

Causes of death 2008: data sources and methods

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1. Introduction

This update of estimates of deaths by cause, age and sex for the year 2008 uses the same general methods as previous revisions carried out by WHO for 2002 and 2004 (1;2). These estimates are available on the WHO website by country, and for selected regional groupings of countries (3). Annex Table 1 lists the cause of death categories and their definitions in terms of the International Classification of Diseases, Tenth Revision (ICD-10) (4).

Apart from the incorporation of new epidemiological data for specific causes, these estimates have incorporated:

- more recent vital registration (VR) data for many countries and VR data for a number of countries for the first time
- updated and additional information on levels of child and adult mortality in many countries without good death registration data
- improvements in methods used for the estimation of causes of child deaths in countries without good death registration data.

For these reasons, and also because of revisions to the UN population estimates, these estimates of deaths by cause for the year 2008 are not directly comparable with the previous WHO estimates for the year 2004, for countries and regions where the 2004 and 2008 estimates were not both based on reasonably complete death registration data. A consultation with Member States was carried out for these estimates towards the end of 2010 to give Member States an opportunity to review the country estimates, data sources and methods, to provide advice on primary data sources that may not have been previously reported or used, to build mutual understanding of the strengths and weaknesses of available data and ensure broad ownership of the results.

The figures in the excel table represent the best estimates of WHO, based on the evidence available to it up until end 2010, rather than the official estimates of Member States, and have not necessarily been endorsed by Member States. They have been computed using standard categories, definitions and methods to ensure cross-national comparability and may not be the same as official national estimates produced using alternate, potentially equally rigorous methods. The following sections of this document provide explanatory notes on data sources and methods for preparing mortality estimates by cause.

2. Population and all-cause mortality estimates for 2008

Life tables for the 193 WHO Member States in 2008 were published in *World health statistics 2010* (5). Following the release of revised child mortality estimates for 1980 to 2009 by the Interagency Group on Mortality Estimation in September 2010 (6), WHO life tables for 2008 were revised to take into account the revised child mortality estimates for year 2008 and, in addition, recent revisions in estimates of human immunodeficiency virus (HIV) deaths by UNAIDS and WHO (7). Total deaths by age and sex were estimated for each country by applying these death rates to the estimated 2008 de facto resident populations prepared by the United

Nations Population Division in its 2008 revision (8). They may thus differ slightly from official national estimates for 2008.

All-cause mortality estimates for children aged under 5 years

Estimated total child deaths under age 5 years for 2008 were estimated by applying the life table mortality rates for 0 and 1-4 years to the estimated de facto population for these age groups. Methods for developing under-5 mortality rates (U5MR) have been developed and agreed upon within the Inter-agency Group for Child Mortality Estimation (IGME) which is made up of WHO, UNICEF, UNPD, World Bank and academic groups (9).

Estimates of total neonatal deaths

For countries with high coverage of VR data, the neonatal mortality rate (NNMR) for 2008 was estimated from the estimated U5MR by applying the observed ratio of NNMR to U5MR in the most recent available year of death registration data. For other countries with survey data, the previous WHO method for estimation of NNMR (10) was revised to take account of the impact of the projected trend in U5MR from the years for which data are available until 2008. The database of observed NNMR and U5MR from death registration systems and household surveys has been updated to include 3203 country-year data points across 168 countries and all WHO regions, of which 1001 country-years are from survey data.

A number of regression models were evaluated and the best performing model was selected. For the regression analysis, all observed U5MR and NNMR were rescaled to match IGME estimates of U5MR for the relevant country-years. A country-specific model of the following form was then fitted to data from 1990 onwards:

$$\log[\text{Pr}(\text{NNMR}/1000)] = \alpha + \beta_1 * \log[\text{Pr}(\text{U5MR}/1000)] + \beta_1 * (\log[\text{Pr}(\text{U5MR}/1000)])^2 + \beta_3 * X_i$$

where X_i is 1 for country i and zero otherwise, β_3 is a country-level fixed effect.

For countries with no data available on both NNMR and U5MR, the above regression model was run with region-specific indicator variables rather than country-specific, and used to predict the 2008 ratio of NNMR to U5MR.

3. Estimates of mortality by cause for countries with VR data

Where the latest available year was earlier than 2008, VR data from 1980 up to the latest available year were analysed as a basis for projecting recent trends for specific causes, and these trend estimates were used to project the cause distribution for 2008 from the latest available year. When estimating cause-of-death distributions for very small countries, an average of the three last years of data were used to minimize stochastic variation. Adjustments for deaths due to HIV, drug use disorders, maternal causes, homicides, war and natural disasters were based on other sources of information as described below.

If death registration coverage was assessed as less than 85%, cause-of-death modelling (CodMod) was used to adjust the proportions of deaths occurring in Groups I, II and III by age and sex as described elsewhere (11). Annex Table 2 lists the years of death registration data used for assessing cause of death for year 2008, and also whether CoDMod or other adjustments were made.

Correction algorithms (11) were applied to the vital registration data to resolve problems of miscoding for cardiovascular diseases (mainly involving redistribution of deaths coded to heart failure or ill-defined heart disease), cancer (involving redistribution of deaths coded to secondary sites or ill-defined primary sites) and injuries (involving redistribution of deaths coded as due to events of undetermined intent).

The ICD-10 provides a chapter on 'Certain conditions originating in the perinatal period' (codes P00-P96). Most of the conditions occurring during the neonatal period are coded to that chapter. However for some conditions which could apply to both neonates and older age-groups, we have found that coding could be inconsistent. For example, in a number of countries, neonatal septicaemia (P36) was frequently assigned to A40 and A41 (septicaemia) as the age of death was not taken into account when assigning the code. These deaths were recoded back to P36. This recoding allowed capturing more deaths due to causes originating in the perinatal period. Annex Table 2 provides a list of codes outside the P chapter not suitable for neonatal deaths which we have re-assigned to relevant codes.

The ICD-10 provides a chapter on 'Congenital malformations, deformations and chromosomal abnormalities' which captures most of the deaths among neonates due to congenital abnormalities. In addition neonatal deaths classified in other chapters of the ICD-10 such as endocrine, nutritional and metabolic diseases, diseases of the nervous, digestive, circulatory, musculoskeletal and genitourinary systems were reassigned to congenital abnormalities as these are consequences of congenital malformations.

Cause of death estimates for a number of countries drew on non-national death registration data or other data sources with cause of death information as follows.

China

Cause-specific mortality data for China were available from two sources – the sample vital registration system data for 2007 and the Third Retrospective Survey on mortality 2004-2005 both carried by the Ministry of Health (12). Both data sets were assessed for suitability in estimating 2008 cause-specific mortality for China at the national level. Since the survey had a nation-wide sampling, it was more nationally representative than the sample vital registration system data. We therefore based the update of the broad cause-of-death patterns (Groups I, II and III) for 2008 on the survey data. CodMod was used to adjust for changes in mortality rates and income levels from 2004-2005 to 2008. For the within-group cause-specific estimates, we used specific proportionate mortality distributions from both the VR and the survey. The VR data were however weighted as follows: 43% urban and 57% rural. The resulting cause-specific estimates were further adjusted with information for 2008 from WHO technical programmes and UNAIDS on maternal, perinatal and childhood cluster conditions, as well as epidemiological estimates for TB, HIV, cancers, illicit drug dependence and problem use, rheumatoid arthritis and war deaths (see below).

