

Levels and trends in under-5 mortality, 1990–2008

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As global momentum and investment for accelerating maternal and child survival grows, monitoring of progress at the global and country level has become even more needed. Millennium Development Goal 4 (MDG 4) calls for a two-thirds reduction in the mortality rate among children under the age of 5 years between 1990 and 2015. Generating accurate estimates of under-5 mortality poses a considerable challenge because of the limited data available for many developing countries. In response, experts at UNICEF, WHO, the World Bank, the UN Population Division (UNPD), and members of the academic community formed the Inter-agency Group for Child Mortality Estimation (IGME).¹ The IGME aims to source and share data on child mortality, to improve and harmonise estimation methods across partners, and to produce consistent estimates on the levels and trends in child mortality worldwide.

The IGME compiles national-level estimates, including data from vital-registration systems, population censuses, and household surveys (eg, DHS, MICS, LSMS, RHS, PAFAM). A regression curve is then fitted to these points and extrapolated to a common reference year. The method aims to provide a transparent and objective way of fitting a smoothed trend to a set of observations, and of extrapolating the trend to cover the period from around 1960 to the present.

For this year's estimates, several changes have been made. First, a substantial amount of newly available data and data missing from the past have been incorporated. These new data have resulted in substantial changes in child mortality levels and trends for some countries (eg, Ghana, Sierra Leone), compared with the previous estimates. Second, to take into account reporting bias associated with maternal death in settings with a high prevalence of HIV, estimates have been adjusted in affected countries. Essentially, survey-based estimates tend to under-report child deaths in households where mothers are absent due to HIV-related death or illness. This year the Technical Advisory Group of the IGME developed a new method to adjust mortality related to HIV/AIDS for each data observation, by adopting a set of simplified assumptions about the distribution of births to HIV-positive women by the duration of their infection, rates of vertical transmission, survival times of both mothers and children from the time of the birth, and coverage of key HIV-related services. Third, birth transference was adjusted for before the adjustment of deaths related to HIV/AIDS for data from the surveys with serious birth-transference issues. Fourth, new methods for estimating absolute numbers of deaths have been included. Methodological details are available elsewhere.² Because the regression curve

	1990	1995	2000	2005	2007	2008	Decrease 1990–2008 (%)	Average annual rate of reduction 1990–2008 (%)	Progress towards the MDG target
Africa*	168	165	152	139	134	132	21	1.3	Insufficient
Sub-Saharan Africa†	184	180	165	152	146	144	22	1.4	Insufficient
Eastern and Southern Africa	167	162	146	129	122	119	29	1.9	Insufficient
West and Central Africa	206	202	188	176	171	169	18	1.1	Insufficient
Middle East and North Africa	77	66	56	47	44	43	44	3.2	Insufficient
Asia	87	82	71	60	56	54	38	2.6	Insufficient
South Asia	124	111	99	83	78	76	39	2.7	Insufficient
East Asia and Pacific	54	49	41	32	29	28	48	3.6	On track
Latin America and Caribbean	52	43	33	26	24	23	56	4.5	On track
Central and Eastern Europe/ Commonwealth of Independent States	51	49	37	27	24	23	55	4.4	On track
Industrialised countries	10	8	7	6	6	6	40	2.8	On track
Developing countries	99	95	86	77	73	71	28	1.8	Insufficient
Least developed countries	179	168	150	136	131	129	28	1.8	Insufficient
World	90	87	78	70	66	65	28	1.8	Insufficient

*Africa includes sub-Saharan Africa, Algeria, Egypt, Libya, Morocco, and Tunisia. †Sub-Saharan Africa includes Eastern and Southern Africa, West and Central Africa, Djibouti, and Sudan, see reference 4. On track=under-5 mortality is <40 per 1000 livebirths or is ≥40 per 1000 livebirths and average annual rate of reduction is ≥4.0%. Insufficient=under-5 mortality is ≥40 per 1000 livebirths and average annual rate of reduction is <4.0% but ≥1.0%.

