Global and Regional Causes of Death: Patterns and Trends, 2000–15

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INTRODUCTION

One of the six core functions of the World Health Organization (WHO) is monitoring the health situation, trends, and determinants in the world. Global, regional, and country statistics on population and health indicators are important for assessing progress toward goals for development and health and for guiding the allocation of resources. Timely data are needed to monitor progress on increasing life expectancy and reducing age- and cause-specific mortality rates. In particular, timely data are needed to monitor progress toward reaching the health-related targets within the Sustainable Development Goals (SDGs), which will require regular reporting on child mortality; maternal mortality; and mortality owing to noncommunicable diseases (NCDs), suicide, air pollution, road traffic injuries, homicide, natural disasters, and conflict.

This chapter summarizes global and regional patterns of causes of death for 2015 and trends for 2000–15 using the 2015 Global Health Estimates (GHE 2015) released by the WHO at the beginning of 2017 (WHO 2017a). The GHE 2015 statistics provide a comprehensive, comparable set of cause-of-death estimates from 2000 onward, consistent with and incorporating estimates from the United Nations (UN) and interagency and the WHO data for population, births, all-cause deaths, and specific causes of death.

The GHE 2015 present results for 183 WHO member states with a population of 90,000 or greater in 2015. The GHE 2015 cause-of-death estimates by country, region, and world for 2000–15 confirm and expand previous WHO analyses of global health trends. In particular, the WHO published an assessment of progress toward achievement of the UN Millennium Development Goals (MDGs) at the end of 2015 (WHO 2015b), followed by the *World Health Statistics 2016: Monitoring Health for the SDGs* (WHO 2016d), which focused on progress and challenges for achieving the SDGs for 2030.

The SDGs expand the focus of health targets from the unfinished MDG agenda for child and maternal mortality and priority infectious diseases to a broader agenda including NCDs, injuries, health emergencies, and health risk factors as well as a strong focus on universal health coverage (UN Statistics Division 2017; WHO 2016d). The GHE 2015 estimates of trends and levels of mortality by cause will contribute to WHO and UN monitoring and reporting of progress toward the SDG health goals and targets.

METHODS

Categories of Analysis

The GHE 2015 provide estimates of the total number of deaths in 2000–15 for 177 detailed categories of disease and injury as well as for all causes. The categories of

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cause are specified in the *International Statistical Classification of Diseases and Related Health Problems* (known as the International Classification of Diseases, or ICD) tenth revision codes (WHO 1990), as shown in annex 4A. Deaths are estimated for the neonatal period (1 to 27 days), the postneonatal period (1 to 11 months), 1 to 4 years, and 5-year age groups starting at age 5 to 85 years and above.

This chapter uses 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.

All-Cause Mortality

The WHO life tables were revised and updated for 183 member states for 1990–2015 (WHO 2016b), drawing on the *World Population Prospects: 2015 Revision* (UN 2015), recent and unpublished analyses of all-cause mortality and mortality from human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) for countries with high HIV/AIDS prevalence (Avenir Consulting 2016; UNAIDS 2016), vital registration data (WHO 2016c), and United Nations Inter-agency Group for Child Mortality Estimation estimates of levels and trends for under-age-5 mortality (UN-IGME 2015). Methods and data sources are documented in more detail in annex 4A. The WHO life tables are available in the WHO Global Health Observatory (2016).

Total deaths by age and sex were estimated for each country by applying death rates in the WHO life tables to the estimated de facto resident population prepared by the UN Population Division in its 2015 revision (UN 2015).

Causes of Death

The GHE 2015 are consistent with UN agency, interagency, and WHO estimates for population, births, all-cause deaths, and specific causes of death, including the following:

• The most recent vital registration data for all countries where the quality of data is assessed as usable
• UN estimates of levels and trends for all-cause mortality for older children and adults and UN interagency estimates of neonatal, infant, and child mortality
• WHO programs and interagency groups' updated estimates for specific causes of death, including maternal, HIV/AIDS, tuberculosis, malaria, cancers, road traffic injuries, and homicide

• Global Burden of Disease 2015 (GBD 2015) estimates for other causes in countries lacking usable vital registration data or other nationally representative sources of information on causes of death (IHME 2016).

Figure 4.1 provides an overview of the data and processes used to produce the GHE 2015. Annex 4A provides a more detailed summary, which covers the processes involved in the use of death registration data submitted to the WHO Mortality Database (WHO 2016c).

Death Registration Data Used Directly

Death registration data, with medical certification of the cause of death and the cause of death coded using the ICD, are the preferred source of information for monitoring mortality by cause, age, and sex. However, there are major gaps in the coverage of death registration data and persistent issues in the quality of such data. In 2015, nearly half of all deaths worldwide were registered in a national death registration system with information on cause of death (figure 4.2), an improvement from about one-third in 2005. However, only 38 percent of all global deaths are currently reported to the WHO Mortality Database (WHO 2016c). Of these reported deaths, 43 percent are for high-income countries (HICs), 44 percent are for upper-middle-income countries, 13 percent are for lower-middle-income countries, and less than 1 percent are for low-income countries, (LICs). Only about 28 percent of all global deaths are reported to the WHO by ICD code, and only 23 percent are reported to the WHO with meaningful information on their underlying cause.

Two main dimensions of quality impede the use of death registration data for public health monitoring: (a) low level of completeness and (b) missing, incomplete, or invalid information on the underlying cause of death. "Completeness" is defined as the percentage of all deaths in the de facto resident population that are registered and compiled nationally. The quality of information on underlying cause of death is summarized by the proportion of deaths coded to so-called garbage codes, which do not provide information on valid underlying disease or injury causes of death.

Since 2010, the WHO has been summarizing the usability of death registration data for estimating causes of death in a population with a usability score calculated as follows:

$$(\text{Percentage usable}) = \text{Completeness (\%)} \times (1 - \text{Proportion garbage}). \quad (4.1)$$

Death registration data reported to the WHO were used to estimate causes of death for 69 countries

Figure 4.1 Overview of the Processes Involved in Preparing the Global Health Estimates Dataset for Causes of Death in 183 WHO Member States, 2000–15
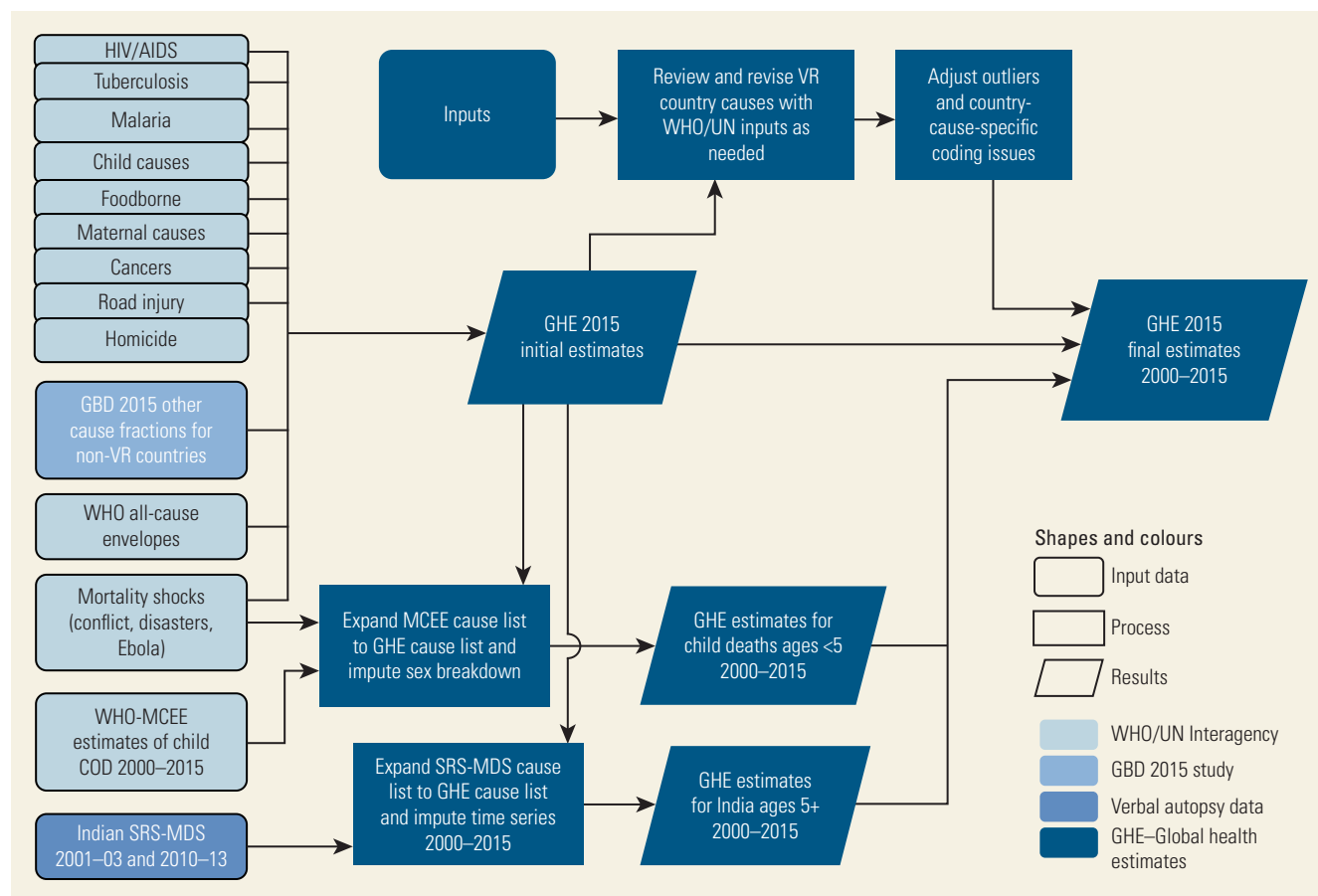

Note: COD = cause of death; GBD 2015 = Global Burden of Disease 2015; GHE 2015 = 2015 Global Health Estimates; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome; MCEE = Maternal and Child Epidemiology Estimation Collaboration; SRS-MDS = Sample Registration System–Million Death Study; UN = United Nations; VR = vital registration; WHO = the World Health Organization.

meeting the following inclusion criteria: (a) at least five years of data were available during 2005–15, and (b) at least 65 percent of deaths were usable for 2000 to the latest available year (WHO 2016c). The following short list of garbage codes was used to compute the usable percentage:

- Symptoms, signs, and ill-defined conditions (ICD 10 codes R00–R99)
- Injuries undetermined whether intentional or unintentional (ICD 10 Y10–Y34, Y87.2)
- Ill-defined cancers (C76, C80, and C97)
- Ill-defined cardiovascular diseases (I46, I47.2, I49.0, I50, I51.4, I51.6, I51.9, and I70.9).

Deaths coded to these and various other garbage codes were redistributed to valid underlying causes of death. Estimates for India were based on WHO analyses of data from the Sample Registration System (SRS) for two

Figure 4.2 Number of Global Deaths in 2015, by Expected Registration or Reporting Status
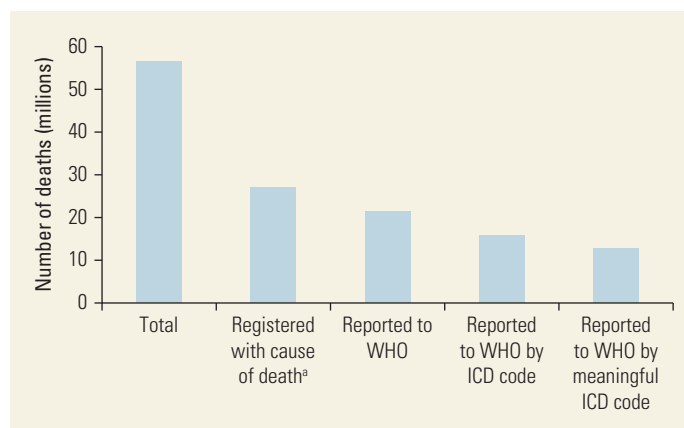
Note: Reports to the World Health Organization (WHO) are projected on the basis of 2010 data to allow for reporting lag. ICD = International Classification of Diseases.
a. Local death registration, in the absence of a state or national system to compile data, is excluded, as is registration with cause of death based on verbal autopsy.

periods: 2001–03 (Registrar General of India 2009) and 2010–13 (Registrar General of India and CGHR 2015). Estimates for China drew on death registration data for 2013 (China CDC 2016) together with IHME analyses of trends in causes of death (GBD 2016).