For estimates of causes of death under age 5, a separate analysis was undertaken based on an analysis of 206 Chinese community-based longitudinal studies that reported multiple causes of child death (13;14). The Child Health Epidemiology Reference Group (CHERG) conducted a systematic search of publically available Chinese databases in collaboration with researchers from Peking University. Information was obtained from the Chinese Ministry of Health and Bureau of Statistics websites, Chinese National Knowledge Infrastructure (CNKI) database and Chinese Health Statistics Yearbooks published between 1990-2008. A model was developed to assign the total number of child deaths to provinces, age groups and main causes of child death.

Table 2. Distribution of population and deaths from VR and Survey data

Source	TOTAL	URBAN of which -->	big cities	medium and small cities	RURAL
VR 2007					
Population	79,101,646	42,511,570	20,457,434	22,054,136	36,590,076
Deaths	475,289	262,621	131,110	131,511	212,668
death rate/100 000	601	618	641	596	581
Survey 2004-2005					
Population	142,660,482	47,899,806	94,760,676
Deaths	868,484	287,422	581,062
death rate/100 000	609	600	613

India

Cause patterns of mortality were based on the Medical Certificate of Cause of Death Database (MCCD) for urban India (2003-2004), the Million Deaths Study data for years 2001-2003(15) and information from WHO technical programmes and UNAIDS. Verbal autopsy methods used in the Indian sample registration system for assigning cause of death have been substantially revised as part of the Million Deaths Study (16).

Nationally representative cause distributions for India were derived from detailed tabulations from the Million Deaths Study and adjusted to the 2008 all-cause envelope. For external causes of injury, urban distributions from the 2003-2004 MCCD data were also taken into account. The resulting cause-specific estimates were further adjusted with information for 2008 from WHO technical programmes and UNAIDS on maternal, perinatal and childhood cluster conditions, as well as epidemiological estimates for TB, HIV, illicit drug dependence and problem use, rheumatoid arthritis and war deaths (see below).

Iran

The latest death registration data available for the Islamic Republic of Iran were for the period 21 March 2006 to 20 March 2007, as per the Iranian calendar. The registration system operated by the Deputy of Health Programme (Ministry of Health and Medical Education) captured deaths from 29 out of 30 provinces, with a reported overage of around 80% of all deaths occurring in the country. Tehran Province, which is the most populous province (population 13 million), was the only province not covered by the death registration system (17). Coverage has substantially improved compared to earlier years. In 1999, the system was capturing deaths in only four provinces with coverage of 5% of all deaths in the entire country. In 2001, the system further expanded by recording deaths in 18 provinces and one district with coverage of nearly 40% of all deaths in the country.

The 2006 data were coded to a condensed list of 320 cause categories, using the ICD-10 classification system. As coverage was partial, CodMod was used to predict the proportionate mortality distributions for Groups I, II and III, and specific cause mortality distributions adjusted within these groups. Supplementary information from WHO technical programmes and UNAIDS was also used in estimating specific causes of death.

South Africa

The completeness of the 2007 death registration data for South Africa was assessed to lie in the range of 75–89%. Approximately 13 000 deaths were reported to be due to HIV/AIDS, although

UNAIDS has estimated that HIV/AIDS was responsible for 310 000 deaths in 2009 (18). Comparison of age-specific death rates for individual causes in 2007 with the corresponding death rates for 1993 and 1996 (when there were far fewer HIV deaths – around 11 000 and 45 000, respectively) showed clear evidence of miscoding of HIV deaths into other causes. This was particularly evident for diarrhoea and gastroenteritis of presumed infectious origin, respiratory TB, and herpes zoster, causes which the national statistical office had also found to be often associated with HIV/AIDS (19). In addition, deaths classified as ill-defined and AIDS-defining diseases such as Kaposi sarcoma were also examined. Averaged age distributions for cause-specific mortality rates for 1993 and 1996 were used to remove the embedded misdiagnosed HIV/AIDS deaths in the 2007 data, in order to obtain HIV/AIDS-free sex-age-cause distribution patterns.

The HIV/AIDS-free sex-age-cause distribution patterns thus obtained were then proportionately scaled up to the WHO estimated number of deaths by sex and age for South Africa in 2008. Supplementary information from WHO technical programs for some specific diseases and causes was also used to adjust final estimates by cause. We used separate estimates from the National Injury Mortality Surveillance System prepared for the revised South African Burden of Disease study (20) to obtain the distribution of deaths from external causes of injuries.

Thailand

Death registration data were available for the year 2006, with an estimated coverage of about 85%. However, the proportion of ill-defined conditions was nearly 50%, since many deaths in Thailand occur at home, and the cause of death is reported by lay people. In order to improve the usability of the death registration data, the Thai Ministry of Health conducted a re-test survey on the death certificates in 2005-2008 using verbal autopsy methods, to ascertain the true cause of death. Published results of the reassignment of ill-defined causes from this survey (21) were used for estimating the 2008 causes of death. The resultant cause-specific proportionate mortality was inflated to the national mortality envelope derived from the life table analysis. Supplementary information from WHO technical programmes and UNAIDS was also used in estimating specific causes of death.

Turkey

Death registration data for 2004 and 2008 were only available for urban areas of Turkey, with an estimated national coverage of around 50%. Causes of death were coded using the condensed list of the ICD eighth revision. Data for the urban population covered by these data were not available. As a result, it was difficult to interpret and make use of the trends in these data, and in addition, it is difficult to map ICD 8 categories satisfactorily to the ICD-10 based categories used by WHO. As a result, it was decided to defer use of the VR data until the planned transition to ICD-10 coding has taken place. The national cause of death distribution for Turkey thus continues to be based on detailed analyses of causes of death from a burden of disease study conducted by the national authorities in Turkey (22). Supplementary information from WHO technical programmes and UNAIDS was also used in estimating specific causes of death as described below. Child cause of death distributions were estimated as described in Section 4 below.

Vietnam

Cause distributions were revised for 2008 using proportional distributions from a nationally representative verbal autopsy survey (23) conducted in 2006, with further adjustments for specific causes from WHO technical programs and UNAIDS. Child cause of death distributions were estimated as described in Section 4 below.

4. Child mortality by cause for countries without VR data

Cause-specific estimates of deaths for children under age 5 were estimated as described by Black et al. (14) and on the WHO website (24). These previously published estimates for 2008 were revised to take account of revisions in child mortality levels (6), and cause-specific estimates for HIV, tuberculosis and malaria deaths for 2008 (7;25;26). Cause-specific estimates for cancers were derived from Globocan 2008 (27).

Causes of neonatal death (deaths at less than 28 days of age)

In 2010, WHO and the Child Health Epidemiology Reference Group (CHERG) published estimates of deaths by cause in the neonatal period for 2008 that drew on two multicause models developed by the WHO Child Health Epidemiology Reference Group as well as cause-specific estimates from WHO technical programmes (14). For these 2008 estimates, the multicause model for neonatal deaths (28;29) was revised to include additional study data and rerun with updated inputs for the year 2008. Together with cause-specific inputs for neonatal tetanus deaths from the WHO technical programme, the resulting cause-specific inputs were adjusted country-by-country to fit the estimated neonatal death envelope for 2008.

The CHERG neonatal working group undertook an extensive exercise to derive mortality estimates for seven causes of neonatal death, including preterm birth, asphyxia, severe infection, neonatal tetanus, diarrhoea, congenital malformation and other causes, based on 56 studies of neonatal deaths from 29 countries that met inclusion criteria (28;29). For the 2008 analysis, this model was revised to include input data from 60 countries with death registration data where adult completeness was assessed as 80% or more, and also included additional recent data from 15 research studies in high mortality populations that met inclusion criteria. A separate cause category for neonatal pneumonia was added to the model, and the neonatal infection category renamed as neonatal sepsis. This latter category also includes a number of neonatal infections, such as meningitis, not separately identified. Annex Table 2 specifies the cause categories used for the neonatal and 1-59 month cause of death estimates.

