Global, regional, and national progress towards Sustainable Development Goal 3.2 for neonatal and child health: all-cause and cause-specific mortality findings from the Global Burden of Disease Study 2019

**Summary**

**Background** Sustainable Development Goal 3.2 has targeted elimination of preventable child mortality, reduction of neonatal death to less than 12 per 1000 livebirths, and reduction of death of children younger than 5 years to less than 25 per 1000 livebirths, for each country by 2030. To understand current rates, recent trends, and potential trajectories of child mortality for the next decade, we present the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019 findings for all-cause mortality and cause-specific mortality in children younger than 5 years of age, with multiple scenarios for child mortality in 2030 that include the consideration of potential effects of COVID-19, and a novel framework for quantifying optimal child survival.

**Methods** We completed all-cause mortality and cause-specific mortality analyses from 204 countries and territories for detailed age groups separately, with aggregated mortality probabilities per 1000 livebirths computed for neonatal mortality rate (NMR) and under-5 mortality rate (U5MR). Scenarios for 2030 represent different potential trajectories, notably including potential effects of the COVID-19 pandemic and the potential impact of improvements preferentially targeting neonatal survival. Optimal child survival metrics were developed by age, sex, and cause of death across all GBD location-years. The first metric is a global optimum and is based on the lowest observed mortality, and the second is a survival potential frontier that is based on stochastic frontier analysis of observed mortality and Healthcare Access and Quality Index.

**Findings** Global U5MR decreased from 71.2 deaths per 1000 livebirths (95% uncertainty interval [UI] 68.3–74.0) in 2000 to 37.1 (33.2–41.7) in 2019 while global NMR correspondingly declined more slowly from 28.0 deaths per 1000 livebirths (26.8–29.5) in 2000 to 17.9 (16.3–19.8) in 2019. In 2019, 136 (67%) of 204 countries had a U5MR at or below the SDG 3.2 threshold and 133 (65%) had an NMR at or below the SDG 3.2 threshold, and the reference scenario suggests that by 2030, 154 (75%) of all countries could meet the U5MR targets, and 139 (68%) could meet the NMR targets. Deaths of children younger than 5 years totalled 9.65 million (95% UI 9.05–10.30) in 2000 and 5.05 million (4.27–6.02) in 2019, with the neonatal fraction of these deaths increasing from 39% (3.76 million [95% UI 3.53–4.02]) in 2000 to 48% (2.42 million; 2.06–2.86) in 2019. NMR and U5MR were generally higher in males than in females, although there was no statistically significant difference at the global level. Neonatal disorders remained the leading cause of death in children younger than 5 years in 2019, followed by lower respiratory infections, diarrhoeal diseases, congenital birth defects, and malaria. The global optimum analysis suggests NMR could be reduced to as low as 0.80 (95% UI 0.71–0.86) deaths per 1000 livebirths and U5MR to 1.44 (95% UI 1.27–1.58) deaths per 1000 livebirths, and in 2019, there were as many as 1.87 million (95% UI 1.35–2.58; 37% [95% UI 32–43]) of 5.05 million more deaths of children younger than 5 years than the survival potential frontier.

**Interpretation** Global child mortality declined by almost half between 2000 and 2019, but progress remains slower in neonates and 65 (32%) of 204 countries, mostly in sub-Saharan Africa and south Asia, are not on track to meet either SDG 3.2 target by 2030. Focused improvements in perinatal and newborn care, continued and expanded delivery of essential interventions such as vaccination and infection prevention, an enhanced focus on equity, continued focus on poverty reduction and education, and investment in strengthening health systems across the development spectrum have the potential to substantially improve U5MR. Given the widespread effects of COVID-19, considerable effort will be required to maintain and accelerate progress.

**Funding** Bill & Melinda Gates Foundation.

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Introduction

Under-5 mortality rate (USMR) and neonatal mortality rate (NMR) are important indicators reflecting multiple aspects of societal wellbeing such as access to nutrition and food; basic infrastructure such as housing, water, and sanitation; education; agency; financial security; access to preventive and treatment health services; and future human capital. The UN Millennium Development Goals (MDGs) are credited with mobilising global action on child health, and manifested as an unprecedented, accelerated reduction in child mortality and resulted on child health, and manifested as an unprecedented, accelerated reduction in child mortality and resulted.

SDG 3.2 explicitly prioritises ending preventable child deaths. Therefore, based on all-cause and cause-specific mortality estimates from GBD 2019, this study introduces a novel, reproducible, and holistic heuristic for quantifying optimal child survival. Within this framework are two complementary cause-specific benchmarks: a global optimum, based on the lowest observed neonatal and under-5 mortality, and a survival potential frontier, based on stochastic frontier analysis of observed mortality and the Healthcare Access and Quality Index. The latter allows for comparing performance between similar countries, and specifically helps those countries with high mortality to establish intermediate goals.

Implications of all the available evidence

The prevention of child deaths accelerated in the MDG era. In the emerging SDG period, progress to prevent child deaths remains slowest in neonates. The study findings highlight regions with potential imbalances in health priorities. The findings can also identify causes of death with the most potential for reduction, and those with the greatest need for resources, expertise, and service delivery, or for basic research into prevention and treatment. To reach the SDG targets by 2030, policy makers must focus on balancing priorities between early newborn care while continuing prenatal and older child health initiatives. Strengthening quality health systems and ensuring effective investment in high-burden countries are imperative in order to scale up interventions. Equally pressing are the needs to examine within-country disparities and pursue integrative action on other determinants of health.

Research in context

Evidence before this study

During the Millennium Development Goal (MDG) era (2000–15), numerous organisations comprehensively described global progress in reducing child and neonatal mortality (MDG 4), but the early Sustainable Development Goal (SDG) period has seen few comparable efforts to track progress and none to date have attempted to quantify the preventable portion of child mortality (SDG 3.2). Past preventable mortality analyses have focused on health-care delivery, or were limited to high-income countries and adult populations. The most recent child mortality report from the UN Inter-agency Group for Child Mortality Estimation (UNIGME), published in 2017 for the year 2015, reports on all-cause mortality only. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) is the only annual assessment of trends in all-cause mortality and cause-specific mortality by detailed age groups for all locations with a population greater than 50,000 people from 1990 to the present that is compliant with the Guidelines for Accurate and Transparent Health Estimates Reporting.

Added value of this study

This analysis presents levels and trends in all-cause and cause-specific neonatal and under-5 mortality from 2000 to 2019. Multiple future health scenarios for child mortality in 2030 were constructed to represent potential trajectories, including the potential impacts of the COVID-19 pandemic and scenarios with targeted improvements in neonatal survival. Additionally, this study presents for the first time all-cause mortality estimates for granular age groups of 0–6 days, 7–27 days, 1–5 months, 6–11 months, 12–23 months, and 2–4 years. This study presents the potential impacts of the COVID-19 pandemic and scenarios with targeted improvements in neonatal survival. Additionally, this study presents for the first time all-cause mortality estimates for granular age groups of 0–6 days, 7–27 days, 1–5 months, 6–11 months, 12–23 months, and 2–4 years.

