Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

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Summary

Background Remarkable financial and political efforts have been focused on the reduction of child mortality during the past few decades. Timely measurements of levels and trends in under-5 mortality are important to assess progress towards the Millennium Development Goal 4 (MDG 4) target of reduction of child mortality by two thirds from 1990 to 2015, and to identify models of success.

Methods We generated updated estimates of child mortality in early neonatal (age 0–6 days), late neonatal (7–28 days), postneonatal (29–364 days), childhood (1–4 years), and under-5 (0–4 years) age groups for 188 countries from 1970 to 2013, with more than 29 000 survey, census, vital registration, and sample registration datapoints. We used Gaussian process regression with adjustments for bias and non-sampling error to synthesise the data for under-5 mortality for each country, and a separate model to estimate mortality for more detailed age groups. We used explanatory mixed effects regression models to assess the association between under-5 mortality and income per person, maternal education, HIV child death rates, secular shifts, and other factors. To quantify the contribution of these different factors and birth numbers to the change in numbers of deaths in under-5 age groups from 1990 to 2013, we used Shapley decomposition. We used estimated rates of change between 2000 and 2013 to construct under-5 mortality rate scenarios out to 2030.

Findings We estimated that 6·3 million (95% UI 6·0–6·6) children under-5 died in 2013, a 64% reduction from 17·6 million (17·1–18·1) in 1970. In 2013, child mortality rates ranged from 152·5 per 1000 livebirths (130·6–177·4) in Guinea-Bissau to 2·3 (1·8–2·9) per 1000 in Singapore. The annualised rates of change from 1990 to 2013 ranged from –6·8% to 0·1%. 99 of 188 countries, including 43 of 48 countries in sub-Saharan Africa, had faster decreases in child mortality during 2000–13 than during 1990–2000. In 2013, neonatal deaths accounted for 41·6% of under-5 deaths compared with 37·4% in 1990. Compared with 1990, in 2013, rising numbers

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of births, especially in sub-Saharan Africa, led to 1·4 million more child deaths, and rising income per person and maternal education led to 0·9 million and 2·2 million fewer deaths, respectively. Changes in secular trends led to 4·2 million fewer deaths. Unexplained factors accounted for only –1% of the change in child deaths. In 30 developing countries, decreases since 2000 have been faster than predicted attributable to income, education, and secular shift alone.

Interpretation **Only 27 developing countries are expected to achieve MDG 4. Decreases since 2000 in under-5 mortality rates are accelerating in many developing countries, especially in sub-Saharan Africa. The Millennium Declaration and increased development assistance for health might have been a factor in faster decreases in some developing countries. Without further accelerated progress, many countries in west and central Africa will still have high levels of under-5 mortality in 2030.**

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Introduction

During the past few decades, substantial political, donor, and country focus has been placed on the reduction of child mortality. The Millennium Development Goal 4 (MDG 4) target of reduction of child mortality by two thirds from 1990 to 2015 has captured the attention of high-level leaders.[1–5] The UN Commission for Accountability for Women's and Children's Health is a further reminder of intensified interest, along with numerous initiatives from donor organisations.[4,6,7] Global interest in child mortality reduction is not new; the child survival revolution,[8] Jim Grant's pioneering work at UNICEF on child interventions,[9] and the Health for All by the Year 2000 campaign[10] are examples of the worldwide focus on improvement of child survival that began more than three decades ago. Key actors such as the governments of the USA, Ethiopia, and India, together with UNICEF, are arguing for a continued post-2015 focus on further reductions in child mortality to eliminate all child deaths from preventable causes by 2035.[1] This global goal is mainly motivated, not only by the huge disparities between and within nations in child mortality, but also by compelling evidence that child mortality can be reduced even in low-resource settings.[11,12]

Child mortality worldwide is decreasing and has been in many countries for many decades.[1,13–20] The decreases achieved in high-income, middle-income, and low-income countries surely count among the more important achievements for humanity in the past 60 years.[21–27] Four types of interconnected explanations have been suggested for the sustained but heterogeneous decrease in child mortality. Demographers and other social scientists have identified long-term associations between child mortality and maternal education, income per person, and technology change.[28–32] Health-system researchers have explained why some health systems are able to achieve faster rates of decrease or lower levels of child mortality at similar amounts of income and health expenditure than are others.[33] More recently, detailed analyses by the Countdown to 2015 and other groups have sought to explain levels and trends in child mortality through the coverage of a short list of proven technologies.[5,34] Political scientists have called attention to the potential role of global collective action, such as the Millennium Declaration itself, as a key contributor to social phenomenon and health development.[35,36] All of these explanations have merit; understanding the balance and interconnection between them might provide important insights for future global and national action to accelerate decreases in child mortality.

Timely, local, and valid assessments of trends in child mortality along with the associated drivers of these trends can provide an important input to national, regional, and global debates on next steps. Although the long-term trend in child mortality has been downward, important heterogeneity exists across countries and age groups. Understanding this heterogeneity can help to catalyse and optimise a process of shared learning from success stories and to identify crucial areas that need more attention.

Here, we aimed to use data from the Global Burden of Diseases, Injuries, and Risk Factors Study 2013 (GBD 2013) to assess levels and trends of child mortality, and to explore key factors associated with progress. We aimed to use the GBD 2013 data to report three interrelated themes: estimate the levels and trends in early neonatal (age 0–6 days), late neonatal (7–28 days), postneonatal (29–364 days), childhood (1–4 years), and under-5 (0–4 years) mortality from 1990 to 2013, for 188 countries (with one additional country comparing to GBD 2010[37] because we included Sudan and South Sudan in this analysis) with the most up-to-date data and methods; explore the contribution of broad drivers of child mortality during the past few decades and whether accelerated reductions have been beyond what might have been expected after 2000; and forecast child mortality to 2030 to identify populations that are likely to be the main challenges to further global progress with child survival strategies in the mid-term.

Methods

Estimation of child, infant, and neonatal mortality by country during 1990–2013

We used the broad data analysis strategy from the Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) to measure national trends in child mortality.

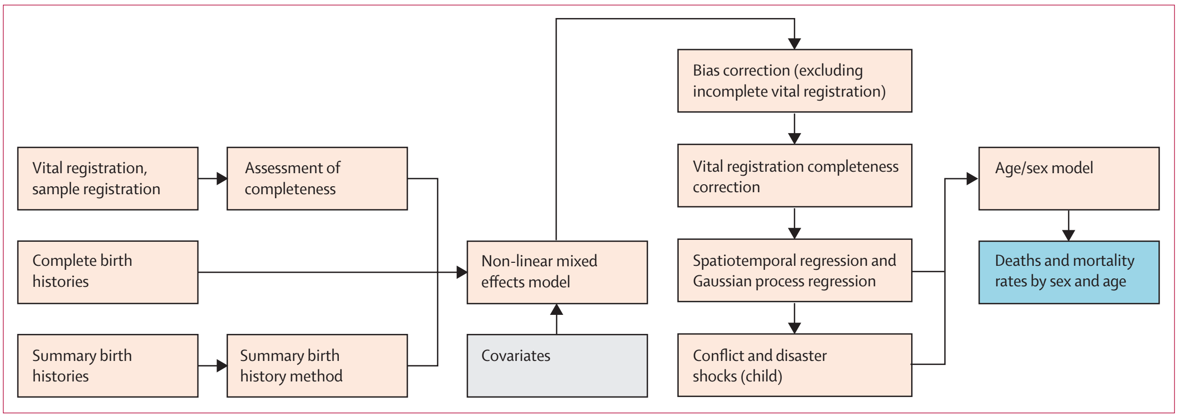

Figure 1: **Child mortality estimation process for the Global Burden of Diseases, Injuries, and Risk Factors Study 2013**

The appendix summarises the methods we used,[13,14,18] including further refinements on the basis of feedback for GBD 2010. Figure 1 shows the analytical steps we used to estimate under-5 mortality. This process had three components. First, we used improved formal demographic methods to analyse empirical data for child deaths reported from censuses, vital registration systems, sample registration systems, disease surveillance systems, and various surveys with different birth history modules. Demographic techniques applied to major sources of data collectively generated more than 29 000 child mortality point estimates for countries in various years given that there might be multiple mortality estimates from different sources for a specific country in a given year. Next, we synthesised child mortality data for each country following a three-step process. First, we applied a non-linear mixed effects model to examine the relationship between child mortality, lagged distributed income per person, maternal education, and the crude death rate from HIV/AIDS in the under-5 age group. In the second stage, we applied spatiotemporal regression to the residuals from the first stage regression in which we effectively borrowed strength over time and across countries within the same GBD region. Results from the second step were then used as priors in the third stage in which we applied a Gaussian process regression to generate best estimates of child mortality with 95% uncertainty intervals. In the final component, we applied an age and sex model to estimate age-specific and sex-specific mortality for early neonatal, late neonatal, postneonatal, and childhood age groups. The age and sex model improves upon the GBD 2010[18] by applying a mixed effects model that accounts for the differential effect of the HIV/AIDS epidemic on age-specific mortality among the neonatal age groups and postneonatal deaths under age 5. The appendix provides details of each component, data, estimates for under-5 mortality, and visualisation of model fits.

Factors associated with child mortality trends

We explored the correlates of child mortality to establish the contribution of different factors to recent changes in under-5 mortality rates. We estimated the following equation with mixed effects linear regression

$$\ln({}_5q_0) = \beta_0 + \beta_1 \times \ln(LDI_{cy}) + \beta_2 \times maternal\ education_{cy} + \beta_3 \times HIV_{cy} + \sum_{s=1}^{308} \alpha_s \times year\_GBD\ super\ region_s + \gamma_c + \varepsilon_{cy}$$

where c is country, y is year, γ_c is a random effect on country, LDI_{cy} is lagged distributed income per person[38] for country c in year y, $maternal\ education_{cy}$ is the average years of education earned by women in the age group 15 to 49, HIV_{cy} is HIV-related child crude death rate[39,40] as estimated with the improved EPP-Spectrum for GBD 2013,[40–42] and ${}_5q_0$ is the probability of death before the age of 5 estimated from this study. We also added combined year and GBD super-region fixed effects, *year_GBD super region*, to capture the differential secular trends of child mortality by geographic units. Following Preston,[32] we used time (year) as a proxy for changes in availability and use of technologies designed to improve child health that are correlated with time. We used the term "secular trend" to more broadly encompass the availability of specific child health technologies and changes in our understanding of how to more effectively deliver health interventions, and the interaction of health programmes with other technological change such as the expansion of roads or other related infrastructure.

We tested alternative model specifications including within and between estimators with different auto-regressive terms,[43] country fixed effects, and mixed effects models; the general magnitude of the effects for income, education, and time were robust to specification. We used this specification because it is the simplest to explain, and we recorded no qualitative difference in our results across model specifications. We applied Shapley decomposition[44,45] to quantify the contribution of changes in income per person, maternal education, HIV, secular trend, births, and a collective of "other" factors to the change in under-5 mortality from 1990 to 2013. Shapley

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***Figure 2:* Global under-5 mortality rate and rate of change, 1970–2013**
(A) Global under-5 mortality, 1970–2013. (B) Annualised rate of change in global child mortality, 1970–2013.

decomposition is a method with a game theory foundation that allows for decomposition of changes in a variable because of different contributory factors. Specifically, to assess the effect of these six factors on changes in under-5 deaths from 1990 to 2013, we constructed 64 scenarios in which all six factors took on values from either 1990 or 2013 in each specific scenario.

To compute the effect of any one factor, we assessed 32 pairs of scenarios in which all five remaining factors had the same values. For each pair, we then calculated the change in under-5 deaths, for which only the factor of interest changed value, and used this as a measure of the contribution of this specific factor to the change in under-5 deaths. The average of the changes in all 32 pairs of scenarios was the contribution of one factor. We repeated the same process for all six factors.

We used the above equation to predict annualised rates of change for each country from 2000 to 2013 with recorded changes in income per person and maternal education and counterfactual levels of HIV in the absence of intervention. We generated counterfactual HIV death rates with the improved EPP-Spectrum models for GBD 2013[39,40] by setting prevention of mother-to-child transmission, co-trimoxazole prophylaxis, and antiretroviral therapy (ART) to zero for all years. These predicted rates provided an estimate of the effect of changes in income per person, education, and the long-term secular trend by GBD super-region on the basis of a comparison with observed rates of change.

	1970	1980	1990	2000	2013
Early neonatal (0–6 days)	31·4 (30·0–32·8)	26·7 (25·7–27·7)	22·6 (21·8–23·3)	19·8 (19·2–20·4)	14·0 (13·5–14·6)
Late neonatal (7–28 days)	16·8 (16·3–17·4)	12·8 (12·6–13·1)	9·3 (9·1–9·5)	7·2 (7·1–7·4)	4·4 (4·1–4·6)
Postneonatal (29–364 days)	48·1 (45·1–51·4)	36·5 (34·9–38·2)	27·6 (26·4–28·8)	22·2 (21·3–23·0)	13·2 (12·4–14·1)
Child (1–4 years)	54·1 (49·8–58·7)	38·7 (36·2–41·3)	27·9 (26·1–29·6)	22·1 (20·9–23·3)	13·1 (12·0–14·3)
Under 5 (0–4 years)	142·6 (138·5–146·9)	110·0 (108·1–111·7)	84·6 (83·3–85·9)	69·4 (68·5–70·4)	44·0 (41·9–46·3)

***Table 1:* Global mortality rate (deaths per 1000 livebirths) for early neonatal, late neonatal, postneonatal, child, and under-5 age groups for 1970, 1980, 1990, 2000, and 2013**

Scenarios for under-5 mortality in 2030

We developed four scenarios to predict the under-5 mortality rate in 2030 on the basis of the distribution of observed annualised rates of change from 2000 to 2013. Scenario one used the observed rate of change from 2000 to 2013 for each country to project to 2030. We assumed child mortality rates in any country with an increase in mortality in this time stayed at a constant level during the projection period. In scenario two, we applied the best 75th percentile rate of change in all countries from 2000 to 2013. In scenario three, all countries had a rate of change corresponding to the best 90th percentile, and in scenario four, to the best 95th percentile rate of change. We used observed rates of change for all-cause mortality by detailed age groups (early neonatal, late neonatal, postneonatal, and childhood deaths at age 1–4 years) to generate scenarios for the age composition of under-5 deaths. Our predictions of the number of deaths were based on these predicted rates and UN Population Division fertility forecasts.[46] We then rescaled predicted age-specific and sex-specific mortality to match the predicted all-cause under-5 mortality rate in 2030. For analyses, we used Stata (version 13.1), R (versions 2.15.2, 3.0.1, and 3.0.2), and Python (version 2.7.3).

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or

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Results

Figure 2 shows the trend in global under-5 mortality rates and the annualised rate of change in the years from 1970 to 2013. Worldwide, under-5 mortality decreased by slightly more than two-thirds from 143 per 1000 livebirths in 1970, to 85 per 1000 in 1990, and to 44 per 1000 in 2013. The global number of under-5 deaths fell from 17·6 million in 1970, to 12·2 million in 1990, and to 6·3 million in 2013. Child mortality fell at an annual rate of between 2·5% and 3·0% from 1970 until 1985, but slowed beginning in 1985, and was at its lowest (–1·2%) in 1994. Progress in reduction of child mortality accelerated after 1997. Since 2003, the global child mortality rate has decreased at a faster rate than in the 1970s and 1980s. Tables 1 and 2 show early neonatal, late neonatal, postneonatal, childhood, and under-5 mortality rates and number of deaths for 1970, 1980, 1990, 2000, and 2013. In 2013, 31·9% of under-5 deaths worldwide happened in the early neonatal period, 9·7% in the late neonatal period, 29·4% in the postneonatal period, and 28·9% between the ages of 1–4 years. The age composition of global child deaths has progressively changed during the past 43 years; the proportion of child deaths in the neonatal (early and late) period increased from 33·4% in 1970, to 37·4% 1990, and to 41·6% in 2013. Annual rates of change between 1970 and 2013 have been very similar (close to –3%) for late neonatal, postneonatal, and ages 1–4 years, but slower (–1·9%) for the early neonatal period (data not shown). Between 2000 and 2013, the annualised rate of change for the early neonatal period was 1·2 to 1·4 percentage points slower than for other under-5 age-groups, albeit faster than the early neonatal rate of decline in previous decades. We used the following equation to calculate rate of change

$$\ln(R_t/R_0)/t$$

where R_t is the rate in time t and R_0 is the rate in time 0, or the baseline. The appendix shows trends and annualised rates of change for super-regions.

Table 3 provides estimates and uncertainty intervals for early neonatal, late neonatal, postneonatal, childhood, and under-5 mortality rates by country, and under-5 deaths for 2013, and the annualised rates of change in under-5 mortality rate from 1990 to 2000, 2000 to 2013, and 1990 to 2013 for 188 countries and 21 GBD regions. Under-5 mortality rates ranged by 66·3 times, from 152·5 per 1000 livebirths in Guinea-Bissau to 2·3 per 1000 in Singapore in 2013. The ten countries with the highest under-5 mortality rate in 2013 were all in sub-Saharan Africa. 55 countries achieved under-5 mortality rates lower than 10 per 1000 livebirths in 2013; nine of them were developing countries. In 2013, 26 countries accounted for 80% of child deaths worldwide (Afghanistan, Angola, Bangladesh, Brazil, Burkina Faso, Cameroon, Chad, China, Cote d'Ivoire, Democratic Republic of the Congo, Ethiopia, Ghana, India, Indonesia, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Pakistan, Philippines, Somalia, Sudan, Tanzania, and Uganda; table 3). Neonatal mortality rates ranged from 42·6 per 1000 in Mali to 1·2 per 1000 in Singapore in 2013 (data not shown). On the basis of rates of change from 1990 to 2013, 27 of 138 developing countries are likely to achieve the MDG 4 target of a two-thirds reduction in child mortality from 1990 levels by 2015 (Armenia, Bahrain, Bangladesh, Benin, Bhutan, Brazil, Burma, China, Egypt, El Salvador, Federated States of Micronesia, Iran, Lebanon, Liberia, Libya, Maldives, Nepal, Nicaragua, Oman, Peru, Saudi Arabia, Sri Lanka, Thailand, Timor-Leste, Tunisia, Turkey, and United Arab Emirates).