An additional model for low neonatal mortality countries (NNMR<15) without useable death registration data was developed using available death registration data for low mortality countries. For countries without high coverage death registration data on neonatal deaths, the death-registration model was used for countries with NNMR below 15 and the high mortality model for countries with NNMR above 20. For countries with an NNMR in the range 15-20, both models are fitted and an average of the two results used. The methods used for each country are listed in Annex Table 4.

The WHO Department of Immunization, Vaccines and Biologicals and CHERG developed a revised statistical model which predicts the odds of neonatal death due to tetanus in high burden countries based on WHO estimates of proportion protected at birth, the skilled birth attendance rate, and the female literacy rate (30;31). These were used for high burden countries for 2008. For countries without either good death registration data or estimates from the single cause model, neonatal tetanus death estimates from the CHERG neonatal multicause model were used.

Causes of child death at ages 1-59 months

In 2010, WHO and the Child Health Epidemiology Reference Group (CHERG) published 2008 estimates of deaths by cause for children aged 1-59 months that drew on multicause models developed by the WHO Child Health Epidemiology Reference Group as well as cause-specific estimates from WHO technical programmes and UNAIDS (14). For the 2008 estimates, the WHO CHERG developed a new multi-cause model to derive mortality estimates for seven causes of postneonatal death, including pneumonia, diarrhea, malaria, meningitis, measles, injuries and

other causes, based on 84 studies of postneonatal deaths from 25 countries that met inclusion criteria¹. Studies were predominantly from lower income high mortality countries. Malnutrition deaths were reallocated to infection cause of death categories based on relative importance of each cause of death. Deaths due to unknown causes and HIV/AIDS were excluded from the analysis. The cause categories used for this model are listed in Annex Table 2.

Using similar statistical methods to the WHO CHERG multi-cause model for neonatal deaths, the new multi-cause model for postneonatal death estimates was populated with year 2008 country-level input data and then estimates for were further adjusted for intervention coverage (pneumonia and meningitis estimates adjusted for use of Hib vaccine; malaria estimates adjusted for insecticide treated mosquito nets) (14).

Together with cause-specific inputs from WHO technical programmes and UNAIDS (as summarized in Table 1, the resulting cause-specific inputs were adjusted to fit the estimated total deaths at ages 1-59 months. This method was used for countries without useable death registration data and with U5MR>26 and gross national income per capita less than \$7,510.

Table 1. Data inputs and assumptions for estimation of post-neonatal deaths by cause

Cause	Data inputs and assumptions
HIV/AIDS	UNAIDS and WHO estimates for 2008 (7)
Diarrhoeal diseases	Multicausal model
Pertussis, measles and postneonatal tetanus	WHO estimates for 2008 (see Section 6)
Meningitis	Multicausal model
Malaria	WHO estimates for 2008 (see Section 6)
Injuries	Multicausal model
Other causes	Multicausal model

For countries without useable death registration data and with U5MR<26 or gross national income (GNI) per capita of \$7,510 or more, a separate multi-cause model was developed using death registration data for causes of death at ages 1-59 months from 97 countries. This model included covariates for U5MR, GNI per capita and regional indicator variables for Europe and Latin America and Caribbean. This model was also used for countries with U5MR in the range 26 to 35, and an average of this model and the model for high mortality countries was used (see Annex Table 4).

5. Mortality at ages 5 and over by cause for countries without nationally representative data

To estimate deaths at ages 5+ years by cause for Member States without usable death registration data, previous estimated distributions of deaths by cause (2) were projected forward from 2004 to 2008, excluding HIV, war and natural disasters. Specific causes were further adjusted on the basis of epidemiological evidence from registries, verbal autopsy studies, disease surveillance systems

¹ Studies conducted in year 1980 or later, a multiple of 12 months in study duration, cause of death available for more than a single cause, with at least 25 deaths in children <5 years of age, each death represented once, and less than 25% of deaths due to unknown causes were included. Studies conducted in sub-groups of the study population (e.g. intervention groups in clinical trials) and verbal autopsy studies conducted without use of a standardized questionnaire or the methods could not be confirmed were excluded from the analysis.

and analyses from WHO technical programs (see Section 6). Annex Table 4 identifies the countries for which this approach was used.

6. Estimates for specific causes with additional information

HIV, tuberculosis and malaria

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 miscoding of HIV/AIDS deaths. In such cases, a time series analysis of causes where there was likely miscoding of HIV/AIDS deaths was carried out to identify and re-assign miscoded HIV/AIDS deaths. For other countries, estimates were based on UNAIDS and WHO estimated HIV/AIDS mortality for 2008 (7), or in some cases where that was not available, on estimated HIV death rates for 2004 (2).

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 (both sexes, all ages) were derived from latest published WHO estimates (26). Age and sex distributions for tuberculosis deaths were imputed using the age patterns of tuberculosis deaths in 2004 (2), adjusted where necessary to fit all-cause mortality envelopes with appropriate allowance for other causes.

Malaria

Cause-specific estimates for malaria deaths for 2008 were derived from latest published WHO estimates (25).

Pertussis

Updated estimates of pertussis cases for 2008 were prepared by the WHO Department of Immunization, Vaccines and Biologicals using WHO–UNICEF estimates for vaccine coverage in 2008, interpolated for missing data (32). Pertussis deaths for countries without good death registration data were based on a natural history model using vaccine coverage and age-specific case fatality rates from community-based studies (33).

Measles

Measles mortality for 2008 was estimated for countries without high vital events coverage using a revised natural history model whose inputs included routine vaccine coverage (32), supplementary immunization activities, reported measles cases, estimates of notification efficiency, and estimates of age-specific case fatality rates (34). Estimated case fatality rates were validated by comparison with a single cause proportional mortality model based on 28 studies in 16 countries.

Meningitis

Estimates for 2008 for *Haemophilus influenzae* (HiB) meningitis deaths, together with deaths for meningitis due to *Streptococcus pneumoniae* were estimated by the Department of Immunization, Vaccines and Biologicals using vaccine coverage data and information on case fatality rates (35;36). For the relatively few countries in which estimated deaths for these two causes exceeded the total meningitis deaths predicted by the multicausal model, the latter estimate was adjusted upwards.

Dengue, Japanese encephalitis, schistosomiasis and other tropical diseases

Previous country-specific estimates for year 2004 (2) were brought forward to 2008.

Maternal mortality

Country-specific estimates for maternal mortality were based on the recent Interagency estimates for 2008 (37). Note that numbers of maternal deaths were adjusted upwards by a country-specific fraction, or by 50%, for countries with useable death registration data, to allow for under-identification of maternal deaths. Note also 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 estimated by UNAIDS for 2008.

For countries without useable death registration data, estimates of cause-specific maternal mortality were based on earlier analysis of cause distributions for the year 2004 together with an analysis of regional cause patterns (37;38).

Cancers

Cause-specific estimates for cancer deaths were derived from Globocan 2008 (27) for countries without useable death registration data.

Drug use disorders

Estimates of deaths due to drug use disorders for 2008 were updated using regional trends in the use of illicit opiate drugs reported by the UN Office on Drugs and Crime (39).

Road traffic accidents

To be written

Homicides

For a number of countries where fewer homicide deaths were estimated from death registration data sources than were reported from criminal justice sources (40), estimated number of homicides was adjusted accordingly.