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There has not yet been a comprehensive assessment of NMR and U5MR in the SDG era. Selected publications assessed interim progress towards part of SDG 3.2 or provided projections to 2030, but none have been comprehensive with respect to cause, age, trends, geography, and progress towards 2030 targets. The comprehensive nature of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019 lends itself to a detailed analysis of levels, trends, and drivers of change for specific age groups, causes, and locations. Additionally, there has not been any previous effort, to our knowledge, to empirically explore the concept of preventable mortality in children. Although preventable death has been theoretically defined since the early 2000s, the definitions has usually been through a healthcare delivery lens rather than a more holistic lens of preventability that might be interpreted as the intended wording of SDG 3.2. Furthermore, although the Organisation for Economic Co-operation and Development (OECD) and Eurostat convened to provide a more uniform approach to interpreting avoidable deaths in 2019, this was with a singular focus on high-income countries and the adult population.

In this study, based on GBD 2019, we have three objectives. First, we aim to present a detailed, comprehensive numerical assessment of progress towards SDG 3.2 targets for all-cause NMR and U5MR at the global, regional, and national level, including a series of scenarios that reflect possible trends over the next decade including the potential effects of the COVID-19 pandemic on young children. Second, we aim to evaluate comparative progress in cause-specific mortality in neonates and children from 2000 to 2019 to highlight successes and potential focus areas for improvement. Third, we aim to better define a holistic focus of preventable mortality by exploring two different measures of optimal child survival that can both inform global progress and provide a benchmark for intermediate progress evaluation in high-mortality settings. In so doing, this study seeks to meet the needs of an expansive, integrative SDG agenda, and to highlight the locations, age groups, and causes of preventable deaths, to inform policy and public health priorities aiming to achieve SDG 3.2. This manuscript was produced as part of the GBD Collaborator Network and in accordance with the GBD Protocol.

Methods
Overview
This study is compliant with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) appendix p 9). A brief summary of each component of our study is described below. Extensive methodological details are provided in the appendix (pp 10–86).

Dimensions of the GBD study
GBD 2019 includes all-cause and cause-specific mortality by age and sex for 204 countries and territories, 21 of which were estimated at the subnational level from 1990 to 2019, inclusive. Results in this study are presented only for countries and territories. All-cause mortality estimation covers six under-5 age groups: 0–6 days (early neonatal), 7–27 days (late neonatal), 1–5 months, 6–11 months, 12–23 months, and 2–4 years. Cause-specific mortality estimates cover four age groups: early neonatal, late neonatal, late neonatal, and the under-5 age group (0–4 years), to best align with the SDG under-5 and neonatal targets. Similarly, we focus on results for the aggregate neonatal age group (<28 days) and the under-5 age group (0–4 years), to best align with the SDG under-5 and neonatal targets.

Injuries, and Risk Factors Study (GBD) 2019 lends itself to a detailed analysis of levels, trends, and drivers of change for specific age groups, causes, and locations.
of four levels (appendix p 87). Some conditions only result in fatal burden (eg, sudden infant death syndrome), whereas others cause only disability (eg, scabies); most causes have both fatal and non-fatal burden. Comprehensive methods for cause-specific mortality estimation for GBD have been previously described and are detailed in the appendix (p 35). We present most results at level 3 because this level is sufficiently detailed to reflect important cause groupings for the age groups presented in this analysis (eg, neonatal disorders and congenital birth defects), but not so detailed as to obscure important groupings of related conditions.

Scenarios for 2030 and beyond
USMR and NMR were projected for six scenarios, all computed at the national level, up to 2030 as previously described. The first three scenarios represent the reference, better-than-reference, and worse-than-reference scenarios, while a fourth represents the 2030 NMR and USMR in the absence of COVID-19. The remaining two scenarios are intended to assess outcomes for interventions that focus only on specific age groups, to evaluate if opportunity is greater in a particular age group than in others, and to show the limits of achievement when efforts do not consider distinct needs of different age groups. For the first of these age-specific scenarios, neonatal mortality is at the better-than-reference level and remaining under-5 mortality stays at reference level (neonatal scenario), and for the second, mortality for children aged 28–364 days is at the better-than-reference level and neonatal mortality stays at the reference level (child scenario). Many strategies to address neonatal mortality are fundamentally different from strategies targeting older infants and children, so these two scenarios are a broad representation of those differences.

Assessment of optimal survival potential
Our approach to inform an assessment of preventable mortality focused on the quantification of two different measures of optimal child survival based on historical trends. The first measure, what we term the global optimum, represents a universal level at which all additional mortality is theoretically avoidable given current medical knowledge and technology. This is analogous to the GBD method used for estimating global standard life expectancy. The second measure, what we term the survival potential frontier, aims to quantify the amount of mortality that is avoidable given the country’s level of Healthcare Access and Quality (HAQ) Index, thereby accounting for the differential resources available for health investment in different locations.

First, we calculated the global optimum for NMR and USMR based on the aggregate of the lowest observed age-specific and cause-specific mortality rates in locations with populations higher than 10 000 children younger than 5 years (to remove noise associated with small numbers) between 2000 and 2019, scaling them to match an all-cause mortality minimum that was calculated using the same approach. The scaling step was added to account for potential differences due to small numbers in low-mortality settings or geographical differences in cause assignment that can occur between, for example, subcauses of neonatal disorders. This method is analogous to that used by GBD to calculate a global standard life expectancy for the purposes of calculating years of life lost and therefore can be interpreted to represent the optimum potential for reductions in child mortality based on current technology and health delivery systems.

Second, to help with developing intermediate goals and to evaluate progress in higher-mortality settings, we calculated a survival potential frontier using stochastic frontier analysis to evaluate the historical relationship between cause-specific neonatal and under-5 mortality rates and HAQ Index, which is an aggregate metric of health system performance across all age groups combined. The specific formulation of the stochastic frontier analysis is described in detail in the appendix (p 70), but briefly, it uses a spline to estimate the expected lower bound of mortality for a given value of HAQ Index. Stochastic frontier analysis was chosen to quantify system inefficiency because of its flexibility in shape, its assumption of performance possibilities given static system inputs, and the fact that it allows for random effects in the model rather than assuming uniformity of inputs across locations.

All components of the analysis are based on 1000 draws of the posterior distribution of the quantity of interest by age, sex, location, and year. Point estimates are the mean of the draws, and 95% uncertainty intervals (UIs) represent the 2.5th and 97.5th percentiles.

Presentation of results
Results are presented by country, GBD super-region, and Socio-demographic Index (SDI) quintile. SDI is a composite index of income per capita, educational attainment, and inverse fertility, and it is used to categorise countries into SDI quintiles: low SDI (ie, low income per capita, low educational attainment, high fertility), low-middle SDI, middle SDI, high-middle SDI, and high SDI. Full results for GBD 2019 are available in an online visualisation at GBD Compare and for download from the GBD Results Tool.