Table 1: Levels and trends in under-5 mortality, 1990–2008—mortality rate (per 1000 livebirths)

involves retrofitting the entire time series, estimates might differ from and might not be comparable with previous years' estimates for the same reference year if there is any change in the available observations (eg, addition of newly available data or addition of missing data for the past, and revised data points adjusted for HIV/AIDS). To increase the transparency of the estimation process, the IGME developed a publicly accessible database called CME Info with full details of the country-specific estimates and their underlying source data.³

Since 1990, the global under-5 mortality rate has declined by 28% from 90 deaths per 1000 livebirths to 65 in 2008 (table 1). The total number of under-5 deaths in the world has declined from 12.5 million in 1990 to 8.8 million in 2008 (table 2). The highest rates of mortality in children under 5 continue to occur in sub-Saharan Africa. There, in 2008, one in seven children (144 per 1000 livebirths) died before their fifth birthday; the highest levels were in Western and Central Africa where one out of six children die before age 5 years (169 per 1000 livebirths). Among the 34 countries with under-5 mortality rates exceeding 100 per 1000 livebirths in 2008, all are in sub-Saharan Africa, except for Afghanistan. Although under-5 mortality has declined by 22% since 1990, the rate of improvement in child survival in sub-Saharan Africa is insufficient to reach MDG 4. Furthermore, high levels of fertility in sub-Saharan Africa, combined with the high levels of under-5 mortality, have resulted in an increase in the absolute number of under-5 deaths (from 4.0 million in 1990 to 4.4 million in 2008). Sub-Saharan Africa now accounts for half of the 8.8 million under-5 deaths worldwide in 2008.

South Asia has the next highest rate of mortality in children under 5 in the world. About one out of 13 children (76 per 1000 livebirths) died in 2008. Although the under-5 mortality rate has declined by 39% since 1990, the rate of progress toward MDG 4 remains insufficient. South Asia now accounts for 32% of the world's under-5 deaths in 2008 (figure).

Under-5 mortality is increasingly concentrated: 75% of the world's under-5 deaths in 2008 occurred in only 18 countries. Half of the deaths occurred in only five countries: India, Nigeria, Democratic Republic of the Congo, Pakistan, and China. And India and Nigeria together account for nearly one-third of the total number of under-5 deaths worldwide (21% and 12%,

	1990	1995	2000	2005	2007	2008	Decrease 1990-2008 (%)	Proportion of total deaths worldwide in 2008 (%)
Africa*	4.3	4.5	4.5	4.5	4.5	4.5	-5	51
Sub-Saharan Africa†	4.0	4.3	4.3	4.4	4.4	4.4	-10	50
Eastern and Southern Africa	1.7	1.8	1.7	1.7	1.6	1.6	6	19
West and Central Africa	2.2	2.4	2.5	2.6	2.6	2.6	-18	30
Middle East and North Africa	0.8	0.6	0.5	0.4	0.4	0.4	50	5
Asia	6.7	5.8	5.0	4.1	3.8	3.7	45	42
South Asia	4.6	4.2	3.7	3.2	2.9	2.8	39	32
East Asia and Pacific	2.2	1.6	1.3	1.0	0.9	0.8	64	9
Latin America and Caribbean	0.6	0.5	0.4	0.3	0.3	0.2	67	3
Central and Eastern Europe/ Commonwealth of Independent States	0.4	0.3	0.2	0.1	0.1	0.1	75	1
Industrialised countries	0.1	0.1	0.1	0.1	0.1	0.1	0	1
Developing countries	12.2	11.3	10.3	9.2	8.8	8.7	29	99
Least developed countries	3.8	3.9	3.7	3.6	3.5	3.5	8	40
World	12.5	11.4	10.4	9.3	8.9	8.8	30	100

*Africa includes sub-Saharan Africa, Algeria, Egypt, Libya, Morocco, and Tunisia. †Sub-Saharan Africa includes Eastern and Southern Africa, West and Central Africa, Djibouti, and Sudan, see reference 4.

Table 2: Levels and trends in under-5 mortality, 1990-2008—deaths (millions)

respectively). Africa and Asia combined represent 93% of all under-5 deaths (51% and 42%, respectively).

The greatest progress has been made in the Latin America/Caribbean and Central and Eastern Europe and Commonwealth of Independent States regions, which have achieved greater than 50% reduction in under-5 mortality between 1990 and 2008 (56% and 55%, respectively [tables 1 and 2]). At country level, the best performers (on the basis of the average annual rate of reduction among countries with under-5 mortality of 40 or higher) include Nepal, Bangladesh, Eritrea, Lao People's Democratic Republic, Mongolia, Bolivia, and Malawi, which have all consistently achieved annual rates of reduction of under-5 mortality of 4.5% or higher. Additionally, Niger, Malawi, Mozambique, and Ethiopia achieved absolute reductions of more than a 100 per 1000 livebirths since 1990. These countries are providing proof of concept that MDG 4 is achievable, even in the poorest environments.