Figure 3 compares annualised rates of change from 2000 to 2013, with 1990 to 2000. 99 of 188 countries had faster rates of decline between 2000 and 2013 than between 1990 and 2000. Of note, 90% (43 of 48) of countries in sub-Saharan Africa had a faster rate of decline. 20 of 29 countries in central Europe, eastern Europe, and central Asia have also had accelerated decreases. Conversely, 23 of 29 countries in Latin America and the Caribbean had slower rates of decline after 2000 than before. Additionally, we recorded slower rates of change in ten regions. Large differences in the rate of change of child mortality were apparent in several small island nations, most likely due to large random fluctuations over time.

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	1970	1980	1990	2000	2013
Early neonatal (0–6 days)	3886·0 (3707·1–4062·4)	3420·8 (3289·8–3553·1)	3256·8 (3148·0–3363·1)	2638·9 (2561·5–2716·4)	2001·4 (1918·4–2084·3)
Late neonatal (7–28 days)	1999·8 (1944·5–2068·3)	1587·4 (1558·6–1616·9)	1307·9 (1283·2–1333·3)	937·0 (918·8–955·4)	610·7 (578·6–646·1)
Postneonatal (29–364 days)	5636·5 (5294·9–6004·9)	4459·7 (4269·7–4655·4)	3853·7 (3695·1–4015·1)	2874·9 (2768·3–2980·8)	1847·8 (1731·1–1969·8)
Childhood (1–4 years)	6088·4 (5598·6–6604·3)	4554·9 (4254·0–4871·4)	3826·8 (3594·8–4066·9)	2876·8 (2721·4–3040·9)	1816·0 (1654·1–1985·1)
Under 5 (0–4 years)	17597·8 (17119·3–18099·4)	14012·4 (13782·5–14227·7)	12206·3 (12026·1–12384·0)	9327·6 (9206·8–9455·7)	6274·8 (5976·8–6593·4)

Table 2: **Global number of deaths (thousands) for early neonatal, late neonatal, postneonatal, child, and under-5 age groups for 1970, 1980, 1990, 2000, and 2013**

	Deaths per 1000 livebirths					Number of under to 5 deaths (thousands)	Annualised rate of change		
	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
Global	14·0 (13·5 to 14·6)	4·4 (4·1 to 4·6)	13·2 (12·4 to 14·1)	13·1 (12·0 to 14·3)	44·0 (41·9 to 46·3)	6274·8 (5976·8 to 6593·4)	–2·0 (–1·8 to –2·1)	–3·5 (–3·1 to –3·9)	–2·8 (–2·6 to –3·1)
High–income Asia Pacific	1·0 (0·8 to 1·2)	0·4 (0·4 to 0·5)	0·9 (0·8 to 1·1)	0·8 (0·7 to 1·1)	3·2 (2·7 to 3·8)	5·1 (4·4 to 6·1)	–3·0 (–2·0 to –4·2)	–4·0 (–2·7 to –5·2)	–3·6 (–2·6 to –4·4)
Brunei	2·7 (2·1 to 3·4)	0·9 (0·8 to 1·0)	2·2 (1·6 to 2·8)	2·5 (1·8 to 3·2)	8·2 (6·8 to 10·0)	0·1 (0·0 to 0·1)	–1·2 (0·0 to –2·2)	–0·8 (1·1 to –2·4)	–1·0 (0·0 to –1·8)
Japan	0·9 (0·7 to 1·2)	0·4 (0·3 to 0·5)	0·9 (0·7 to 1·2)	0·8 (0·6 to 1·1)	3·0 (2·3 to 3·8)	3·2 (2·5 to 4·0)	–2·9 (–2·6 to –3·3)	–3·3 (–1·4 to –5·1)	–3·2 (–2·1 to –4·2)
Singapore	0·8 (0·6 to 1·1)	0·4 (0·3 to 0·4)	0·6 (0·4 to 0·7)	0·5 (0·4 to 0·7)	2·3 (1·8 to 2·9)	0·1 (0·1 to 0·1)	–7·5 (–6·4 to –8·7)	–3·6 (–1·5 to –5·5)	–5·3 (–4·2 to –6·4)
South Korea	1·3 (1·1 to 1·5)	0·5 (0·5 to 0·6)	1·0 (0·9 to 1·2)	0·9 (0·6 to 1·2)	3·7 (3·4 to 4·1)	1·8 (1·6 to 1·9)	–2·9 (–0·5 to –5·5)	–4·9 (–4·2 to –5·6)	–4·1 (–2·9 to –5·3)
Central Asia	13·3 (12·5 to 14·1)	3·0 (2·8 to 3·3)	11·1 (10·0 to 12·3)	7·0 (6·1 to 8·1)	34·0 (31·6 to 36·5)	61·9 (57·7 to 66·5)	–1·6 (–1·1 to –2·0)	–3·5 (–2·9 to –4·1)	–2·7 (–2·3 to –3·0)
Armenia	7·3 (6·2 to 8·4)	1·8 (1·6 to 2·0)	4·6 (3·7 to 5·4)	3·2 (2·3 to 4·4)	16·8 (15·2 to 18·7)	0·7 (0·6 to 0·8)	–4·2 (–3·2 to –5·1)	–4·9 (–4·0 to –5·9)	–4·6 (–4·0 to –5·1)
Azerbaijan	14·5 (13·4 to 15·8)	3·4 (3·0 to 3·8)	12·5 (10·5 to 14·9)	5·1 (3·7 to 6·9)	35·1 (31·8 to 39·0)	5·9 (5·3 to 6·5)	–2·0 (–1·1 to –3·1)	–4·6 (–3·6 to –5·4)	–3·5 (–2·9 to –4·0)
Georgia	9·4 (8·3 to 10·6)	2·0 (1·9 to 2·2)	5·8 (4·8 to 6·9)	4·0 (2·7 to 5·6)	21·1 (19·0 to 23·4)	1·2 (1·1 to 1·4)	–1·3 (0·0 to –2·4)	–4·0 (–2·9 to –5·2)	–2·8 (–2·2 to –3·4)
Kazakhstan	9·8 (8·6 to 11·0)	2·0 (1·9 to 2·2)	6·1 (5·1 to 7·3)	5·1 (3·9 to 6·6)	22·8 (20·6 to 25·3)	7·7 (7·0 to 8·6)	–1·1 (0·0 to –2·3)	–3·5 (–2·4 to –4·5)	–2·4 (–1·9 to –3·0)
Kyrgyzstan	14·5 (13·3 to 15·6)	2·2 (2·0 to 2·4)	9·1 (7·8 to 10·5)	4·1 (3·1 to 5·4)	29·6 (27·0 to 32·2)	4·4 (4·0 to 4·8)	–3·8 (–2·7 to –4·7)	–3·9 (–3·0 to –4·9)	–3·9 (–3·4 to –4·3)
Mongolia	15·1 (13·8 to 16·3)	3·7 (3·3 to 4·1)	14·7 (12·3 to 17·4)	10·0 (7·4 to 13·3)	42·9 (38·8 to 47·5)	2·7 (2·5 to 3·0)	–4·0 (–3·0 to –4·9)	–3·2 (–2·1 to –4·1)	–3·5 (–3·0 to –4·0)
Tajikistan	14·4 (13·0 to 15·5)	3·3 (2·9 to 3·6)	16·1 (13·7 to 18·4)	8·6 (6·3 to 11·6)	41·7 (37·9 to 45·2)	11·1 (10·1 to 12·1)	–2·5 (–1·6 to –3·3)	–4·4 (–3·6 to –5·3)	–3·6 (–3·1 to –4·0)
Turkmenistan	17·5 (16·0 to 19·0)	4·7 (4·1 to 5·4)	19·6 (15·9 to 23·3)	11·5 (8·2 to 15·9)	52·3 (46·7 to 58·9)	5·8 (5·2 to 6·6)	–2·1 (–0·8 to –3·4)	–3·3 (–2·1 to –4·3)	–2·8 (–2·2 to –3·4)
Uzbekistan	14·0 (12·5 to 15·5)	3·4 (3·0 to 3·8)	10·9 (9·0 to 13·1)	8·1 (6·2 to 10·3)	35·9 (32·5 to 39·9)	22·3 (20·2 to 24·8)	–0·9 (0·0 to –1·8)	–2·6 (–1·7 to –3·7)	–1·9 (–1·4 to –2·4)
East Asia	4·9 (4·3 to 5·5)	1·4 (1·3 to 1·6)	3·5 (2·9 to 4·1)	3·3 (2·4 to 4·2)	13·0 (12·1 to 13·8)	247·4 (229·7 to 265·2)	–4·7 (–3·9 to –5·5)	–7·9 (–7·3 to –8·6)	–6·5 (–6·1 to –6·9)
China	4·9 (4·3 to 5·5)	1·4 (1·3 to 1·6)	3·5 (2·9 to 4·1)	3·2 (2·3 to 4·2)	13·0 (12·0 to 13·8)	238·8 (220·9 to 256·0)	–4·7 (–3·9 to –5·5)	–8·1 (–7·4 to –8·7)	–6·6 (–6·2 to –7·0)
North Korea	8·8 (6·8 to 10·9)	2·0 (1·7 to 2·3)	5·5 (3·9 to 7·5)	5·1 (3·5 to 7·2)	21·2 (17·2 to 26·3)	7·6 (6·1 to 9·4)	–2·1 (–0·1 to –4·0)	–5·7 (–3·9 to –7·5)	–4·1 (–2·9 to –5·4)
Taiwan (Province of China)	2·1 (1·8 to 2·3)	0·8 (0·7 to 0·8)	1·7 (1·4 to 2·0)	2·2 (1·7 to 2·8)	6·7 (6·1 to 7·3)	1·0 (0·9 to 1·1)	–0·2 (0·2 to –0·6)	–1·8 (–1·1 to –2·5)	–1·1 (–0·7 to –1·5)
South Asia	22·5 (21·0 to 24·1)	6·4 (5·7 to 7·2)	14·2 (12·7 to 16·2)	10·5 (8·7 to 12·9)	52·6 (48·3 to 50·0)	1844·0 (1694·2 to 2031·5)	–2·9 (–2·7 to –3·2)	–3·9 (–3·2 to –4·6)	–3·5 (–3·1 to –3·9)
Afghanistan	20·9 (18·7 to 23·1)	10·7 (9·5 to 12·1)	34·9 (28·0 to 41·9)	26·7 (19·3 to 35·2)	90·2 (81·6 to 100·0)	94·7 (85·6 to 105·2)	–1·7 (–0·9 to –2·5)	–3·6 (–2·6 to –4·4)	–2·7 (–2·2 to –3·3)
Bangladesh	19·3 (17·6 to 21·1)	5·4 (4·8 to 6·2)	9·0 (7·5 to 10·8)	7·6 (5·8 to 9·8)	40·8 (36·9 to 45·4)	128·2 (116·0 to 142·7)	–4·7 (–4·3 to –5·1)	–5·6 (–4·7 to –6·4)	–5·2 (–4·7 to –5·6)
Bhutan	18·9 (16·8 to 21·3)	5·7 (4·6 to 7·0)	14·4 (10·7 to 18·7)	9·3 (6·3 to 14·3)	47·5 (39·9 to 57·0)	0·7 (0·6 to 0·8)	–4·1 (–3·2 to –5·0)	–4·9 (–3·6 to –6·1)	–4·5 (–3·7 to –5·3)
India	22·4 (20·4 to 24·5)	5·7 (4·9 to 6·8)	12·0 (10·0 to 14·6)	9·6 (7·1 to 12·9)	48·8 (43·1 to 56·4)	1249·7 (1103·8 to 1443·7)	–3·0 (–2·7 to –3·4)	–4·3 (–3·2 to –5·1)	–3·7 (–3·1 to –4·3)
Nepal	17·7 (16·1 to 19·4)	4·3 (3·8 to 5·0)	9·2 (7·6 to 11·2)	7·0 (5·2 to 9·1)	37·7 (33·9 to 42·1)	22·2 (20·0 to 24·9)	–5·4 (–5·0 to –5·9)	–6·1 (–5·2 to –6·9)	–5·8 (–5·3 to –6·3)
Pakistan	26·3 (24·2 to 28·6)	10·2 (9·3 to 11·3)	26·5 (22·8 to 30·7)	14·9 (11·1 to 19·4)	75·8 (70·1 to 82·5)	348·5 (321·9 to 379·2)	–1·4 (–1·1 to –1·9)	–1·8 (–1·1 to –2·5)	–1·7 (–1·3 to –2·1)
Southeast Asia	9·8 (8·9 to 10·6)	3·2 (2·9 to 3·5)	7·9 (6·8 to 9·2)	6·6 (5·5 to 7·9)	27·2 (24·5 to 30·4)	320·9 (289·3 to 358·5)	–4·1 (–3·7 to –4·6)	–4·0 (–3·1 to –4·8)	–4·0 (–3·5 to –4·5)

(Table 3 continues on next page)

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	Deaths per 1000 livebirths					Number of under to 5 deaths (thousands)	Annualised rate of change		
	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
(Table continued from previous page)									
Burma	14·3 (12·7 to 16·1)	3·9 (3·2 to 4·7)	11·1 (8·4 to 14·6)	8·3 (5·6 to 11·8)	37·1 (31·6 to 43·7)	34·1 (29·0 to 40·2)	–3·5 (–1·6 to –5·6)	–5·5 (–3·7 to –7·1)	–4·6 (–3·7 to –5·5)
Cambodia	15·5 (14·0 to 17·1)	4·8 (4·1 to 5·6)	15·6 (12·4 to 19·0)	7·9 (5·6 to 10·5)	43·2 (37·4 to 49·5)	16·7 (14·4 to 19·2)	–1·4 (–0·6 to –2·1)	–6·6 (–5·3 to –7·7)	–4·3 (–3·6 to –5·0)
Indonesia	11·1 (9·9 to 12·3)	3·8 (3·4 to 4·3)	10·0 (8·2 to 12·3)	7·0 (5·2 to 9·0)	31·5 (28·1 to 35·6)	148·8 (132·2 to 168·2)	–4·7 (–4·1 to –5·3)	–4·1 (–3·1 to –5·1)	–4·4 (–3·8 to –4·9)
Laos	18·6 (16·6 to 20·7)	6·7 (5·6 to 7·8)	20·6 (16·2 to 25·5)	16·7 (11·8 to 23·8)	61·3 (52·8 to 69·4)	11·1 (9·5 to 12·6)	–2·6 (–1·5 to –3·8)	–5·3 (–4·1 to –6·6)	–4·1 (–3·5 to –4·9)
Malaysia	2·3 (1·9 to 2·7)	1·0 (0·9 to 1·1)	1·6 (1·3 to 2·1)	1·6 (1·2 to 2·1)	6·5 (5·5 to 7·6)	3·3 (2·9 to 4·0)	–6·1 (–5·8 to –6·4)	–2·7 (–1·3 to –3·8)	–4·2 (–3·4 to –4·8)
Maldives	8·0 (6·4 to 10·1)	1·9 (1·7 to 2·1)	2·9 (2·4 to 3·5)	3·6 (2·7 to 4·7)	16·3 (13·5 to 19·7)	0·1 (0·1 to 0·1)	–6·1 (–4·8 to –7·3)	–6·7 (–5·1 to –8·2)	–6·5 (–5·6 to –7·2)
Philippines	9·9 (8·4 to 11·3)	2·6 (2·3 to 3·0)	6·9 (5·4 to 8·9)	8·2 (6·2 to 10·7)	27·3 (23·2 to 32·2)	65·1 (55·4 to 76·9)	–3·3 (–2·3 to –4·3)	–2·7 (–1·3 to –4·2)	–3·0 (–2·2 to –3·7)
Sri Lanka	3·2 (2·6 to 3·8)	1·3 (1·2 to 1·5)	1·9 (1·5 to 2·3)	2·5 (1·8 to 3·2)	8·8 (7·5 to 10·5)	3·4 (2·8 to 4·0)	–8·0 (–7·7 to –8·3)	–4·8 (–3·5 to –6·1)	–6·2 (–5·4 to –6·9)
Thailand	4·6 (3·7 to 5·8)	2·1 (1·8 to 2·4)	2·3 (1·9 to 2·6)	2·1 (1·6 to 2·9)	11·0 (9·3 to 13·2)	7·7 (6·5 to 9·2)	–5·0 (–3·1 to –6·9)	–4·2 (–2·5 to –5·8)	–4·5 (–3·5 to –5·4)
Timor-Leste	13·7 (12·3 to 15·1)	2·4 (2·0 to 2·8)	15·3 (12·2 to 19·1)	7·9 (5·7 to 10·7)	38·8 (33·3 to 45·3)	1·6 (1·3 to 1·8)	–3·4 (–2·6 to –4·1)	–7·9 (–6·6 to –9·2)	–5·9 (–5·2 to –6·7)
Vietnam	6·9 (5·4 to 8·5)	2·6 (2·4 to 2·9)	3·7 (3·0 to 4·6)	5·4 (4·1 to 7·1)	18·6 (15·8 to 21·9)	26·6 (22·6 to 31·5)	–5·0 (–3·7 to –6·2)	–3·4 (–1·9 to –5·1)	–4·1 (–3·3 to –4·8)
Australasia	1·8 (1·5 to 2·2)	0·5 (0·4 to 0·6)	1·4 (1·1 to 1·6)	0·9 (0·7 to 1·1)	4·6 (3·9 to 5·4)	1·8 (1·5 to 2·1)	–4·1 (–3·7 to –4·5)	–2·8 (–1·4 to –4·1)	–3·4 (–2·6 to –4·1)
Australia	1·8 (1·5 to 2·2)	0·5 (0·4 to 0·6)	1·2 (1·0 to 1·4)	0·8 (0·6 to 1·1)	4·4 (3·7 to 5·1)	1·3 (1·1 to 1·6)	–4·2 (–3·6 to –4·7)	–2·9 (–1·5 to –4·1)	–3·4 (–2·7 to –4·1)
New Zealand	1·8 (1·5 to 2·2)	0·5 (0·5 to 0·6)	2·1 (1·7 to 2·6)	1·1 (0·8 to 1·5)	5·6 (4·7 to 6·7)	0·3 (0·3 to 0·4)	–4·0 (–3·1 to –4·8)	–2·4 (–0·9 to –3·8)	–3·1 (–2·3 to –3·8)
Caribbean	11·6 (10·1 to 13·6)	4·5 (4·0 to 5·2)	12·0 (10·1 to 14·4)	7·8 (6·0 to 9·9)	35·5 (30·9 to 41·2)	29·8 (26·1 to 34·4)	–3·5 (–3·0 to –4·1)	–2·2 (–1·1 to –3·3)	–2·8 (–2·1 to –3·4)
Antigua and Barbuda	7·0 (2·8 to 14·4)	2·0 (1·1 to 3·3)	3·8 (1·8 to 8·1)	2·6 (1·1 to 5·7)	15·3 (6·9 to 30·9)	0·0 (0·0 to 0·0)	–0·7 (6·1 to –7·7)	–1·6 (4·9 to –8·4)	–1·2 (2·8 to –5·2)
Barbados	8·1 (3·1 to 16·3)	2·2 (1·3 to 3·9)	4·4 (2·1 to 10·1)	1·8 (0·8 to 3·9)	16·5 (7·3 to 33·5)	0·1 (0·0 to 0·1)	–3·1 (4·4 to –10·2)	–1·7 (5·5 to –8·8)	–2·3 (1·3 to –6·0)
Belize	8·7 (3·7 to 15·6)	2·3 (1·3 to 3·9)	4·6 (2·4 to 10·3)	3·1 (1·4 to 6·3)	18·6 (9·0 to 35·5)	0·1 (0·1 to 0·3)	–3·8 (–1·1 to –6·6)	–3·6 (1·8 to –9·1)	–3·7 (–0·5 to –6·7)
Cuba	2·0 (1·6 to 2·4)	0·9 (0·8 to 1·1)	1·7 (1·3 to 2·0)	1·1 (0·8 to 1·4)	5·7 (4·9 to 6·6)	0·6 (0·5 to 0·7)	–4·9 (–4·4 to –5·3)	–3·1 (–1·9 to –4·3)	–3·9 (–3·2 to –4·5)
Dominica	10·2 (4·3 to 17·5)	2·6 (1·5 to 4·8)	5·6 (2·6 to 13·8)	3·6 (1·7 to 7·9)	21·8 (10·2 to 42·8)	0·0 (0·0 to 0·0)	–2·1 (5·1 to –9·1)	–1·3 (5·4 to –7·7)	–1·6 (2·7 to –5·6)
Dominican Republic	13·6 (11·7 to 15·6)	3·1 (2·6 to 3·8)	7·6 (5·5 to 10·1)	4·6 (3·1 to 6·6)	28·8 (24·1 to 34·5)	6·2 (5·2 to 7·5)	–4·7 (–3·8 to –5·6)	–1·9 (–0·3 to –3·4)	–3·1 (–2·3 to –3·9)
Grenada	5·9 (2·5 to 12·6)	1·8 (1·0 to 2·9)	3·3 (1·5 to 6·7)	2·2 (1·0 to 4·2)	13·2 (6·1 to 25·9)	0·0 (0·0 to 0·1)	–3·2 (3·4 to –10·1)	–3·6 (2·5 to –9·8)	–3·4 (0·5 to –7·2)
Guyana	11·8 (6·8 to 16·8)	3·6 (2·1 to 7·0)	14·0 (5·4 to 29·3)	7·2 (2·8 to 17·3)	36·2 (17·2 to 69·5)	0·6 (0·3 to 1·1)	–4·1 (–2·0 to –6·1)	0·1 (5·7 to –5·4)	–1·7 (1·5 to –4·7)
Haiti	16·7 (14·7 to 18·8)	8·8 (7·6 to 10·4)	25·4 (20·6 to 31·4)	16·9 (11·7 to 22·9)	66·1 (56·8 to 77·6)	17·4 (14·9 to 20·5)	–4·0 (–3·3 to –4·8)	–3·0 (–1·8 to –4·2)	–3·5 (–2·8 to –4·2)
Jamaica	7·6 (2·7 to 14·5)	2·0 (1·1 to 3·7)	4·1 (1·9 to 9·9)	4·6 (1·9 to 10·3)	18·3 (8·0 to 37·6)	0·9 (0·4 to 1·9)	–2·8 (1·1 to –7·0)	–2·2 (4·0 to –8·5)	–2·5 (1·2 to –6·2)
Saint Lucia	8·4 (3·3 to 16·2)	2·3 (1·2 to 4·1)	4·6 (2·2 to 10·8)	3·1 (1·3 to 6·6)	18·2 (8·1 to 37·1)	0·1 (0·0 to 0·1)	–5·0 (1·6 to –11·4)	–0·8 (5·9 to –7·3)	–2·6 (1·6 to –6·4)
Saint Vincent and the Grenadines	10·9 (4·7 to 18·2)	2·7 (1·6 to 5·1)	6·2 (2·9 to 15·1)	3·9 (1·7 to 8·6)	23·6 (11·0 to 46·0)	0·0 (0·0 to 0·1)	–2·8 (4·2 to –10·0)	–2·1 (4·2 to –7·8)	–2·4 (1·4 to –6·0)