Role of the funding source
The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results
All-cause mortality and progress towards SDG 3.2
Over the past two decades, there has been a substantial decrease in global deaths of children younger than 5 years, from 9·65 million (95% UI 9·05–10·30) in 2000,
| SDI regions       | Neonatal deaths | NMR | Under-5 deaths | USMR |
|-------------------|-----------------|-----|-----------------|------|
|                   | 2000            | 2015| 2019            | 2030*| 2000            | 2015            | 2019            | 2019            | 2030*            |
| Global            | 3'760'000       | 2'820'000 | 2'420'000       | 1'79' | 9'650'000       | 6'100'000       | 5'090'000       | 37'1             | 29'6            |
|                   | (3'530'000–4'040'000) | (2'480'000–3'210'000) | (2'060'000–2'860'000) | (16'3–19'8) | (9'500'000–10'300'000) | (6'150'000–6'910'000) | (5'200'000–6'200'000) | (33'2–41'7) |
| Low SDI           | 1'260'000       | 1'190'000 | 1'110'000       | 2'70' | 4'010'000       | 3'040'000       | 2'670'000       | 71'8             | 40'0            |
|                   | (1'190'000–1'340'000) | (1'030'000–1'370'000) | (918'000–1'340'000) | (24'0–30'8) | (2'780'000–2'260'000) | (1'640'000–2'520'000) | (2'220'000–2'340'000) | (16'2–18'2) |
| Low-middle SDI    | 1'480'000       | 1'020'000 | 841'000         | 217 | 3'390'000       | 1'890'000       | 1'490'000       | 42'0             | 30'3            |
|                   | (883'000–1'170'000) | (768'000–985'000) | (768'000–985'000) | (19'7–24'0) | (1'340'000–3'630'000) | (1'640'000–2'150'000) | (1'260'000–1'750'000) | (37'8–46'7) |
| Middle SDI        | 777'000         | 479'000 | 368'000         | 10 | 1'730'000       | 912'000         | 686'000         | 18'9             | 27'3            |
|                   | (419'000–546'000) | (312'000–432'000) | (312'000–432'000) | (11'9–11'2) | (1'610'000–1'850'000) | (803'000–1'040'000) | (5'830'000–8'100'000) | (17'1–21'0) |
| High-middle SDI   | 199'000         | 104'000 | 78'000          | 5 | 427'000         | 197'000         | 150'000         | 9'36             | 612             |
|                   | (187'000–213'000) | (67'100–90900) | (67'100–90900) | (47'1–55'5) | (400'000–455'000) | (180'000–217'000) | (130'000–172'000) | (8'66–10'2) |
| High SDI          | 435'000         | 30'500 | 26'800          | 2 | 84'400         | 55'800          | 48'000          | 4'70             | 502             |
|                   | (416'100–45'300) | (29'300–37'100) | (29'300–37'100) | (25'2–27'0) | (54'200–57'600) | (44'500–53'200) | (44'500–53'200) | (45'6–48'6) |
|                   | **G6D super-regions** | | | | | | | | |
| Central Europe, eastern Europe, and central Asia | 57'800 | 39'400 | 30'800 | 5'88 | 127'000 | 77'900 | 61'100 | 11'5 | 9'34 |
|                   | (35'300–61'800) | (35'300–43'800) | (26'400–36'000) | (53'5–56'2) | (70'200–86'900) | (70'200–86'900) | (52'200–72'100) | (10'4–12'8) |
| Region          | 2000   | 2015   | 2019   | 2030*  | 2000   | 2015   | 2019   | 2030*  | 2019   | 2030*  |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| **Neonatal deaths** |        |        |        |        |        |        |        |        |        |        |
| Czech Republic  | 275    | 174    | 159    | 1.45   | 1.08   | 4.83   | 3.42   | 2.93   | 2.64   | 1.87   |
| Hungary         | 572    | 252    | 173    | 2.09   | 1.37   | 1.020  | 1.489  | 3.36   | 4.00   | 2.80   |
| Montenegro      | 77.4   | 181    | 15.1   | 2.29   | 1.60   | 1.16   | 2.98   | 24.9   | 3.74   | 2.58   |
| North           | 22.6   | 155    | 5.22   | 4.13   | 399    | 191    | 8.51   | 600    |
| Macedonia       | 203    | 24-170 | 99.9   | 4.70   | 4.69   | 366-434| 215.263| 155-290| 79.29-100|
| Poland          | 952    | 787    | 2.35   | 1.36   | 3.250  | 3.770  | 3.85   | 2.60   |
| Romania         | 290    | 884    | 690    | 3.98   | 3.17   | 5.130  | 1.790  | 24.9   | 8.03   | 5.89   |
| Serbia          | 865    | 269    | 196    | 2.45   | 1.47   | 1590   | 454    | 334    | 4.12   | 2.42   |
| Slovakia        | 236    | 174    | 141    | 2.52   | 1.85   | 533    | 364    | 301    | 5.83   | 2.32   |
| Slovenia        | 57.9   | 31.4   | 23.8   | 1.26   | 0.930  | 96.1   | 49.4   | 38.1   | 1.98   | 1.43   |
| Eastern Europe  | 18.000 | 1300   | 73.40  | 3.37   | 2.41   | 3.500  | 21.600 | 35.900 | 6.87   | 5.29   |
| Belarus         | 746    | 328    | 244    | 2.38   | 1.51   | 1.510  | 730    | 562    | 53.1   | 3.64   |
| Estonia         | 67.4   | 197    | 15.1   | 1.14   | 0.710  | 142    | 46.0   | 35.6   | 2.65   | 1.64   |
| Latvia          | 139    | 55.4   | 41.0   | 2.14   | 1.54   | 272    | 108    | 82.8   | 4.21   | 3.01   |
| Lithuania       | 156    | 70.8   | 48.6   | 1.80   | 1.20   | 369    | 155    | 110    | 4.01   | 2.83   |
| Moldova         | 734    | 374    | 278    | 8.64   | 6.69   | 12.40  | 5.26   | 39.9   | 12.2   | 8.96   |
| Russia          | 124000 | 7040   | 4990   | 3.00   | 2.19   | 24.500 | 15.200 | 11.000 | 6.53   | 5.04   |
| Ukraine         | 3760   | 2300   | 1720   | 4.45   | 3.45   | 6.440  | 4.770  | 3500   | 8.76   | 7.05   |
| **High income** | 476000 | 354000 | 312000 | 2.78   | 2.39   | 889000 | 635000 | 556000 | 495    | 4.14   |
| Australasia     | 1060   | 886    | 794    | 2.14   | 1.77   | 1980   | 351    | 1380   | 3.73   | 2.96   |
| Australia       | 863    | 710    | 647    | 2.08   | 1.68   | 1550   | 1220   | 1110   | 3.57   | 2.80   |
| New Zealand     | 199    | 175    | 147    | 2.46   | 2.21   | 431    | 313    | 270    | 4.53   | 3.80   |