Causes of Death for Children under Age 5

For countries lacking usable death registration data, neonatal deaths and deaths at age 1–59 months were estimated for 15 major causes identifiable from verbal autopsy studies using methods described by Liu and others (2015). These categories were expanded to the full GHE list of causes using nested cause fraction results predicted from the GBD 2015 study.

For China, estimates of causes of death for children under age 5 were based on a separate analysis of data from the Maternal and Child Health Surveillance System (WHO 2016b). For India, a separate multiple-cause model was used to prepare state-level estimates based on about 40 subnational community-based verbal autopsy studies (WHO and MCEE 2016).

Cause-Specific Estimates from the WHO and UN Agencies

The GHE 2015 incorporate the latest updated WHO and UN interagency assessments of levels and trends for the following specific causes of death:

- Tuberculosis: *Global Tuberculosis Report 2016* (WHO 2016a)
- HIV/AIDS: UNAIDS (2016); WHO (2016b)
- Malaria: *World Malaria Report 2016* (WHO 2016e)
- Vaccine-preventable child causes: Patel and others (2016); WHO (2017b)
- Other major child causes: the WHO and the Maternal and Child Epidemiology Estimation collaboration (WHO and MCEE 2016)
- Foodborne diseases: the WHO Foodborne Disease Burden Epidemiology Reference Group (Torgerson and others 2015)
- Ebola virus infection: WHO estimates of direct deaths owing to infections and indirect deaths owing to measles outbreaks and reduced coverage of treatment for HIV/AIDS and malaria (see annex 4A)
- Maternal mortality: UN Maternal Mortality Estimation Inter-Agency Group (MMEIG 2015)
- Cancers: International Agency for Research on Cancer (Ferlay and others 2013)
- Road injuries: *Global Status Report on Road Safety 2015* (WHO 2015a)
- Homicide: *Global Status Report on Violence Prevention 2014* (WHO 2014a)

- Conflict and natural disasters: the WHO and the Centre for Research on the Epidemiology of Disasters. For methods, see WHO (2016b).

Additional adjustments and revisions were applied to GBD 2015 estimates for schistosomiasis, rabies, leprosy, liver cancer, alcohol use disorders, drug use disorders, and liver cirrhosis, as described in annex 4A.

Other Causes of Death for Countries Lacking Death Registration Data

Estimates of mortality and causes of death were released in 2016 (GBD 2015 Mortality and Causes of Death Collaborators 2016) by the Institute of Health Metrics and Evaluation (IHME) as part of the GBD 2015 study (IHME 2016). The WHO has drawn on the GBD 2015 analyses for selected causes for member states lacking comprehensive death registration data.

For major causes of death except HIV/AIDS and measles, the IHME used ensemble modeling to create a weighted average of many individual covariate-based models (ranging from hundreds to thousands in some cases) for each specific cause. The overall out-of-sample predictive validity of the ensemble is usually not much different from that of the top-ranked model, but ranges of uncertainty are generally much wider and more plausible than for single models. 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, the IHME applied a final step to rescale the cause-specific estimates. This step effectively *squeezed* or *expanded* causes with wider uncertainty ranges more than those with narrower uncertainty ranges. The GBD 2015 results (IHME 2016) were resqueezed to the WHO all-cause envelopes to produce a set of so-called prior estimates for the GHE categories of cause by age, sex, country, and year.

Final Adjustments

IHME results for priority causes such as HIV/AIDS, tuberculosis, malaria, cancers, maternal mortality, and child mortality differ to varying degrees from those of the WHO and UN agency partners. In part, these variations reflect not only differences in modeling strategies but also the inclusion by IHME of data from verbal autopsy studies, mapped to ICD categories using IHME-developed computer algorithms. We carried out an adjustment process to ensure that the estimated number of deaths tallied across causes to the estimated total number of deaths by age, sex, country, and year for all countries.

Levels of Evidence and Uncertainty

General guidance on the quality and uncertainty of these cause-of-death estimates for 2000–15 is provided with regard to the quality of data inputs and methods used. Most of the inputs to the GHE 2015 have explicit uncertainty ranges. The two main exceptions are the UN Population Division's *World Population Prospects* 2015 life tables (UN 2015) and the Globocan cancer mortality estimates (IARC 2013). The Globocan 2012 database provides information on sources of data and quality of inputs for seven categories of incidence data and six categories of mortality data as well as six estimation methods for mortality (IARC 2013). The GBD 2015 estimates of deaths by cause, age, sex, country, and year also include estimates of 95 percent uncertainty ranges that take into account some, but not all, sources of uncertainty.

Based on the uncertainty ranges estimated for the inputs, explicit uncertainty ranges for the GHE 2015 are available on the WHO website (see box 4.1).

RESULTS

Broad Patterns of Causes of Death in 2015

In 2015, a total of 56.4 million deaths occurred in the world; of these, 7.0 million occurred in LICs and 20.4 million occurred in lower-middle-income countries. Just under half (46 percent) of all deaths in LICs were caused by Group I conditions, which include communicable diseases, maternal causes, conditions arising during the perinatal period, and nutritional deficiencies (figure 4.3). For HICs that have passed through the epidemiological transition, Group I conditions accounted for less than 7 percent of deaths. For LICs, Group I conditions accounted for 65 percent of deaths in 2000,

and death rates for most diseases and disorders in this group of countries declined substantially between 2000 and 2015.

NCDs caused 70 percent of deaths globally in 2015, with regional figures ranging from 43 percent in LICs to 87 percent in HICs. In terms of the absolute number of deaths, however, 74 percent of global NCD-related deaths occurred in low- and middle-income countries (LMICs).

Injuries claimed nearly 5 million lives in 2015 (8.8 percent of total deaths). More than a quarter (27 percent) of these deaths were due to road traffic injuries. LICs had the highest mortality rate for road traffic injuries, with 25.0 deaths per 100,000 population, compared with a global rate of 18.3. More than 90 percent of road traffic deaths occur in LMICs, which account for 82 percent of the world's population but only 54 percent of the world's registered vehicles. Several factors are at work, including poorly designed or implemented regulations, inadequate road and vehicle quality, and a higher proportion of vulnerable road users (pedestrians, cyclists, and motorcyclists).

Leading Causes of Death in 2015

Figure 4.4 shows the 10 leading causes of death for the world and for country income groups in 2015. The 10 leading causes of death globally were 6 NCDs, 3 infectious diseases, and road injuries, which collectively accounted for more than half of all deaths. Ischemic heart disease (IHD) and stroke killed 15 million people in 2015; these two diseases have been the biggest killers globally in the past 15 years. Whereas 7 of the 10 leading causes in low-income countries were Group I conditions, all but 1 of the

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Figure 4.3 Overall Mortality Rates, by Cause and Country Income Group, 2000 and 2015
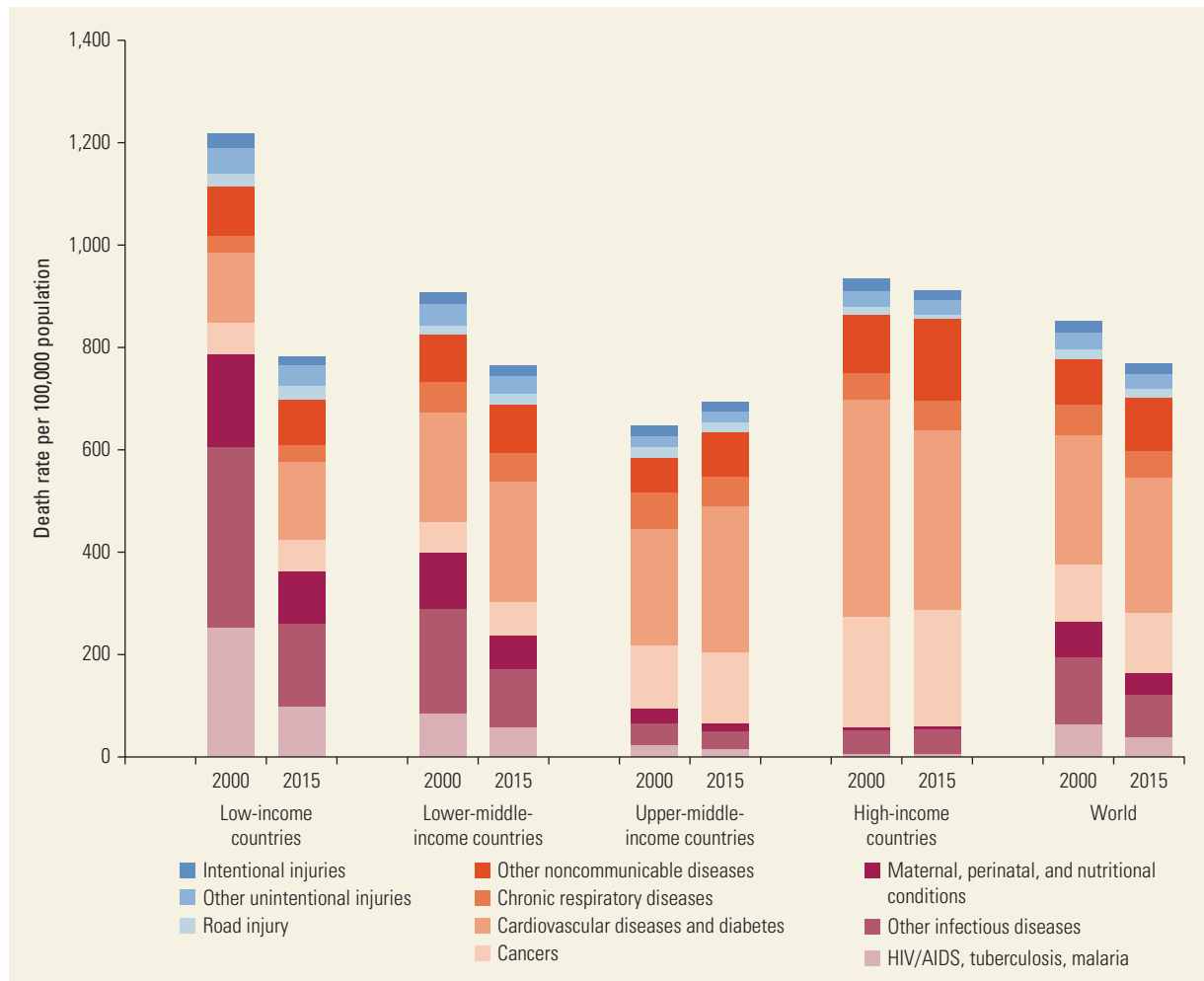
Note: HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

10 leading causes of death in HICs were NCDs. Road injuries were among the 10 leading causes of death for countries at all income levels except HICs. The colors of the bars in figure 4.4 indicate causes for which overall death rates are increasing (red) or decreasing (green). Increases in overall (crude) death rates (total deaths divided by total population) may reflect the effect of population aging as well as changes in age-specific risks of death. Population aging is often a dominant factor for diseases with death rates that rise with age, such as most cancers, cardiovascular diseases, and dementia, even when age-specific death rates are falling. One important exception is the substantial decline in the death rates of IHD and stroke in HICs.

Chronic lung disease claimed 3.2 million lives in 2015, while lung cancer (along with tracheal and bronchus cancers) caused 1.7 million deaths. Diabetes killed 1.6 million people in 2015, up from less than 1 million in 2000. Total deaths attributable to diabetes are more than double this number, because diabetes raises the risk of cardiovascular and other diseases. Estimated deaths from dementia more than doubled between 2000 and 2015, making dementia the seventh-leading cause of death globally in 2015. In the case of dementia and diabetes, aging and rising death rates contribute to the rise in overall number of deaths. Rising reported death rates for these two causes may also reflect an increase in diagnosis or recording as an underlying cause of death rather than an increase in the age-specific risk of mortality.