(Table 3 continues on next page)

	Deaths per 1000 livebirths					Number of under to 5 deaths (thousands)	Annualised rate of change		
	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
(Table continued from previous page)									
Suriname	16·5 (14·4 to 18·6)	4·2 (3·4 to 5·1)	11·4 (8·4 to 15·3)	6·6 (4·3 to 9·4)	38·1 (31·8 to 45·7)	0·4 (0·3 to 0·4)	–1·5 (0·3 to –3·3)	–1·1 (0·7 to –2·8)	–1·3 (–0·4 to –2·2)
The Bahamas	11·3 (4·9 to 22·4)	1·0 (0·6 to 1·7)	2·1 (1·1 to 4·7)	2·1 (0·9 to 4·5)	16·5 (7·5 to 32·6)	0·1 (0·0 to 0·2)	–6·8 (0·2 to –13·0)	–0·6 (5·8 to –7·4)	–3·3 (0·9 to –7·2)
Trinidad and Tobago	11·2 (4·4 to 20·4)	4·0 (2·2 to 7·6)	4·0 (1·9 to 10·8)	3·3 (1·5 to 6·7)	22·3 (9·9 to 45·0)	0·4 (0·2 to 0·9)	0·7 (5·0 to –3·7)	–2·7 (3·5 to –9·2)	–1·2 (2·3 to –4·7)
Central Europe	2·4 (1·7 to 3·5)	1·0 (0·8 to 1·4)	2·2 (1·6 to 3·1)	1·1 (0·8 to 1·5)	6·7 (4·9 to 9·4)	8·4 (6·1 to 11·8)	–4·9 (–4·5 to –5·4)	–5·1 (–2·4 to –7·5)	–5·1 (–3·5 to –6·3)
Albania	2·7 (1·0 to 4·8)	1·8 (0·9 to 2·8)	8·3 (4·0 to 18·4)	5·2 (2·6 to 10·4)	17·9 (8·6 to 35·1)	0·7 (0·3 to 1·4)	–4·1 (–2·0 to –6·2)	–3·5 (2·3 to –8·6)	–3·8 (–0·6 to –6·7)
Bosnia and Herzegovina	3·1 (2·0 to 4·5)	0·6 (0·5 to 0·8)	1·0 (0·7 to 1·6)	0·7 (0·4 to 1·1)	5·4 (3·6 to 7·9)	0·2 (0·1 to 0·3)	–5·4 (–4·5 to –6·2)	–5·2 (–2·2 to –8·3)	–5·3 (–3·6 to –6·9)
Bulgaria	2·9 (2·0 to 4·5)	1·5 (1·1 to 2·1)	3·6 (2·4 to 4·8)	1·7 (1·1 to 2·6)	9·7 (6·8 to 13·8)	0·7 (0·5 to 1·0)	–0·3 (0·4 to –0·9)	–4·6 (–1·8 to –7·2)	–2·7 (–1·1 to –4·2)
Croatia	2·2 (1·4 to 3·3)	0·7 (0·5 to 0·9)	1·0 (0·7 to 1·5)	0·7 (0·4 to 1·0)	4·6 (3·1 to 6·6)	0·2 (0·1 to 0·3)	–3·3 (–2·1 to –4·4)	–4·9 (–1·8 to –7·8)	–4·2 (–2·5 to –5·8)
Czech Republic	1·0 (0·6 to 1·5)	0·6 (0·4 to 0·8)	0·9 (0·7 to 1·3)	0·5 (0·3 to 0·7)	3·0 (2·1 to 4·3)	0·4 (0·2 to 0·5)	–8·6 (–7·7 to –9·6)	–4·5 (–1·5 to –7·1)	–6·3 (–4·6 to –7·8)
Hungary	2·3 (1·8 to 2·9)	0·9 (0·8 to 1·1)	1·3 (1·0 to 1·6)	0·6 (0·4 to 0·9)	5·1 (4·1 to 6·4)	0·5 (0·4 to 0·6)	–4·8 (–4·1 to –5·4)	–5·5 (–3·8 to –7·3)	–5·2 (–4·1 to –6·1)
Macedonia	3·3 (2·2 to 5·3)	1·4 (1·0 to 1·9)	2·3 (1·5 to 3·4)	0·9 (0·6 to 1·5)	8·0 (5·3 to 11·9)	0·2 (0·1 to 0·3)	–8·1 (–7·2 to –8·9)	–5·2 (–1·9 to –8·2)	–6·4 (–4·7 to –8·2)
Montenegro	2·4 (1·3 to 4·0)	1·0 (0·6 to 1·5)	1·9 (1·1 to 3·2)	1·0 (0·5 to 1·8)	6·3 (3·6 to 10·5)	0·0 (0·0 to 0·1)	–0·1 (6·4 to –6·3)	–9·1 (–5·0 to –13·0)	–5·2 (–1·7 to –8·5)
Poland	2·2 (1·5 to 3·2)	0·9 (0·7 to 1·2)	1·3 (0·9 to 1·9)	0·6 (0·4 to 1·0)	5·0 (3·5 to 7·2)	2·1 (1·4 to 3·0)	–6·4 (–6·1 to –6·8)	–4·9 (–2·0 to –7·5)	–5·5 (–3·9 to –7·0)
Romania	3·2 (1·8 to 6·0)	1·5 (1·0 to 2·2)	4·5 (2·6 to 6·8)	1·9 (1·1 to 3·0)	11·0 (6·6 to 17·7)	2·5 (1·5 to 4·0)	–3·5 (–3·3 to –3·9)	–6·0 (–2·2 to –9·5)	–4·9 (–2·7 to –7·0)
Serbia	2·4 (1·8 to 3·0)	0·7 (0·6 to 0·8)	1·2 (0·9 to 1·5)	0·7 (0·5 to 0·9)	4·9 (3·9 to 6·0)	0·5 (0·4 to 0·6)	–8·9 (–3·2 to –13·9)	–3·3 (–1·7 to –5·1)	–5·7 (–3·0 to –8·2)
Slovakia	2·3 (1·3 to 3·8)	1·1 (0·8 to 1·7)	2·2 (1·2 to 3·6)	1·0 (0·6 to 1·8)	6·7 (4·0 to 10·8)	0·4 (0·2 to 0·6)	–3·2 (–2·3 to –4·1)	–3·4 (0·6 to –7·0)	–3·3 (–1·0 to –5·3)
Slovenia	1·5 (0·8 to 2·6)	0·5 (0·3 to 0·8)	1·0 (0·6 to 1·6)	0·6 (0·3 to 1·1)	3·6 (2·1 to 6·0)	0·1 (0·0 to 0·1)	–5·8 (–3·9 to –7·8)	–3·5 (0·6 to –7·2)	–4·5 (–2·0 to –6·7)
Eastern Europe	3·5 (2·6 to 4·7)	1·3 (1·1 to 1·6)	3·0 (2·3 to 3·6)	2·0 (1·5 to 2·6)	9·7 (7·7 to 12·2)	23·6 (18·5 to 29·4)	–1·3 (0·1 to –2·7)	–5·5 (–3·7 to –7·4)	–3·7 (–2·5 to –4·9)
Belarus	2·7 (2·0 to 3·9)	1·1 (0·9 to 1·5)	2·4 (1·6 to 3·4)	1·4 (0·9 to 2·0)	7·6 (5·5 to 10·4)	0·8 (0·6 to 1·1)	–2·3 (1·3 to –5·9)	–5·8 (–2·8 to –9·0)	–4·3 (–2·4 to –6·0)
Estonia	1·4 (1·0 to 1·8)	0·8 (0·6 to 1·0)	1·1 (0·8 to 1·5)	0·9 (0·6 to 1·2)	4·2 (3·4 to 5·2)	0·1 (0·0 to 0·1)	–4·5 (–3·5 to –5·7)	–7·7 (–5·8 to –9·4)	–6·3 (–5·3 to –7·3)
Latvia	2·1 (1·7 to 2·5)	1·1 (1·0 to 1·3)	1·8 (1·4 to 2·3)	1·4 (1·0 to 1·8)	6·4 (5·3 to 7·6)	0·1 (0·1 to 0·2)	–2·8 (–1·9 to –3·7)	–5·8 (–4·3 to –7·4)	–4·5 (–3·7 to –5·3)
Lithuania	1·4 (1·1 to 1·8)	0·7 (0·6 to 0·8)	1·5 (1·1 to 1·8)	1·0 (0·7 to 1·3)	4·6 (3·6 to 5·6)	0·2 (0·1 to 0·2)	–2·6 (–1·6 to –3·6)	–6·8 (–5·2 to –8·7)	–5·0 (–4·0 to –6·0)
Moldova	5·3 (3·5 to 7·3)	1·5 (1·1 to 1·9)	3·8 (2·9 to 4·7)	2·2 (1·4 to 3·3)	12·6 (9·2 to 16·4)	0·5 (0·4 to 0·7)	–1·4 (0·7 to –3·5)	–5·8 (–3·3 to –8·4)	–3·9 (–2·4 to –5·3)
Russia	3·4 (2·6 to 4·6)	1·3 (1·1 to 1·6)	2·9 (2·2 to 3·7)	2·0 (1·4 to 2·8)	9·6 (7·5 to 12·1)	16·3 (12·6 to 20·7)	–1·6 (0·7 to –4·1)	–5·5 (–3·7 to –7·4)	–3·8 (–2·3 to –5·2)
Ukraine	4·1 (2·9 to 5·7)	1·5 (1·2 to 1·9)	3·3 (2·5 to 4·2)	2·0 (1·4 to 2·8)	10·9 (8·3 to 13·9)	5·4 (4·1 to 6·9)	0·2 (2·3 to –1·9)	–5·4 (–3·1 to –7·9)	–3·0 (–1·7 to –4·3)
Western Europe	1·6 (1·3 to 2·0)	0·6 (0·5 to 0·7)	1·1 (0·9 to 1·3)	0·7 (0·6 to 0·8)	3·9 (3·3 to 4·7)	18·2 (15·2 to 21·9)	–5·0 (–4·8 to –5·2)	–2·9 (–1·4 to –4·3)	–3·8 (–3·0 to –4·6)
Andorra	1·0 (0·6 to 1·8)	0·4 (0·2 to 0·7)	0·7 (0·4 to 1·2)	0·4 (0·2 to 0·8)	2·6 (1·5 to 4·4)	0·0 (0·0 to 0·0)	–6·4 (–0·6 to –11·4)	–2·9 (1·8 to –7·3)	–4·5 (–1·4 to –7·3)

(Table 3 continues on next page)