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(Table continues on next page)
| Geographic Region | 2000  | 2015  | 2019  | 2020* | NMR   | Under-5 deaths | USMR   |
|-------------------|-------|-------|-------|-------|-------|----------------|--------|
| **Neonatal deaths** |       |       |       |       |       |                |        |
| High-income Asia | 3830  | 1730  | 1430  | 1041  | 810   | 9500           | 4440   |
| (Continued from previous page) |       |       |       |       |       |                |        |
| Pacific           | (3530–4140) | (1590–1870) | (1290–1590) | (990–1-08) | (9190–9820) | (4240–4659) | (3350–4000) |
| Brunei            | 364   | 347   | 319   | 485   | 443   | 708            | 668    |
| Japan             | 2100  | 964   | 782   | 870   | 640   | 5290           | 2740   |
| (1850–2370) | (880–1050) | (657–880) | (850–890) | (5190–5410) | (2650–2830) | (2060–2450) |
| Singapore         | 95.7  | 58.8  | 50.5  | 880   | 650   | 198            | 123    |
| South Korea       | 1600  | 673   | 567   | 137   | 115   | 3320           | 1390   |
| (495–774) | (468–658) | (123–1351) | (3660–4200) | (1370–1690) | (1100–1490) |
| High-income       | 9190  | 16800 | 15200 | 361   | 329   | 35400          | 25900  |
| North America     | (18700–21000) | (15800–17700) | (14000–16500) | (352–3-67) | (35200–35700) | (29000–29800) | (24600–28700) |
| Canada            | 1200  | 1220  | 1130  | 298   | 266   | 2040           | 2010   |
| (1120–1280) | (1140–1310) | (996–1250) | (863–10) | (2000–2090) | (1960–2060) | (1640–2010) |
| Greenland         | 9.98  | 4.92  | 4.10  | 5.14  | 3.78  | 18.8           | 9.09   |
| (8.56–11.5) | (3.88–6.22) | (2.66–6.22) | (3.74–6.97) | (15.9–22.0) | (7.09–11.6) | (4.97–11.4) |
| USA               | 18700 | 15500 | 14000 | 367   | 336   | 33400          | 27590  |
| (17500–18900) | (14600–16400) | (13000–15300) | (62.3–73) | (33000–33600) | (27200–27800) | (23000–26700) |
| Southern Latin America | 9300 | 6180 | 5240 | 538 | 430 | 17100 | 11100 |
| (9060–9520) | (5950–6420) | (4140–5640) | (508–572) | (1600–1700) | (10900–11300) | (7600–11600) |
| Argentina         | 4380  | 4210  | 389   | 467   | 3340  | 37100          | 7420   |
| (7150–7610) | (4590–5020) | (330–560) | (290–410) | (19300–21700) | (8580–8840) | (61100–6900) |
| Chile             | 3420  | 907   | 398   | 331   | 2840  | 1960           | 1560   |
| (1360–1500) | (1090–1180) | (686–1200) | (3.4–4–65) | (2750–2390) | (1880–2030) | (1200–2020) |
| Uruguay           | 493   | 240   | 211   | 454   | 337   | 884            | 439    |
| (442–546) | (207–276) | (154–286) | (2.9–4–59) | (818–955) | (395–486) | (289–516) |
| Western Europe    | 13500 | 9810  | 8550  | 200   | 161   | 24900          | 17000  |
| (13000–14000) | (9300–10300) | (7370–9960) | (1.9–2–10) | (24700–25200) | (16600–17300) | (12900–16800) |
| Andorra           | 1.11  | 0.585 | 0.516 | 0.820 | 0.540 | 2.59 | 1.30 |
| (0.900–1.35) | (0.469–0.729) | (0.384–0.674) | (0.690–0.988) | (2.663–3.15) | (1.086–1.62) | (0.783–1.14) |
| Austria           | 238   | 186   | 166   | 190   | 152   | 445            | 307    |
| (217–273) | (170–201) | (141–160) | (169–210) | (4270–4632) | (294–322) | (252–316) |
| Belgium           | 343   | 258   | 230   | 189   | 148   | 690            | 480    |
| (303–387) | (222–291) | (189–279) | (1.78–201) | (2666–715) | (457–502) | (354–505) |
| Cyprus            | 43.4  | 287   | 273   | 180   | 131   | 773            | 49.3   |
| (38.7–48.6) | (24–433) | (19–36–6) | (1.42–2.24) | (69–6–87) | (422–573) | (35–632) |
| Denmark           | 216   | 157   | 145   | 231   | 190   | 371            | 237    |
| (187–245) | (143–171) | (118–178) | (2.12–2.52) | (258–396) | (221–255) | (179–264) |
| Finland           | 136   | 65.4  | 84.9  | 138   | 860   | 244            | 125    |
| (124–148) | (59.4–71.9) | (49.3–70.5) | (1.08–1.29) | (230–258) | (17–134) | (94.0–139) |
| France            | 2515  | 1740  | 1480  | 905   | 726   | 4160           | 2170   |
| (1910–2270) | (1590–1900) | (1270–1720) | (1.95–2–16) | (4080–4250) | (3040–3190) | (2980–2960) |
| Germany           | 2110  | 1610  | 1440  | 195   | 164   | 4120           | 2730   |
| (1920–2280) | (1490–1730) | (1320–1580) | (1.88–203) | (4050–4190) | (2600–2790) | (2520–2670) |