Lower respiratory infections remained the deadliest communicable disease, causing 3.2 million deaths worldwide in 2015. The diarrhea death rate almost halved between 2000 and 2015, but the disease still caused 1.4 million deaths in 2015. Similarly, the tuberculosis death rate fell during the same period, but the

Figure 4.4 The 10 Leading Causes of Death, for the World and by Country Income Group, 2015

a. Global

Ischemic heart disease
Stroke
Lower respiratory infections
COPD
Lung cancers
Diabetes mellitus
Dementias
Diarrheal diseases
Tuberculosis
Road injuries

CDR per 100,000 population

b. Low-income countries

Lower respiratory infections
Stroke
Ischemic heart disease
Diarrheal diseases
HIV/AIDS
Tuberculosis
Preterm birth complications
Malaria
Road injuries
Birth asphyxia and birth trauma

CDR per 100,000 population

c. Lower-middle-income countries

Ischemic heart disease
Stroke
Lower respiratory infections
COPD
Tuberculosis
Diarrheal diseases
Preterm birth complications
Diabetes mellitus
Cirrhosis of the liver
Road injuries

CDR per 100,000 population

d. Upper-middle-income countries

Ischemic heart disease
Stroke
COPD
Lung cancers
Lower respiratory infections
Diabetes mellitus
Dementias
Road injuries
Liver cancer
Stomach cancer

CDR per 100,000 population

e. High-income countries

Ischemic heart disease
Stroke
Dementias
Lung cancers
COPD
Lower respiratory infections
Colon and rectum cancers
Diabetes mellitus
Kidney diseases
Breast cancers

CDR per 100,000 population

Size of bar indicates crude death rate (CDR) per 100,000 population

Color indicates % change in CDR within the region between 2000 and 2015:

−70.0%   170.0%

Note: The colors of the bars indicate causes for which overall death rates are increasing (red) or decreasing (green). CDR = crude death rate; COPD = chronic obstructive pulmonary disease; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

disease was still among the top 10 causes of death in 2015, with a death toll of 1.4 million. HIV/AIDS dropped out of the top 10 causes of death globally, falling from 1.5 million deaths in 2000 to just under 1.1 million in 2015. However, it remains the fifth-leading cause of death in LICs.

Cause-Specific Trends from 2000 to 2015

Tables 4.1 to 4.10 provide summary tabulations of deaths by cause, age, and sex for the world and for country income groups for 2000 and 2015. More detailed results at the country and regional levels are also available on the WHO website (see box 4.1).

Table 4.1 Deaths from Selected Causes in the World, by Age and Sex, 2015

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*7,344*	*3,705*	*3,639*	*671*	*1,244*	*1,802*	*1,987*	*1,248*	*393*
All causes	56,441	30,177	26,264	5,992	1,303	2,687	5,780	14,628	26,051
I. Communicable, maternal, perinatal, and nutritional conditions	11,959	6,317	5,642	4,843	638	792	1,525	1,620	2,540
A. Infectious and parasitic diseases	5,706	3,195	2,512	1,452	463	513	1,202	1,115	961
1. Tuberculosis[a]	1,373	927	446	69	28	87	328	513	348
3. HIV/AIDS	1,060	617	443	87	46	134	602	178	13
4. Diarrheal diseases	1,389	684	705	526	103	90	95	207	368
5. Vaccine-preventable diseases[b]	273	139	134	207	34	10	8	9	5
6. Meningitis and encephalitis	405	209	196	116	91	69	44	47	37
7. Acute hepatitis[c]	145	77	68	8	14	24	32	41	28
8. Malaria	439	228	211	312	31	27	29	22	18
9. Other infectious and parasitic diseases	623	314	309	129	116	71	65	97	145
B. Respiratory infections	3,913	2,122	1,791	36	14	36	122	989	2,716
C. Maternal conditions	303	—	303	—	—	155	148	—	—
D. Neonatal conditions	2,311	1,292	1,019	2,311	—	—	—	—	—
1. Preterm birth complications	1,058	586	472	1,058	—	—	—	—	—
2. Birth asphyxia and birth trauma	691	386	305	691	—	—	—	—	—
3. Neonatal sepsis and infections	405	240	166	405	—	—	—	—	—
4. Other neonatal conditions	157	81	76	157	—	—	—	—	—
E. Nutritional deficiencies	439	215	224	160	35	23	26	60	135
II. Noncommunicable diseases	39,544	20,541	19,003	783	312	778	3,049	12,001	22,622
A. Malignant neoplasms	8,763	4,982	3,781	37	49	152	947	3,498	4,080
3. Stomach cancer	754	490	263	—	—	5	64	300	384
4. Colon and rectum cancers	774	418	356	1	1	7	61	267	438
5. Liver cancer	788	554	235	—	2	11	112	347	315
7. Lung cancer	1,695	1,174	521	1	—	4	95	724	870
9. Breast cancer	571	1	570	—	—	8	131	247	185
Other cancers	4,182	2,345	1,836	36	46	117	484	1,611	1,889
C. Diabetes mellitus	1,586	729	856	2	4	18	101	582	879
E. Mental and behavioral disorders	317	233	84	—	—	49	115	109	44
4. Alcohol use disorders[d]	129	108	21	—	—	9	46	59	15
5. Drug use disorders[e]	168	117	51	—	—	39	63	43	23

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Sex / Age group	Both sexes Total	Male Total	Female Total	Both sexes 0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	2,011	812	1,199	17	29	60	66	209	1,629
1. Alzheimer's disease and other dementias	1,542	557	985	—	—	—	2	109	1,432
H. Cardiovascular diseases	17,689	8,850	8,839	39	37	194	1,072	5,136	11,210
3. Ischemic heart disease	8,756	4,603	4,153	2	2	62	528	2,586	5,576
4. Stroke	6,241	2,990	3,250	12	15	57	314	1,845	3,997
I. Respiratory diseases	3,913	2,122	1,791	36	14	36	122	989	2,716
J. Digestive diseases	2,347	1,355	991	27	47	119	386	853	914
2. Cirrhosis of the liver	1,162	762	400	8	20	59	258	517	301
K. Genitourinary diseases	1,382	701	681	18	17	55	134	407	751
1. Kidney diseases	1,129	580	549	12	14	44	113	349	598
N. Congenital anomalies	647	340	307	509	58	34	20	16	10
Other noncommunicable diseases[f]	888	415	473	96	56	62	87	201	388
III. Injuries	4,939	3,319	1,619	366	352	1,118	1,206	1,007	889
A. Unintentional injuries	3,527	2,322	1,204	344	304	646	749	731	752
1. Road traffic injury	1,342	1,014	328	73	70	353	400	307	140
2. Other unintentional injuries	2,184	1,308	877	271	234	293	349	425	612
B. Intentional injuries	1,412	997	415	22	48	472	457	276	137
1. Suicide	788	504	284	—	13	221	241	200	114
2. Homicide and collective violence	624	493	131	22	35	251	216	76	23

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.2 Deaths from Selected Causes in Low-Income Countries, by Age and Sex, 2015

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*896*	*446*	*449*	*128*	*223*	*249*	*193*	*83*	*20*
All causes	6,997	3,712	3,285	1,902	460	652	945	1,362	1,676
I. Communicable, maternal, perinatal, and nutritional conditions	3,248	1,706	1,542	1,588	265	283	427	334	349
A. Infectious and parasitic diseases	1,730	948	782	569	195	178	329	256	203
1. Tuberculosis[a]	326	222	104	25	10	16	66	119	90
3. HIV/AIDS	334	179	155	35	22	46	177	49	4
4. Diarrheal diseases	413	214	199	177	42	37	32	47	77
5. Vaccine-preventable diseases[b]	103	52	52	78	14	5	3	2	1
6. Meningitis and encephalitis	142	76	66	47	36	27	14	11	8
7. Acute hepatitis[c]	18	10	8	1	2	4	4	4	3
8. Malaria	225	115	110	155	19	17	16	10	9
9. Other infectious and parasitic diseases	171	82	88	51	51	26	17	14	12
B. Respiratory infections	291	155	136	8	5	10	18	85	165
C. Maternal conditions	117	—	117	—	—	61	56	—	—
D. Neonatal conditions	632	359	273	632	—	—	—	—	—
1. Preterm birth complications	242	136	106	242	—	—	—	—	—
2. Birth asphyxia and birth trauma	223	124	99	223	—	—	—	—	—
3. Neonatal sepsis and infections	130	80	50	130	—	—	—	—	—
4. Other neonatal conditions	36	19	17	36	—	—	—	—	—
E. Nutritional deficiencies	160	89	71	80	19	12	9	14	25
II. Noncommunicable diseases	3,014	1,517	1,497	192	90	174	377	932	1,249
A. Malignant neoplasms	549	268	281	8	9	28	124	235	144
3. Stomach cancer	31	18	13	—	—	1	6	15	9
4. Colon and rectum cancers	27	14	13	—	—	1	6	12	8
5. Liver cancer	35	22	13	—	—	2	9	17	7
7. Lung cancer	46	28	17	—	—	—	5	22	17
9. Breast cancer	43	—	43	—	—	2	18	18	6
Other cancers	367	185	183	8	8	23	81	151	97
C. Diabetes mellitus	138	70	68	—	1	4	13	47	73
E. Mental and behavioral disorders	18	14	5	—	—	4	7	5	3
4. Alcohol use disorders[d]	9	8	1	—	—	2	4	3	1
5. Drug use disorders[e]	8	5	3	—	—	3	3	1	2

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Table 4.2 Deaths from Selected Causes in Low-Income Countries, by Age and Sex, 2015 (continued)

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	116	54	62	6	6	18	10	12	65
1. Alzheimer's disease and other dementias	66	25	42	—	—	—	—	6	60
H. Cardiovascular diseases	1,229	581	648	9	12	39	113	404	653
3. Ischemic heart diseases	474	248	226	—	1	9	43	162	258
4. Stroke	521	236	285	3	4	14	42	174	284
I. Respiratory diseases	291	155	136	8	5	10	18	85	165
J. Digestive diseases	285	170	114	8	13	26	59	96	82
2. Cirrhosis of the liver	146	92	53	2	4	12	36	58	34
K. Genitourinary diseases	107	54	53	5	5	13	15	29	41
1. Kidney diseases	77	39	38	3	4	10	10	21	29
N. Congenital anomalies	156	83	73	119	21	10	4	2	1
Other noncommunicable diseases[f]	124	68	57	30	19	20	15	17	23
III. Injuries	735	489	246	121	105	195	141	95	77
A. Unintentional injuries	583	381	202	115	96	132	96	76	68
1. Road traffic injury	224	158	66	28	21	67	50	36	22
2. Other unintentional injuries	360	223	136	87	76	65	46	40	45
B. Intentional injuries	151	108	43	6	9	63	45	19	10
1. Suicide	66	44	22	—	3	25	18	12	8
2. Homicide and collective violence	85	64	21	6	6	38	26	7	2

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.3 Deaths from Selected Causes, in Lower-Middle-Income Countries, by Age and Sex, 2015

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*2,669*	*1,361*	*1,307*	*290*	*538*	*717*	*682*	*355*	*87*
All causes	20,422	11,064	9,358	3,308	665	1,317	2,646	5,606	6,880
I. Communicable, maternal, perinatal, and nutritional conditions	6,323	3,339	2,984	2,745	328	420	781	902	1,146
A. Infectious and parasitic diseases	3,143	1,767	1,376	785	238	277	624	663	556
1. Tuberculosis[a]	905	604	301	40	16	63	227	343	218
3. HIV/AIDS	425	252	173	44	17	55	243	62	4
4. Diarrheal diseases	858	413	445	303	56	50	58	147	243
5. Vaccine-preventable diseases[b]	160	82	78	120	20	5	4	6	3
6–7. Meningitis and encephalitis	217	109	107	59	49	37	24	27	20
8. Acute hepatitis[c]	107	55	52	6	11	18	25	28	19
9a. Malaria	199	106	93	146	11	10	12	12	9
Other infectious and parasitic diseases	273	146	126	67	57	39	32	39	40
B. Respiratory infections	1,437	779	658	24	7	17	63	465	862
C. Maternal conditions	165	—	165	—	—	84	81	—	—
D. Neonatal conditions	1,381	766	615	1,381	—	—	—	—	—
1. Preterm birth complications	669	367	302	669	—	—	—	—	—
2. Birth asphyxia and birth trauma	385	216	169	385	—	—	—	—	—
3. Neonatal sepsis and infections	237	137	99	237	—	—	—	—	—
4. Other neonatal conditions	91	46	45	91	—	—	—	—	—
E. Nutritional deficiencies	188	85	104	63	13	9	13	36	54
II. Noncommunicable diseases	12,065	6,383	5,681	389	160	385	1,366	4,330	5,435
A. Malignant neoplasms	1,768	916	852	14	21	62	337	831	503
3. Stomach cancer	116	75	41	—	—	2	21	58	36
4. Colon and rectum cancers	125	69	56	—	—	4	22	56	44
5. Liver cancer	140	94	46	—	1	4	26	69	40
7. Lung cancer	199	147	52	—	—	2	24	110	63
9. Breast cancer	181		180	—	—	4	60	84	32
Other cancers	1,006	530	476	14	19	45	185	455	288
C. Diabetes mellitus	643	292	351	1	2	8	48	263	321
E. Mental and behavioral disorders	76	59	17	—	—	19	28	21	8
4. Alcohol use disorders[d]	26	22	4	—	—	3	10	9	3
5. Drug use disorders[e]	47	36	11	—	—	15	16	11	4