	Deaths per 1000 livebirths					Number of under to 5 deaths (thousands)	Annualised rate of change		
	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
(Table continued from previous page)									
Austria	1·7 (1·3 to 2·1)	0·6 (0·5 to 0·7)	1·2 (0·9 to 1·5)	0·7 (0·5 to 0·9)	4·1 (3·2 to 5·2)	0·3 (0·3 to 0·4)	–5·6 (–4·8 to –6·6)	–2·3 (–0·4 to –4·1)	–3·8 (–2·7 to –4·8)
Belgium	1·8 (1·5 to 2·1)	0·6 (0·5 to 0·7)	1·2 (1·0 to 1·4)	0·7 (0·5 to 0·9)	4·2 (3·6 to 5·0)	0·5 (0·5 to 0·6)	–5·7 (–5·3 to –6·2)	–2·4 (–1·2 to –3·7)	–3·9 (–3·1 to –4·5)
Cyprus	1·9 (1·4 to 2·4)	0·7 (0·6 to 0·8)	1·2 (1·0 to 1·6)	0·3 (0·2 to 0·4)	4·1 (3·3 to 5·1)	0·0 (0·0 to 0·0)	–6·3 (–5·2 to –7·4)	–2·9 (–0·9 to –4·7)	–4·4 (–3·3 to –5·4)
Denmark	1·7 (1·3 to 2·1)	0·5 (0·4 to 0·6)	1·0 (0·8 to 1·2)	0·7 (0·5 to 0·9)	3·8 (3·0 to 4·8)	0·2 (0·2 to 0·3)	–5·1 (–4·1 to –5·9)	–3·0 (–0·9 to –4·8)	–3·9 (–2·8 to –5·0)
Finland	1·3 (1·0 to 1·8)	0·4 (0·3 to 0·5)	0·7 (0·5 to 0·9)	0·6 (0·4 to 0·8)	3·0 (2·3 to 3·8)	0·2 (0·1 to 0·2)	–5·1 (–4·1 to –6·2)	–2·7 (–0·7 to –4·4)	–3·7 (–2·6 to –4·7)
France	1·3 (1·0 to 1·6)	0·6 (0·5 to 0·7)	1·2 (1·0 to 1·5)	0·7 (0·5 to 0·9)	3·7 (3·1 to 4·6)	3·0 (2·4 to 3·7)	–4·8 (–4·5 to –5·2)	–2·9 (–1·3 to –4·5)	–3·8 (–2·9 to –4·6)
Germany	1·6 (1·3 to 1·8)	0·5 (0·4 to 0·5)	1·0 (0·8 to 1·1)	0·6 (0·5 to 0·8)	3·6 (3·2 to 4·1)	2·5 (2·2 to 2·9)	–5·5 (–5·2 to –5·9)	–3·0 (–1·9 to –3·9)	–4·1 (–3·5 to –4·6)
Greece	1·6 (1·4 to 1·9)	0·9 (0·8 to 1·0)	1·0 (0·9 to 1·2)	0·6 (0·4 to 0·7)	4·0 (3·6 to 4·6)	0·4 (0·4 to 0·5)	–4·9 (–4·5 to –5·4)	–3·5 (–2·5 to –4·5)	–4·1 (–3·5 to –4·7)
Iceland	0·9 (0·6 to 1·4)	0·4 (0·3 to 0·5)	0·7 (0·5 to 1·0)	0·4 (0·2 to 0·6)	2·4 (1·7 to 3·5)	0·0 (0·0 to 0·0)	–5·7 (–3·0 to –8·3)	–3·8 (–0·8 to –6·6)	–4·6 (–2·8 to –6·3)
Ireland	2·0 (1·4 to 2·7)	0·5 (0·4 to 0·7)	1·3 (1·0 to 1·8)	0·8 (0·5 to 1·1)	4·6 (3·4 to 6·1)	0·3 (0·2 to 0·4)	–3·4 (–2·2 to –4·3)	–3·3 (–1·0 to –5·5)	–3·3 (–2·0 to –4·5)
Israel	1·6 (1·3 to 2·0)	0·6 (0·6 to 0·7)	1·3 (1·0 to 1·5)	0·8 (0·6 to 1·0)	4·3 (3·7 to 5·0)	0·7 (0·6 to 0·8)	–5·1 (–4·4 to –5·8)	–4·1 (–2·8 to –5·2)	–4·5 (–3·8 to –5·1)
Italy	1·7 (1·3 to 2·3)	0·7 (0·5 to 0·8)	0·8 (0·6 to 1·0)	0·5 (0·4 to 0·7)	3·7 (2·8 to 4·8)	2·1 (1·6 to 2·7)	–5·6 (–5·1 to –5·9)	–3·1 (–1·0 to –5·2)	–4·2 (–3·0 to –5·3)
Luxembourg	1·1 (0·8 to 1·6)	0·4 (0·3 to 0·6)	0·8 (0·6 to 1·1)	0·4 (0·3 to 0·7)	2·8 (2·0 to 3·9)	0·0 (0·0 to 0·0)	–6·2 (–3·9 to –8·4)	–4·6 (–1·9 to –7·2)	–5·3 (–3·7 to –6·8)
Malta	3·2 (2·3 to 4·3)	1·0 (0·8 to 1·2)	2·1 (1·5 to 3·0)	0·7 (0·5 to 1·0)	7·0 (5·1 to 9·5)	0·0 (0·0 to 0·0)	–3·4 (–1·4 to –5·4)	0·0 (2·5 to –2·5)	–1·5 (0·0 to –2·9)
Netherlands	1·8 (1·4 to 2·3)	0·5 (0·4 to 0·6)	0·9 (0·7 to 1·2)	0·8 (0·6 to 1·1)	4·1 (3·3 to 5·1)	0·7 (0·6 to 0·9)	–3·2 (–2·5 to –3·8)	–3·6 (–1·9 to –5·3)	–3·4 (–2·4 to –4·3)
Norway	1·2 (0·9 to 1·4)	0·4 (0·3 to 0·4)	0·8 (0·7 to 1·0)	0·6 (0·5 to 0·8)	3·0 (2·5 to 3·6)	0·2 (0·2 to 0·2)	–5·9 (–4·9 to –6·9)	–4·0 (–2·6 to –5·4)	–4·8 (–4·0 to –5·6)
Portugal	1·2 (1·1 to 1·4)	0·5 (0·5 to 0·6)	1·0 (0·9 to 1·2)	0·7 (0·5 to 0·9)	3·5 (3·0 to 4·0)	0·3 (0·3 to 0·4)	–7·1 (–6·7 to –7·5)	–5·6 (–4·6 to –6·6)	–6·2 (–5·6 to –6·8)
Spain	1·3 (1·0 to 1·7)	0·7 (0·6 to 0·8)	1·0 (0·8 to 1·2)	0·6 (0·5 to 0·8)	3·6 (2·9 to 4·4)	1·8 (1·4 to 2·2)	–5·5 (–5·0 to –6·0)	–3·2 (–1·6 to –4·7)	–4·2 (–3·3 to –5·1)
Sweden	1·2 (0·9 to 1·5)	0·3 (0·3 to 0·4)	0·7 (0·6 to 0·9)	0·5 (0·4 to 0·7)	2·7 (2·1 to 3·4)	0·3 (0·2 to 0·4)	–6·2 (–5·3 to –7·1)	–3·0 (–1·1 to –4·8)	–4·4 (–3·3 to –5·4)
Switzerland	2·0 (1·7 to 2·3)	0·5 (0·4 to 0·5)	1·1 (0·9 to 1·3)	0·8 (0·6 to 1·1)	4·3 (3·8 to 5·0)	0·4 (0·3 to 0·4)	–4·0 (–3·5 to –4·5)	–2·1 (–1·0 to –3·1)	–2·9 (–2·3 to –3·5)
UK	2·1 (1·7 to 2·7)	0·7 (0·6 to 0·8)	1·4 (1·1 to 1·7)	0·8 (0·6 to 1·0)	4·9 (4·0 to 6·0)	3·8 (3·1 to 4·7)	–4·1 (–3·8 to –4·5)	–2·0 (–0·4 to –3·5)	–2·9 (–2·0 to –3·8)
Andean Latin America	8·5 (7·9 to 9·0)	3·2 (3·1 to 3·4)	10·0 (9·1 to 10·9)	6·8 (5·8 to 7·9)	28·2 (26·9 to 29·6)	34·0 (32·4 to 35·7)	–5·0 (–4·7 to –5·4)	–3·8 (–3·3 to –4·2)	–4·3 (–4·1 to –4·6)
Bolivia	13·1 (12·0 to 14·2)	4·1 (3·8 to 4·4)	15·5 (13·3 to 17·8)	9·9 (7·5 to 12·9)	41·9 (39·0 to 45·2)	11·4 (10·7 to 12·3)	–4·5 (–4·0 to –5·1)	–3·9 (–3·2 to –4·5)	–4·2 (–3·8 to –4·5)
Ecuador	5·6 (5·0 to 6·2)	3·5 (3·3 to 3·7)	11·9 (10·1 to 13·8)	7·8 (6·0 to 9·9)	28·6 (26·6 to 30·9)	9·4 (8·7 to 10·1)	–3·1 (–2·3 to –3·9)	–2·7 (–1·9 to –3·3)	–2·8 (–2·4 to –3·2)
Peru	8·0 (7·1 to 8·9)	2·7 (2·6 to 2·8)	6·6 (5·7 to 7·6)	4·9 (3·7 to 6·3)	22·0 (20·5 to 23·8)	13·2 (12·3 to 14·3)	–6·4 (–5·7 to –6·9)	–4·5 (–3·8 to –5·1)	–5·3 (–4·9 to –5·7)
Central Latin America	5·8 (5·2 to 6·4)	2·3 (2·2 to 2·4)	6·0 (5·4 to 6·7)	4·0 (3·5 to 4·5)	18·0 (16·5 to 19·7)	87·7 (80·4 to 96·1)	–4·0 (–3·5 to –4·5)	–3·6 (–2·8 to –4·4)	–3·8 (–3·3 to –4·2)
Colombia	5·2 (4·5 to 6·0)	2·2 (2·1 to 2·3)	5·9 (5·1 to 6·8)	4·8 (3·8 to 6·0)	17·9 (16·3 to 19·8)	16·3 (14·9 to 18·0)	–2·3 (–1·5 to –3·2)	–3·1 (–2·3 to –4·0)	–2·8 (–2·3 to –3·2)

(Table 3 continues on next page)

	Deaths per 1000 livebirths					Number of under to 5 deaths (thousands)	Annualised rate of change		
	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
(Table continued from previous page)									
Costa Rica	3·9 (3·5 to 4·5)	1·3 (1·2 to 1·4)	3·3 (2·9 to 3·7)	1·9 (1·5 to 2·5)	10·4 (9·5 to 11·5)	0·8 (0·7 to 0·8)	–3·3 (–2·2 to –4·5)	–2·9 (–1·9 to –3·9)	–3·1 (–2·5 to –3·6)
El Salvador	4·6 (3·7 to 5·5)	1·9 (1·7 to 2·1)	4·6 (3·6 to 5·7)	2·4 (1·9 to 3·1)	13·4 (12·2 to 14·8)	1·7 (1·6 to 1·9)	–5·9 (–4·8 to –7·0)	–6·2 (–5·2 to –7·2)	–6·1 (–5·6 to –6·6)
Guatemala	6·5 (5·9 to 7·3)	2·8 (2·6 to 3·0)	10·4 (8·8 to 12·2)	8·6 (6·9 to 10·7)	28·1 (25·5 to 30·9)	13·3 (12·1 to 14·7)	–4·0 (–3·0 to –4·9)	–4·6 (–3·7 to –5·5)	–4·3 (–3·9 to –4·8)
Honduras	9·2 (8·2 to 10·1)	2·6 (2·4 to 2·8)	6·3 (5·3 to 7·2)	5·3 (4·1 to 6·6)	23·1 (21·2 to 25·2)	4·8 (4·4 to 5·2)	–3·9 (–3·1 to –4·7)	–3·6 (–2·8 to –4·3)	–3·7 (–3·3 to –4·2)
Mexico	5·8 (5·1 to 6·6)	2·4 (2·2 to 2·6)	5·6 (4·8 to 6·6)	3·1 (2·3 to 3·8)	16·8 (15·3 to 18·6)	38·1 (34·7 to 42·0)	–4·6 (–3·6 to –5·7)	–3·6 (–2·6 to –4·5)	–4·0 (–3·5 to –4·5)
Nicaragua	8·9 (8·0 to 9·7)	2·7 (2·5 to 2·9)	8·7 (7·5 to 10·3)	4·1 (3·2 to 5·1)	24·1 (22·0 to 26·7)	3·3 (3·0 to 3·7)	–5·1 (–4·3 to –5·9)	–3·8 (–3·0 to –4·7)	–4·4 (–3·9 to –4·9)
Panama	5·9 (5·0 to 6·9)	2·2 (2·1 to 2·4)	4·4 (3·7 to 5·3)	6·2 (5·0 to 7·5)	18·7 (17·0 to 20·6)	1·4 (1·3 to 1·5)	–1·7 (–0·5 to –2·8)	–1·7 (–0·8 to –2·6)	–1·7 (–1·1 to –2·2)
Venezuela	4·7 (4·2 to 5·2)	1·8 (1·7 to 1·9)	4·0 (3·6 to 4·4)	2·9 (2·3 to 3·5)	13·3 (12·5 to 14·1)	8·0 (7·5 to 8·5)	–3·6 (–3·4 to –3·7)	–3·5 (–3·0 to –4·0)	–3·5 (–3·2 to –3·8)
Southern Latin America	4·8 (3·3 to 6·9)	1·7 (1·3 to 2·1)	4·0 (3·1 to 5·3)	1·8 (1·2 to 2·6)	12·3 (9·2 to 16·5)	12·2 (9·1 to 16·4)	–4·1 (–3·9 to –4·3)	–2·5 (–0·2 to –4·7)	–3·2 (–1·9 to –4·4)
Argentina	5·7 (4·0 to 8·0)	2·0 (1·6 to 2·4)	4·4 (3·6 to 5·7)	2·1 (1·4 to 3·1)	14·2 (10·8 to 18·5)	9·8 (7·5 to 12·8)	–3·9 (–3·6 to –4·1)	–2·5 (–0·3 to –4·5)	–3·1 (–1·9 to –4·2)
Chile	2·6 (1·7 to 3·8)	1·0 (0·8 to 1·4)	2·8 (1·8 to 4·0)	1·1 (0·6 to 1·7)	7·4 (5·1 to 10·8)	1·8 (1·3 to 2·6)	–5·8 (–5·4 to –6·2)	–2·9 (0·0 to –5·8)	–4·2 (–2·5 to –5·7)
Uruguay	3·6 (2·2 to 6·2)	1·8 (1·3 to 2·6)	4·3 (2·7 to 6·2)	1·3 (0·8 to 2·0)	10·9 (7·0 to 16·7)	0·5 (0·3 to 0·8)	–3·8 (–3·1 to –4·4)	–3·1 (0·3 to –6·4)	–3·4 (–1·4 to –5·2)
Tropical Latin America	7·5 (6·7 to 8·5)	2·6 (2·4 to 2·8)	6·1 (5·4 to 6·9)	2·0 (1·5 to 2·7)	18·1 (16·7 to 19·8)	57·4 (52·9 to 62·7)	–5·0 (–4·2 to –6·0)	–4·2 (–3·4 to –5·0)	–4·6 (–4·1 to –5·0)
Brazil	7·5 (6·6 to 8·4)	2·6 (2·4 to 2·7)	6·1 (5·4 to 6·9)	1·9 (1·3 to 2·7)	18·0 (16·6 to 19·7)	54·1 (49·8 to 59·0)	–5·1 (–4·3 to –6·0)	–4·3 (–3·5 to –5·1)	–4·6 (–4·2 to –5·1)
Paraguay	8·9 (7·9 to 9·9)	2·7 (2·6 to 2·9)	5·6 (4·8 to 6·6)	3·9 (2·9 to 5·2)	21·0 (19·3 to 22·9)	3·4 (3·1 to 3·7)	–2·6 (–1·7 to –3·5)	–2·5 (–1·7 to –3·3)	–2·6 (–2·1 to –3·0)
North Africa and Middle East	9·1 (8·5 to 9·8)	3·2 (3·0 to 3·4)	7·7 (7·0 to 8·6)	5·3 (4·7 to 6·0)	25·2 (23·4 to 27·1)	291·4 (271·2 to 313·9)	–4·6 (–4·2 to –5·0)	–4·6 (–4·0 to –5·1)	–4·6 (–4·2 to –4·9)
Algeria	10·0 (8·8 to 11·4)	2·9 (2·7 to 3·3)	7·0 (5·7 to 8·7)	4·5 (3·3 to 5·9)	24·3 (21·2 to 28·0)	22·9 (20·1 to 26·4)	–4·2 (–3·3 to –5·2)	–3·5 (–2·4 to –4·5)	–3·8 (–3·2 to –4·5)
Bahrain	2·5 (2·2 to 2·7)	1·3 (1·2 to 1·4)	2·2 (1·9 to 2·6)	0·9 (0·7 to 1·2)	6·9 (6·2 to 7·5)	0·1 (0·1 to 0·2)	–5·6 (–4·9 to –6·4)	–4·2 (–3·4 to –5·1)	–4·8 (–4·4 to –5·3)
Egypt	7·3 (6·4 to 8·2)	3·5 (3·3 to 3·8)	6·5 (5·4 to 7·8)	4·7 (3·6 to 6·0)	21·8 (19·6 to 24·3)	41·3 (37·2 to 46·1)	–6·5 (–5·9 to –7·0)	–5·4 (–4·5 to –6·2)	–5·8 (–5·3 to –6·3)
Iran	7·8 (6·5 to 9·2)	2·6 (2·3 to 2·8)	5·2 (4·3 to 6·4)	3·4 (2·5 to 4·6)	18·9 (16·4 to 21·9)	27·4 (23·7 to 31·8)	–6·0 (–5·1 to –6·9)	–6·3 (–5·2 to –7·3)	–6·2 (–5·5 to –6·8)
Iraq	11·3 (10·3 to 12·4)	3·3 (3·0 to 3·7)	8·8 (7·0 to 10·7)	5·7 (3·9 to 7·8)	28·8 (26·2 to 31·7)	29·9 (27·3 to 33·0)	–2·1 (–1·4 to –2·8)	–3·1 (–2·2 to –3·9)	–2·7 (–2·2 to –3·1)
Jordan	6·7 (5·8 to 7·6)	2·3 (2·1 to 2·4)	4·6 (3·8 to 5·4)	5·0 (3·9 to 6·1)	18·3 (16·7 to 20·2)	3·5 (3·2 to 3·9)	–2·3 (–1·6 to –2·9)	–2·9 (–2·1 to –3·6)	–2·6 (–2·2 to –3·1)
Kuwait	3·1 (2·8 to 3·5)	1·3 (1·3 to 1·4)	2·7 (2·4 to 3·1)	1·8 (1·4 to 2·2)	8·9 (8·2 to 9·6)	0·6 (0·6 to 0·6)	–3·5 (–3·0 to –4·1)	–2·7 (–2·1 to –3·4)	–3·1 (–2·7 to –3·5)
Lebanon	4·9 (4·1 to 5·9)	2·0 (1·7 to 2·3)	3·8 (3·1 to 4·5)	2·7 (1·9 to 3·8)	13·3 (11·7 to 15·2)	0·8 (0·7 to 0·9)	–6·1 (–5·0 to –7·1)	–3·9 (–2·7 to –4·8)	–4·8 (–4·2 to –5·4)
Libya	5·1 (4·1 to 6·2)	2·0 (1·7 to 2·2)	4·2 (3·3 to 5·2)	3·2 (2·4 to 4·1)	14·3 (12·5 to 16·6)	1·9 (1·6 to 2·1)	–4·5 (–3·3 to –5·5)	–4·5 (–3·4 to –5·5)	–4·5 (–3·8 to –5·2)
Morocco	10·5 (9·3 to 11·8)	4·1 (3·7 to 4·6)	7·4 (5·9 to 9·0)	4·5 (3·4 to 6·0)	26·3 (23·2 to 29·8)	19·4 (17·2 to 22·1)	–3·9 (–3·2 to –4·5)	–4·6 (–3·7 to –5·5)	–4·3 (–3·7 to –4·9)
Oman	2·7 (2·3 to 3·3)	1·3 (1·2 to 1·5)	2·6 (2·1 to 3·1)	2·0 (1·5 to 2·6)	8·5 (7·4 to 10·0)	0·6 (0·5 to 0·7)	–7·1 (–5·9 to –8·2)	–6·6 (–5·4 to –7·7)	–6·8 (–6·1 to –7·5)