(Table continues on next page)
| Country      | Neonatal deaths | NMR | Under-5 deaths | U5MR |
|-------------|-----------------|-----|----------------|------|
| | 2000 | 2015 | 2019 | 2030* | 2000 | 2015 | 2019 | 2030* |
| Greece      | 390 (261,418) | 242 (223,262) | 188 (152,233) | 1.7 (1.99-2.38) | 217 (167,671) | 154 (131,190) | 643 (8.48-13.8) | 339 (6.21-15.5) | 484 (160-248) |
| Iceland     | 9.77 | 6.69 | 6.28 | 1.45 | 1.20 | 139 | 10.9 | 9.95 |
| Ireland     | 221 (201,241) | 157 (141,175) | 124 (97.7-157) | 2.04 (1.88-2.21) | 1.60 (364-407) | 385 (234-274) | 253 (160-248) |
| Israel      | 483 | 369 | 331 | 1.72 | 1.27 | 920 | 285 |
| Italy       | 870 | 770 | 770 | 1.75 | 1.20 | 2930 (2930-3030) | 1670 (190-14-800) |
| Luxembourg  | 14 | 9.02 | 8.56 | 1.32 | 1.00 | 273 | 16.7 |
| Malta       | 19.7 | 187 | 163 | 3.80 | 3.08 | 311 | 27.7 |
| Monaco      | 0.477 | 0.297 | 0.287 | 1.02 | 0.830 | 1.26 | 0.808 | 0.727 |
| Netherlands | 777 | 425 | 345 | 1.37 | 1.94 | 1280 | 893-135 |
| Norway      | 155 | 801 | 132 | 1.01 | 1.10 | 294 | 166 |
| Portugal    | 405 | 178 | 129 | 1.61 | 1.08 | 841 | 313 |
| San Marino  | 0.977 | 0.655 | 0.606 | 1.95 | 1.57 | 1.83 | 1.2 |
| Spain       | 1090 | 760 | 603 | 1.63 | 1.20 | 2130 | 1400 |
| Sweden      | 193 | 165 | 165 | 1.41 | 1.12 | 357 | 357 |
| Switzerland | 269 | 263 | 227 | 2.57 | 2.26 | 457 | 375 |
| UK†         | 2510 | 2070 | 1920 | 2.45 | 2.09 | 4440 | 3470 |
| Latin America and Caribbean | 1810000 | 1120000 (948000-131000) | 939000 (749000-116000) | 956600 (8.28-11.1) | 770000 (369000-427000) | 397000 (2260000-231000) |
| Andean Latin America | 22700 | 14900 | 12600 | 9.42 | 7.58 | 56000 | 29600 |
| Bolivia     | 6710 | 5560 | 4840 | 14.8 | 12.2 | 18300 | 11400 |
| Ecuador     | 5400 | 3050 | 2720 | 7.74 | 6.22 | 31900 | 5980 |
| Peru        | 10600 | 6290 | 5010 | 7.61 | 5.92 | 264000 | 12200 |

(Table continues on next page)
| Country         | Neontal deaths | NMR | Under-5 deaths | U5MR |
|-----------------|----------------|-----|----------------|------|
| Caribbean       |                |     |                |      |
| Antigua and Barbuda | 13.4 (16-19.4) | 93 (14-16.6) | 35.3 (16-32.1) | 38.8 (28-45) |
| The Bahamas     | 38 (31-45.1)   | 281 (20-43.2) | 608 (150-300) | 7.6 (3-13.2) |
| Barbados        | 40.6 (33-54.8) | 270 (18-35.3) | 27.1 (2-32.2) | 4.6 (2.4-6) |
| Belize          | 87.6 (76-101)  | 72.9 (56-83.9) | 3.9 (2-7) | 12.4 (7-20) |
| Bermuda         | 1.43 (1.1-1.8) | 1.66 (1.1-2.2) | 2.9 (1.9-4.2) | 3.1 (2.4-4.4) |
| Cuba            | 608 (553-664)  | 236 (198-291) | 2.2 (1.8-2.9) | 10.2 (5.8-16.6) |
| Dominican       | 15.8 (12-19.4) | 146 (11-18.6) | 16.2 (13-19.3) | 19.0 (15-30) |
| Dominican Republic | 557 (460-6490) | 391 (2800-3530) | 1.9 (1.4-2.3) | 2.8 (2.6-3.6) |
| Grenada         | 19.8 (15-25.6) | 341 (20-48) | 3.5 (2.5-4.5) | 2.3 (1.9-2.7) |
| Guyana          | 418 (35-490)   | 217 (151-303) | 3.0 (2-6.9) | 3.0 (2-6.9) |
| Haiti           | 8840 (7890-9890) | 9810 (8020-12 900) | 24.0 (20-30.8) | 25.4 (20-30.8) |
| Jamaica         | 732 (57-913)   | 545 (407-670) | 2.6 (2.0-3.2) | 6.6 (5.6-7.6) |
| Puerto Rico     | 42 (39-467)    | 128 (94-171) | 5.0 (4.1-6.7) | 1.0 (0.7-1.3) |
| Saint Kitts and Nevis | 12.2 (10-14.5) | 8.4 (6.5-10.8) | 7.0 (5.5-9.1) | 12.7 (9.8-16.1) |
| Saint Lucia     | 38.1 (30-46.9) | 217 (12-9.2) | 10.6 (8.9-12.6) | 17.4 (14.0-21.2) |
| Saint Vincent and the Grenadines | 35.3 (29-41.9) | 181 (13-22.1) | 9.4 (8.2-10.6) | 18.4 (16.4-20.2) |
| Suriname        | 246 (210-287)  | 155 (129-215) | 16.8 (14.1-20.0) | 25.7 (21.6-30.3) |
| Trinidad and Tobago | 372 (274-393)  | 265 (130-218) | 10.1 (8.8-12.1) | 15.2 (12.7-18.3) |
| Virgin Islands  | 14.9 (12.1-17.2) | 7.08 (5.5-9.8) | 4.6 (3.9-6.4) | 3.6 (2.7-4.2) |
| Central Latin America | 70.00 (61.400-79.900) | 40600 (34.000-48.200) | 3.0 (2.0-4.0) | 3.0 (2.0-4.0) |
| Colombia        | 13.400 (11.300-15.700) | 6610 (5200-8340) | 6.6 (5.2-8.1) | 6.7 (5.7-7.8) |
| Costa Rica      | 553 (503-606)  | 412 (375-462) | 5.0 (4.3-5.4) | 7.9 (7.6-8.2) |

(Continued from previous page)
### Neonatal deaths and NMR Under-5 deaths

| Country        | 2000 | 2015 | 2019 | 2030* | 2000 | 2015 | 2019 | 2030* |
|----------------|------|------|------|-------|------|------|------|-------|
| El Salvador    | 1770 | 792  | 593  | 526   | 386  | 4290 | 1680 | 1240  |
| Guatemala      | 7130 | 3830 | 3440 | 835   | 622  | 18100| 10400| 8870  |
| Honduras       | 3300 | 2590 | 2180 | 936   | 753  | 6880 | 4500 | 3970  |
| Mexico         | 3530 | 1200 | 1570 | 744   | 612  | 6980 | 37000| 30900 |
| Nicaragua      | 1580 | 660  | 400  | 484   | 400  | 1200 | 1120 | 8870  |
| Panama         | 630  | 539  | 490  | 642   | 498  | 1430 | 1100 | 8400  |
| Venezuela      | 590  | 560  | 420  | 883   | 764  | 11700| 9770 | 7220  |
| Tropical Latin America | 70000 | 29600 | 23000 | 53000 | 23000 | 17000 | 16600 | 128000 |
| Brazil         | 7800 | 4500 | 3610 | 45000 | 35000 | 19600 | 77700 | 62800 |
| Paraguay       | 1900 | 893  | 333  | 453   | 586  | 2500 | 1370 | 1200  |
| North Africa and Middle East | 298000 | 182000 | 152000 | 122000 | 11333 | 9822 | 682000 | 582000 |
| Afghanistan    | 3890 | 3490 | 3740 | 250   | 195  | 1200 | 83800 | 81400 |
| Algeria        | 1560 | 1360 | 1070 | 120   | 104  | 29400 | 22200 | 17300 |
| Bahain         | 645  | 479  | 307  | 326   | 157  | 158  | 126  | 873   |
| Egypt          | 4050 | 1540 | 1180 | 555   | 311  | 84400 | 72600 | 47400 |
| Iran           | 3370 | 1800 | 9140 | 627   | 519  | 60800 | 29300 | 15200 |
| Iraq           | 22300 | 3050 | 12300 | 19400 | 39900 | 20700 | 17200 | 15000 |
| Jordan         | 2160 | 2070 | 2130 | 850   | 672  | 3650 | 3540 | 3640  |
| Kuwait         | 262  | 369  | 310  | 509   | 446  | 5000 | 6590 | 5550  |
| Lebanon        | 1050 | 684  | 521  | 482   | 365  | 1920 | 980  | 989   |
| Libya          | 1650 | 560  | 458  | 562   | 443  | 3240 | 1470 | 1110  |
| Monaco         | 2200 | 9820 | 6760 | 111   | 792  | 40800 | 16200 | 11100 |
| Oman           | 478  | 504  | 418  | 538   | 425  | 926  | 958  | 809   |