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Table 4.3 Deaths from Selected Causes, in Lower-Middle-Income Countries, by Age and Sex, 2015 (continued)

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	374	169	206	7	16	26	26	52	248
1. Alzheimer's disease and other dementias	261	107	154	—	—	—	1	28	232
H. Cardiovascular diseases	5,640	2,992	2,649	17	18	103	537	2,068	2,897
3. Ischemic heart disease	3,117	1,749	1,368	2	1	35	292	1,162	1,625
4. Stroke	1,813	894	919	6	8	28	142	660	968
I. Respiratory diseases	1,437	779	658	24	7	17	63	465	862
J. Digestive diseases	1,008	589	418	15	31	80	214	369	299
2. Cirrhosis of the liver	545	362	183	6	15	42	147	220	115
K. Genitourinary diseases	538	305	232	9	10	32	78	196	213
1. Kidney diseases	455	259	197	7	8	25	67	172	177
N. Congenital anomalies	310	161	149	257	27	14	6	4	2
Other noncommunicable diseases[f]	270	121	149	45	29	26	28	60	83
III. Injuries	2,034	1,341	693	174	176	512	500	374	298
A. Unintentional injuries	1,479	962	517	163	152	295	314	289	268
1. Road traffic injury	517	404	113	29	31	147	159	109	43
2. Other unintentional injuries	962	558	404	134	121	148	155	180	225
B. Intentional injuries	554	379	176	11	25	218	186	85	30
1. Suicide	298	183	115	—	7	123	99	50	19
2. Homicide and collective violence	257	196	61	11	18	95	87	35	12

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.
a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.
b. Pertussis, diphtheria, measles, and tetanus are included here.
c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.
d. Only direct deaths because of alcohol intoxication are included.
e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.
f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.4 Deaths from Selected Causes in Upper-Middle-Income Countries, by Age and Sex, 2015

thousands

Sex / Age group	Both sexes Total	Male Total	Female Total	Both sexes 0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*2,473*	*1,252*	*1,221*	*179*	*337*	*590*	*747*	*486*	*134*
All causes	17,124	9,343	7,781	693	156	555	1,531	4,963	9,227
I. Communicable, maternal, perinatal, and nutritional conditions	1,606	863	743	465	43	75	248	266	510
A. Infectious and parasitic diseases	617	356	262	95	29	51	204	145	94
1. Tuberculosis[a]	110	77	33	4	2	6	25	43	30
3. HIV/AIDS	248	146	103	7	7	29	151	51	4
4. Diarrheal diseases	84	44	40	45	4	3	5	9	18
5. Vaccine-preventable diseases[b]	10	5	5	8	1	—	—	—	—
6–7. Meningitis and encephalitis	36	19	17	8	6	4	5	7	5
8. Acute hepatitis[c]	15	9	6	—	—	1	3	6	4
9a. Malaria	15	8	8	11	1	1	1	1	1
Other infectious and parasitic diseases	98	48	51	11	7	6	13	29	32
B. Respiratory infections	1,430	781	649	4	2	7	30	314	1,073
C. Maternal conditions	20	—	20	—	—	10	10	—	—
D. Neonatal conditions	261	146	115	261	—	—	—	—	—
1. Preterm birth complications	125	70	54	125	—	—	—	—	—
2. Birth asphyxia and birth trauma	77	42	35	77	—	—	—	—	—
3. Neonatal sepsis and infections	36	21	15	36	—	—	—	—	—
4. Other neonatal conditions	24	13	11	24	—	—	—	—	—
E. Nutritional deficiencies	66	33	33	17	2	2	3	8	34
II. Noncommunicable diseases	14,066	7,476	6,590	164	51	160	887	4,348	8,455
A. Malignant neoplasms	3,474	2,153	1,322	12	16	48	351	1,416	1,631
3. Stomach cancer	417	281	136	—	—	2	28	169	218
4. Colon and rectum cancers	256	143	113	—	—	2	20	90	144
5. Liver cancer	464	339	125	—	1	5	71	206	181
7. Lung cancer	817	580	236	—	—	2	48	338	428
9. Breast cancer	138	—	138	—	—	1	33	64	39
Other cancers	1,383	809	574	12	15	37	150	549	621
C. Diabetes mellitus	532	234	298	—	1	4	31	206	290
E. Mental and behavioral disorders	90	62	28	—	—	10	27	33	20
4. Alcohol use disorders[d]	35	31	4	—	—	2	12	16	5
5. Drug use disorders[e]	43	26	17	—	—	7	12	12	12

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Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	593	243	350	4	5	11	18	77	477
1. Alzheimer's disease and other dementias	497	190	306	—	—	—	1	51	445
H. Cardiovascular diseases	6,507	3,245	3,262	12	7	39	279	1,837	4,332
3. Ischemic heart disease	2,809	1,426	1,383	—	—	14	125	773	1,897
4. Stroke	2,756	1,380	1,377	3	2	12	103	823	1,813
I. Respiratory diseases	1,430	781	649	4	2	7	30	314	1,073
J. Digestive diseases	617	363	255	4	3	11	79	250	271
2. Cirrhosis of the liver	309	201	108	1	1	5	51	153	99
K. Genitourinary diseases	447	212	235	3	2	10	35	138	259
1. Kidney diseases	375	180	195	2	2	8	30	121	212
N. Congenital anomalies	138	73	65	109	9	7	6	4	3
Other noncommunicable diseasesᶠ	237	111	126	15	7	13	31	72	99
III. Injuries	1,452	1,005	448	63	62	320	396	349	261
A. Unintentional injuries	988	678	311	59	50	172	252	250	205
1. Road traffic injury	483	367	117	14	16	113	156	130	54
2. Other unintentional injuries	505	311	194	45	34	59	95	121	151
B. Intentional injuries	464	327	137	4	12	148	144	99	56
1. Suicide	228	129	98	—	2	41	60	74	50
2. Homicide and collective violence	236	198	38	4	10	106	84	25	6

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.5 Deaths from Selected Causes in High-Income Countries, by Age and Sex, 2015

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*1,307*	*645*	*662*	*74*	*146*	*247*	*365*	*324*	*152*
All causes	11,899	6,058	5,841	90	22	164	658	2,698	8,269
I. Communicable, maternal, perinatal, and nutritional conditions	781	409	373	45	2	13	69	118	534
A. Infectious and parasitic diseases	216	124	92	4	1	7	46	51	107
1. Tuberculosis[a]	31	23	8	—	—	2	10	9	11
3. HIV/AIDS	53	41	12	—	—	4	31	17	1
4. Diarrheal diseases	34	13	21	1	—	—	1	4	29
5. Vaccine-preventable diseases[b]	1	—	—	1	—	—	—	—	—
6–7. Meningitis and encephalitis	10	5	5	1	—	—	1	3	3
8. Acute hepatitis[c]	5	3	2	—	—	—	1	2	2
9a. Malaria	—	—	—	—	—	—	—	—	—
Other infectious and parasitic diseases	81	38	44	1	—	1	3	16	61
B. Respiratory infections	755	407	348	—	—	2	11	125	617
C. Maternal conditions	2	—	2	—	—	1	1	—	—
D. Neonatal conditions	37	21	16	37	—	—	—	—	—
1. Preterm birth complications	22	13	10	22	—	—	—	—	—
2. Birth asphyxia and birth trauma	6	3	3	6	—	—	—	—	—
3. Neonatal sepsis and infections	3	2	1	3	—	—	—	—	—
4. Other neonatal conditions	6	3	3	6	—	—	—	—	—
E. Nutritional deficiencies	25	10	15	—	—	—	—	2	21
II. Noncommunicable diseases	10,400	5,165	5,234	37	11	60	420	2,391	7,482
A. Malignant neoplasms	2,972	1,646	1,326	3	4	14	134	1,015	1,803
3. Stomach cancer	189	116	73	—	—	—	9	59	121
4. Colon and rectum cancers	365	192	174	—	—	1	13	109	243
5. Liver cancer	149	98	51	—	—	—	6	56	87
7. Lung cancer	633	418	215	—	—	—	18	253	362
9. Breast cancer	209	1	208	—	—	—	20	81	108
Other cancers	1,426	821	605	2	4	12	68	457	883
C. Diabetes mellitus	273	133	140	—	—	1	10	66	195
E. Mental and behavioral disorders	133	99	34	—	—	16	52	51	14
4. Alcohol use disorders[d]	58	47	12	—	—	2	19	31	6
5. Drug use disorders[e]	70	50	20	—	—	14	32	18	6

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Table 4.5 Deaths from Selected Causes in High-Income Countries, by Age and Sex, 2015 (continued)

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	927	347	581	1	2	5	13	68	839
1. Alzheimer's disease and other dementias	718	235	483	—	—	—	—	24	694
H. Cardiovascular diseases	4,313	2,032	2,281	1	1	13	142	827	3,328
3. Ischemic heart disease	2,356	1,180	1,176	—	—	3	67	489	1,796
4. Stroke	1,150	481	669	—	—	2	27	187	933
I. Respiratory diseases	755	407	348	—	—	2	11	125	617
J. Digestive diseases	437	233	204	—	—	2	34	138	262
2. Cirrhosis of the liver	162	107	55	—	—	1	23	85	53
K. Genitourinary diseases	290	130	160	—	—	1	7	44	238
1. Kidney diseases	222	103	119	—	—	1	6	35	180
N. Congenital anomalies	43	23	20	25	2	3	4	6	4
Other noncommunicable diseases[f]	257	115	141	6	1	3	13	50	182
III. Injuries	718	484	234	8	8	90	169	189	253
A. Unintentional injuries	476	301	175	7	6	47	87	116	212
1. Road traffic injury	118	85	33	2	2	27	35	33	21
2. Other unintentional injuries	357	216	142	6	4	20	53	84	191
B. Intentional injuries	242	183	59	1	2	44	82	73	41
1. Suicide	196	148	48	—	1	31	63	63	38
2. Homicide and collective violence	46	35	11	1	1	13	18	10	3

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.6 Deaths from Selected Causes in the World, by Age and Sex, 2000

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*6,122*	*3,082*	*3,040*	*606*	*1,241*	*1,587*	*1,609*	*813*	*266*
All causes	52,135	27,617	24,517	10,063	1,644	2,993	5,937	12,016	19,481
I. Communicable, maternal, perinatal, and nutritional conditions	16,160	8,384	7,776	8,715	901	1,053	1,879	1,617	1,995
A. Infectious and parasitic diseases	8,608	4,615	3,993	3,551	697	717	1,515	1,223	906
1. Tuberculosis[a]	1,667	1,108	559	100	50	133	425	590	369
3. HIV/AIDS	1,463	754	709	222	29	227	788	181	16
4. Diarrheal diseases	2,177	1,061	1,116	1,206	166	115	111	234	345
5. Vaccine-preventable diseases[b]	1,040	527	513	802	172	33	13	13	7
6–7. Meningitis and encephalitis	560	289	271	281	96	65	40	44	33
8. Acute hepatitis[c]	131	71	60	19	16	23	24	30	19
9a. Malaria	859	440	419	749	23	24	26	23	15
Other infectious and parasitic diseases	711	366	345	171	144	97	88	108	102
B. Respiratory infections	3,672	1,976	1,696	61	17	44	157	1,043	2,350
C. Maternal conditions	425	—	425	—	—	220	205	—	—
D. Neonatal conditions	3,232	1,817	1,415	3,232	—	—	—	—	—
1. Preterm birth complications	1,340	731	609	1,340	—	—	—	—	—
2. Birth asphyxia and birth trauma	1,120	637	483	1,120	—	—	—	—	—
3. Neonatal sepsis and infections	540	325	215	540	—	—	—	—	—
4. Other neonatal conditions	232	124	108	232	—	—	—	—	—
E. Nutritional deficiencies	475	234	241	207	43	27	28	53	117
II. Noncommunicable diseases	31,391	16,128	15,263	914	321	778	2,875	9,623	16,880
A. Malignant neoplasms	6,950	3,840	3,110	37	60	149	916	2,789	2,998
3. Stomach cancer	739	460	280	—	—	6	80	303	350
4. Colon and rectum cancers	578	292	285	—	1	6	51	202	318
5. Liver cancer	662	450	212	—	4	14	128	282	233
7. Lung cancer	1,255	886	370	1	—	5	101	556	592
9. Breast cancer	445	2	443	—	—	6	113	185	140
Other cancers	3,272	1,751	1,521	36	55	112	442	1,262	1,365
C. Diabetes mellitus	958	431	527	3	4	17	80	365	489
E. Mental and behavioral disorders	267	206	60	—	—	45	116	81	26
4. Alcohol use disorders[d]	143	119	24	—	—	11	64	56	12
5. Drug use disorders[e]	105	79	26	—	—	31	45	19	9