(Table 3 continues on next page)

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	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
(Table continued from previous page)									
Palestine	8·0 (6·6 to 9·5)	2·5 (2·3 to 2·8)	5·3 (4·4 to 6·5)	3·9 (2·7 to 5·3)	19·6 (17·0 to 22·8)	2·6 (2·2 to 3·0)	–4·0 (–2·9 to –5·1)	–3·5 (–2·3 to –4·6)	–3·7 (–2·9 to –4·4)
Qatar	3·5 (2·9 to 4·3)	1·6 (1·4 to 1·8)	3·1 (2·6 to 3·7)	2·2 (1·6 to 2·9)	10·3 (9·0 to 12·0)	0·2 (0·2 to 0·3)	–3·5 (–2·3 to –4·8)	–3·1 (–2·1 to –4·1)	–3·3 (–2·5 to –4·0)
Saudi Arabia	4·3 (3·4 to 5·3)	1·8 (1·6 to 2·1)	3·5 (2·9 to 4·2)	2·5 (1·7 to 3·4)	12·0 (10·4 to 14·0)	6·8 (5·9 to 7·9)	–6·5 (–5·4 to –7·7)	–5·0 (–3·9 to –6·1)	–5·7 (–5·0 to –6·4)
Sudan	15·5 (14·0 to 17·4)	4·7 (4·1 to 5·4)	14·2 (11·6 to 17·2)	13·4 (9·9 to 17·1)	47·1 (41·6 to 53·4)	59·5 (52·7 to 67·5)	–3·1 (–2·2 to –4·1)	–4·1 (–3·1 to –5·0)	–3·6 (–3·1 to –4·2)
Syria	6·0 (5·2 to 6·8)	2·1 (2·0 to 2·2)	4·2 (3·4 to 5·1)	4·8 (3·7 to 5·9)	17·0 (15·8 to 18·3)	9·0 (8·4 to 9·7)	–6·5 (–5·6 to –7·5)	–2·1 (–1·2 to –2·8)	–4·0 (–3·6 to –4·4)
Tunisia	5·1 (4·3 to 5·9)	2·2 (1·9 to 2·4)	4·0 (3·4 to 4·6)	3·0 (2·2 to 3·8)	14·1 (12·6 to 15·9)	2·7 (2·4 to 3·0)	–5·7 (–4·8 to –6·5)	–5·2 (–4·3 to –6·1)	–5·4 (–4·9 to –6·0)
Turkey	7·3 (6·3 to 8·5)	2·5 (2·3 to 2·6)	5·4 (4·7 to 6·3)	2·3 (1·7 to 3·0)	17·4 (15·5 to 19·6)	22·0 (19·6 to 24·8)	–5·6 (–4·9 to –6·3)	–6·4 (–5·5 to –7·2)	–6·0 (–5·5 to –6·6)
United Arab Emirates	2·2 (1·9 to 2·5)	1·1 (1·0 to 1·3)	2·0 (1·6 to 2·5)	1·4 (1·0 to 2·0)	6·8 (6·0 to 7·6)	0·9 (0·8 to 1·0)	–5·5 (–4·2 to –6·9)	–4·6 (–3·4 to –5·7)	–5·0 (–4·3 to –5·8)
Yemen	15·3 (13·0 to 17·6)	5·7 (4·8 to 6·8)	20·7 (16·0 to 25·3)	9·6 (7·2 to 12·7)	50·4 (44·5 to 57·5)	38·0 (33·6 to 43·4)	–3·4 (–2·8 to –4·0)	–4·2 (–3·2 to –5·1)	–3·9 (–3·3 to –4·4)
High-income North America	2·9 (2·4 to 3·5)	0·7 (0·6 to 0·8)	1·9 (1·5 to 2·4)	1·1 (0·7 to 1·5)	6·5 (5·4 to 7·9)	30·1 (24·8 to 36·7)	–3·2 (–3·1 to –3·4)	–1·6 (–0·1 to –3·1)	–2·3 (–1·5 to –3·1)
Canada	2·5 (2·0 to 3·0)	0·6 (0·5 to 0·7)	1·5 (1·2 to 1·9)	0·9 (0·6 to 1·3)	5·4 (4·4 to 6·6)	2·1 (1·7 to 2·6)	–3·5 (–3·0 to –4·0)	–0·9 (0·7 to –2·4)	–2·1 (–1·2 to –2·9)
USA	2·9 (2·4 to 3·5)	0·7 (0·6 to 0·8)	1·9 (1·5 to 2·4)	1·1 (0·7 to 1·5)	6·6 (5·5 to 8·1)	28·0 (23·1 to 34·2)	–3·2 (–3·1 to –3·4)	–1·7 (–0·1 to –3·1)	–2·3 (–1·5 to –3·2)
Oceania	15·7 (12·3 to 19·9)	4·7 (3·0 to 7·3)	17·3 (10·1 to 26·9)	13·8 (6·9 to 25·8)	50·5 (32·6 to 76·5)	14·2 (9·2 to 21·4)	–1·1 (1·0 to –3·1)	–2·5 (0·1 to –5·1)	–1·9 (0·0 to –3·7)
Federated States of Micronesia	5·8 (3·0 to 10·1)	1·7 (1·1 to 2·2)	3·9 (2·4 to 6·3)	3·4 (1·9 to 5·6)	14·7 (8·9 to 23·5)	0·0 (0·0 to 0·1)	–5·9 (–2·9 to –8·8)	–4·7 (–1·7 to –7·5)	–5·2 (–3·1 to –7·2)
Fiji	12·1 (8·7 to 15·8)	2·9 (2·0 to 4·3)	9·5 (5·1 to 16·6)	8·6 (5·0 to 14·3)	32·7 (21·5 to 48·9)	0·6 (0·4 to 0·9)	–0·7 (1·9 to –3·3)	0·3 (3·4 to –2·4)	–0·1 (2·4 to –2·3)
Kiribati	16·5 (13·2 to 20·6)	4·9 (3·2 to 7·2)	18·1 (10·7 to 28·4)	13·7 (7·2 to 23·6)	52·2 (35·6 to 75·4)	0·1 (0·1 to 0·2)	–2·5 (–0·3 to –4·7)	–2·3 (0·6 to –5·0)	–2·4 (–0·6 to –4·1)
Marshall Islands	12·3 (8·2 to 16·5)	2·9 (2·0 to 5·1)	9·5 (4·9 to 18·2)	7·4 (3·8 to 14·4)	31·8 (19·2 to 51·8)	0·1 (0·0 to 0·1)	–1·5 (1·5 to –4·5)	–2·1 (1·1 to –5·3)	–1·9 (0·6 to –4·0)
Papua New Guinea	17·1 (13·6 to 21·7)	5·3 (3·3 to 8·3)	19·9 (11·5 to 30·6)	15·8 (7·5 to 30·5)	57·0 (36·7 to 86·4)	12·0 (7·7 to 18·1)	–1·4 (0·9 to –3·6)	–2·8 (–0·1 to –5·4)	–2·2 (–0·3 to –4·1)
Samoa	4·5 (2·3 to 8·7)	1·4 (0·9 to 2·1)	3·2 (1·8 to 5·2)	3·1 (1·7 to 5·5)	12·1 (6·9 to 20·4)	0·1 (0·0 to 0·1)	–3·1 (0·3 to –6·7)	–2·7 (1·1 to –6·1)	–2·9 (0·2 to –5·7)
Solomon Islands	9·0 (5·0 to 13·5)	2·2 (1·5 to 3·2)	5·8 (3·3 to 10·9)	5·0 (2·8 to 8·4)	21·8 (13·2 to 35·1)	0·4 (0·2 to 0·6)	–2·7 (0·2 to –5·6)	–3·1 (0·4 to –6·0)	–2·9 (–0·8 to –5·1)
Tonga	9·6 (5·2 to 14·4)	2·3 (1·6 to 3·6)	6·4 (3·3 to 12·9)	5·4 (2·8 to 10·0)	23·5 (13·5 to 39·3)	0·1 (0·0 to 0·1)	0·6 (4·0 to –2·7)	–1·9 (1·6 to –5·3)	–0·8 (1·5 to –3·1)
Vanuatu	13·0 (9·7 to 16·3)	3·2 (2·2 to 4·7)	10·6 (6·0 to 17·4)	8·1 (4·6 to 13·9)	34·5 (23·5 to 50·0)	0·2 (0·2 to 0·3)	0·3 (2·5 to –1·9)	–0·7 (2·3 to –3·7)	–0·3 (1·6 to –2·2)
Central sub-Saharan Africa	22·7 (20·0 to 25·8)	7·7 (6·5 to 9·1)	39·8 (32·6 to 48·6)	45·1 (33·7 to 60·0)	110·7 (93·0 to 130·9)	461·4 (386·8 to 547·7)	–0·7 (–0·2 to –1·2)	–3·0 (–1·6 to –4·3)	–2·0 (–1·2 to –2·8)
Angola	16·6 (14·0 to 19·7)	8·6 (6·9 to 10·5)	29·5 (21·3 to 39·6)	38·3 (26·4 to 54·4)	90·1 (72·2 to 109·9)	83·4 (67·2 to 101·5)	–2·0 (–1·0 to –2·8)	–4·1 (–2·4 to –5·8)	–3·2 (–2·3 to –4·2)
Central African Republic	29·6 (24·8 to 35·8)	11·6 (8·9 to 15·1)	50·3 (38·5 to 65·9)	53·4 (34·3 to 76·5)	137·7 (107·4 to 176·5)	21·5 (16·8 to 27·6)	–0·8 (0·1 to –1·7)	–1·4 (0·7 to –3·2)	–1·1 (0·0 to –2·2)
Congo	17·7 (15·5 to 19·9)	4·8 (4·0 to 5·6)	21·8 (16·7 to 26·9)	18·1 (12·3 to 24·5)	61·1 (51·8 to 69·9)	10·0 (8·5 to 11·5)	1·9 (2·6–1·0)	–4·6 (–3·4 to –6·0)	–1·8 (–1·2 to –2·6)
Democratic Republic of the Congo	24·7 (20·8 to 29·1)	7·5 (5·9 to 9·5)	44·2 (33·6 to 57·0)	49·3 (33·8 to 71·2)	120·3 (96·1 to 150·2)	340·4 (272·3 to 425·8)	–0·4 (0·2 to –1·1)	–2·8 (–1·0 to –4·5)	–1·7 (–0·7 to –2·7)

(Table 3 continues on next page)

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(Table continued from previous page)									
Equatorial Guinea	23·9 (19·7 to 28·2)	8·4 (6·3 to 11·3)	40·4 (28·4 to 54·5)	41·1 (26·0 to 63·8)	109·4 (82·5 to 142·6)	2·9 (2·2 to 3·8)	0·1 (1·6 to –1·1)	–3·4 (–0·8 to –5·6)	–1·9 (–0·6 to –3·2)
Gabon	19·1 (16·5 to 21·4)	3·9 (3·2 to 4·6)	20·7 (16·1 to 25·1)	17·9 (13·0 to 23·7)	60·4 (50·5 to 71·2)	3·2 (2·7 to 3·8)	–1·9 (–1·0 to –2·8)	–1·3 (–0·1 to –2·8)	–1·5 (–0·8 to –2·3)
Eastern sub-Saharan Africa	19·6 (18·5 to 20·8)	6·3 (5·8 to 6·8)	26·8 (24·4 to 29·3)	25·9 (22·8 to 29·5)	76·5 (71·0 to 82·6)	1005·0 (932·7 to 1085·4)	–2·4 (–2·2 to –2·6)	–4·4 (–3·8 to –5·0)	–3·5 (–3·2 to –3·9)
Burundi	19·4 (16·6 to 22·4)	7·2 (6·1 to 8·5)	28·5 (22·8 to 34·7)	36·4 (27·0 to 49·1)	88·7 (75·3 to 104·8)	39·1 (33·2 to 46·3)	0·2 (0·9 to –0·5)	–5·4 (–4·1 to –6·8)	–3·0 (–2·2 to –3·8)
Comoros	18·2 (14·8 to 22·3)	6·3 (4·5 to 9·2)	13·6 (8·7 to 20·4)	8·5 (5·4 to 13·3)	45·8 (33·2 to 63·1)	1·2 (0·9 to 1·6)	–3·8 (–1·9 to –5·7)	–4·7 (–2·0 to –7·0)	–4·3 (–2·9 to –5·6)
Djibouti	17·6 (15·1 to 21·0)	5·4 (4·0 to 7·1)	21·8 (15·1 to 29·7)	19·5 (12·3 to 30·9)	62·9 (47·3 to 82·1)	1·5 (1·1 to 2·0)	–0·9 (0·6 to –2·1)	–3·8 (–1·3 to –6·0)	–2·5 (–1·3 to –3·7)
Eritrea	15·9 (13·4 to 18·9)	4·1 (3·0 to 5·7)	16·9 (11·7 to 24·0)	22·6 (14·0 to 36·7)	58·2 (41·9 to 79·9)	13·3 (9·6 to 18·2)	–2·8 (–2·1 to –3·6)	–5·3 (–2·8 to –7·7)	–4·2 (–2·7 to –5·5)
Ethiopia	22·9 (20·0 to 26·1)	7·0 (5·8 to 8·4)	23·3 (18·3 to 28·9)	23·2 (16·7 to 32·6)	74·4 (62·7 to 88·4)	229·3 (193·4 to 273·0)	–3·5 (–2·9 to –4·1)	–5·1 (–3·8 to –6·5)	–4·4 (–3·6 to –5·2)
Kenya	17·5 (15·1 to 20·5)	4·4 (3·4 to 5·6)	21·1 (15·4 to 28·7)	16·6 (11·2 to 23·2)	58·3 (46·5 to 73·4)	89·5 (71·4 to 112·8)	0·1 (0·8 to –0·6)	–3·9 (–1·9 to –5·6)	–2·2 (–1·0 to –3·1)
Madagascar	14·6 (12·5 to 17·0)	5·3 (4·2 to 6·7)	21·6 (16·2 to 28·4)	18·3 (12·5 to 26·2)	58·5 (46·5 to 73·7)	45·7 (36·3 to 57·7)	–4·1 (–3·5 to –4·8)	–3·9 (–2·1 to –5·8)	–4·0 (–3·0 to –5·0)
Malawi	19·7 (16·9 to 22·1)	6·5 (5·5 to 7·4)	30·6 (24·7 to 36·5)	36·1 (26·8 to 46·9)	89·9 (76·5 to 103·4)	57·2 (48·7 to 65·9)	–3·1 (–2·6 to –3·7)	–4·8 (–3·5 to –5·9)	–4·0 (–3·4 to –4·7)
Mauritius	6·2 (5·2 to 7·4)	1·9 (1·7 to 2·1)	3·3 (2·9 to 3·8)	2·6 (2·0 to 3·3)	14·0 (12·2 to 16·0)	0·2 (0·2 to 0·2)	–2·3 (–1·6 to –3·1)	–1·7 (–0·6 to –2·8)	–2·0 (–1·4 to –2·6)
Seychelles	4·5 (3·6 to 5·5)	1·6 (1·4 to 1·9)	3·0 (2·5 to 3·6)	2·7 (1·9 to 3·7)	11·7 (10·1 to 13·7)	0·0 (0·0 to 0·0)	–2·8 (–1·0 to –4·5)	–0·9 (0·9 to –2·3)	–1·7 (–0·8 to –2·5)
Mozambique	21·0 (18·4 to 23·9)	6·8 (5·7 to 7·8)	33·5 (26·6 to 41·0)	30·1 (21·4 to 39·8)	88·4 (76·9 to 101·5)	87·9 (76·3 to 101·1)	–3·4 (–2·9 to –4·0)	–4·4 (–3·3 to –5·5)	–4·0 (–3·4 to –4·6)
Rwanda	17·6 (15·4 to 20·3)	5·4 (4·3 to 6·8)	21·6 (16·3 to 29·2)	19·5 (12·5 to 28·4)	62·6 (50·7 to 78·2)	25·7 (20·8 to 32·1)	–0·3 (0·2 to –1·0)	–7·2 (–5·4 to –8·8)	–4·2 (–3·2 to –5·1)
Somalia	23·8 (19·8 to 28·2)	10·0 (7·5 to 13·0)	39·2 (27·3 to 53·1)	45·5 (29·5 to 67·2)	113·7 (88·9 to 144·5)	51·3 (40·1 to 65·3)	–1·8 (–0·7 to –2·8)	–2·6 (–0·5 to –4·4)	–2·2 (–1·2 to –3·3)
South Sudan	23·0 (19·8 to 26·9)	9·0 (6·9 to 11·8)	36·9 (27·6 to 48·8)	41·1 (26·2 to 59·9)	105·9 (83·8 to 135·1)	41·8 (33·2 to 53·5)	–3·0 (–0·8 to –5·0)	–2·7 (–0·3 to –4·8)	–2·8 (–1·6 to –4·0)
Tanzania	18·0 (15·7 to 20·4)	5·8 (4·8 to 6·9)	30·2 (23·2 to 37·2)	24·6 (18·0 to 33·1)	76·5 (63·8 to 90·4)	145·2 (121·1 to 171·8)	–2·1 (–1·6 to –2·7)	–3·6 (–2·2 to –5·0)	–3·0 (–2·2 to –3·7)
Uganda	20·2 (17·6 to 22·7)	5·7 (4·9 to 6·6)	27·9 (22·4 to 33·1)	28·8 (21·7 to 37·0)	80·1 (69·4 to 93·1)	127·3 (110·3 to 147·9)	–1·7 (–1·2 to –2·3)	–4·2 (–2·9 to –5·3)	–3·1 (–2·4 to –3·7)
Zambia	15·2 (13·2 to 17·7)	6·9 (5·5 to 8·6)	29·5 (22·8 to 37·9)	31·2 (20·7 to 43·6)	80·5 (63·4 to 101·2)	48·7 (38·3 to 61·3)	–1·4 (–0·8 to –1·9)	–4·9 (–3·3 to –6·7)	–3·4 (–2·4 to –4·4)
Southern sub-Saharan Africa	13·8 (12·4 to 15·2)	4·2 (3·5 to 4·9)	17·5 (13·7 to 21·4)	12·3 (9·5 to 15·4)	46·9 (39·8 to 54·6)	83·2 (70·7 to 96·7)	1·3 (2·7 to –0·3)	–4·1 (–2·5 to –5·6)	–1·7 (–1·0 to –2·5)
Botswana	12·5 (10·1 to 14·8)	2·6 (2·0 to 3·7)	9·6 (6·3 to 15·1)	6·6 (3·9 to 10·5)	30·9 (22·4 to 41·9)	1·5 (1·1 to 2·0)	2·0 (3·3–0·7)	–6·0 (–3·1 to –8·4)	–2·5 (–1·2 to –4·0)
Lesotho	31·3 (26·3 to 37·2)	7·4 (5·8 to 9·7)	35·0 (26·9 to 47·6)	18·8 (12·5 to 27·0)	89·6 (71·3 to 113·8)	5·1 (4·0 to 6·5)	1·1 (2·0–0·1)	–1·1 (0·9 to –2·9)	–0·1 (1·0 to –1·2)
Namibia	14·0 (11·2-17·8)	2·5 (1·7 to 3·7)	9·4 (5·8 to 15·6)	9·2 (5·5 to 15·3)	34·7 (24·2 to 49·0)	2·1 (1·4 to 2·9)	–1·0 (0·0 to –1·7)	–4·8 (–2·0 to –7·4)	–3·1 (–1·6 to –4·6)
South Africa	11·4 (9·5 to 13·3)	3·2 (2·5 to 4·2)	14·7 (9·2 to 20·3)	8·2 (5·3 to 12·2)	37·0 (27·8 to 47·8)	40·6 (30·6 to 52·6)	1·4 (3·6 to –1·0)	–6·1 (–3·6 to –8·5)	–2·8 (–1·6 to –4·1)
Swaziland	16·8 (14·4 to 19·9)	5·0 (3·9 to 6·4)	34·5 (26·1 to 45·0)	20·1 (13·0 to 28·4)	74·4 (58·1 to 96·0)	2·8 (2·1 to 3·5)	2·9 (3·8–2·1)	–2·4 (–0·4 to –4·3)	–0·1 (1·2 to –1·2)
Zimbabwe	17·7 (15·4 to 20·8)	6·5 (5·3 to 8·1)	23·3 (18·5 to 30·6)	23·1 (16·0 to 31·0)	69·0 (56·3 to 84·7)	30·3 (24·7 to 37·2)	1·0 (1·6–0·3)	–0·6 (1·0 to –2·3)	0·1 (0·9 to –0·7)