*(Table continues on next page)*
| Country          | 2000   | 2015   | 2019   | 2019*   | 2020*   |
|------------------|--------|--------|--------|--------|--------|
| Articles         | 146    | 43     | 652    | 39     | 75     |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |
|                  | (5910–9040) | (5970–9450) | (5970–9450) | (5970–9450) | (5970–9450) |

(Table continues on next page)
| Country                  | 2000  | 2015  | 2019  | 2030* | 2000  | 2015  | 2019  | 2030* |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Marshall Islands         | 24.5  | 5.05  | 10.5  | 35.6  | 28.4  | 42.2  | 6.85  | 281.7 |
| Federated States of Micronesia | 34.0| 5.05  | 10.5  | 35.6  | 28.4  | 42.2  | 6.85  | 281.7 |
| Fiji                     | 217   | 198   | 177   | 10.0  | 8.70  | 471   | 432   | 387   |
| Guam                     | 20.2  | 24.6  | 23.6  | 7.18  | 7.31  | 413   | 460   | 439   |
| Kiribati                 | 54.1  | 48.5  | 44.5  | 14.6  | 12.0  | 157   | 116   | 101   |
| Marshall Islands         | 24.5  | 5.05  | 10.5  | 35.6  | 28.4  | 42.2  | 6.85  | 281.7 |
| Nauru                    | 5.85  | 3.71  | 3.04  | 10.1  | 8.58  | 177   | 8.94  | 703   |
| Niue                     | 0.415 | 0.224 | 0.205 | 8.12  | 6.92  | 101   | 0.520 | 0.472 |
| Northern Mariana Islands | 9.67  | 2.73  | 2.22  | 4.40  | 3.89  | 175   | 600   | 469   |
| Palau                    | 3.22  | 1.52  | 1.35  | 6.04  | 5.15  | 7.78  | 3.72  | 2.77  |
| Papua New Guinea         | 46.90 | 62.80 | 65.80 | 19.6  | 16.8  | 14,400| 17,600| 17,600|
| Samoa                    | 30.9  | 24.0  | 22.3  | 6.24  | 5.35  | 51.1  | 49.9  | 46.4 |
| Solomon Islands          | 325   | 272   | 245   | 11.5  | 9.36  | 767   | 593   | 519   |
| Tokelau                  | 0.406 | 0.139 | 0.119 | 3.19  | 2.71  | 0.961 | 0.338 | 0.286 |
| Tonga                    | 26.9  | 17.5  | 14.5  | 6.36  | 5.37  | 56.4  | 37.2  | 22.5 |
| Tuvalu                   | 4.62  | 1.70  | 1.42  | 6.60  | 5.65  | 30.6  | 35.0  | 29.2 |
| Vanuatu                  | 99.6  | 93.4  | 88.3  | 11.6  | 7.23  | 263   | 30.0  | 185   |
| Indonesia                | 115.0 | 66.90 | 52.40 | 13.7  | 10.5  | 260.0 | 129.0 | 98.9  |
| Laos                     | 730.8 | 396.0 | 347.0 | 19.9  | 12.8  | 216.0 | 8.80  | 70.0  |
| Malaysia                 | 2.460 | 2.340 | 1930  | 3.55  | 2.82  | 4840  | 4270  | 3410  |
| Maldives                 | 134   | 99.9  | 81.9  | 9.58  | 8.08  | 241   | 169   | 140   |

(Table continues on next page)
| Country            | 2000   | 2015   | 2019   | 2013*  | 2013   | 2019   | 2013*  |
|-------------------|--------|--------|--------|--------|--------|--------|--------|
| Mauritius         | 228    | 120    | 304    | 8.07   | 6.79   | 349    | 192    |
| Myanmar           | 4830   | 26600  | 222000 | 21.6   | 16.2   | 135000 | 55000  |
| Philippines       | 37800  | 31200  | 274000 | 10.2   | 8.59   | 87100  | 69000  |
| Seychelles        | 12.6   | 12.7   | 10.7   | 7.15   | 6.12   | 20.6   | 20.3   |
| Sri Lanka         | 3300   | 1750   | 1300   | 4.37   | 3.16   | 5880   | 3060   |
| Thailand          | 7780   | 2790   | 2120   | 3.68   | 2.39   | 16100  | 6030   |
| Timor-Leste       | 966    | 622    | 602    | 15.5   | 12.4   | 3150   | 1340   |
| Vietnam           | 2270   | 12300  | 9700   | 6.83   | 5.21   | 43300  | 27600  |
| Sub-Saharan Africa| 112000 | 109000 | 102000 | 27.9   | 23.6   | 402000 | 307000 |
| Central sub       |        |        |        |        |        |        |        |
| Saharan Africa    |        |        |        |        |        |        |        |
| Angola            | 28700  | 26200  | 24000  | 217    | 16.9   | 11600  | 7300   |
| Central African   | 770    | 8600   | 7770   | 39.3   | 35.4   | 28300  | 26900  |
| Congo             | 3400   | 3240   | 2680   | 18.4   | 15.3   | 12100  | 7540   |
| Equatorial        | 1090   | 795    | 683    | 37.7   | 14.4   | 3710   | 1890   |
| Guinea            | 886    | 1300   | 1060   | (429-952) | 14.8   | 3140   | 1890   |
| Gabon             | 1140   | 795    | 680    | 15.8   | 13.5   | 2940   | 1660   |
| Eastern sub       | 424000 | 378000 | 353000 | 24.9   | 20.6   | 145000 | 94000  |
| Saharan Africa    | 392000 | 457000 | 448000 | (286000-439000) | 21.6   | 19.3   | 343000 |
| Burundi           | 10700  | 11100  | 11700  | 24.0   | 19.3   | 43300  | 32100  |
| Comoros           | 934    | 553    | 469    | 27.3   | 22.0   | 2140   | 1050   |
| Djibouti          | 864    | 863    | 790    | 21.2   | 17.2   | 2620   | 2080   |
| Eritrea           | 4530   | 4220   | 3870   | 19.3   | 15.7   | 16900  | 11300  |
| Ethiopia          | 144000 | 110000 | 97900  | 26.6   | 21.5   | 42600  | 29900  |