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Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	1,008	437	571	20	30	64	67	130	698
1. Alzheimer's disease and other dementias	654	243	411	—	—	—	1	64	589
H. Cardiovascular diseases	14,425	7,009	7,416	60	43	210	989	4,164	8,958
3. Ischemic heart disease	6,883	3,531	3,352	4	3	67	468	1,989	4,353
4. Stroke	5,407	2,479	2,927	21	17	63	304	1,590	3,412
I. Respiratory diseases	3,672	1,976	1,696	61	17	44	157	1,043	2,350
J. Digestive diseases	1,880	1,110	769	39	47	109	355	655	674
2. Cirrhosis of the liver	905	603	302	12	18	54	230	379	212
K. Genitourinary diseases	898	467	431	23	19	53	110	259	434
1. Kidney diseases	709	368	341	16	15	42	90	212	333
N. Congenital anomalies	687	355	331	575	50	29	16	9	7
Other noncommunicable diseases[f]	647	296	351	97	49	58	69	129	246
III. Injuries	4,583	3,105	1,478	434	422	1,163	1,183	775	606
A. Unintentional injuries	3,228	2,150	1,078	409	375	675	726	544	500
1. Road traffic injury	1,118	829	289	75	90	320	339	200	95
2. Other unintentional injuries	2,110	1,321	789	334	284	356	387	344	405
B. Intentional injuries	1,355	955	400	25	47	488	457	231	106
1. Suicide	748	479	269	—	15	240	245	162	87
2. Homicide and collective violence	607	476	131	25	32	248	212	70	20

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.7 Deaths from Selected Causes in Low-Income Countries, by Age and Sex, 2000

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*636*	*317*	*319*	*101*	*166*	*176*	*125*	*55*	*12*
All causes	7,735	4,030	3,705	3,145	535	706	1,084	1,162	1,102
I. Communicable, maternal, perinatal, and nutritional conditions	4,998	2,554	2,444	2,856	343	383	689	401	326
A. Infectious and parasitic diseases	3,070	1,599	1,470	1,446	269	258	571	321	203
1. Tuberculosis[a]	380	252	128	34	15	24	86	129	92
3. HIV/AIDS	744	349	396	129	20	101	393	92	9
4. Diarrheal diseases	683	352	330	409	59	44	36	57	78
5. Vaccine-preventable diseases[b]	359	182	177	281	60	11	4	3	1
6–7. Meningitis and encephalitis	200	108	93	120	33	23	11	9	5
8. Acute hepatitis[c]	17	9	8	1	2	5	4	3	2
9a. Malaria	474	241	233	426	12	12	12	7	6
Other infectious and parasitic diseases	212	107	106	47	69	39	25	21	11
B. Respiratory infections	212	111	101	11	6	9	17	72	97
C. Maternal conditions	158	—	158	—	—	82	77	—	—
D. Neonatal conditions	797	451	346	797	—	—	—	—	—
1. Preterm birth complications	306	170	135	306	—	—	—	—	—
2. Birth asphyxia and birth trauma	297	165	132	297	—	—	—	—	—
3. Neonatal sepsis and infections	151	92	59	151	—	—	—	—	—
4. Other neonatal conditions	43	23	20	43	—	—	—	—	—
E. Nutritional deficiencies	202	109	93	86	25	15	14	25	36
II. Noncommunicable diseases	2,087	1,036	1,051	175	79	137	276	691	729
A. Malignant neoplasms	389	177	212	6	7	19	83	183	91
3. Stomach cancer	26	15	11	—	—	1	5	13	7
4. Colon and rectum cancers	18	9	9	—	—	1	4	9	4
5. Liver cancer	26	16	10	—	—	1	6	13	5
7. Lung cancer	28	17	11	—	—	—	3	16	9
9. Breast cancer	29	—	29	—	—	1	12	12	3
Other cancers	262	121	141	6	6	15	54	119	62
C. Diabetes mellitus	70	37	33	—	1	3	8	28	29
E. Mental and behavioral disorders	11	9	2	—	—	3	5	3	1
4. Alcohol use disorders[d]	7	6	1	—	—	2	3	2	1
5. Drug use disorders[e]	4	3	1	—	—	1	1	—	—

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Table 4.7 Deaths from Selected Causes in Low-Income Countries, by Age and Sex, 2000 (continued)

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	79	40	40	6	5	14	7	8	38
1. Alzheimer's disease and other dementias	39	15	24	—	—	—	—	4	35
H. Cardiovascular diseases	803	369	433	9	11	32	83	286	380
3. Ischemic heart diseases	275	142	133	—	1	8	29	102	136
4. Stroke	356	155	201	3	4	11	32	132	174
I. Respiratory diseases	212	111	101	11	6	9	17	72	97
J. Digestive diseases	235	139	96	10	14	25	50	79	57
2. Cirrhosis of the liver	108	66	42	2	4	10	29	42	21
K. Genitourinary diseases	71	38	34	6	5	10	11	19	22
1. Kidney diseases	50	26	24	4	4	8	7	13	14
N. Congenital anomalies	126	66	61	100	15	7	3	1	1
Other noncommunicable diseasesf	90	51	39	27	16	14	10	12	12
III. Injuries	650	440	210	113	113	186	119	70	48
A. Unintentional injuries	472	311	161	106	96	106	70	52	42
1. Road traffic injury	148	105	43	17	19	47	32	20	11
2. Other unintentional injuries	324	206	118	89	77	59	37	31	30
B. Intentional injuries	178	129	50	7	17	80	50	18	6
1. Suicide	52	34	18	—	3	22	14	9	4
2. Homicide and collective violence	127	95	32	7	14	58	36	9	2

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.8 Deaths from Selected Causes in Lower-Middle-Income Countries, by Age and Sex, 2000

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*2,103*	*1,072*	*1,032*	*261*	*488*	*582*	*491*	*224*	*57*
All causes	19,067	10,121	8,946	5,414	829	1,352	2,283	4,339	4,850
I. Communicable, maternal, perinatal, and nutritional conditions	8,403	4,329	4,074	4,803	492	521	804	887	897
A. Infectious and parasitic diseases	4,474	2,395	2,079	1,863	381	345	628	709	548
1. Tuberculosis[a]	1,042	684	358	54	28	91	265	381	224
3. HIV/AIDS	383	204	179	59	7	60	203	50	4
4. Diarrheal diseases	1,335	627	708	689	101	67	68	166	243
5. Vaccine-preventable diseases[b]	650	329	321	501	106	21	8	9	5
6–7. Meningitis and encephalitis	294	147	147	134	54	36	22	27	21
8. Acute hepatitis[c]	82	42	40	16	13	16	13	14	9
9a. Malaria	359	187	173	302	10	12	13	15	9
Other infectious and parasitic diseases	329	176	153	107	62	43	37	46	33
B. Respiratory infections	1,272	711	561	41	7	21	80	489	634
C. Maternal conditions	236	—	236	—	—	123	112	—	—
D. Neonatal conditions	1,887	1,052	835	1,887	—	—	—	—	—
1. Preterm birth complications	774	412	361	774	—	—	—	—	—
2. Birth asphyxia and birth trauma	639	367	272	638	—	—	—	—	—
3. Neonatal sepsis and infections	332	199	133	332	—	—	—	—	—
4. Other neonatal conditions	142	74	69	142	—	—	—	—	—
E. Nutritional deficiencies	182	83	99	95	15	9	9	18	36
II. Noncommunicable diseases	8,945	4,683	4,262	419	150	368	1,087	3,184	3,738
A. Malignant neoplasms	1,259	617	642	11	20	51	266	578	333
3. Stomach cancer	102	64	39	—	—	2	20	50	30
4. Colon and rectum cancers	77	40	37	—	—	2	14	34	26
5. Liver cancer	105	67	39	—	1	4	23	48	29
7. Lung cancer	131	97	34	—	—	1	18	72	39
9. Breast cancer	123	—	123	—	—	3	44	55	20
Other cancers	721	349	371	11	19	37	147	319	189
C. Diabetes mellitus	326	151	175	1	2	8	35	141	139
E. Mental and behavioral disorders	54	42	11	—	—	14	21	14	5
4. Alcohol use disorders[d]	23	20	3	—	—	3	10	8	2
5. Drug use disorders[e]	27	21	6	—	—	10	10	5	2

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Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	254	122	132	6	16	33	32	42	124
1. Alzheimer's diseases and other dementias	136	56	79	—	—	—	1	23	112
H. Cardiovascular diseases	4,147	2,123	2,023	24	19	108	400	1,485	2,111
3. Ischemic heart diseases	2,185	1,190	994	3	1	37	210	786	1,148
4. Stroke	1,441	683	758	10	8	30	111	525	757
I. Respiratory diseases	1,272	711	561	41	7	21	80	489	634
J. Digestive diseases	755	461	294	24	27	66	167	266	205
2. Cirrhosis of the liver	385	261	124	9	13	36	106	145	76
K. Genitourinary diseases	361	208	154	11	11	29	57	121	132
1. Kidney diseases	279	157	122	8	8	23	46	96	98
N. Congenital anomalies	300	151	149	257	22	11	6	2	1
Other noncommunicable diseases[f]	218	98	120	44	24	26	25	45	54
III. Injuries	1,719	1,109	610	192	187	463	393	268	215
A. Unintentional injuries	1,268	808	460	182	171	271	247	203	193
1. Road traffic injury	342	263	79	29	34	101	94	59	26
2. Other unintentional injuries	926	544	381	153	138	170	153	145	168
B. Intentional injuries	451	301	149	10	16	193	146	65	21
1. Suicide	270	165	106	—	7	125	86	40	13
2. Homicide and collective violence	180	137	43	10	9	68	60	25	8

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.9 Deaths from Selected Causes in Upper-Middle-Income Countries, by Age and Sex, 2000

thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*2,184*	*1,106*	*1,078*	*173*	*428*	*575*	*634*	*290*	*84*
All causes	14,130	7,751	6,380	1,369	244	695	1,668	3,828	6,326
I. Communicable, maternal, perinatal, and nutritional conditions	2,053	1,129	924	983	63	134	309	229	334
A. Infectious and parasitic diseases	892	512	380	234	45	104	264	151	94
1. Tuberculosis[a]	193	130	62	12	7	15	55	64	40
3. HIV/AIDS	302	175	126	33	2	63	168	32	3
4. Diarrheal diseases	150	78	72	106	6	4	6	10	17
5. Vaccine-preventable diseases[b]	30	16	14	20	6	1	1	1	1
6–7. Meningitis and encephalitis	53	27	26	25	8	5	6	5	4
8. Acute hepatitis[c]	24	15	9	1	1	2	6	9	5
9a. Malaria	25	12	13	21	1	1	1	1	1
Other infectious and parasitic diseases	117	59	58	16	13	13	22	29	24
B. Respiratory infections	1,548	800	748	9	3	11	45	362	1,117
C. Maternal conditions	29	—	29	—	—	14	15	—	—
D. Neonatal conditions	493	283	211	493	—	—	—	—	—
1. Preterm birth complications	227	129	98	227	—	—	—	—	—
2. Birth asphyxia and birth trauma	175	100	75	175	—	—	—	—	—
3. Neonatal sepsis and infections	51	30	21	51	—	—	—	—	—
4. Other neonatal conditions	40	23	16	40	—	—	—	—	—
E. Nutritional deficiencies	72	35	36	26	3	3	4	8	28
II. Noncommunicable diseases	10,706	5,666	5,039	270	77	201	954	3,366	5,838
A. Malignant neoplasms	2,718	1,612	1,106	17	28	62	386	1,086	1,137
3. Stomach cancer	399	254	146	—	—	3	40	164	192
4. Colon and rectum cancers	164	82	81	—	—	2	18	57	86
5. Liver cancer	410	286	123	—	3	8	91	169	139
7. Lung cancer	543	380	163	—	—	3	52	232	256
9. Breast cancer	99	—	99	—	—	1	31	42	25
Other cancers	1,103	609	494	16	25	45	155	422	439
C. Diabetes mellitus	325	139	186	1	1	5	26	135	158
E. Mental and behavioral disorders	68	50	18	—	—	10	27	21	10
4. Alcohol use disorders[d]	31	27	4	—	—	2	13	12	3
5. Drug use disorders[e]	24	17	8	—	—	7	9	5	4