(Table 3 continues on next page)

	Deaths per 1000 livebirths					Number of under to 5 deaths (thousands)	Annualised rate of change		
	Early neonatal (0–6 days)	Late neonatal (7–28 days)	Post to neonatal (29–364 days)	Childhood (1–4 years)	Under 5 (0–4 years)		1990–2000	2000–13	1990–13
(Table continued from previous page)									
Western sub-Saharan Africa	25·7 (23·7 to 27·7)	8·7 (8·1 to 9·3)	32·4 (29·2 to 35·8)	52·3 (45·7 to 59·6)	114·3 (106·8 to 122·1)	1645·9 (1537·4 to 1758·6)	–1·3 (–1·1 to –1·6)	–3·1 (–2·6 to –3·6)	–2·3 (–2·0 to –2·6)
Benin	18·1 (16·0 to 20·3)	3·6 (3·2 to 4·1)	18·9 (15·8 to 22·2)	20·8 (16·1 to 26·7)	60·1 (54·1 to 67·1)	22·3 (20·0 to 24·9)	–3·1 (–2·6 to –3·6)	–5·9 (–4·9 to –6·8)	–4·7 (–4·1 to –5·1)
Burkina Faso	20·2 (17·5 to 23·1)	8·7 (7·8 to 9·9)	32·3 (26·9 to 38·6)	46·6 (36·7 to 57·0)	104·0 (93·0 to 116·6)	70·6 (63·1 to 79·4)	–1·3 (–0·8 to –1·9)	–4·3 (–3·4 to –5·2)	–3·0 (–2·5 to –3·5)
Cameroon	25·1 (22·5 to 28·4)	7·5 (6·8 to 8·5)	30·3 (25·9 to 35·5)	41·8 (33·5 to 52·5)	100·9 (91·9 to 113·9)	82·5 (75·1 to 93·2)	0·3 (0·9 to –0·2)	–2·5 (–1·5 to –3·4)	–1·3 (–0·7 to –1·7)
Cape Verde	9·1 (7·5 to 10·7)	2·4 (2·2 to 2·8)	7·3 (5·7 to 9·7)	5·5 (4·1 to 7·2)	24·1 (20·0 to 29·2)	0·2 (0·2 to 0·3)	–2·4 (–1·0 to –3·8)	–4·8 (–3·0 to –6·4)	–3·8 (–2·9 to –4·6)
Chad	29·6 (25·2 to 34·5)	12·1 (10·0 to 14·6)	46·3 (34·9 to 59·9)	66·5 (47·9 to 84·6)	146·5 (128·2 to 170·3)	84·5 (74·0 to 98·5)	–0·7 (–0·1 to –1·3)	–2·0 (–0·7 to –3·1)	–1·4 (–0·8 to –2·0)
Côte d'Ivoire	27·0 (24·0 to 30·1)	9·4 (8·4 to 10·7)	31·9 (27·0 to 38·0)	31·3 (24·8 to 40·5)	96·0 (86·7 to 108·9)	70·2 (63·3 to 79·5)	–0·8 (–0·2 to –1·4)	–3·0 (–1·9 to –3·8)	–2·0 (–1·4 to –2·5)
Ghana	21·9 (19·1 to 24·8)	5·9 (5·1 to 6·8)	18·3 (14·9 to 22·1)	27·2 (21·5 to 34·2)	71·4 (62·4 to 82·3)	56·6 (49·4 to 65·2)	–1·8 (–1·3 to –2·3)	–2·8 (–1·7 to –3·8)	–2·3 (–1·7 to –2·9)
Guinea	26·1 (22·9 to 29·2)	8·6 (7·8 to 9·5)	33·6 (28·0 to 38·9)	44·6 (35·8 to 53·6)	108·6 (99·6 to 117·7)	46·3 (42·4 to 50·3)	–2·8 (–2·3 to –3·4)	–3·6 (–2·9 to –4·3)	–3·3 (–2·9 to –3·7)
Guinea–Bissau	30·0 (25·2 to 35·5)	12·3 (10·0 to 14·9)	47·6 (36·4 to 60·6)	71·2 (52·3 to 92·2)	152·5 (130·6 to 177·4)	9·6 (8·2 to 11·2)	–1·3 (–0·3 to –2·5)	–1·9 (–0·3 to –3·2)	–1·6 (–0·8 to –2·4)
Liberia	20·4 (18·2 to 22·8)	5·9 (5·0 to 7·0)	32·6 (26·9 to 39·6)	20·8 (15·0 to 27·8)	77·5 (66·2 to 91·4)	11·6 (9·9 to 13·7)	–3·4 (–2·8 to –4·0)	–5·6 (–4·3 to –6·9)	–4·6 (–3·9 to –5·3)
Mali	31·4 (26·0 to 36·9)	11·5 (9·6 to 13·9)	38·8 (30·4 to 48·6)	75·0 (58·5 to 96·3)	148·8 (126·4 to 176·0)	104·2 (88·5 to 123·0)	–1·5 (–1·0 to –2·0)	–3·0 (–1·7 to –4·3)	–2·4 (–1·7 to –3·1)
Mauritania	26·8 (23·5 to 30·7)	6·7 (5·5 to 8·1)	16·0 (12·6 to 20·4)	21·6 (15·7 to 28·5)	69·3 (58·4 to 82·5)	9·1 (7·7 to 10·8)	–0·7 (0·2 to –1·6)	–2·7 (–1·2 to –4·0)	–1·8 (–1·0 to –2·6)
Niger	17·7 (15·1 to 20·5)	8·3 (7·4 to 9·2)	31·3 (25·6 to 37·6)	62·6 (51·6 to 75·5)	115·4 (104·9 to 127·4)	97·8 (88·7 to 108·1)	–2·9 (–2·4 to –3·4)	–5·1 (–4·3 to –5·9)	–4·1 (–3·7 to –4·6)
Nigeria	27·9 (23·9 to 31·7)	9·2 (8·1 to 10·4)	34·8 (28·6 to 41·1)	62·0 (49·8 to 76·1)	128·0 (114·3 to 142·0)	892·6 (796·1 to 991·6)	–1·2 (–0·7 to –1·7)	–2·8 (–1·9 to –3·8)	–2·1 (–1·6 to –2·6)
São Tomé and Príncipe	15·2 (13·3 to 17·0)	3·2 (2·7 to 4·0)	11·7 (8·7 to 15·3)	11·2 (8·1 to 15·2)	40·7 (34·5 to 48·2)	0·3 (0·2 to 0·3)	–2·4 (–1·5 to –3·3)	–4·8 (–3·4 to –6·1)	–3·8 (–3·0 to –4·5)
Senegal	18·0 (15·9 to 20·1)	5·6 (5·0 to 6·3)	14·8 (12·3 to 17·7)	22·4 (17·6 to 27·7)	59·5 (53·4 to 66·8)	31·1 (27·9 to 35·0)	–1·5 (–1·0 to –2·0)	–5·7 (–4·9 to –6·6)	–3·9 (–3·4 to –4·4)
Sierra Leone	27·7 (24·1 to 31·4)	9·8 (8·5 to 11·4)	48·9 (40·2 to 58·7)	46·4 (34·3 to 60·0)	126·8 (111·6 to 144·3)	28·1 (24·7 to 32·0)	–1·4 (–0·9 to –2·0)	–3·5 (–2·5 to –4·5)	–2·6 (–2·0 to –3·2)
The Gambia	20·6 (18·1 to 23·7)	6·1 (5·0 to 7·6)	23·4 (17·9 to 29·9)	26·5 (17·9 to 36·1)	74·6 (62·2 to 90·0)	5·7 (4·8 to 6·9)	–2·6 (–1·4 to –3·7)	–4·0 (–2·5 to –5·5)	–3·4 (–2·5 to –4·2)
Togo	25·2 (22·0 to 28·6)	6·1 (5·1 to 7·4)	26·2 (21·0 to 32·1)	38·4 (27·8 to 50·2)	92·8 (77·5 to 111·8)	22·6 (18·9 to 27·2)	–1·6 (–0·8 to –2·4)	–2·3 (–0·6 to –3·7)	–2·0 (–1·2 to –2·7)

Table 3: Early neonatal, late neonatal, postneonatal, childhood, and under–5 mortality rate and under–5 deaths in 2013, and annualised rates of change in mortality rates for 1990–2000, 2000–2013, and 1990–2013 for 188 countries and 21 Global Burden of Disease regions

Since 2000 in sub-Saharan Africa, child mortality has decreased fastest where it increased in the 1990s (probably because of the HIV epidemic) and then subsequently fell with the scale-up of prevention of mother-to-child transmission and ART.[47–52] Bangladesh has maintained a consistently higher rate of change of around –4·7% to –5·5% since 1990, slightly higher than in neighbouring India (–3·0% to –4·3%), although the pace of child mortality change in India has improved during the past 13 years, reaching –4·5% from 2012 to 2013. Timor-Leste had one of the fastest rates of change (–7·9% per year) since 2000. Nine countries accounted for two-thirds of the global decrease of 3·1 million child deaths in 2013 compared with 2000 (in order of magnitude): India, China, Ethiopia, Bangladesh, Indonesia, Pakistan, Brazil, Afghanistan, and Nigeria (table 3).

Table 4 shows results for the four regression model specifications that assessed the broad determinants of change in under-5 mortality. These models account for a very large share of the recorded variation in under-5 mortality; R^2 values ranged from 0·85 to 0·97.

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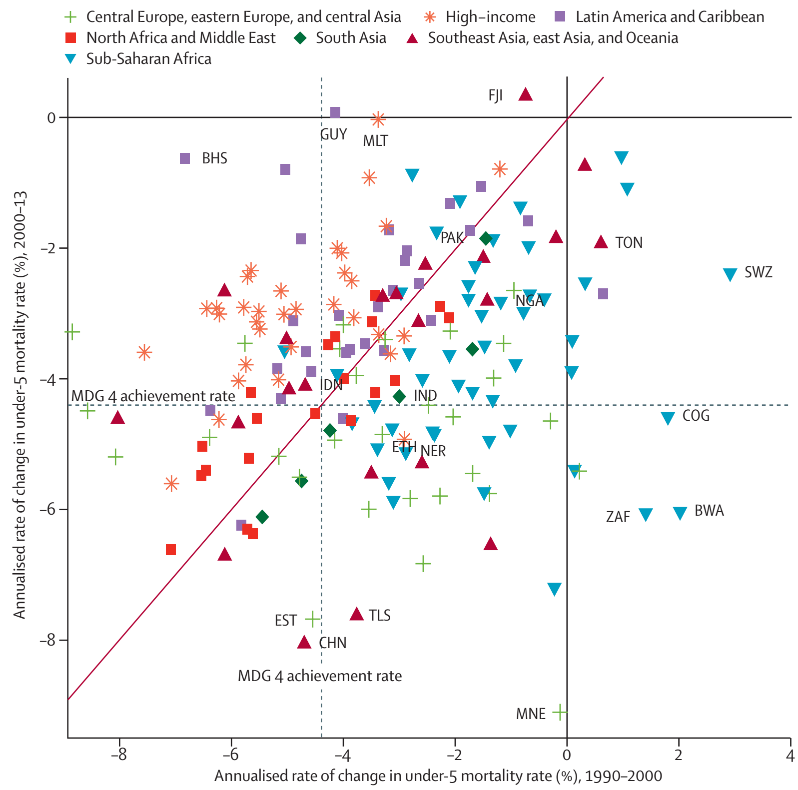

Figure 3: **Global annualised rate of change in under-5 mortality rate (%) from 1990–2000, and 2000–13**
Solid line shows the equivalence line between the two periods. Dashed lines show the Millenium Development Goal 4 target rate of 4·4% per year. We excluded North Korea from the figure because of substantially higher rates of change that distort the scales in the figure.CHN=China. EST=Estonia. IDN=Indonesia. GUY=Guyana. ETH=Ethiopia. TLS=Timor-Leste. IND=India. NER=Niger. PAK=Pakistan. NGA=Nigeria. MNE=Montenegro. ZAF=South Africa. COG=Congo. TON=Tonga. SWZ =Swaziland. BWA=Botswana. BHS=The Bahamas. MLT=Malta. FJI=Fiji.

	Coefficient	SE	95% CI
Lagged distributed income (logarithmic scale)			
Mixed effects regression	–0·16‡	0·007	–0·18 to –0·15
Within–between regression*	–0·15‡	0·013	–0·17 to –0·12
Generalised linear model	–0·15‡	0·007	–0·17 to –0·14
Within–between regression†	–0·15‡	0·008	–0·17 to –0·14
Maternal education			
Mixed effects regression	–0·08‡	0·004	–0·09 to –0·08
Within–between regression*	–0·09‡	0·009	–0·11 to –0·07
Generalised linear model	–0·08‡	0·004	–0·09 to –0·07
Within–between regression†	–0·08‡	0·004	–0·09 to –0·07
Crude death rate from HIV			
Mixed effects regression	92·42‡	4·137	84·31 to 100·52
Within–between regression*	56·42‡	4·323	47·95 to 64·90
Generalised linear model	91·26‡	4·098	83·22 to 99·29
Within–between regression†	91·26‡	4·156	83·13 to 99·38

Combined GBD super–region and year fixed effects, and country level random effects, when included, not shown here. *Within–between estimator with AR(1) autocorrelation specification. †Within–between estimator without AR(1) autocorrelation specification. ‡Significant at 0·001 level.

Table 4: **Regression models for the log of the under–5 mortality rate for different model specifications for 188 countries 1970–2013**

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For the mixed effects regression model, the effect of a 10% increase in income per person corresponded with a 1·6% decrease in under-5 mortality rates. A 1 year increase in maternal education corresponded with an 8·5% decrease in under-5 mortality rate. Therefore, our findings confirm and quantify the findings of other researchers that show that improved levels of maternal education in low-income and middle-income countries have a far greater effect on reduction of child mortality than do any other intervention.[28–32] The year fixed effects for each super-region that captured the secular trend unobserved by income, maternal education, or HIV were essentially linear for all regions, although the slope and level of these regional time trends were quite heterogeneous across regions (data not shown). The average annual change explained by the secular trend was –2·3% overall, ranging from –0·4% to –5·4% across regions.

We estimated the contribution of changes in income, education, birth numbers, secular trend, HIV, and other (unobserved) factors to changes in the number of child deaths in each country, comparing 1990 with 2013. Worldwide, higher numbers of births contributed to 1·42 million (95% UI 1·41 million–1·44 million) more child deaths in 2013 compared with in 1990. Similarly, the HIV/AIDS epidemic has resulted in a 32 400 (29 600–35 200) increase in under-5 deaths from 1990 to 2013 (table 5). Conversely, increased income, especially after 2000, led to 902 100 (821 100–983 300) fewer deaths in 2013, whereas improved maternal education led to 2·2 million (2·0 million–2·4 million) fewer deaths. The secular trend, which we posit to likely represent technological changes and their diffusion, accounted for 4·2 million (3·5 million–4·8 million) fewer deaths in 2013 than in 1990. Changes in other factors not accounted for in this simple model led to an increase of 57 800 (–555 900–662 700) deaths in 2013 compared with 1990.

Figure 4 provides the results of the Shapley decomposition of changes in under-5 deaths for the seven GBD super-regions. We noted the largest decrease in the number of under-5 deaths in south Asia where the secular shift contributed the most, followed by maternal education, and then income. Other factors actually led to an increase in the number of child deaths—ie, south Asia has had less progress than expected in reduction of child deaths because of unobserved other factors. Child deaths in southeast Asia, east Asia, and Oceania have also decreased, with most factors except HIV making important contributions to observed changes (figure 4). In sub-Saharan Africa, increasing birth numbers in the absence of other change would have led to an increase in under-5 deaths. The main contributors to lower child mortality were secular factors and maternal education. Table 5 shows more detail on the Shapley decomposition of changes in the number of under-5 deaths for the 21 GBD regions.