Conflicts and natural disasters

Country-specific estimates of war and conflict deaths were updated to 2008 using information on conflict intensity, time trends, and mortality obtained from a variety of published and unpublished war mortality databases (41-44). Additional information from epidemiological studies and surveys was also used for certain specific conflicts (45-50). Murray et al. have summarized the issues with estimation of war deaths, and emphasized the very considerable uncertainty in most estimates for conflict deaths (51). Estimated deaths for major natural disasters in 2008 were obtained from the OFDA/CRED International Disaster Database (52). For four countries where estimated child deaths due to war and conflict exceeded 1% of estimated total child deaths, these were added to the estimated deaths for injuries and all causes. These countries were China, Iraq, Myanmar and Sri Lanka.

6. Uncertainty of estimates

Uncertainty ranges for all-cause mortality rates for WHO Member States were published in the World Health Report 2006 (53). Uncertainty ranges for 2008 all-cause mortality rates are likely to be generally similar in magnitude to previous assessment, ranging from $\pm 1\%$ for high-income countries to $\pm 15\text{--}20\%$ for sub-Saharan Africa, reflecting differential data availability (54).

Uncertainty analysis for the 2008 cause-specific mortality estimates has not been carried out, but uncertainty ranges are likely to be similar to previous assessments (54). Uncertainty ranges were generally larger for deaths from specific diseases than for all-cause mortality. For example, the relative uncertainty for deaths from IHD ranged from $\pm 12\%$ for high-income countries to $\pm 25\text{--}35\%$ for countries in Sub-Saharan Africa.

Country-level estimates of mortality for 2004 previously released on the WHO website included guidance to users on the data sources and methods used for each country, in terms of four levels of evidence. The summary estimates for 2008 released at country level contain similar guidance on levels of evidence and uncertainty.

Annex Table 1: GBD cause categories and ICD codes

GBD cause name	ICD-10 code
I. Communicable, maternal, perinatal and nutritional conditions^a	A00-B99, G00-G04, N70-N73, J00-J06, J10-J18, J20-J22, H65-H66, O00-O99, P00-P96, E00-E02, E40-E46, E50, D50-D53, D64.9, E51-64
A. Infectious and parasitic diseases	A00-B99, G00, G03-G04, N70-N73
1. Tuberculosis	A15-A19, B90
2. Sexually transmitted diseases excluding HIV	A50-A64, N70-N73
a. Syphilis	A50-A53
b. Chlamydia	A55-A56
c. Gonorrhoea	A54
Other STDs	A57-A64, N70-N73
3. HIV/AIDS	B20-B24
4. Diarrhoeal diseases	A00, A01, A03, A04, A06-A09
5. Childhood-cluster diseases	A33-A37, A80, B05, B91
a. Pertussis	A37
b. Poliomyelitis	A80, B91
c. Diphtheria	A36
d. Measles	B05
e. Tetanus	A33-A35
6. Meningitis	A39, G00, G03
7. Hepatitis B	B16-B19 (minus B17.1, B18.2)
Hepatitis C	B17.1, B18.2
8. Malaria	B50-B54
9. Tropical-cluster diseases	B55-B57, B65, B73, B74.0-B74.2
a. Trypanosomiasis	B56
b. Chagas disease	B57
c. Schistosomiasis	B65
d. Leishmaniasis	B55
e. Lymphatic filariasis	B74.0-B74.2
f. Onchocerciasis	B73
10. Leprosy	A30
11. Dengue	A90-A91
12. Japanese encephalitis	A83.0
13. Trachoma	A71

Annex Table 1 (continued): GBD cause categories and ICD codes

GBD cause name	ICD-10 code
14. Intestinal nematode infections	B76-B81
a. Ascariasis	B77
b. Trichuriasis	B79
c. Hookworm disease (ancylostomiasis and necatoriasis)	B76
Other intestinal infections	B78, B80, B81
Other infectious diseases	A02, A05, A20-A28, A31, A32, A38, A40-A49, A65-A70, A74-A79, A81, A82, A83.1-A83.9, A84-A89, A92-A99, B00-B04, B06-B15, B25-B49, B58-B60, B64, B66-B72, B74.3-B74.9, B75, B82-B89, B92-B99, G04
B. Respiratory infections	J00-J06, J10-J18, J20-J22, H65-H66
1. Lower respiratory infections	J10-J18, J20-J22
2. Upper respiratory infections	J00-J06
3. Otitis media	H65-H66
C. Maternal conditions	O00-O99
1. Maternal haemorrhage	O44-O46, O67, O72
2. Maternal sepsis	O85-O86
3. Hypertensive disorders of pregnancy	O10-O16
4. Obstructed labour	O64-O66
5. Abortion	O00-O07
Other maternal conditions	O20-O43, O47-O63, O68-O71, O73-O75, O87-O99
D. Conditions arising during the perinatal period	P00-P96
1. Prematurity and low birth weight	P05, P07, P22, P27-P28
2. Birth asphyxia and birth trauma	P03, P10-P15, P20-P21, P24-P26, P29
Neonatal infections and other conditions	P00-P02, P04, P08, P23, P35-P96
E. Nutritional deficiencies	E00-E02, E40-E46, E50, D50-D53, D64.9, E51-E64
1. Protein-energy malnutrition	E40-E46
2. Iodine deficiency	E00-E02
3. Vitamin A deficiency	E50
4. Iron-deficiency anaemia	D50, D64.9
Other nutritional disorders	D51-D53, E51-E64
II. Noncommunicable diseases^a	C00-C97, D00-D48, D55-D64 (minus D 64.9), D65-D89, E03-E07, E10-E16, E20-E34, E65-E88, F01-F99, G06-G98, H00-H61, H68-H93, I00-I99, J30-J98, K00-K92, N00-N64, N75-N98, L00-L98, M00-M99, Q00-Q99
A. Malignant neoplasms	C00-C97
1. Mouth and oropharynx cancers ^b	C00-C14
2. Oesophagus cancer ^b	C15
3. Stomach cancer ^b	C16
4. Colon and rectum cancers ^b	C18-C21
5. Liver cancer	C22
6. Pancreas cancer	C25
7. Trachea, bronchus and lung cancers	C33-C34
8. Melanoma and other skin cancers ^b	C43-C44

Annex Table 1 (continued): GBD cause categories and ICD codes

GBD cause name	ICD-10 code
9. Breast cancer ^b	C50
10. Cervix uteri cancer ^b	C53
11. Corpus uteri cancer ^b	C54-C55
12. Ovary cancer	C56
13. Prostate cancer ^b	C61
14. Bladder cancer ^b	C67
15. Lymphomas and multiple myeloma ^b	C81-C90, C96
16. Leukaemia ^b	C91-C95
Other malignant neoplasms ^b	C17, C23, C24, C26-C32, C37-C41, C45-C49, C51, C52, C57-C60, C62-C66, C68-C80, C97
B. Other neoplasms	D00-D48
C. Diabetes mellitus	E10-E14
D. Endocrine disorders	D55-D64 (minus D64.9), D65-D89, E03-E07, E15-E16, E20-E34, E65-E88
E. Neuropsychiatric conditions	F01-F99, G06-G98
1. Unipolar depressive disorders	F32-F33
2. Bipolar affective disorder	F30-F31
3. Schizophrenia	F20-F29
4. Epilepsy	G40-G41
5. Alcohol use disorders	F10
6. Alzheimer and other dementias	F01, F03, G30-G31
7. Parkinson disease	G20-G21
8. Multiple sclerosis	G35
9. Drug use disorders	F11-F16, F18-F19
10. Post-traumatic stress disorder	F43.1
11. Obsessive-compulsive disorder	F42
12. Panic disorder	F40.0, F41.0
13. Insomnia (primary)	F51
14. Migraine	G43
Mental retardation attributable to lead exposure	F70-F79
Other neuropsychiatric disorders	F04-F09, F17, F34-F39, F401-F409, F411-F419, F43(minus F43.1), F44-F50, F52-F69, F80-F99, G06-G12, G23-G25, G36, G37, G44-G98
F. Sense organ diseases	H00-H61, H68-H93
1. Glaucoma	H40
2. Cataracts	H25-H26
3. Refractive errors	H524
4. Hearing loss, adult onset	H90-H91
Macular degeneration and other	H00-H21, H27-H35, H43-H61(minus H524), H68-H83, H92-H93