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Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	304	133	171	6	6	12	15	41	223
1. Alzheimer's disease and other dementias	233	94	139	—	—	—	—	26	207
H. Cardiovascular diseases	4,637	2,326	2,311	25	11	53	304	1,409	2,835
3. Ischemic heart diseases	1,717	898	819	1	1	17	124	523	1,052
4. Stroke	2,131	1,062	1,069	8	4	18	119	668	1,315
I. Respiratory diseases	1,548	800	748	9	3	11	45	362	1,117
J. Digestive diseases	494	299	194	5	5	15	91	191	186
2. Cirrhosis of the liver	259	173	86	1	1	7	62	118	69
K. Genitourinary diseases	260	129	131	6	3	12	34	83	123
1. Kidney diseases	224	111	113	4	3	10	29	74	104
N. Congenital anomalies	209	112	97	182	11	7	4	2	2
Other noncommunicable diseases[f]	143	67	77	18	8	13	22	36	47
III. Injuries	1,372	955	417	116	104	360	405	234	154
A. Unintentional injuries	933	651	282	109	93	204	256	159	111
1. Road traffic injury	452	334	118	26	32	121	158	82	33
2. Other unintentional injuries	481	317	164	83	61	83	99	77	78
B. Intentional injuries	439	304	135	7	11	155	149	74	42
1. Suicide	222	123	99	—	4	57	70	54	37
2. Homicide and collective violence	217	181	36	7	7	98	79	20	6

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Table 4.10 Deaths from Selected Causes in High-Income Countries, by Age and Sex, 2000
thousands

Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes					
				0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
Population (millions)	*1,200*	*588*	*612*	*70*	*158*	*255*	*360*	*244*	*113*
All causes	11,202	5,715	5,487	135	35	241	902	2,686	7,203
I. Communicable, maternal, perinatal, and nutritional conditions	706	371	335	73	3	15	78	100	438
A. Infectious and parasitic diseases	173	110	63	8	2	9	52	41	60
1. Tuberculosis[a]	52	42	11	1	—	4	20	15	13
3. HIV/AIDS	35	26	8	—	—	3	24	7	—
4. Diarrheal diseases	10	4	6	2	—	—	—	1	6
5. Vaccine-preventable diseases[b]	1	1	1	1	—	—	—	—	—
6–7. Meningitis and encephalitis	13	7	6	2	1	2	2	3	3
8. Acute hepatitis[c]	9	5	4	—	—	—	2	3	3
9a. Malaria	1	—	—	1	—	—	—	—	—
Other infectious and parasitic diseases	52	24	28	1	1	1	4	11	35
B. Respiratory infections	641	355	286	1	1	3	15	120	502
C. Maternal conditions	3	—	3	—	—	1	1	—	—
D. Neonatal conditions	55	32	23	55	—	—	—	—	—
1. Preterm birth complications	33	19	14	33	—	—	—	—	—
2. Birth asphyxia and birth trauma	10	6	4	10	—	—	—	—	—
3. Neonatal sepsis and infections	5	3	2	5	—	—		—	—
4. Other neonatal conditions	7	4	3	7	—	—		—	—
E. Nutritional deficiencies	20	7	13			—	—	1	2	17
II. Noncommunicable diseases	9,654	4,743	4,911	50	15	72	559	2,383	6,575
A. Malignant neoplasms	2,585	1,434	1,150	3	5	17	181	942	1,437
3. Stomach cancer	212	127	84	—	—	1	15	75	121
4. Colon and rectum cancers	319	161	158	—	—	1	15	101	202
5. Liver cancer	121	81	40	—	—	1	9	52	60
7. Lung cancer	554	392	162	—	—	—	29	236	288
9. Breast cancer	194	2	192	—	—	—	27	75	91
Other cancers	1,185	671	514	3	5	14	86	402	675
C. Diabetes mellitus	237	104	133	—	—	2	11	61	163
E. Mental and behavioral disorders	134	105	29	—	—	17	63	43	10
4. Alcohol use disorders[d]	81	65	16	—	—	4	38	34	6
5. Drug use disorders[e]	50	39	11	—	—	13	24	9	3

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Sex Age group	Both sexes Total	Male Total	Female Total	Both sexes 0–4 yrs.	5–14 yrs.	15–29 yrs.	30–49 yrs.	50–69 yrs.	70+ yrs.
F. Neurological conditions	371	143	228	1	3	4	12	38	312
1. Alzheimer's disease and other dementias	246	78	168	—	—	—	—	11	235
H. Cardiovascular diseases	4,838	2,190	2,648	2	2	17	203	983	3,632
3. Ischemic heart diseases	2,706	1,301	1,404	—	—	5	106	578	2,017
4. Stroke	1,479	580	899	—	1	4	42	266	1,166
I. Respiratory diseases	641	355	286	1	1	3	15	120	502
J. Digestive disease	396	211	185	—	—	3	47	119	227
2. Cirrhosis of the liver	153	103	50	—	—	1	33	73	46
K. Genitourinary diseases	205	93	113	—	—	2	9	36	157
1. Kidney diseases	156	73	83	—	—	1	8	29	117
N. Congenital anomalies	51	27	24	35	3	3	4	4	3
Other noncommunicable diseasesf	196	81	115	8	2	4	13	37	132
III. Injuries	842	601	241	13	17	154	265	203	190
A. Unintentional injuries	555	380	175	12	14	94	153	129	154
1. Road traffic injury	177	127	49	3	5	51	55	38	25
2. Other unintentional injuries	379	253	125	9	9	44	98	91	129
B. Intentional injuries	287	221	66	1	3	60	113	74	37
1. Suicide	204	157	47	—	1	36	76	59	32
2. Homicide and collective violence	83	64	19	1	2	24	37	15	4

Note: — = fewer than 500 deaths are attributable to a specific cause; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

a. Tuberculosis deaths in HIV-negative people. Tuberculosis deaths in HIV-positive people are included in the HIV/AIDS category.

b. Pertussis, diphtheria, measles, and tetanus are included here.

c. Liver cancer and cirrhosis deaths resulting from past hepatitis infection are not included here.

d. Only direct deaths because of alcohol intoxication are included.

e. Only direct deaths because of drug overdose or adverse reaction for licit and illicit drugs are included.

f. Benign neoplasms; endocrine, blood, and immune disorders; sense organ diseases; skin diseases; musculoskeletal diseases; oral conditions; and sudden infant death syndrome are included.

Figure 4.5 displays the trends in global death rates for specific causes from 2000 to 2015, covering NCDs, Group I conditions, and injuries. Trends include those for dementia, already noted; for HIV/AIDS, where the scale-up of antiretroviral treatment coverage has had a significant effect; and for falls, where population aging is driving much of the increase in deaths.

The relative contributions of population growth, aging, and epidemiological change (changes in age-specific death rates) to overall growth in the number of deaths from 2000 to 2015 are summarized in figure 4.6 for HICs and for LMICs. Population growth and epidemiological improvement have been the dominant factors in mortality for LMICs over the past 15 years, acting in opposite directions and resulting in an overall increase of 34 percent for total NCD-related deaths and 13 percent for injury-related deaths. The 28 percent decline in Group I–related deaths is driven by epidemiological improvement. Population aging is an important factor for only NCD mortality, but it is likely to become more important over the next 15 years. For HICs, population aging and epidemiological change act in opposite directions, resulting in a relatively small increase in the number of deaths overall from Group I causes and NCDs and a decline in deaths from injuries from 2000 to 2015.

Table 4.11 summarizes average annual rates of change for cause-specific death rates over the period 2000 to 2015 for the world and for countries grouped by income. For children under age 15 years, death rates from leading infectious causes have declined for all groups of countries by more than 4 percent per year, while death rates from preterm birth complications have declined in all groups, but at a lower rate of about 2 to 4 percent.

For younger adults ages 15–49 years, death rates from major causes are declining across all income groups, with the exception of road injuries, where rates are almost flat or rising in LMICs and declining significantly in HICs.

For older adults ages 50–69 years, NCD mortality rates are declining slowly in most regions at 1–2 percent per year, with the exception of mortality from IHD, which is increasing in low-income and upper-middle-income countries, and mortality from IHD, stroke,

Figure 4.5 Trends in Global Mortality Rates for Selected Causes, 2000–15
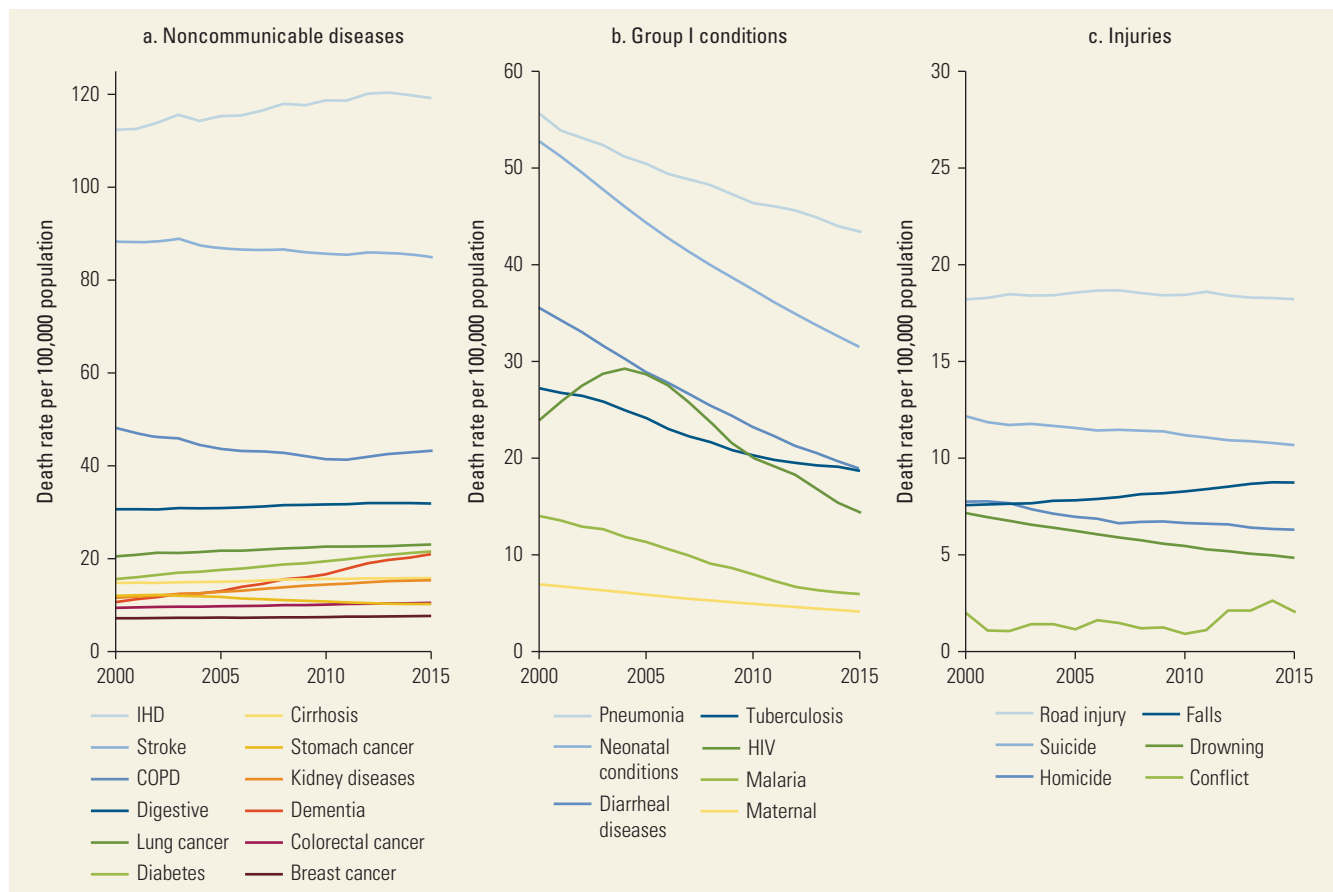
Note: COPD = chronic obstructive pulmonary disease; HIV = human immunodeficiency virus; IHD = ischemic heart disease.