To quantify the potential contribution of global and national action after the Millennium Declaration on trends in under-5 mortality, figure 5 shows which countries had a much faster rate of decline than expected. Expected trends are based on recorded income per person, maternal education, secular trends, and HIV child death rates in the absence of intervention (ie, what would happen without the global effort in scaling up ART and prevention of mother-to-child transmission). 14 countries in sub-Saharan Africa (Burundi, Benin, Burkina Faso, Congo, Ethiopia, Guinea, Liberia, Mozambique, Niger, Rwanda, Senegal, Sao Tome and Principe, South Africa, and Zambia) had faster than expected decreases (figure 5). Child mortality decreased faster than predicted in Asia and Europe (China, Estonia, Cambodia, Laos, Lithuania, Maldives, Montenegro, North Korea, and Timor-Leste) and in seven countries in Latin America (Bolivia, Brazil, Guatemala, Nicaragua, Peru, El Salvador, and Venezuela). Countries with slower than expected decreases include five in Africa and four in Central Asia, and Pakistan (figure 5).

Figure 6 shows possible global trends in under-5 mortality from 2013 to 2030 on the basis of the

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	Fertility	Maternal education	HIV/AIDS	Income	Unexplained	Secular trend	Total
Global	1423·6 (1412·9 to 1436·2)	–2223·8 (–2402·7 to –2040·4)	32·4 (29·6 to 35·2)	–902·1 (–983·3 to –821·1)	57·8 (–555·9 to 662·7)	–4170·4 (–4789 to –3495·9)	–5782·5 (–5834·6 to –5746·9)
High-income Asia Pacific	–2·3 (–2·3 to –2·3)	–1·6 (–1·8 to –1·5)	0 (0 to 0)	–0·9 (–1 to –0·8)	0·6 (0 to 1·3)	–5·3 (–6 to –4·6)	–9·5 (–9·6 to –9·5)
Central Asia	–6·2 (–6·3 to –6)	–19·8 (–21·5 to –18·3)	0 (0 to 0)	–2·7 (–3 to –2·4)	30·2 (22·5 to 38·7)	–67·3 (–75·9 to –59·8)	–65·7 (–66·4 to –65·2)
East Asia	–242·1 (–242·9 to –241·4)	–195·4 (–211·1 to –180·3)	0·3 (0·3 to 0·3)	–211·9 (–230·7 to –192·8)	–316·4 (–368·1 to –262·1)	–292·2 (–347·7 to –237·9)	–1257·7 (–1259·2 to –1256·4)
South Asia	–78·5 (–82·5 to –75·6)	–826·2 (–900·1 to –752)	–7·9 (–8·6 to –7·2)	–405·1 (–447·9 to –366·3)	492·2 (–38·6 to 1046)	–1608.0 (–2153·1 to –1081·3)	–2433·5 (–2485·7 to –2398·3)
Southeast Asia	–19·7 (–19·8 to –19·6)	–142·3 (–153·9 to –131·3)	0·6 (0·5 to 0·6)	–73·6 (–80·3 to –67)	–65.0 (–107·4 to –23)	–229·8 (–275·1 to –185·8)	–529·8 (–531·4 to –528·7)
Australasia	0·4 (0·4 to 0·4)	–0·3 (–0·4 to –0·3)	0 (0 to 0)	–0·2 (–0·2 to –0·2)	0·1 (–0·1 to 0·3)	–1·4 (–1·6 to –1·2)	–1·4 (–1·4 to –1·4)
Caribbean	–1·2 (–1·2 to –1·2)	–12·5 (–13·5 to –11·5)	–1·6 (–1·8 to –1·5)	–0·5 (–0·6 to –0·5)	0·7 (–2·4 to 3·9)	–16·5 (–19·7 to –13·2)	–31·7 (–31·8 to –31·6)
Central Europe	–7·1 (–7·2 to –7·1)	–3·5 (–3·8 to –3·2)	0 (0 to 0)	–1·4 (–1·5 to –1·2)	–2·5 (–4 to –0·9)	–13·4 (–15 to –12)	–27·9 (–28·1 to –27·8)
Eastern Europe	–9·8 (–9·9 to –9·6)	–7·1 (–7·7 to –6·6)	0 (0 to 0)	–0·6 (–0·6 to –0·5)	2·9 (–0·5 to 6·4)	–29·8 (–33·5 to –26·6)	–44·5 (–44·8 to –44·2)
Western Europe	0·3 (0·3 to 0·3)	–5·3 (–5·7 to –4·9)	0 (0 to 0)	–1·7 (–1·9 to –1·6)	–1.0 (–2·9 to 1·1)	–16·8 (–19 to –14·8)	–24·6 (–24·6 to –24·5)
Andean Latin America	0·5 (0·5 to 0·5)	–16·4 (–17·7 to –15·1)	0 (0 to 0)	–3·8 (–4·1 to –3·4)	–14·6 (–18·8 to –10·3)	–23·2 (–27·6 to –18·6)	–57·5 (–57·6 to –57·5)
Central Latin America	0·8 (0·8 to 0·8)	–35·4 (–38·3 to –32·7)	–0·1 (–0·2 to –0·1)	–6·5 (–7·1 to –5·9)	–25·1 (–35·4 to –14·7)	–56·2 (–66·9 to –45)	–122·7 (–122·9 to –122·5)
Southern Latin America	–1·2 (–1·2 to –1·2)	–4·4 (–4·8 to –4·1)	0 (0 to 0)	–1·9 (–2·1 to –1·8)	3·5 (2·2 to 5)	–11·2 (–12·7 to –9·8)	–15·2 (–15·3 to –15·1)
Tropical Latin America	–19·4 (–19·4 to –19·4)	–31 (–33·5 to –28·6)	–0·2 (–0·2 to –0·2)	–5·2 (–5·7 to –4·7)	–34·3 (–42·2 to –26·1)	–44·2 (–52·5 to –35·5)	–134·2 (–134·4 to –134·2)
North Africa and Middle East	57·2 (56·1 to 58·5)	–139·7 (–150·9 to –128·3)	0·3 (0·3 to 0·3)	–37·1 (–40·6 to –33·8)	–27 (–72·6 to 17·7)	–321·9 (–368·3 to –276·2)	–468·1 (–469·4 to –467·3)
High-income North America	1·8 (1·8 to 1·9)	–2 (–2·2 to –1·9)	–0·1 (–0·1 to –0·1)	–2·3 (–2·5 to –2·1)	7·2 (4·4 to 10·3)	–23·4 (–26·6 to –20·5)	–18·8 (–18·9 to –18·8)
Oceania	5 (4·9 to 5·1)	–4·1 (–4·4 to –3·7)	0 (0 to 0)	–0·7 (–0·8 to –0·6)	4·2 (3 to 5·5)	–6·6 (–7·9 to –5·3)	–2·1 (–2·1 to –2·1)
Central sub-Saharan Africa	245·1 (243·6 to 246·9)	–99·5 (–107·6 to –91·5)	3·6 (3·3 to 3·9)	31·6 (28·7 to 34·4)	30·9 (–0·6 to 62·5)	–183·1 (–214·1 to –151·5)	28·6 (27·5 to 29·9)
Eastern sub-Saharan Africa	561 (559·2 to 563·6)	–240·9 (–260·5 to –221·7)	–5·9 (–6·4 to –5·4)	–78·7 (–85·8 to –71·5)	–219·2 (–297·9 to –138·5)	–490·3 (–571·3 to –407)	–474·1 (–474·6 to –473·2)
Southern sub-Saharan Africa	5·6 (5·5 to 5·7)	–30 (–32·5 to –27·6)	2·5 (2·3 to 2·8)	–1·2 (–1·3 to –1·1)	28 (21·4 to 34·9)	–38·5 (–45·2 to –31·8)	–33·6 (–33·8 to –33·4)
Western sub-Saharan Africa	933·4 (927·4 to 940·8)	–406·2 (–439·5 to –373·5)	40·9 (37·5 to 44·6)	–97·5 (–106·1 to –88·5)	162·3 (47·5 to 281·2)	–691·3 (–808·8 to –572·2)	–58·4 (–60·8 to –55·2)

Table 5: Shapley decomposition analysis of the change in the number of under-5 deaths (thousands) related to changes in income per person, maternal education, HIV child death rate, births, secular trends, and unexplained factors, 2013 versus 1990, worldwide and in the 21 GBD regions

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four scenarios for change in child mortality rate. Even under the most ambitious scenario for reduction of child mortality, the number of child deaths worldwide in 2030 would still be about 2·4 million, roughly 4 million less than the present number, but still substantial. If the present rates of change continue, 3·8 million children could be expected to die in 2030. These scenarios assume the UN Population Division forecasts of fertility; faster

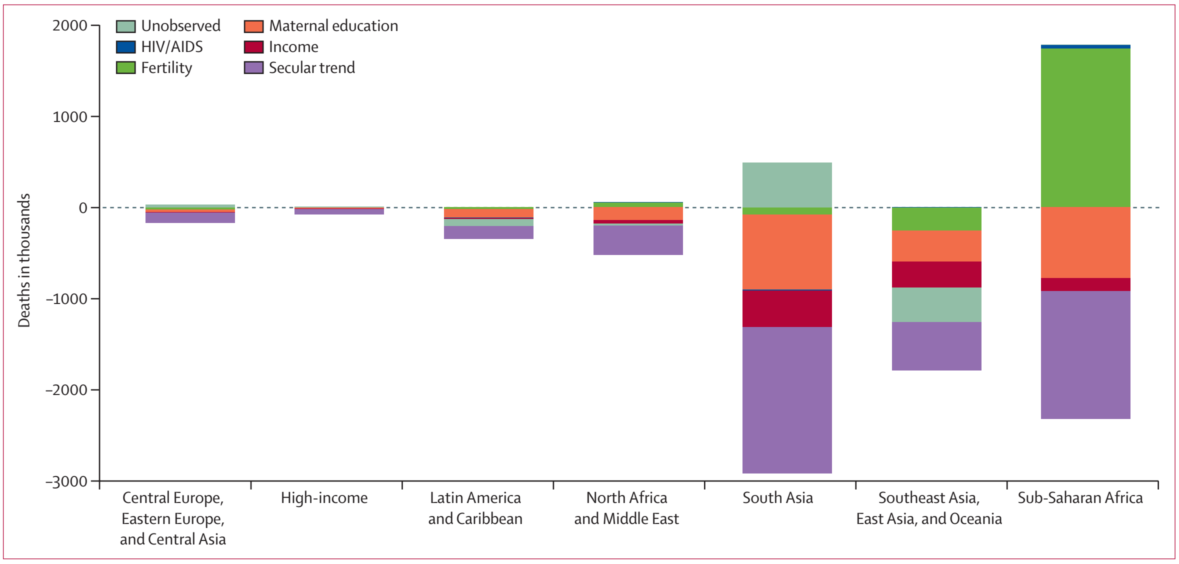

Figure 4: **Change in the number of deaths comparing 2013 with 1990**
Change due to income per person, maternal education, HIV child death rate, shift in secular trend, births, and unexplained factors for seven Global Burden of Disease super-regions.

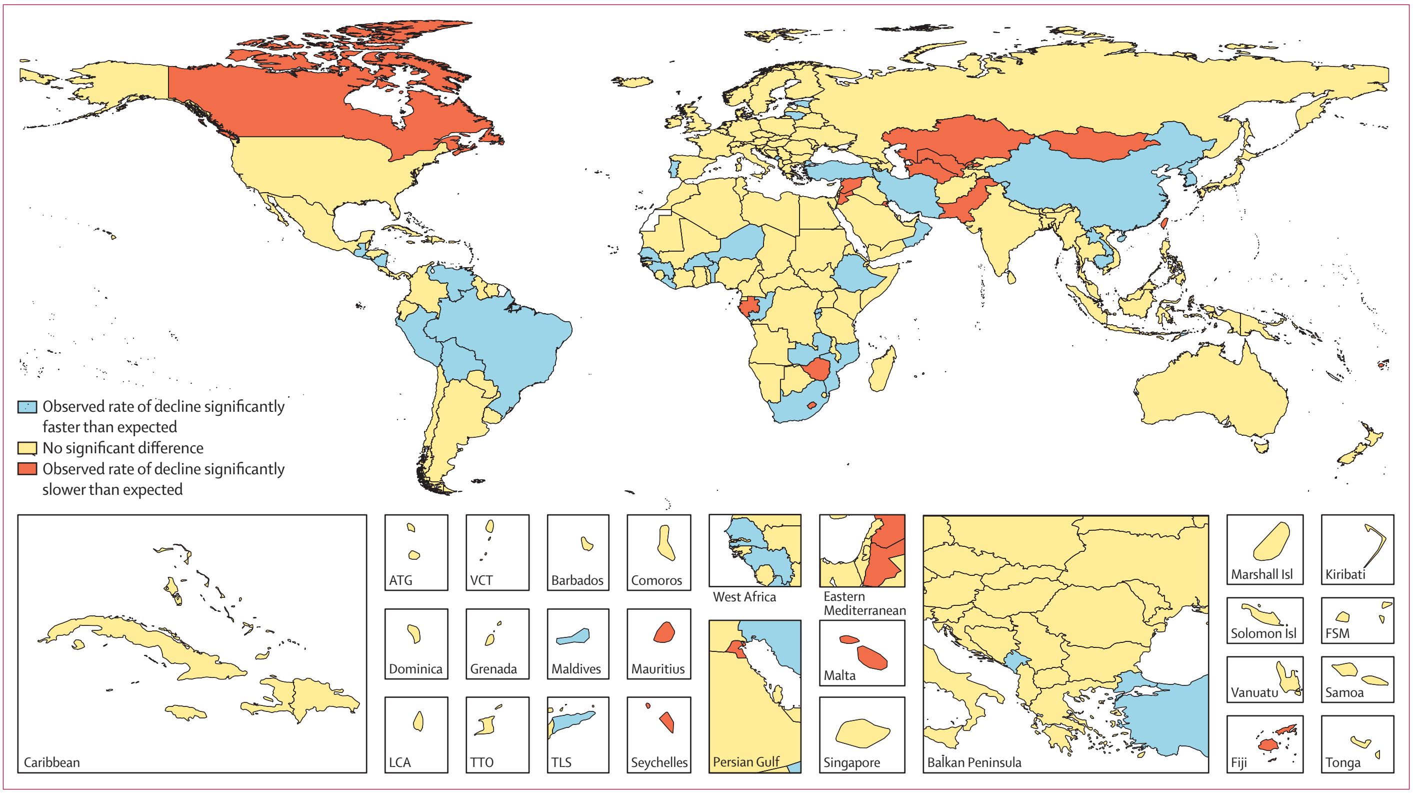

Figure 5: **Countries with statistically significant differences between the observed rate of decline in under-5 mortality between 2000 and 2013, compared with the expected rate of decline on the basis of income, education, shift in secular trend, and HIV death rates in the absence of intervention**
ATG=Antigua and Barbuda. LCA=Saint Lucia. VCT=Saint Vincent and the Grenadines. TTO=Trinidad and Tobago. TLS=Timor-Leste. FSM=Federated States of Micronesia.

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rates of fertility decrease than projected by the UN, which might be achieved through scale-up of family planning services, are not factored into these scenarios, but would lead to fewer deaths. Figure 7 shows the expected level of child mortality worldwide in 2030 if rates of change continue as presently recorded. Under this scenario, several countries would still be expected to have high levels of under-5 mortality in 2030. Under-5 mortality higher than 100 per 1000 livebirths would still prevail in the Central African Republic, Guinea-Bissau, and Chad; those with expected mortality greater than 70 per 1000 livebirths include Nigeria, Democratic Republic of the Congo, and Mali (figure 7). Our projections suggest that the global age composition of under-5 deaths would continue to shift towards a younger structure. In 2013, neonatal deaths accounted for 41·6% of under-5 deaths worldwide. If decreases in child mortality do not accelerate, neonatal deaths would account for 44·9% in 2030, by which time postneonatal deaths and those at ages 1–4 years would account, for 28·1% and 26·9%, respectively, of under-5 deaths worldwide.

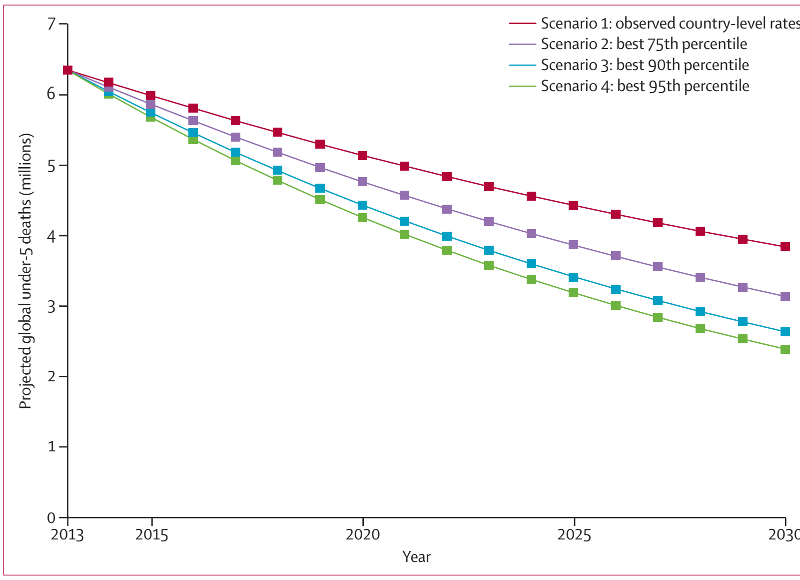

Figure 6: **Projected global under-5 deaths for four scenarios, 2013–30**
Scenarios have been defined by the distribution of observed rates of change 2000 to 2013.