Annex Table 1 (continued): GBD cause categories and ICD codes

GBD cause name	ICD-10 code
G. Cardiovascular diseases	I00-I99
1. Rheumatic heart disease	I01-I09
2. Hypertensive heart disease	I10-I13
3. Ischaemic heart disease ^c	I20-I25
4. Cerebrovascular disease	I60-I69
5. Inflammatory heart diseases	I30-I33, I38, I40, I42
Other cardiovascular diseases ^c	I00, I26-I28, I34-I37, I44-I51, I70-I99
H. Respiratory diseases	J30-J98
1. Chronic obstructive pulmonary disease	J40-J44
2. Asthma	J45-J46
Other respiratory diseases	J30-J39, J47-J98
I. Digestive diseases	K20-K92
1. Peptic ulcer disease	K25-K27
2. Cirrhosis of the liver	K70, K74
3. Appendicitis	K35-K37
Other digestive diseases	K20-K22, K28-K31, K38, K40-K66, K71-K73, K75-K92
J. Genitourinary diseases	N00-N64, N75-N98
1. Nephritis and nephrosis	N00-N19
2. Benign prostatic hypertrophy	N40
Other genitourinary system diseases	N20-N39, N41-N64, N75-N98
K. Skin diseases	L00-L98
L. Musculoskeletal diseases	M00-M99
1. Rheumatoid arthritis	M05-M06
2. Osteoarthritis	M15-M19
3. Gout	M10
4. Low back pain	M45-M48, M54 (minus M54.2)
Other musculoskeletal disorders	M00-M02, M08, M11-M13, M20-M43, M50-M53, M54.2, M55-M99
M. Congenital anomalies	Q00-Q99
1. Abdominal wall defect	Q79.2-Q79.5
2. Anencephaly	Q00
3. Anorectal atresia	Q42
4. Cleft lip	Q36
5. Cleft palate	Q35, Q37
6. Oesophageal atresia	Q39.0-Q39.1
7. Renal agenesis	Q60
8. Down syndrome	Q90
9. Congenital heart anomalies	Q20-Q28
10. Spina bifida	Q05
Other congenital anomalies	Q01-Q04, Q06-Q18, Q30-Q34, Q38, Q392-Q399, Q40-Q41, Q43-Q56, Q61-Q78, Q790, Q791, Q796, Q798, Q799, Q80-Q89, Q91-Q99

Annex Table 1 (continued): GBD cause categories and ICD codes

GBD cause name	ICD-10 code
N. Oral conditions	K00-K14
1. Dental caries	K02
2. Periodontal disease	K05
3. Edentulism	—
Other oral diseases	K00, K01, K03, K04, K06-K14
III. Injuries	V01-Y89
A. Unintentional injuries^d	V01-X59, Y40-Y86, Y88, Y89
1. Road traffic accidents ^e	
2. Poisonings	X40-X49
3. Falls	W00-W19
4. Fires	X00-X09
5. Drownings	W65-W74
6. Other unintentional injuries	Rest of V, W20-W64, W75-W99, X10-X39, X50-X59, Y40-Y86, Y88, Y89
B. Intentional injuries^d	X60-Y09, Y35-Y36, Y870, Y871
1. Self-inflicted injuries	X60-X84, Y870
2. Violence	X85-Y09, Y871
3. War and conflict	Y36
Other intentional injuries	Y35

—, not available, STD, sexually transmitted diseases.

^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 causes within Group I and Group II.

^b 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 (ICD-10 C76, C80, C97 or ICD-9 195, 199) were redistributed pro-rata across the footnoted malignant neoplasm categories within each age–sex group, so that the category “Other malignant neoplasms” includes only malignant neoplasms of other specified sites (11).

^c 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 (23). Relevant ICD-9 codes are 427.1, 427.4, 427.5, 428, 429.0, 429.1, 429.2, 429.9, 440.9, and relevant ICD-10 codes are I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9 and I70.9.

^d Injury deaths where the intent is not determined (E980-989 of ICD-9 and Y10-Y34, Y872 in ICD-10) are distributed proportionately to all causes below the group level for injuries.

^e For countries with 3-digit ICD10 data, for “Road traffic accidents” use: V01-V04, V06, V09-V80, V87, V89 and V99. For countries with 4-digit ICD10 data, for “Road traffic accidents” 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 2: Categories and ICD codes for modelling of causes of death under 5 years of age

GBD cause name	ICD-10 code	ICD-9 code
All causes	A00-Y89	001-999
I. Communicable, maternal, perinatal and nutritional conditions	A00-B99, D50-D53, D64.9, E00-E02, E40-E64, G00, G03-G04, 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- 323, 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	A39, A83, A84, A87, G00, G03, G04	036, 047, 320-322
Malaria	B50-B54	084
Acute respiratory infections	H65-H66, J00-J22, J85, P23	460- 466, 480- 487, 381- 382, 513, 770.0
Prematurity	P01.0, P01.1, P07, P22, P25-P28, 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 & birth trauma	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	771.0-771.2, 771.4-771.8
Other Group I	Remainder	Remainder
II. Noncommunicable diseases	C00-C97, D00-D48, D55-D64 (exclude D 64.9), D65-D89, E03-E34, E65-E88, F01-F99, G06-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, 324- 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 Group II	Remainder	Remainder
III. Injuries	V01-Y89	E800-E999

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 causes within Group I and Group II.