Figure 4.6 Decomposition of Changes in Annual Number of Deaths, by Country Income Group and Major Cause, 2000–15
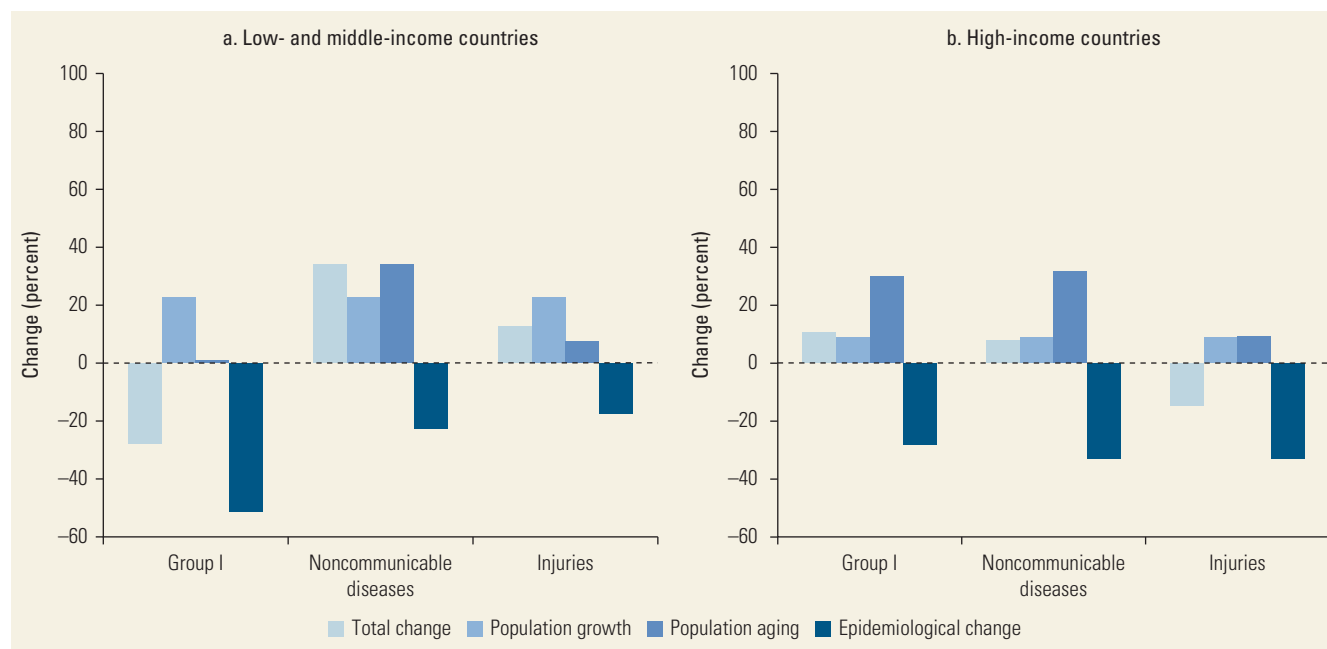
Table 4.11 Average Annual Rate of Change in Cause-Specific Death Rates, by Selected Causes within Age Groups, for the World and by Country Income Group, 2000–15

percent

Age and cause	World	Low income	Lower-middle income	Upper-middle income	High income
Ages 0–14 years					
Diarrheal diseases	–6.0	–6.9	–6.0	–5.8	–5.6
Malaria	–6.3	–8.0	–5.4	–4.4	–6.5
Lower respiratory infections	–4.8	–5.0	–4.7	–6.1	–5.9
Preterm birth complications	–2.2	–3.1	–1.7	–4.1	–2.9
Ages 15–49 years					
HIV/AIDS	–3.2	–7.6	–0.9	–2.3	1.8
Tuberculosis	–3.1	–4.4	–3.1	–5.7	–4.5
Maternal conditions	–3.3	–4.5	–4.1	–3.1	–1.4
Road injury	–0.2	0.0	1.2	–0.9	–3.5
Self-harm	–1.4	–1.2	–1.4	–2.1	–1.1
Interpersonal violence	–1.3	–0.8	–1.3	–0.9	–3.7
Ages 50–69 years					
Malignant neoplasms	–1.0	–0.7	–0.5	–1.3	–0.8
Ischemic heart disease	–1.1	0.9	–0.6	0.2	–2.7
Stroke	–1.7	–0.2	–1.4	–1.5	–3.5
Chronic obstructive pulmonary disease	–2.2	0.2	–1.4	–3.9	–1.1

Note: HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

and COPD, which are declining at around 3 to 4 percent per year in HICs.

Gains in Life Expectancy

Figure 4.7 decomposes the gains in life expectancy from 2000 to 2015 to identify the contribution of major causes using the methods of Beltran-Sanchez, Preston, and Canudas-Romo (2008). For LICs, 88 percent of the nine-year increase in life expectancy is due to declines in Group I cause-specific death rates, particularly for HIV/AIDS, tuberculosis, malaria, diarrheal diseases, lower respiratory infections (mainly pneumonia), and neonatal causes (mainly complications of prematurity, birth trauma, and neonatal infections). At the other end of the epidemiological spectrum, in HICs, 96 percent of the 3.7-year gain in life expectancy is associated with a reduction in mortality from NCDs (62 percent) and injuries (33 percent).

Figure 4.7 Gains in Life Expectancy at Birth Because of Improved Outcomes for Major Causes of Death, for the World and by Country Income Group, 2000–15

Legend:
- Other injury
- Homicide
- Road traffic injuries
- Other noncommunicable diseases
- Chronic respiratory disease
- Cancer
- Cardiovascular diseases and diabetes
- Neonatal, maternal, and nutritional conditions
- Other infectious diseases
- Respiratory infections
- HIV/AIDS, tuberculosis, malaria
- Diarrheal diseases
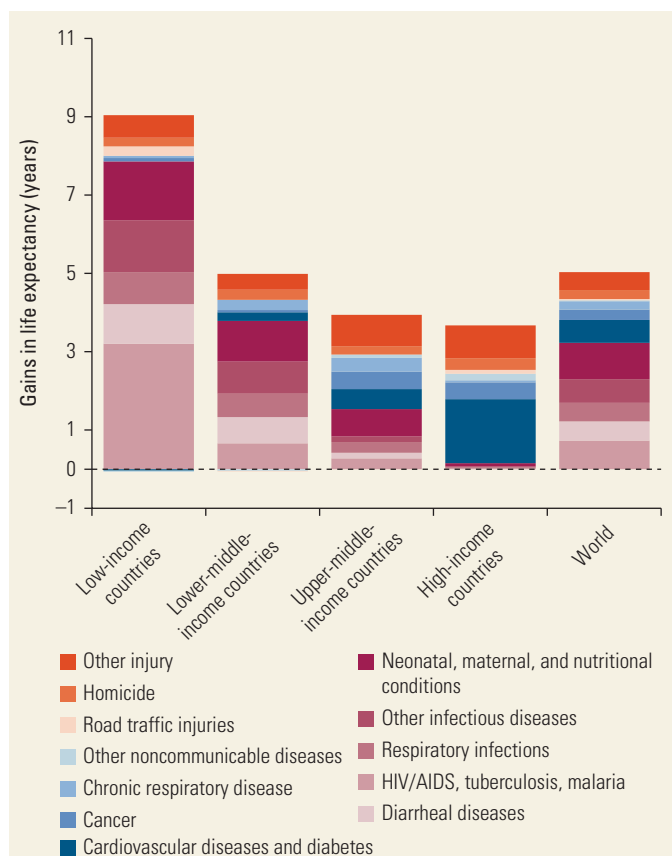
Note: HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome.

DISCUSSION

Globally, life expectancy has been improving at a rate of more than three years per decade since 1950, with the exception of the 1990s (UN 2015). During that period, progress on life expectancy stalled in Africa because of the rising HIV/AIDS epidemic and in Europe because of higher mortality in many former Soviet republics following the collapse of the Soviet Union. Gains in life expectancy accelerated in most regions from 2000 onward, and overall life expectancy rose 5.0 years overall between 2000 and 2015, with an even larger increase of 9.4 years in Sub-Saharan Africa (WHO Global Health Observatory 2016). Almost 90 percent of the increase in life expectancy in Sub-Saharan Africa is the result of lower death rates for Group I causes, the main focus of the MDG health targets and of global health policies over the MDG period. In contrast, the increase of 3.7 years in life expectancy in HICs (corresponding to an average increase of 2.5 years per decade or 6 hours per day) was dominated by decreases in NCD death rates, particularly for cardiovascular disease. Rates of premature deaths (ages 50–69 years) from IHD and stroke decreased 36 percent and 47 percent, respectively, from 2000 to 2015.

The global average increase in life expectancy at birth since 2000 exceeds the overall average increase in life expectancy achieved by the best-performing countries over the past century (Oeppen and Vaupel 2002). The world as a whole is catching up with those countries, and improvements in outcomes for all major causes of death have contributed to these huge gains. The gap between life expectancy for HICs and LICs has narrowed, from 26 years in 2000 to 19 years in 2015, a decrease of 7 years.

Prospects for Accelerated Improvement to Achieve the 2030 Sustainable Development Agenda

The post-2015 SDGs include 13 cause-specific or age-specific mortality targets (WHO 2017c), with many focusing on reducing or ending *preventable* deaths. Achievement of the major SDG targets for child, maternal, and infectious diseases and for NCDs would result in a projected increase in global average life expectancy of about 4 years by 2030. The gap in average life expectancy between HICs and LICs would narrow from about 19 years in 2015 to about 14 years in 2030 (WHO 2014b).

Norheim and others (2015) have proposed an overarching target for health of reducing the number of deaths before age 70 years—both globally and in every country—by 40 percent by 2030. Countries at different stages of development could, depending on their epidemiological priorities, achieve this kind of gain in

premature mortality by reducing mortality from HIV/AIDS, malaria, and tuberculosis or reducing causes of child deaths or NCD-related deaths under age 70 years. Concerted action to reduce NCD-related deaths before age 70 years would also reduce NCD death rates for people ages 70 years and over.

Applying the SDG targets to the estimated number of deaths in 2015 by cause, age, and sex can approximate the effect of attaining the SDG health-related targets for number of deaths under age 70 years. In 2015, there were an estimated 30.3 million deaths under age 70 years; if the SDG mortality targets had been achieved in 2015, the number would have been reduced to 19.6 million deaths.[1] This represents a 35 percent reduction (almost 11 million premature deaths averted)—close to the proposed 40 percent target. Of these averted deaths, 5 million from infectious diseases, malnutrition, and child and maternal mortality (the MDG causes) would have been avoided, with a further 5 million from NCDs and 900,000 from injuries also avoided. Figure 4.8 shows the rates of premature deaths (under age 70 years) per 1,000 population in 2015 for the world and for country income groups, together with the estimated number of deaths that would have been averted by achievement of the SDG mortality targets in 2015. The achievement of SDG mortality targets would have dramatically narrowed cross-income variations in the rate of premature deaths.

Uncertainty of Estimates and Limitations

Comparable information about the number of deaths and mortality rates by cause, age, sex, country, and year provides important information for discussing priorities and for monitoring and evaluating progress toward global health goals. However, serious problems exist with the quality and availability of information on levels and causes of death, particularly in LICs, where the mortality burden is highest. For this reason, there is considerable uncertainty in most cause-of-death estimates.

Demographic methods of assessing the completeness of death registration all involve strong assumptions or information about migration and are prone to error resulting from age misstatement in registration or census data and to differential completeness of successive censuses. These errors can result in considerable uncertainty in estimates for countries with partially complete registration systems, even before one considers the quality of cause-of-death assignment.