Overall, substantial progress has been made towards the achievement of MDG 4. In 2008, 10 000 fewer children are dying every day than in 1990, the baseline year for the MDGs. Moreover, the rate of decline in under-5 mortality increased for the period 2000 to 2008 compared with the 1990s (the average annual rate of decline for 2000-08 is

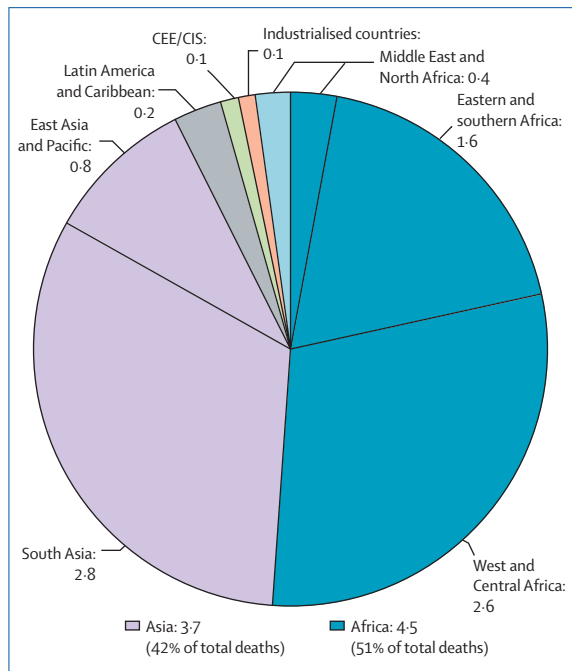


Figure: Regional distribution of the 8.8 million children who died before they reached their fifth birthday in 2008 (in millions)

The sum of the number of deaths by region is not equal to 8.8 million due to rounding. CEE/CIS=Central and Eastern Europe/Commonwealth of Independent States.

2.3% compared with 1.4% for 1990–2000). Additionally, most of the recent survey data incorporated in these estimates generally reflect mortality over the preceding 3–5 years. Thus the major improvements in coverage in recent years for insecticide-treated bednets for malaria, prevention of mother-to-child transmission and paediatric HIV, *Haemophilus influenzae* type B vaccine, and further progress on measles, tetanus, and vitamin A supplementation, for instance, might not yet be fully reflected in these mortality data. There is evidence therefore to believe that the acceleration in child survival might already be well under way.^{5,7} There is an urgent need for the global health community to refocus on pneumonia and diarrhoea as two of the three most important causes of under-5 mortality; new tools, such as vaccines against pneumococcal pneumonia and rotaviral diarrhoea, might provide much needed momentum and an entry point for the revitalisation of comprehensive programming against these two diseases.⁸

However, the rate of decline in under-5 mortality is still grossly insufficient to obtain the MDG goal by 2015, particularly in sub-Saharan Africa and South Asia, and it is alarming that among the 67 countries with high mortality rates (40 per 1000 or more), only ten are on

track to meet MDG 4. These findings call for a more concerted effort to accelerate progress, which will require a combination of different strategies. First, in addition to the countries with the highest mortality rates, a renewed focus on high-burden countries with the greatest number of deaths is required. Achieving faster progress in these countries, including India, Nigeria, Democratic Republic of the Congo, Pakistan, and China (which make up nearly 50% of all under-5 deaths), will be crucial in accelerating progress toward meeting MDG 4 at the global level. Second, review of the countries with the highest absolute levels of under-5 mortality or of those making the least progress since 1990, shows that countries in conflict or in transition are significantly over-represented. More analytical work needs to be done to document and disseminate best practices in such countries for achieving improvements in child survival. Additionally, the donor community should support these countries by prioritising them in new initiatives, such as the International Health Partnerships⁹ or through resources from global funds, and by supporting implementing UN agencies and non-governmental organisations to develop innovative programming models.

Accelerated progress can be achieved, even in the poorest environments, through: integrated, evidence-driven, and community-based programmes that focus on addressing the major causes of death, including pneumonia, diarrhoea, newborn disorders, malaria, HIV, and undernutrition; reaching the unreached with a basic package of interventions at large scale and achieving coverage with equity; and using data for action and advocacy.

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We declare that we have no conflicts of interest.