Annex Table 3: Re-assignment of ICD-10 codes for certain neonatal deaths

Cause	Recode to	Cause	Recode to	Cause	Recode to	Cause	Recode to	Cause	Recode to
A153	P370	D649	P614	I471	P291	J698	P249	K760	P788
A162	P370	D65	P60	I472	P291	J70	P24	K761	P788
A165	P370	D696	D694	I479	P291	J709	P249	K762	P788
A169	P370	D699	P549	I48	P29	J80	P22	K763	P788
A170	P370	E101	P702	I490	P291	J840	P258	K767	P788
A180	P370	E102	P702	I494	P291	J841	P258	K768	P788
A320	P372	E110	P702	I498	P291	J848	P258	K769	P788
A321	P372	E112	P702	I499	P291	J849	P258	K819	P788
A327	P372	E116	P702	I50	P29	J85	P28	K82	P78
A328	P372	E117	P702	I500	P290	J850	P288	K828	P788
A329	P372	E140	P702	I501	P290	J851	P288	K830	P788
A35	A33	E144	P702	I509	P290	J852	P288	K831	P788
A40	P36	E145	P702	I517	Q248	J860	P288	K838	P788
A401	P360	E147	P702	I518	Q248	J869	P288	K839	P788
A402	P361	E149	P702	I519	Q249	J90	P28	K85	P78
A403	P361	E343	P051	I60	P52	J930	P251	K868	P788
A408	P361	E86	P74	I603	P525	J931	P251	K869	P788
A409	P361	E87	P74	I607	P525	J938	P251	K904	P788
A41	P36	E870	P742	I608	P525	J939	P251	K909	P788
A410	P362	E871	P742	I609	P525	J940	P288	K920	P540
A412	P363	E872	P740	I61	P52	J941	P288	K922	P543
A413	P368	E874	P748	I610	P524	J942	P548	K928	P788
A415	P368	E875	P743	I612	P524	J948	P288	K929	P789
A418	P368	E876	P743	I615	P524	J96	P28	N133	Q620
A419	P369	E877	P744	I616	P524	J960	P285	N139	Q623
B00	P35	E878	P744	I618	P524	J961	P285	N17	P96
B000	P352	F322	P914	I619	P524	J969	P285	N170	P960
B004	P352	F328	P914	I620	P528	J980	P288	N171	P960
B007	P352	F329	P914	I629	P529	J981	P281	N172	P960
B008	P352	F439	P209	I632	P529	J982	P250	N179	P960
B009	P352	G91	Q03	I633	P529	J984	P288	N180	P960
B01	P35	G911	Q039	I634	P529	J985	P288	N188	P960
B010	P358	G912	Q039	I635	P529	J986	P288	N189	P960
B011	P358	G913	Q039	I638	P529	J988	P288	N19	P96
B012	P358	G919	Q039	I639	P529	J989	P289	N359	Q643
B018	P358	G930	Q046	I64	P52	K220	Q395	N390	P393
B019	P358	G931	P219	I671	I607	K311	Q400	N433	P835
B059	P358	G936	P524	J12	P23	K44	Q79	N883	P010
B060	P350	G952	P025	J120	P230	K440	Q790	R001	P209
B068	P350	I050	Q232	J121	P230	K441	Q790	R011	P298
B069	P350	I059	Q238	J128	P230	K449	Q790	R030	P292
B09	P35	I071	Q228	J129	P230	K561	Q438	R040	P548
B25	P35	I080	Q238	J13	P23	K562	Q438	R042	P269
B250	P351	I340	Q233	J14	P23	K565	Q433	R048	P548
B251	P351	I348	Q238	J15	P23	K566	P769	R049	P548
B258	P351	I35	Q23	J150	P236	K57	Q43	R05	P28
B259	P351	I350	Q230	J151	P235	K593	Q431	R060	P228
B270	P358	I351	Q231	J152	P232	K625	P542	R064	P228
B370	P375	I352	Q238	J153	P233	K631	P780	R068	P228
B371	P375	I359	Q238	J154	P236	K633	P788	R090	P219
B372	P375	I370	Q221	J155	P234	K65	P78	R092	P285
B373	P375	I379	Q223	J156	P236	K650	P781	R160	Q447
B374	P375	I38	I42	J157	P236	K659	P781	R162	Q447
B375	P375	I42	I42	J158	P236	K660	Q433	R230	Q249
B376	P375	I420	I424	J159	P236	K661	P548	R509	P819
B377	P375	I421	Q248	J16	P23	K720	P788	R568	P90
B378	P375	I422	I424	J18	P23	K729	P788	R571	P741
B379	P375	I429	I424	J180	P239	K732	P788	R58	P54
B509	P373	I442	Q246	J181	P239	K745	P788	R601	P833
B54	P37	I443	Q246	J188	P239	K746	P788	R628	P059
B582	P371	I455	Q246	J189	P239	K750	P788	R629	P059
B589	P371	I458	Q246	J386	Q318	K752	P788	R630	P929
D500	P549	I459	Q246	J439	P250	K758	P788	R638	P929
D609	D610	I460	P291	J69	P24	K759	P788	R75	B24
D62	P61	I469	P291	J690	P249				

Annex Table 4: Data sources and methods for estimation of mortality in 2008 by cause, age and sex

Country	Vital registration data			All-cause mortality method	Cause distribution method for ages 0-4	Cause distribution method for ages 5+
	All-cause mortality: latest year used	Causes of death	Estimated coverage (%)			
Afghanistan				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Albania	2006	2004	50-74	VR projected	VR-MCM	VR (b)
Algeria				Country data (1)	VA-MCM	GBD 2004 (a)
Andorra				Regional (3)	VR-MCM	GBD 2004 (a)
Angola				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Antigua and Barbuda	2008	2008	75-89	VR projected	VR-MCM	VR (c)
Argentina	2008	2008	90-100	VR for 2008	VR	VR (c)
Armenia	2008	2008	50-74	VR for 2008	VR-MCM	VR (b)
Australia	2007	2006	90-100	VR projected	VR	VR (c)
Austria	2008	2008	90-100	VR for 2008	VR	VR (c)
Azerbaijan	2008	2007	50-74	VR for 2008	VA-MCM	VR (b)
Bahamas	2007	2005	90-100	VR projected	VR	VR (c)
Bahrain	2008	2008	90-100	VR projected	VR	VR (c)
Bangladesh				Country data (1)	VA-MCM	GBD 2004 (a)
Barbados	2007	2006	90-100	VR projected	VR	VR (c)
Belarus	2008	2007	90-100	VR for 2008	VR	VR (c)
Belgium	2007	2005	90-100	VR projected	VR	VR (c)
Belize	2008	2008	90-100	VR projected	VR	VR (c)
Benin				Country data (1)	VA-MCM	GBD 2004 (a)
Bhutan				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Bolivia				Country data (1)	VA-MCM	GBD 2004 (a)
Bosnia and Herzegovina	2008	1999	75-89	VR for 2008	VR-MCM	VR (c)
Botswana				Child mortality data (2)	VR-MCM	GBD 2004 (a)
Brazil	2008	2008	75-89	VR for 2008	VR	VR (b)
Brunei Darussalam	2008	2008	90-100	VR projected	VR	VR (c)
Bulgaria	2008	2008	90-100	VR for 2008	VR	VR (c)
Burkina Faso				Country data (1)	VA-MCM	GBD 2004 (a)
Burundi				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Cambodia				Country data (1)	VA-MCM	GBD 2004 (a)
Cameroon				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Canada	2007	2004	90-100	VR projected	VR	VR (c)
Cape Verde	2007			VR projected	VA-MCM (i)	GBD 2004 (a)
Central African Republic				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Chad				Country data (1)	VA-MCM	GBD 2004 (a)
Chile	2008	2007	90-100	VR for 2008	VR	VR (c)
China		2007	50-74	Country data (1)	China-MCM (ii)	VR and survey (d)