All-cause mortality estimates in countries without well-functioning death registration systems rely heavily on census and survey data (particularly sibling survival data) and model life tables. Yet no consensus has been reached on the methods for analyzing sibling survival

Figure 4.8 Premature Deaths (under Age 70 Years) That Would Have Been Averted by Achievement of SDG Mortality Targets, for the World and by Country Income Group, 2015
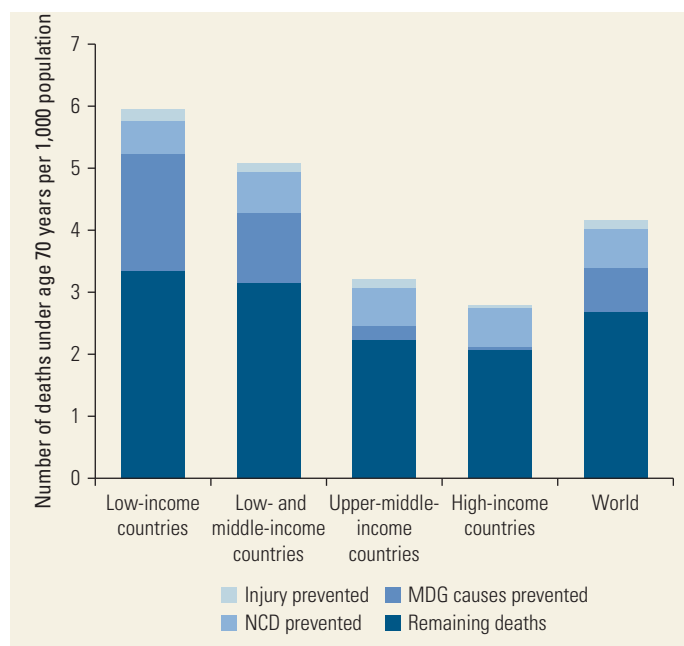
Note: NCD = noncommunicable disease; MDG = Millennium Development Goal.

data or assessing the level of underreporting of deaths in surveys or censuses.

In many low-income countries and lower-middle-income countries, estimates for many causes of death are predicted from available data on causes of death, using covariates such as gross domestic product and educational attainment. Even in HICs with relatively complete health statistics information systems, data quality is problematic for many causes. Approximate estimates of cause-specific uncertainty ranges are available in datasets that can be downloaded from the WHO website (see box 4.1).

Although death registration data are generally the best form of available information on causes of death, such data have 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 reassigning these deaths to valid causes are highly uncertain and generally not based on empirical data. The assignment of underlying cause of death is both 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 (owing to differences in physician practice when certifying a death) in the assignment of valid underlying causes of death has not been addressed to date.

Additionally, some diseases and injuries have specific problems that create difficulty in judging the underlying cause of death (for example, diabetes and heart disease, Alzheimer's disease and heart disease, and drug or alcohol overdose). Finally, HIV/AIDS and other stigmatized causes of death, such as suicide, are routinely certified incorrectly; incorrect certification rates vary substantially across settings.

For many countries without a functioning death registration system, particularly in Africa, there is strong reliance on verbal autopsy studies. Most studies are not nationally representative samples and, even when conducted well, have substantial limitations with respect to sensitivity and specificity of identifying specific causes of death. Considerable variation also exists in verbal autopsy instruments and in analysis and cause assignment methods. Validation studies are challenging and difficult to generalize to other settings.

The WHO GHE bring together single-cause analyses from several WHO departments, interagency collaborations, and other sources and estimates drawn from the GBD 2015 study. These estimates are updated using different timetables and varying methods and assumptions in some cases. Ensuring consistency across cause analyses that are created by various sources is more difficult than for large comprehensive estimates, such as GBD 2015, that are prepared by a single academic group. In addition, preparing separate estimates of total mortality and cause-specific mortality can lead to incompatible cause-specific and total mortality estimates.

Differences from Other Global Cause-of-Death Assessments

Academic institutions are increasingly publishing estimates in parallel to those of the WHO, using different methods that may result in substantially different results. *The Lancet* has become a regular channel for publication of global, regional, and country statistics on key health indicators and the burden of disease. Rudan and Chan (2015) recently characterized this practice as a competitive situation that is challenging the position of the WHO.

Over recent years, investigation into differences in the estimates for the same indicator has led to improvements in the data inputs and estimation methods used by UN agencies and by the GBD 2015 study. The existence of divergent estimates for the same indicator also has led to increased awareness of major data gaps, especially in LMICs. Lack of reliable data suggests greater use of data from other—often higher-income—countries and covariates to predict country statistics.

The type and complexity of models used for GHE vary widely by research and institutional group and by health estimate. More complex models are necessary to generate more comprehensive uncertainty intervals. These models require greater expertise and time and greater computational resources to run. In cases of available, high-quality data, estimates from different institutions are generally in agreement. Discrepancies are more likely to arise for countries where data are poor and for conditions where data are sparse and potentially biased. This situation is best addressed through improving the primary data.

The WHO and the UN devote considerable attention to estimates for several high-priority areas, including neonatal, child, and maternal mortality; HIV/AIDS; tuberculosis; malaria; major causes of child death; road injuries; homicides; and cancers. In all of these cases, input data for the particular area are scrutinized by specialists in that area, including academic collaborators; household survey technical staff involved with data collection; and country experts, including through the WHO country consultation mechanism.

The GHE 2015 draw on these WHO and UN agency or interagency statistics and place them in a consistent comprehensive context for all causes, drawing on death registration data and GBD 2015 analyses for causes and for countries lacking both death registration data and investment by the UN system in detailed estimates. Over time, some convergence has occurred between GBD and WHO estimates for some causes, although major differences remain in areas such as adult malaria mortality. However, the WHO continues to produce its own GHE, partly because of differences in the estimates of all-cause mortality (envelope) and of mortality for some major causes. In addition, the WHO has been unwilling to rely on third-party statistics for which it is not responsible or accountable to member states and for which it does not have, in many cases, access to the data and methods used.

The GHE 2015 use the latest UN Population Division life tables to provide envelopes, with some adjustments for countries with high HIV/AIDS prevalence and for countries with relatively complete death registration data. The UN life tables are less systematic than the GBD project (which uses its own model life table system), in part because of greater investment both in closely examining and assessing available country data and context and in ensuring consistency of estimated deaths with population, fertility, and migration estimates. For countries with high HIV/AIDS prevalence, the UN Population Division works with the Joint United Nations Programme on HIV/AIDS (UNAIDS) to maximize consistency of HIV/AIDS estimates and all-cause mortality trends and age patterns. In its most recent updates, the GBD 2015

study also uses UNAIDS models and inputs but has modified key assumptions regarding survival owing to antiretroviral treatment. It also models HIV/AIDS mortality as part of its overall model life table analysis in a way that may not adequately account for the complexity of time and age patterns for the HIV/AIDS epidemic.

The GBD model life tables differ most significantly from the UN estimates in three ways:

- Much lower estimates of older child mortality
- Different estimates of all-cause mortality in countries with high HIV/AIDS prevalence
- Slower time trends, with lower mortality rates in the 1990s in some parts of the world.

In the latest update, some of these differences are reduced, but the GBD 2015 estimate of 8.0 million deaths for the WHO African region is still much lower than the UN estimate of GHE 2015 of 9.2 million deaths (table 4.12). The GBD 2015 estimates for African deaths are consistently lower by close to 1.1 million across 1990–2015. In contrast, GHE 2015 and GBD 2015 estimates of deaths in children under age 5 years have converged globally and in most regions. Past GBD estimates have oscillated above and below the UN interagency estimates.

There are also significant differences (at the global, regional, and country levels) for some major causes of death. These differences include HIV/AIDS mortality, for which the GBD 2015 has converged somewhat by using the UNAIDS Spectrum model but has changed some input parameters. The parameters also include malaria mortality, which has seen some convergence for child mortality. However, significant differences remain for adult mortality, with the high GBD 2015 estimates for rates of adult malaria deaths not deemed plausible by many experts in malaria. Some convergence has occurred in other areas, such as maternal mortality, tuberculosis, and causes of child death. Pathogen-specific estimates for diarrhea and pneumonia mortality have also converged, largely as a result of revisions to GBD methods.

There are some more specific causes where the WHO and the GBD assessments differ (for example, road traffic injuries and homicides), in part because of different data inclusion and adjustment criteria. For example, both GBD 2015 and the WHO use death registration data and police or justice system data for homicides. Despite the intense effort put into assessing and adjusting data from incomplete death registration, GBD 2015 has not yet put the same effort into assessing and adjusting data from police or justice systems, resulting in low estimates in some countries (for example, estimated homicide rates are lower for Burkina Faso and Nigeria than for Japan).

Table 4.12 Comparison of Estimates of Total Global Deaths, 1990, 2000, and 2015

millions

Year	1990	2000	2015
World			
Global Health Estimates (WHO)	48.9	52.1	56.4
Global Burden of Disease estimates (IHME)	47.9	52.1	55.8
Africa			
Global Health Estimates (WHO)	7.9	9.8	9.2
Global Burden of Disease estimates (IHME)	6.8	8.5	8.0

Note: GHE 2015; WHO = World Health Organization; IHME = Institute for Health Metrics and Evaluation.

The WHO and other UN agencies will continue to prepare and report on global health indicators to fulfill their mandate from member states and to be accountable to those states through a transparent process, reproducible methods, and country involvement. For many years, this involvement has occurred mainly in the context of WHO or UN expert groups; this work is now also taking place in independent academic research institutions, notably through the IHME's work on the global burden of disease. The resulting debates on data interpretation, methods, and results can be healthy and productive and can lead to improvements in global health statistics, as long as the focus on methodological sophistication does not come at the expense of working together to improve the essential investments in data collection, analysis, and resulting use in LMICs.

CONCLUSIONS

The results presented here document major changes during the MDG era. On the whole, progress toward the MDGs has been remarkable, including, for instance, poverty reduction, improved education, and increased access to improved drinking water. Progress on the three health goals and targets has also been considerable. Globally, the HIV/AIDS, tuberculosis, and malaria epidemics have been "turned around," and child mortality and maternal mortality have decreased greatly (53 percent and 44 percent, respectively, since 1990), despite falling short of the MDG targets. Large reductions in mortality have occurred in Sub-Saharan Africa since the early 2000s, coinciding with increased coverage of HIV/AIDS treatment, methods of malaria control, and scale-up of vaccination coverage. Despite this progress, major challenges remain in achieving further progress on child and maternal mortality and on infectious diseases such as

HIV/AIDS, tuberculosis, malaria, neglected tropical diseases, and hepatitis.

The rate of increase in life expectancy in LICs over the past 15 years has exceeded the rate of growth observed for life expectancy in the countries with the highest life expectancies. Longer life expectancies and population aging have resulted in an increased focus on NCDs and their risk factors in LMICs and in HICs. Three-quarters of NCD-related deaths occurred in LMICs in 2015.

Over the past four decades, death rates from cardiovascular disease and smoking-associated cancers have declined substantially in most HICs, and rates for premature deaths from cardiovascular disease at ages 30 to 69 declined 28 percent in HICs over the period 2000–15, more than three times the decrease seen in LMICs. Public health action to address risk factors such as tobacco smoking and air pollution, along with the scale-up of health system coverage for individual-level risk factor interventions, are important priorities in the SDG era, particularly for LMICs. Weak health systems are a major obstacle in many countries, resulting in major deficiencies in universal health coverage for even the most basic health services and inadequate preparedness for health emergencies.

Lower poverty levels and economic growth have moved many countries to the middle-income categories and enabled an increasing proportion of countries to become self-sufficient in health and even to become aid donors and health technology suppliers (Jamison and others 2013). With enhanced investments to scale up health systems toward universal health coverage and to address major risk factors, continuing and accelerating the convergence of death rates across country income categories will be possible. At the same time, the challenges of population aging may be joined by additional challenges arising from climate change, political instability, and potential new epidemic outbreaks.

ACKNOWLEDGMENTS

ANNEXES

The two annexes to this chapter are available at http://www.dcp-3.org/DCP.

- Annex 4A. Global and Regional Causes of Death 2000–15: Data and Methods
- Annex 4B. Global and Regional Burden of Disease 2000–15: Methods and Summary Results

NOTES

World Bank Income Classifications as of July 2014 are as follows, based on estimates of gross national income (GNI) per capita for 2013:

- Low-income countries (LICs) = US$1,045 or less
- Middle-income countries (MICs) are subdivided:
  (a) lower-middle-income = US$1,046 to US$4,125
  (b) upper-middle-income (UMICs) = US$4,126 to US$12,745
- High-income countries (HICs) = US$12,746 or more.

1. Reduction of maternal mortality ratio to 70 per 100,000 live births; reduction of neonatal and under-age-5 mortality rates to 12 and 25 per 1,000 live births, respectively; 90 percent reduction in deaths from HIV/AIDS, tuberculosis, malaria, and neglected tropical diseases; 33 percent reduction in deaths from hepatitis, cancer, diabetes, cardiovascular disease, and chronic respiratory disease; 50 percent reduction in road injury deaths; 50 percent reduction in diarrheal deaths (through achievement of the target for water, sanitation, and hygiene); and 33 percent reduction (arbitrary interpretation of the SDG target of substantial reduction) in deaths from homicide, conflicts, and disasters. These estimated mortality reductions are conservative and do not include the effects of suicide, pollution, and drug and alcohol use on mortality targets (beyond their contribution to NCD mortality).

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