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How many more AIDS deaths?

2 million people died from AIDS in 2007,¹ bringing the cumulative number of deaths since 1980 to 24 million.² These grim estimates are well documented but what lies ahead is unclear. The best projections of deaths by cause are made by the Global Burden of Disease study sponsored by WHO. Its projection published in 2005 expected the global number of deaths from AIDS to rise sharply from 2.85 million in 2002 to 6.5 million in 2030^{3,4} (figure). An update published at the end of 2008 revised the projection for 2030 downward to just 1.2 million for the baseline scenario.⁵

A new projection of deaths from AIDS for the 58 countries most highly affected by the HIV/AIDS epidemic has become available from the UN Population Division as part of the 2008 revision of World Population Prospects, the official UN set of population estimates and projections to 2050.⁶ These 58 countries accounted for 93.2% of deaths from AIDS worldwide in 2007. We projected the corresponding global total by assuming that all other countries will account for 6.8% of the total AIDS deaths in the future. On the basis of this most recent global assessment, the number of deaths from AIDS is expected to increase slightly from 2.1 million in 2007 to 2.4 million in 2030.²

The large difference between the initial projection in the Global Burden of Disease study and the two most recent much lower projections is partly attributable to a major reassessment of the number of people living with HIV/AIDS in 2007. In its 2004 and 2006 reports of the global AIDS epidemic, UNAIDS had estimated the annual number of deaths from AIDS at 2.9 million and 2.8 million, respectively, for 2003 and 2005,^{7,8} levels consistent with the baseline estimate of 2.85 million in 2002 in the first Global Burden of Disease projection. But in its 2007 AIDS epidemic update and 2008 report, UNAIDS reduced this estimate to 2.1 million and 2 million, respectively, for 2007.^{1,9} Other epidemic indicators, such as HIV prevalence and incidence, were also revised downward in 2007. The key cause of this revision was the discovery that earlier

estimates of the epidemic were inflated because they relied mostly on HIV prevalence measures gathered from pregnant women in antenatal clinics. In most developing countries this was the main source of data to track the epidemic through the 1990s and early 2000s. However, since 2000, nationally representative surveys have become available and their more accurate estimates of HIV prevalence have been almost invariably lower than data from antenatal clinics suggested. By 2007 this accumulating evidence led UNAIDS to revise its estimates of the number of people living with HIV/AIDS downward for most developing countries.

Additionally, UNAIDS revised its estimate of the trend of the epidemic. In 2007, UNAIDS concluded for the first time that “Global HIV incidence likely peaked in the late 1990s at over 3 million new infections per year, and was estimated to be 2.5 million new infections in 2007”.⁹ This unexpected peaking in incidence was attributed to “natural trends in the epidemic as well as the result of prevention programmes resulting in behavioural change”.

The future implications of this new assessment are taken into account in the latest UN and Global Burden

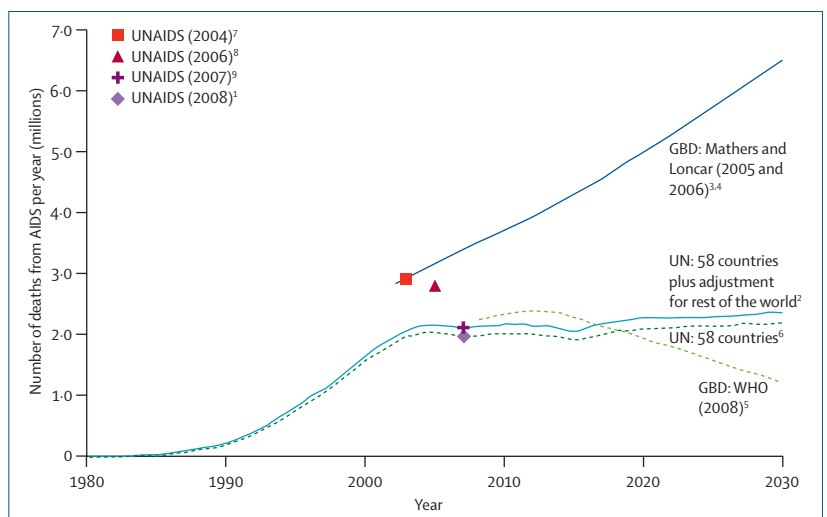


Figure: Alternative estimates and projections of global number of deaths from AIDS
 GBD=Global Burden of Disease.