Country	Vital registration data			All-cause mortality method	Cause distribution method for ages 0-4	Cause distribution method for ages 5+
	All-cause mortality: latest year used	Causes of death	Estimated coverage (%)			
Colombia	2008	2007	90-100	VR for 2008	VR	VR (b)
Comoros				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Congo				Country data (1)	VA-MCM	GBD 2004 (a)
Cook Islands	2008	2001	90-100	VR projected	VR	VR (c)
Costa Rica	2008	2008	90-100	VR for 2008	VR	VR (c)
Côte d'Ivoire				Country data (1)	VA-MCM	GBD 2004 (a,e)
Croatia	2008	2008	90-100	VR for 2008	VR	VR (c)
Cuba	2008	2008	90-100	VR for 2008	VR	VR (c)
Cyprus	2008	2008	90-100	VR for 2008	VR-MCM	VR (b)
Czech Republic	2008	2008	90-100	VR for 2008	VR	VR (c)
Democratic People's Republic of Korea				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Democratic Republic of the Congo				Country data (1)	VA-MCM	GBD 2004 (a)
Denmark	2008	2006	90-100	VR for 2008	VR	VR (c)
Djibouti				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Dominica	2008	2008	90-100	VR projected	VR	VR (c)
Dominican Republic	2008	2004	50-74	VR for 2008	VA-MCM (i)	VR (b)
Ecuador	2008	2008	50-74	VR for 2008	VR-MCM	VR (b)
Egypt	2008	2008	90-100	VR for 2008	VR-MCM	VR (c)
El Salvador	2008	2008	75-89	VR for 2008	VR-MCM	VR (b)
Equatorial Guinea				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Eritrea				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Estonia	2008	2008	90-100	VR for 2008	VR	VR (c)
Ethiopia				Country data (1)	VA-MCM	GBD 2004 (a)
Fiji		2000	90-100	Country data (1)	VR-MCM	VR (c)
Finland	2008	2008	90-100	VR for 2008	VR	VR (c)
France	2008	2008	90-100	VR for 2008	VR	VR (c)
Gabon				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Gambia				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Georgia	2008	2001	75-89	VR for 2008	VA-MCM (i)	VR (b)
Germany	2008	2006	90-100	VR for 2008	VR	VR (c)
Ghana				Country data (1)	VA-MCM	GBD 2004 (a,f)
Greece	2008	2008	90-100	VR for 2008	VR	VR (c)
Grenada	2008	2008	90-100	VR projected	VR-MCM	VR (c)
Guatemala	2008	2008	75-89	VR for 2008	VA-MCM (i)	VR (b)
Guinea				Country data (1)	VA-MCM	GBD 2004 (a)
Guinea-Bissau				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Guyana	2007	2006	75-89	VR projected	VR-MCM (iii)	VR (c)

Country	Vital registration data			All-cause mortality method	Cause distribution method for ages 0-4	Cause distribution method for ages 5+
	All-cause mortality: latest year used	Causes of death	Estimated coverage (%)			
Haiti		2003	<50	Country data (1)	VA-MCM	VR (b)
Honduras				Child mortality data (2)	VA-MCM (i)	GBD 2004 (a)
Hungary	2008	2008	90-100	VR for 2008	VR	VR (c)
Iceland	2008	2008	90-100	VR projected	VR	VR (c)
India	2007	2003-2004	50-74	VR projected	India-specific (iv)	MDS and MCCD (g)
Indonesia				Country data (1)	VA-MCM	GBD 2004 (a)
Iran (Islamic Republic of)		2006	50-74	Country data (1)	VR-MCM (iii)	VR (b)
Iraq				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Ireland	2008	2008	90-100	VR for 2008	VR	VR (c)
Israel	2008	2008	90-100	VR for 2008	VR	VR (c)
Italy	2007	2007	90-100	VR projected	VR	VR (c)
Jamaica	2005	1991	50-74	VR projected	VA-MCM (i)	VR (b)
Japan	2008	2008	90-100	VR for 2008	VR	VR (c)
Jordan		2008	25-49	Child mortality data (2)	VR-MCM	VR (b)
Kazakhstan	2008	2008	75-89	VR for 2008	VR (v)	VR (b)
Kenya				Country data (1)	VA-MCM	GBD 2004 (a,h)
Kiribati	2001	2002	75-89	VR projected	VR-MCM (iii)	VR (c)
Kuwait	2008	2008	90-100	VR for 2008	VR	VR (c)
Kyrgyzstan	2008	2008	75-89	VR for 2008	VA-MCM	VR (b)
Lao People's Democratic Republic				Country data (1)	VA-MCM	GBD 2004 (a)
Latvia	2008	2008	90-100	VR for 2008	VR	VR (c)
Lebanon				Child mortality data (2)	VR-MCM	GBD 2004 (a)
Lesotho				Country data (1)	VA-MCM	GBD 2004 (a)
Liberia				Country data (1)	VA-MCM	GBD 2004 (a)
Libyan Arab Jamahiriya				Child mortality data (2)	VR-MCM	GBD 2004 (a)
Lithuania	2008	2008	90-100	VR for 2008	VR	VR (c)
Luxembourg	2008	2007	90-100	VR projected	VR	VR (c)
Madagascar				Country data (1)	VA-MCM	GBD 2004 (a)
Malawi				Country data (1)	VA-MCM	GBD 2004 (a)
Malaysia	2006	2006	25-49	VR projected	VR-MCM	VR (b)
Maldives	2008	2008	90-100	VR projected	VA-MCM (i)	VR (c)
Mali				Country data (1)	VA-MCM	GBD 2004 (a)
Malta	2008	2008	90-100	VR projected	VR	VR (c)
Marshall Islands	2006			VR projected	VR-MCM (iii)	GBD 2004 (a)
Mauritania				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Mauritius	2008	2008	90-100	VR for 2008	VR	VR (c)
Mexico	2008	2008	90-100	VR for 2008	VR	VR (c)

Country	Vital registration data			All-cause mortality method	Cause distribution method for ages 0-4	Cause distribution method for ages 5+
	All-cause mortality: latest year used	Causes of death	Estimated coverage (%)			
Micronesia (Federated States of)				Country data (1)	VA-MCM	GBD 2004 (j)
Monaco				Regional (3)	VR-MCM	GBD 2004 (a)
Mongolia	2008			VR for 2008	VA-MCM	GBD 2004 (a)
Montenegro	2008	2008	90-100	VR projected	VR-MCM	VR (c)
Morocco				Country data (1)	VA-MCM	GBD 2004 (a)
Mozambique				Country data (1)	VA-MCM	GBD 2004 (a)
Myanmar				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Namibia				Country data (1)	VA-MCM	GBD 2004 (a)
Nauru		1996	<50	Country data (1)	VA-MCM	VR (k)
Nepal				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Netherlands	2008	2008	90-100	VR for 2008	VR	VR (c)
New Zealand	2008	2007	90-100	VR for 2008	VR	VR (c)
Nicaragua	2006	2006	50-74	VR projected	VA-MCM (i)	VR (b)
Niger				Country data (1)	VA-MCM	GBD 2004 (a)
Nigeria				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Niue	2008	2000	90-100	VR projected	VR	VR (c)
Norway	2008	2008	90-100	VR for 2008	VR	VR (c)
Oman				Child mortality data (2)	VR-MCM	GBD 2004 (a)
Pakistan				Country data (1)	VA-MCM	GBD 2004 (a)
Palau	2006			VR projected	VR-MCM	GBD 2004 (a)
Panama	2008	2008	90-100	VR for 2008	VR	VR (b)
Papua New Guinea				Country data (1)	VA-MCM	GBD 2004 (a)
Paraguay	2008	2008	75-89	VR for 2008	VA-MCM (i)	VR (b)
Peru	2007	2007	50-74	VR projected	VR-MCM	VR (b)
Philippines	2005	2003	90-100	VR projected	VA-MCM (i)	VR (b)
Poland	2008	2008	90-100	VR for 2008	VR	VR (c)
Portugal	2008	2008	90-100	VR for 2008	VR-MCM	VR (c)
Qatar	2008	2008	90-100	VR projected	VR-MCM	VR (b)
Republic of Korea	2008	2006	90-100	VR for 2008	VR	VR (c)
Republic of Moldova	2008	2008	90-100	VR for 2008	VR	VR (c)
Romania	2008	2008	90-100	VR for 2008	VR	VR (c)
Russian Federation	2008	2006	90-100	VR for 2008	VR	VR (c)
Rwanda				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Saint Kitts and Nevis	2008	2008	90-100	VR projected	VR	VR (c)
Saint Lucia	2005	2005	90-100	VR projected	VR	VR (c)
Saint Vincent and the Grenadines	2008	2008	90-100	VR projected	VR	VR (c)
Samoa				Country data (1)	VA-MCM (i)	GBD 2004 (a,m)