(Continued from previous page)

| Country            | 2000   | 2015   | 2019   | 2013*  | 2013   | 2019   | 2013*  |
|-------------------|--------|--------|--------|--------|--------|--------|--------|
| Central sub       |        |        |        |        |        |        |        |
| Saharan Africa    |        |        |        |        |        |        |        |
| DR Congo          | 81900  | 74700  | 64700  | 22.0   | 17.6   | 34600  | 222000 |
| Equatorial        | 1090   | 795    | 683    | 37.7   | 14.4   | 3410   | 1890   |
| Guinea            | 886    | 1300   | 1060   | (429-952) | 14.8   | 3140   | 1890   |
| Gabon             | 1140   | 795    | 680    | 15.8   | 13.5   | 2940   | 1660   |
| Eastern sub       | 424000 | 378000 | 353000 | 24.9   | 20.6   | 145000 | 94000  |
| Saharan Africa    | 392000 | 457000 | 448000 | (286000-439000) | 21.6   | 19.3   | 343000 |
| Burundi           | 10700  | 11100  | 11700  | 24.0   | 19.3   | 43300  | 32100  |
| Comoros           | 934    | 553    | 469    | 27.3   | 22.0   | 2140   | 1050   |
| Djibouti          | 864    | 863    | 790    | 21.2   | 17.2   | 2620   | 2080   |
| Eritrea           | 4530   | 4220   | 3870   | 19.3   | 15.7   | 16900  | 11300  |
| Ethiopia          | 144000 | 110000 | 97900  | 26.6   | 21.5   | 42600  | 29900  |

(Continued on next page)
| Country            | Neonatal deaths 2000 | Neonatal deaths 2015 | Neonatal deaths 2019 | Under-5 deaths 2000 | Under-5 deaths 2015 | Under-5 deaths 2019 | Under-5 deaths 2030* | Under-5 deaths 2030* | NMR 2000 | NMR 2015 | NMR 2019 | NMR 2030* | USMR 2000 | USMR 2015 | USMR 2019 | USMR 2030* |
|--------------------|-----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Kenya              | 32000                 | 29200                | 26400                | 19.7                | 16.3                | 99300               | 64500                | 54100                | 40.6             | 39.8            | 37.5           | 33.6           | 488             | 431             | 413             | 366             |
| Madagascar         | 21400                 | 21100                | 19800                | 23.0                | 18.7                | 70600               | 55100                | 48200                | 566             | 533            | 46.3           | 41.8           | 548             | 512             | 480             | 444             |
| Malawi             | 19500                 | 14700                | 13700                | 25.0                | 19.6                | 80000               | 38600                | 31800                | 591             | 575            | 51.2           | 47.4           | 655             | 621             | 599             | 571             |
| Mozambique         | 34600                 | 30400                | 29000                | 25.8                | 20.2                | 130000              | 88900                | 76500                | 69.4             | 67.8           | 60.5           | 57.1           | 800             | 751             | 736             | 711             |
| Rwanda             | 11100                 | 7490                 | 7030                 | 19.9                | 15.1                | 47000               | 18800                | 16300                | 466             | 433            | 40.0           | 37.3           | 520             | 490             | 461             | 438             |
| Somalia            | 20800                 | 25800                | 27000                | 30.9                | 25.2                | 77700               | 81300                | 80600                | 95.4             | 92.2           | 89.8           | 87.9           | 1073            | 1037            | 1006            | 976             |
| South Sudan        | 13100                 | 13100                | 12000                | 33.0                | 29.7                | 47100               | 41400                | 33100                | 92.6             | 90.1           | 88.3           | 86.7           | 1151            | 1114            | 1079            | 1048            |
| Tanzania           | 52100                 | 52300                | 50000                | 23.9                | 20.0                | 186000              | 133000               | 118000               | 57.1             | 55.3           | 53.5           | 51.8           | 677             | 645             | 623             | 600             |
| Uganda             | 42600                 | 43000                | 40800                | 25.6                | 21.9                | 163000              | 107000               | 91700                | 584              | 564            | 55.8           | 54.3           | 734             | 706             | 677             | 652             |
| Zambia             | 14600                 | 13800                | 13300                | 21.1                | 17.4                | 63200               | 36000                | 31500                | 53.8             | 52.2           | 51.0           | 49.7           | 643             | 617             | 593             | 576             |
| Southern sub-Saharan Africa | 45700    | 41000                | 35900                | 21.4                | 19.9                | 128000              | 83800                | 70700                | 42.0             | 40.6           | 39.4           | 38.4           | 500             | 476             | 456             | 440             |
| Botswana           | 1200                 | 1070                 | 1000                 | 20.7                | 18.8                | 33600               | 21900                | 2000                 | 41.3             | 39.6           | 38.0           | 36.6           | 500             | 465             | 433             | 409             |
| Eswatini           | 746                  | 557                  | 506                  | 16.9                | 14.8                | 3160               | 1680                 | 1400                 | 47.3             | 45.4           | 44.0           | 42.7           | 593             | 558             | 530             | 510             |
| Lesotho            | 2330                 | 1540                 | 1350                 | 28.6                | 24.7                | 53800               | 35700                | 3050                 | 644              | 631            | 618            | 605            | 822             | 785             | 750             | 732             |
| Namibia            | 1250                 | 1100                 | 1020                 | 16.2                | 14.3                | 36100               | 24800                | 2200                 | 35.0             | 34.1           | 33.3           | 32.7           | 454             | 431             | 411             | 395             |
| South Africa       | 30300                | 25300                | 21400                | 20.7                | 18.5                | 80600               | 47100                | 38500                | 369              | 354            | 344            | 335            | 463             | 436             | 412             | 397             |
| Zimbabwe           | 9850                 | 11400                | 10500                | 23.4                | 22.1                | 31600               | 26600                | 23600                | 52.4             | 51.4           | 50.6           | 49.8           | 650             | 620             | 595             | 575             |
| Western sub-Saharan Africa | 522000  | 557000               | 525000               | 32.5                | 27.8                | 193000              | 172000               | 153000               | 95.9             | 93.0           | 90.7           | 89.1           | 117            | 110             | 104             | 101             |
| Benin              | 12300                | 15600                | 15400                | 39.5                | 36.8                | 40000               | 45700                | 42000                | 85.0             | 81.8           | 79.4           | 77.2           | 1036            | 993             | 957             | 926             |
| Burkina Faso       | 21500                | 26000                | 26900                | 28.6                | 24.0                | 99300               | 100000               | 98800                | 109              | 107            | 105            | 104            | 1418            | 1355            | 1303            | 1262            |
| Cameroon           | 20900                | 23400                | 21700                | 24.2                | 18.6                | 80000               | 75400                | 64000                | 71.7             | 70.1           | 68.7           | 67.3           | 950             | 917             | 886             | 860             |

