
Rwanda	C	VA MCM	High HIV		
Saint Lucia	A	VR data	VR data	2014	75%
Saint Vincent and the	B	VR data	VR data	2015	93%
Samoa	B	VR MCM	GBD2015 plus (a)		
Sao Tome and Principe	B	VA MCM	GBD2015 plus (a)		
Saudi Arabia	B	VR MCM	GBD2015	2012	21%
Senegal	B	VA MCM	GBD2015 plus (a)		
Serbia	A	VR data	VR data	2014	80%
Seychelles	B	VR MCM	GBD2015 plus (a)	2015	n.a.
Sierra Leone	D	VA MCM	High HIV		
Singapore	B	VR data	VR data	2015	71%
Slovakia	A	VR data	VR data	2014	94%
Slovenia	A	VR data	VR data	2015	89%
Solomon Islands	B	VA MCM	GBD2015 plus (a)		
Somalia	B	VA MCM	GBD2015 plus (a)		
South Sudan	D	VA MCM	High HIV		
Spain	A	VR data	VR data	2014	90%
Sri Lanka	B	VR MCM	GBD2015	2006	72%
Sudan	B	VA MCM	GBD2015 plus (a)	2010	n.a.
Suriname	A	VR data	GBD2015	2014	64%
Swaziland	C	VA MCM	High HIV		

Sweden	A	VR data	VR data	2015	89%
Syrian Arab Republic	B	VR MCM	GBD2015	2010	72%
Tajikistan	A	VA MCM	GBD2015	2005	78%
Thailand	D	VR MCM	High HIV	2014	52%
Timor-Leste	B	VA MCM	GBD2015 plus (a)		
Togo	D	VA MCM	High HIV		
Tonga	B	VR MCM	GBD2015 plus (a)		
Trinidad and Tobago	A	VR data	VR data	2010	84%
Tunisia	B	VR MCM	GBD2015	2013	22%
Turkey	B	VR data	GBD2015	2013	58%
Turkmenistan	A	VA MCM	GBD2015	2013	67%
Uganda	C	VA MCM	High HIV		
Ukraine	A	VR MCM	VR data	2014	90%
United Arab Emirates	B	VR MCM	GBD2015	2010	56%
United Kingdom	A	VR data	VR data	2014	93%
United Republic of Tanzania	C	VA MCM	High HIV	2014	n.a.
United States of America	A	VR data	VR data	2014	93%
Uruguay	A	VR data	VR data	2014	83%
Uzbekistan	A	VA MCM	VR data	2014	85%
Vanuatu	B	VR MCM	GBD2015 plus (a)		
Venezuela (Bolivarian Republic of)	A	VR data	VR data	2013	82%
Viet Nam	B	VR MCM	GBD2015 plus (a)		
Yemen	B	VA MCM	GBD2015 plus (a)		
Zambia	C	VA MCM	High HIV	2014	n.a.
Zimbabwe	C	VA MCM	High HIV	2002	n.a.

[a] WHO and UN Interagency cause-specific estimates (see Section 6).

All-cause mortality method groups:

A: Life tables based on death rates computed from vital registration data.

B: Life tables based on UNPD's World Population Prospects – the 2015 revision, and child mortality estimates from the UN-IGME.

C: Life tables based on UNPD's World Population Prospects – the 2015 revision, updated with the latest HIV/AIDS mortality from UNAIDS and child mortality estimates from the UN-IGME

D: WHO modelled HIV and non-HIV mortality.

Abbreviations: GBD2015= Global Burden of Disease 2015 study estimates (9-111); High HIV = WHO / UNAIDS / WPP2015 estimates for HIV deaths and all-cause deaths, GBD2015 study estimates; VA/VR = Verbal autopsy and Verbal autopsy sample data plus sample death registration data; VR = Vital (death) registration; n.a = usability not assessed

Annex Table D. First-level categories for analysis of child causes of death

GBD cause name	ICD-10 code	ICD-9 code
All causes	A00-Y89	001-999
I. Communicable, maternal, perinatal, and nutritional conditions [a]	A00-B99, D50-D53, D64.9, E00-E02, E40-E64, G00-G09, H65-H66, J00-J22, J85, N30, N34, N390, N70-N73, O00-P96, U04	001-139, 243, 260-269, 279.5-279.6, 280, 281, 285.9, 320-326, 381-382, 460-466, 480-487, 513, 614-616, 630-676, 760-779
HIV/AIDS	B20-B24	279.5-279.6, 042
Diarrhoeal diseases	A00-A09	001-009
Pertussis	A37	033
Tetanus	A33-A35	037, 771.3
Measles	B05	055
Meningitis/encephalitis	A20.3, A32.1, A39.1, G00–G09	036, 320, 322-326
Malaria	B50-B54, P37.3, P37.4	084
Acute respiratory infections	H65-H66, J00-J22, J85, P23, U04	460-466, 480-487, 381-382, 513, 770.0
Prematurity	P01.0, P01.1, P07, P22, P25-P28, P52, P61.2, P77	761.0-761.1, 765, 769, 770.2-770.9, 772.1, 774.2, 776.6, 777.5-777.6,
Birth asphyxia and birth trauma[b]	P01.7-P02.1, P02.4-P02.6, P03, P10- P15, P20-P21, P24, P50, P90-P91	761.7-762.1, 762.4-762.6, 763, 767-768, 770.1, 772.2, 779.0-779.2
Sepsis and other infectious conditions of the newborn	P35-P39 (exclude P37.3, P37.4)	771.0-771.2, 771.4-771.8
Other Group I	Remainder	Remainder
II. Noncommunicable diseases[c]	C00-C97, D000-D48, D55-D64 (exclude D64.9), D65-D89, E03-E34, E65-E88,F01-F99, G10-G98, H00-H61, H68- H93, I00-I99, J30-J84, J86-J98, K00- K92, L00-L98, M00-M99, N00-N28, N31-N32, N35-N64 (exclude N39.0), N75-N98, Q00-Q99	140- 242, 244-259, 270-279, 282-285, 286-319, 330-380, 383-459, 470-478, 490- 512, 514-611, 617- 629, 680- 759 (exclude 279.5-279.6, 285.9)
Congenital anomalies	Q00-Q99	740-759
Other Groups II	Remainder	Remainder
III. Injuries	V01-Y89	E800-E999

[a] Deaths coded to "Symptoms, signs and ill-defined conditions" (780-799 in ICD-9 and R00-R99 in ICD-10) are distributed proportionately to all for neonatal deaths, but exclusively to Group I and Group II for the postneonatal deaths.

[b] Also referred to as "intrapartum-related complications"