Country	Vital registration data			All-cause mortality method	Cause distribution method for ages 0-4	Cause distribution method for ages 5+
	All-cause mortality: latest year used	Causes of death	Estimated coverage (%)			
San Marino	2007	2000	75-89	VR projected	VR	VR (c)
Sao Tome and Principe				Country data (1)	VA-MCM	GBD 2004 (a)
Saudi Arabia				Child mortality data (2)	VR-MCM	GBD 2004 (a)
Senegal				Country data (1)	VA-MCM	GBD 2004 (a,n)
Serbia	2008	2008	75-89	VR for 2008	VR	VR (c)
Seychelles	2008	2008	90-100	VR projected	VR	VR (c)
Sierra Leone				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Singapore	2008	2008	75-89	VR for 2008	VR	VR (c)
Slovakia	2008	2008	90-100	VR for 2008	VR	VR (c)
Slovenia	2008	2008	90-100	VR for 2008	VR	VR (c)
Solomon Islands				Country data (1)	VA-MCM	GBD 2004 (a)
Somalia				Child mortality data (2)	VA-MCM	GBD 2004 (a)
South Africa	2007	2007	90-100	VR projected	VR-MCM	VR (c, p)
Spain	2008	2008	90-100	VR for 2008	VR	VR (c)
Sri Lanka	2007	2003	50-74	VR projected	VR-MCM	VR (b)
Sudan				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Suriname	2007	2005	75-89	VR projected	VR-MCM (iii)	VR (c)
Swaziland				Country data (1)	VA-MCM	GBD 2004 (a)
Sweden	2008	2008	90-100	VR for 2008	VR	VR (c)
Switzerland	2008	2007	90-100	VR for 2008	VR	VR (c)
Syrian Arab Republic		2000	90-100	Country data (1)	VR-MCM	VR (b)
Tajikistan	2005	2005	50-74	VR projected	VA-MCM	VR (b)
Thailand	2006	2005	50-74	VR projected	VR-MCM	VR (q)
The former Yugoslav Republic of Macedonia	2008	2003	90-100	VR for 2008	VR	VR (c)
Timor-Leste				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Togo				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Tonga	2003	1998	50-74	VR projected	VR-MCM	VR (r)
Trinidad and Tobago	2006	2006	90-100	VR projected	VR	VR (c)
Tunisia	2000			VR projected	VR-MCM	GBD 2004 (a)
Turkey	2008	2008	<50	Country data (1)	VR-MCM	VR (s)
Turkmenistan	1998	1998	75-89	VR projected	VA-MCM	VR (b)
Tuvalu	2005			VR projected	VR	GBD 2004 (a)
Uganda				Country data (1)	VA-MCM	GBD 2004 (a)
Ukraine	2008	2008	90-100	VR for 2008	VR	VR (c)
United Arab Emirates				Country data (1)	VR-MCM	GBD 2004 (a)
United Kingdom	2008	2008	90-100	VR for 2008	VR	VR (c)
United Republic of Tanzania				Country data (1)	VA-MCM	GBD 2004 (a)

Country	Vital registration data			All-cause mortality method	Cause distribution method for ages 0-4	Cause distribution method for ages 5+
	All-cause mortality: latest year used	Causes of death	Estimated coverage (%)			
United States of America	2007	2007	90-100	VR projected	VR	VR (c)
Uruguay	2004	2004	90-100	VR projected	VR	VR (c)
Uzbekistan	2005	2005	75-89	VR projected	VA-MCM	VR (b)
Vanuatu				Country data (1)	VA-MCM (i)	GBD 2004 (a,t)
Venezuela	2007	2007	90-100	VR projected	VR	VR (c)
Viet Nam			50-74	Country data (1)	VR-MCM	VA (u)
Yemen				Child mortality data (2)	VA-MCM	GBD 2004 (a)
Zambia				Country data (1)	VA-MCM	GBD 2004 (a)
Zimbabwe				Country data (1)	VA-MCM	GBD 2004 (a)

GBD 2004, Global burden of disease 2004 update (2); VR, Vital registration data for deaths; VR-MCM, VR-based multicausal models for neonatal deaths and 1-59 month deaths(14); VA-MCM, high mortality (verbal autopsy-based) multicausal models for neonatal deaths and 1-59 month deaths(14)

- (1) Country data for 5q0 (child mortality) and 45q15 (adult mortality) used with WHO modified logit life table system (11)
- (2) Child mortality data (II), used with WHO modified logit life table system(11)
- (3) Average mortality rates derived from those for (sub-national) population of a neighbouring region.

- (i) Average of VA-MCM and VR-MCM models used for deaths at ages 1-59 months
- (ii) China-specific multicausal model (13)
- (iii) Average of VA-MCM and VR-MCM models used for deaths at ages 1-59 months
- (iv) Based on data from the Million Death Study, WHO and UN programs (14)
- (v) Average of VA-MCM and VR-MCM models used for deaths at ages 1-59 months

- (a) Cause of death distribution from GBD 2004 (2) projected forward to 2008 mortality envelope with adjustments for cause-specific mortality estimates obtained from WHO technical programmes, IARC, UNAIDS and other sources for the following conditions: AIDS, TB, measles, pertussis, tetanus, dengue, malaria, schistosomiasis, trypanosomiasis, Japanese encephalitis, Chagas, maternal conditions (including abortion), cancers, drug use disorders, rheumatoid arthritis, road traffic accidents and war.
- (b) Vital registration data adjusted using CODMOD and with additional adjustments for cause-specific mortality estimates as listed in footnote (a)
- (c) Vital registration data with additional adjustments based on studies, information from WHO technical Programmes and UNAIDS for the following conditions: AIDS, drug use disorders and war where applicable
- (d) Third Retrospective Survey on Mortality 2004-2005 (12)
- (e) Additional information on cause of death distribution in city hospitals 1973-1992 (55)
- (f) Additional information from hospitals in 20 selected districts and 9 regional hospitals in 2003 (56)
- (g) Million Death Study, Urban Medical certification of Cause of Death System – 2003, 2004
- (h) Additional information from hospital data, Ministry of Health, 1996, 1998-2000
- (j) Cause of death distribution from 1999 FSM Statistical Yearbook with additional adjustments for cause-specific mortality estimates as listed in footnote (a)
- (k) Vital registration data adjusted using unpublished data from R. Taylor & K. Thoma on the mortality decline in Nauru. Further adjusted for cause-specific mortality estimates as listed in footnote
- (m) Additional information from DHS 1999 and 2000 (56,57)

- (n) Additional information from deaths assessed by verbal autopsy for Niakhar 1983–1990 (58)
- (p) National Burden of Disease estimates for 2000 (20)
- (q) Vital registration data corrected by verbal autopsy study (21)
- (r) Additional information from Report of the Minister of Health for the year 1994 (59)
- (s) Cause of death distribution from Turkish National Burden of Disease Study (22), projected forward to 2008, with additional adjustments for cause-specific mortality estimates as listed in footnote (a) and checking against urban VR data for 2008.
- (t) Additional information from hospital data, Ministry of Health, 2001
- (u) Cause of death distribution from national verbal autopsy study (23) with adjustments for cause-specific mortality estimates obtained from WHO technical programmes, IARC, UNAIDS and other sources for the following conditions: AIDS, TB, measles, pertussis, tetanus, dengue, malaria, schistosomiasis, trypanosomiasis, Japanese encephalitis, Chagas, maternal conditions (including abortion), cancers, drug use disorders, rheumatoid arthritis, road traffic accidents and war.

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