Discussion

The dominant global health focus on improvement of child survival in the past four decades has been extremely successful, although more remains to be done. Child mortality levels decreased, on average, by 2·6% per year from 1970 to 1985, then slowed down for a decade until 1997, began to accelerate, and since 2005, have fallen by an average of 3·6% per year. Accelerated decreases have been recorded in India, nearly all countries in sub-Saharan Africa, and eastern Europe. Conversely, the rate of decline in child mortality has slowed down in many Latin America countries (appendix). As a result, 45 (27 of which are developing) countries are expected to achieve the MDG 4 target rate of 4·4% per year by 2015. The annual number of under-5 deaths has decreased by about two-thirds since 1970, falling below 7 million for the first time in 2010 and, on the basis of patterns of change since 2000, should reach 5 million by 2021, and 4 million by 2028. If present trends continue, more than 120 countries would be expected to have child mortality levels lower than 20 per 1000 livebirths in 2030. By our projection, 19 countries will have under-5 mortality higher than 50 per 1000 livebirths in 2030; however, nine countries (Central African Republic, Chad, Democratic Republic of the Congo, Guinea-Bissau, Lesotho, Mali, Nigeria, Sierra Leone, and Somalia) would still have under-5 mortality higher than 70 per 1000. Walker and colleagues[53] have projected under-5 mortality rate to 2035 on the basis of observed rate of change in the coverage of interventions. Data from their analysis suggest that 37 countries will probably still have child mortality rates higher than 50 per 1000 livebirths in 2035 if country level trends in coverage continue unchanged.

Our analysis confirms the findings of previous studies that showed that most countries will not achieve the MDG 4 target. In our view, this should not be the only standard by which country progress is measured. In fact, many countries have made huge strides since the declaration of the MDG goals, including Laos, Cambodia, Rwanda, Vietnam, and Ethiopia. All five countries have been included by The Partnership for Maternal, Newborn and Child Health in its success factor analysis.[54] By our estimation, the annualised rate of change in child mortality in these five countries, although not at the MDG4 rate, are about 4·0%–4·3%. Our data for observed and expected rates of change since the Millennium Declaration suggest that accelerated decreases in child mortality cannot be explained by income, education, or the secular trend (including technological interventions) alone. In fact, in 30 developing countries, under-5 mortality has decreased much faster than expected, including in some southern African countries that had increases in the 1990s related to the HIV epidemic and that have subsequently benefited from the scale-up of ART and prevention of mother-to-child transmission. The commendable progress in this group of countries, which exceeds expectations, might largely be attributable to global action after the MDGs that led to increased funding for HIV control programmes. In Niger, this action has been carefully documented.[31] Alternatively, accelerated decreases in Cambodia, Timor-Leste, Guatemala, and El Salvador after the MDGs could be linked both to government policy change and increased development assistance for health.[55] Changes in Turkey and China, both of which have received little development assistance per person, are more likely to be related to national policy change and health-system strengthening.[56–59] Rudan and colleagues[58] have documented the rapid fall in child mortality in China and

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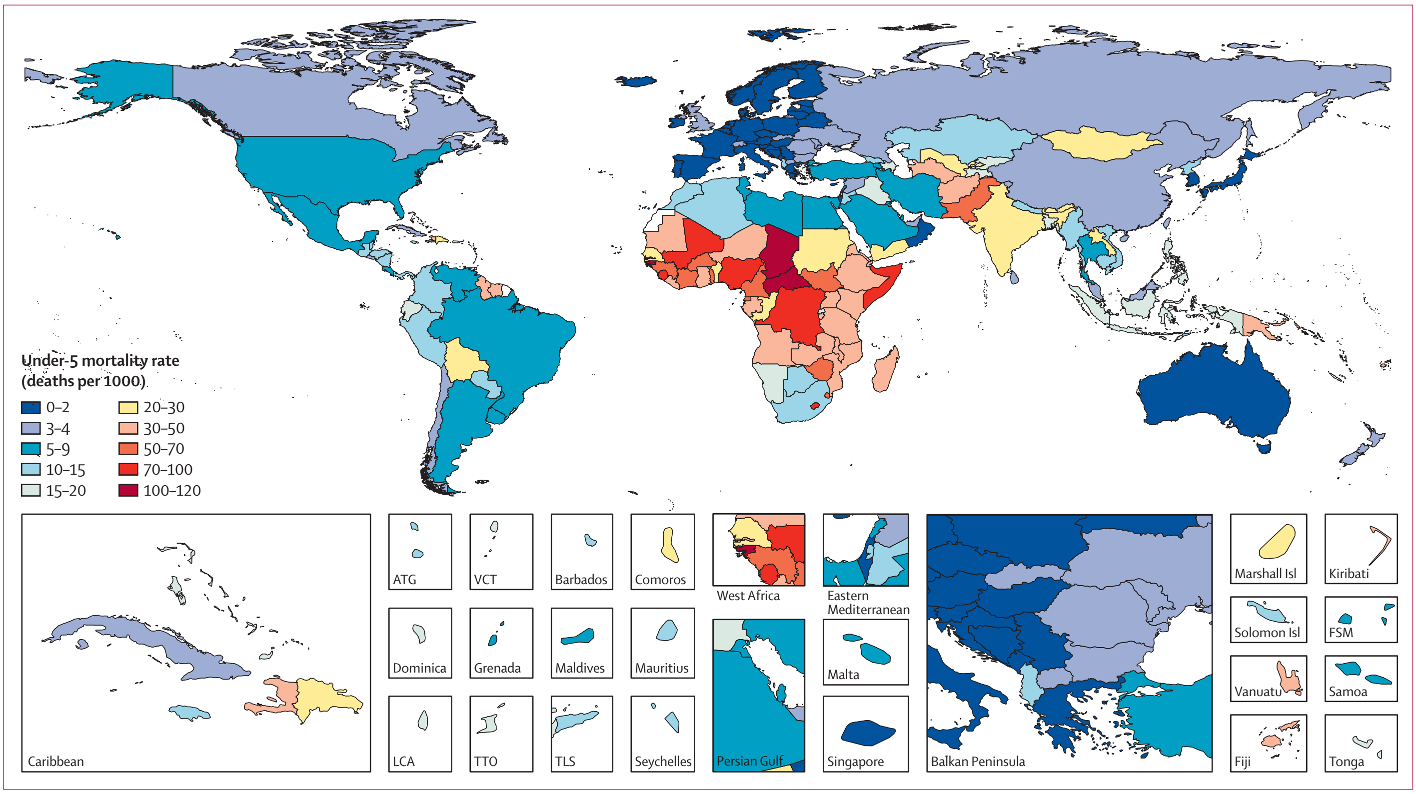

Figure 7: **Projected under-5 mortality rate in 2030, on the basis of the observed rate of change for each country, 2000–13**
ATG=Antigua and Barbuda. LCA=Saint Lucia. VCT=Saint Vincent and the Grenadines. TTO=Trinidad and Tobago. TLS=Timor-Leste. FSM=Federated States of Micronesia.

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findings of analyses by Feng and colleagues[59] have shown the important role that socioeconomic and health system determinants have had in the reduction of child mortality in China.

The reasons underlying these faster than expected decreases in child mortality are undoubtedly multifactorial and complex, and deserve further study, but prominent among them is surely the introduction of national policies that promote development and increased access to essential child-care services among the worst off and increased investments in health and related sectors. The MDG declaration and subsequent political momentum might have affected the health-investment landscape, stimulating a more effective and comprehensive response by bilateral donors, the Global Alliance for Vaccines and Immunisation (GAVI), the US President's Emergency Plan for AIDS Relief (PEPFAR), The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the World Bank, and other development partners to ensure the more widespread dissemination of new technologies and the remarkable progress against HIV. The attention that has been paid to achievement of the MDGs more broadly, and not merely those directly concerned with health, has undoubtedly helped with progress in reduction of child mortality by improvement of broader development indicators such as education, income, and the environment, all of which are likely to lead to improved child survival. By contrast, 17 countries had rates of change in under-5 mortality much slower than expected. A more detailed case study analysis of these countries compared with those with faster than expected decreases could provide further insights into bottlenecks and circumstances that hinder progress.

Our analysis of long-term trends in child mortality provides some insight into the comparative contribution of different factors. Worldwide, income growth between 1990 and 2013 accounted for about 15·6% (95% UI 14·2–16·9) of the change in the number of child deaths. Although correlated (correlation coefficient 0·72) with income, maternal education had a much larger effect on decreases in child mortality (38·5% [35·5–41·2]) than did income, a finding that is consistent with previous research, but provides a quantitative assessment of just how important mothers' education is in the reduction of child mortality.[31,60–65] These findings reinforce the continued importance of investments in primary and secondary schooling for girls in particular. Continued high total fertility rates, especially in western sub-Saharan Africa, have led to increased numbers of births, which, all other things being equal, has led to nearly 1 million more child deaths in 2013 than in 1990. Therefore, the renewed focus on contraceptive programmes for low-income countries[66–68] is very timely

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and a crucial component of national strategies to help countries to reduce the number of child deaths.

In a series of analyses spanning four decades, Preston and others[32,69] have noted an upward shift of the association between life expectancy, income, and education—ie, the same level of income and education today is associated with much lower levels of age-specific mortality and higher life expectancy than before. Investigators attribute this shift associated with time to the advancement of technology and the diffusion of such advancement; technology is defined in this case very broadly to encompass both new methods but also new ways in which societies are organised to deliver programmes and interventions. We find the same major shift in the association in our analysis of child mortality. The way that the secular trend is estimated would also capture systematic improvements in the average efficiency of societies' ability to convert improvements in income and education into child mortality reductions, such as improved efficiency of production. Overall, the secular trend accounts for the largest share (72·1% 95% UI 60·8–82·1]) of the change in child deaths from 1990 with 2013. New drugs, vaccines, diagnostics, procedures, and public health campaigns are part of this shift. In the past 23 years, this shift included innovations such as insecticide-treated bednets, technologies to prevent mother-to-child transmission of HIV, ART, rotavirus vaccine,[70,71] pneumococcal[72] and other vaccines, and many other life-saving technologies. The dominant role of new technologies and more efficient ways of diffusing them in poor countries emphasises the importance of continued innovation in drugs, vaccines, public health programmes, and the delivery of health care for continued declines in under-5 mortality. Our assessment of the comparative role of health technologies in bringing about the massive decreases in child mortality in the past few decades provides indirect evidence for donors, researchers, and countries alike of the crucial effect that these investments have had.

The variation in child mortality around the income and education curve at a given moment in time has been interpreted as variation in country performance in the production of better child health,[31,73,74] a component of which might be related to health systems. In our study, we controlled for time invariant differences between countries that might be related to the environment or other fixed attributes. We noted unobserved factors beyond income, maternal education, time, HIV, birth and time-invariant country factors accounted for only about –1·0% (95% UI –9·5 to 11·5) of the global change in under-5 mortality between 1990 and 2013. Although other factors quantitatively have a much greater role in reductions in child deaths since 1990 than do the unobserved factors, understanding the local policy factors associated with this unobserved change could provide important insights and opportunities for shared learning. Nevertheless, the fact that our model can explain 96·7% of the observed variation in under-5 mortality rates provides strong evidence to support the continued investment in the main determinants of lower child mortality, namely maternal education, income growth, and the development and application of new technologies.

Although substantial progress has been made in reduction of child mortality worldwide, our scenario analysis of projected under-5 mortality in 2030 provides a sobering reminder of the magnitude of the task ahead. Even if present, rapid decreases in mortality in low-income countries of sub-Saharan Africa persist, along with decreases recorded elsewhere, almost 3·8 million children will still die before their fifth birthday in 2030, unless the speed of decrease can be accelerated. Progress is being hindered partly by fertility patterns in which the fraction of births worldwide is likely to increasingly shift towards sub-Saharan Africa where mortality rates are highest. This shift in the distribution of births means that global progress in reducing child mortality, even if every country maintains the same rate of decline, will slow. The countries that will have the highest rates of child mortality in 2030, on the basis of present trends are concentrated in west and central Africa. Ambitious goals to reduce under-5 mortality to 20 per 1000 livebirths as proposed by the USA, Ethiopia, and India will need to strategically focus on countries in these regions.[1] Anticipation of the pace of these decreases suggests that donors might want to prioritise funding for some countries on the basis of their probable future under-5 mortality. Conversely, the pace of child mortality decrease in some countries (eg, India) is accelerating, such that by 2030, according to our base scenario, India will have an under-5 mortality rate lower than 25 per 1000 livebirths.

During the past 6 years, many studies have been done of country levels and trends in child mortality.[1,13,14,75–83] Worldwide, the UN and the GBD estimates of the number of child deaths have largely converged. The appendix shows estimates from UNICEF and independent academic studies, including the GBD 2010 and this analysis. In their latest iteration, the UN Inter-agency Group for Child Mortality Estimation (IGME)[84] changed their methods, which resulted in increased mortality estimates for 1990, which has substantially changed some of the estimates of annualised rates of decrease. The UN has estimated that high-income countries such as Spain are under-reporting child deaths, although no direct evidence of under-reporting exists. Overall, the association between their estimates of the annualised rate of change from 1990 to 2007, published in 2012, and 2013, is 0·93.[83,85] Likewise, the GBD effort has changed some methods such that the association of the annualised rate of change for the same period is 0·87 between GBD iterations. However, the uncertainty intervals on annualised rates of change between 2000 and 2010, generated as part of the GBD collaboration seem to be

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See Online for appendix

Panel: Research in context

Continuous efforts have been made in improving child mortality estimation since the publication of GBD 2010.[18] In this study, significant improvements have been made on several fronts. First, we employed a mixed effects model to adjust non-sampling data biases with source-type specific fixed effects across all countries and source-specific random effects within country. We selected one specific data source in each country as the reference source, calculated the difference in the summed fixed and random effects between other sources and the reference source, and subtracted this difference from each non-reference source to adjust for data bias. In the case that multiple sources were selected as the reference, we took the average value of the selected sources. More than 300 all-cause mortality experts from around the world contributed to the selection of the reference data sources. Second, we used a non-linear mixed effects model to more accurately capture the functional form between child mortality rate and other factors including HIV/AIDS. This has significant implications for the estimation of child mortality in the most recent time period in which data are sparse and covariates have a more pronounced effect on final estimates. Third, we improved our mortality estimation strategy for neonatal deaths. The new strategy we employed accounted for the fact that few children die from HIV in the neonatal age group, and helps improve our estimated age distribution of deaths in children under 5.

robust, and do not overlap in only eight of 188 cases. Continued improvements in methods and data availability, especially for recent years, make the assessment of trends comparatively unstable. The correlation between UNICEF annual rates of change from 1990 to 2007, published in 2009, and in 2013, is 0·79. The correlation between this study and Rajaratnam and colleagues[13] is 0·82. Improvements in methods and data are to be encouraged, but these perhaps surprisingly modest correlations mean that the public health community should be cautious in over-interpreting trends.

This analysis has many limitations. First, we attempted to explicitly model the non-sampling error that affects different surveys in each country (panel). This approach avoids estimation of false trends due to compositional bias in the data available for a given year but depends on the validity of the estimates of non-sampling error. Unfortunately, external validation of this process is not possible except in countries with complete vital registration systems, but most of these countries do not collect summary or complete birth history data. Second, the trend for the most recent years is a short-term estimate for many countries. Our estimates might be too high or too low in these cases and the Gaussian process regression appropriately generates widening uncertainty intervals for them. However, time lags between data collection and inclusion in our synthesis are shortening for many countries. For example, we included results from the sample registration system in India to 2012, and also data for China through to 2013. Third, in our analysis of the factors contributing to under-5 mortality change in each region, we included country random effects and fixed effects on year interacted with region. We might have underestimated the contribution of local policy and health-system organisation if these changes are associated over time within a region. Fourth, although we systematically searched and identified sources of data for under-5 mortality, we probably did not identify all data sources. The large set of collaborators from 100 countries who participated in GBD 2013 has helped to identify new sources and assess the quality of existing data, but this information base can be expanded in the future. Fifth, we used the Shapley decomposition method to parse out the contribution of different factors to changes in under-5 deaths. This method, although computationally intensive, is intuitive. Although other methods have been proposed to decompose effects of different factors on indicators of interest, Shapley value decomposition, to our knowledge, is most suitable in our application.[86,87]

The vigorous debate on setting development goals for the post-2015 era is predicated on the belief that global goal setting and quantitative monitoring can catalyse change. The acceleration of decreases in under-5 mortality beyond that expected on the basis of income, education, and the secular trend, especially in some sub-Saharan African countries, coincides with the MDG era and increased investments in these countries in health and social development programmes by various donors. As the end of the MDG era approaches, the global public health community might better serve the needs of countries by focusing on the accelerated decreases after 2000 reported here, rather than on which countries will achieve the arbitrary but seemingly useful targets set by the MDGs. Galvanising political commitment to ensure life-saving technologies are implemented will be crucial. The essential health intelligence that comes from large global monitoring efforts such as the GBD study will better focus attention on countries where progress has been disappointing. The consequences of not doing so—more than 3 million preventable child deaths in 2030—would be a scathing indictment of the failure of the donor, research, and international development community to collectively build on the impressive reductions in child mortality that we have come to expect.

Contributors

CJLM, ADL, and HW conceived of the study and provided overall guidance. HW, CAL, MMC, CEL, AES, HA, MI, and LS analysed child mortality data sources. CJLM, ADL, HW, CAL, and MMC reviewed each cycle of estimation in detail. HW, CAL, MMC, MDM, CEL, AES, BP, CJLM, and ADL prepared the first draft. HW, ADL, CJLM, CAL, MMC, MDM, CEL, and AES finalised the draft based on comments from other authors and reviewer feedback. All other authors reviewed results, provided guidance on the selection of key data sources, and reviewed the paper.

Declaration of interests

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated. BDG works for AMP, which receives grant specific support from Crusell, GlaxoSmithKline, Merck, Novartis, Pfizer, and Sanofi Pasteur. JAS has received research grants from Takeda and Savient and consultant fees from Savient, Takeda, Regeneron and Allergan. He is a member of the executive of OMERACT, an organisation that develops outcome measures in rheumatology and receives arms-length funding from 36 companies; a member of the American College of Rheumatology's Guidelines Subcommittee of the Quality of Care Committee; and a member of the Veterans Affairs Rheumatology Field Advisory Committee. GAM is required to include the following statement: The views expressed in this article are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute, National Institutes of Health, Department of Health and Human Services, or any other government entity. We declare that we have no further competing interests.

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