(Continued from previous page)
### Table: Neonatal and under-5 deaths in 2000, 2015, and 2019, by country, GBD region, GBD super-region, and SDI, and at the global level for both sexes combined; and neonatal mortality rate in 2019 with reference scenario for 2030

| Country          | 2000   | 2015   | 2019   | 2030* | 2000   | 2015   | 2019   | 2019   | 2030* |
|------------------|--------|--------|--------|-------|--------|--------|--------|--------|-------|
|                  | Neatnat deaths | NMR    | Under-5 deaths | USMR   |        |        |        |        |       |
|                  | 2000 | 2015 | 2019 | 2030* | 2000 | 2015 | 2019 | 2019 | 2030* |
| Cape Verde       | 226  | 125   | 103   | 9.46  | 7.65  | 647   | 246   | 187   | 17.0  | 11.6 |
| Chad             | 180  | 2360  | 2540  | 3.22  | 2.69  | 7660  | 8460  | 8560  | 113   | 83.2 |
| Côte d’Ivoire    | 35300| 34500 | 30400 | 34.2  | 28.3  | 10100 | 7890  | 6480  | 73.3  | 48.2 |
| The Gambia       | 2020 | 1610  | 140   | 19.4  | 14.7  | 5460  | 3330  | 2710  | 37.8  | 23.2 |
| Ghana            | 24100| 21600 | 19800 | 231   | 19.5  | 66800 | 52900 | 44300 | 52.2  | 40.5 |
| Guinea           | 17600| 15100 | 14600 | 30.6  | 23.4  | 61800 | 51300 | 45400 | 97.1  | 67.1 |
| Guinea-Bissau    | 2700 | 2210  | 1980  | 31.5  | 24.3  | 86300 | 5280  | 44300 | 71.2  | 45.6 |
| Liberia          | 53100| 3660  | 3220  | 23.6  | 18.3  | 21000 | 10800 | 8280  | 60.9  | 37.8 |
| Mali             | 29400| 36400 | 38600 | 38.5  | 32.0  | 104000| 111000| 110000| 118   | 86.2 |
| Mauritania       | 8100 | 3100  | 2610  | 23.9  | 18.9  | 9290  | 5860  | 4660  | 42.8  | 29.2 |
| Niger            | 26200| 28300 | 30600 | 26.8  | 21.1  | 138000| 121000| 110000| 111   | 71.1 |
| Nigeria          | 27100| 29400 | 27700 | 36.4  | 32.0  | 101000| 88600 | 77300 | 104   | 78.0 |
| São Tomé and Príncipe | 108   | 71.9  | 66.8  | 12.1  | 9.77  | 386   | 160   | 119   | 25.4  | 17.4 |
| Senegal          | 13900| 12900 | 11700 | 25.0  | 20.1  | 43800 | 27100 | 22800 | 49.3  | 32.6 |
| Sierra Leone     | 1000 | 870   | 8030  | 28.6  | 20.8  | 391000| 279000| 283000| 102   | 67.7 |
| Togo             | 720  | 6720  | 5930  | 24.9  | 19.0  | 73700 | 18500 | 15000 | 62.2  | 41.8 |

Count data are given to three significant figures. Data in parentheses are 95% uncertainty intervals. NMR=neonatal mortality rate. USMR=under-5 mortality rate. SDI=Socio-demographic Index. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study. *Reference scenario. †Subnational analyses are done in these countries and data is available in the appendix (p 109).
to 6·10 million (5·35–6·91) in 2015, and to 5·05 million (4·27–6·02) in 2019 (table). Of these deaths, 3.76 million (95% UI 3·53–4·02; 39%) in 2000, 2·82 million (2·48–3·20; 46%) in 2015, and 2·42 million (2·06–2·86; 48%) in 2019 occurred in neonates (aged <28 days). In each year analysed, the largest share of the global deaths of children younger than 5 years occurred in the sub-Saharan Africa and south Asia super-regions. Although U5MR declined in each successive period in all super-regions, the proportion of global deaths in children younger than 5 years in these two super-regions increased from 73% (7·07 million deaths [95% UI 6·57–7·59]) in 2000 to 80% (4·04 million [3·64–4·86]) deaths in 2019. The share of under-5 deaths also shifted towards lower SDI groups in this period, with the proportion of under-5 deaths in the low SDI quintile increasing from 42% (4·01 million deaths [95% UI 3·78–4·26]) in 2000 to 53% (2·67 million deaths [2·22–3·24]) in 2019.

Global U5MR and NMR both are falling short of SDG targets. Global U5MR declined from 71·2 (95% UI 68·3–74·0) in 1990 to 37·1 (95% UI 33·2–41·7) deaths per 1000 livebirths in 2019, with corresponding changes in NMR from 28·0 (95% UI 26·8–29·5) in 1990 to 17·9 (16·3–19·8) deaths per 1000 livebirths (table). The countries with the highest U5MR in 2019 were Central African Republic, Mali, and Chad, whereas Andorra, Singapore, and Slovenia were found to have the lowest U5MR. As for 2019 neonatal mortality, the highest rate was observed in Pakistan, followed by Mali and Central African Republic. The countries with the lowest 2019 NMR were Andorra, Japan, and Singapore. U5MR and NMR declined in every country between 2000 and 2019, apart from Dominica, Guam, and Northern Mariana Islands (appendix p 311).

We found evidence of accelerated reduction in global USMR, but the largest number of deaths, as well as the slowest progress, occurred in the early neonatal age group (figure 1A, B). In all SDI quintiles, decline in NMR lagged behind mortality declines in other age groups (figure 1C, D). There is evidence of relative progress in neonatal mortality in the time period between 2015 and 2019, compared with between 2000 and 2015, but early neonatal progress in this more recent time period is still slower than overall under-5 progress in low SDI settings (figure 1D). The proportion of neonatal death broadly increases as SDI increases: in 2019, in the low SDI quintile, 1·11 million (41%) of 2·67 million deaths in children younger than 5 years were neonatal deaths, and in the high SDI quintile 26 800 (55%) of 48 600 deaths in children younger than 5 years were neonatal deaths (appendix p 120).

In 2015, 128 (63%) of 204 countries already had an USMR below the SDG 3·2 threshold of 12 neonatal deaths per 1000 livebirths (figure 2A). By 2019, eight additional countries—Syria, Uzbekistan, Guatemala, Philippines, Guyana, Nauru, Vanuatu, and Solomon Islands—had a USMR below this threshold, making a total of 136 (67%; table). In 2015, 126 (62%) of 204 countries had an NMR below the SDG 3.2 threshold of 12 neonatal deaths per 1000 livebirths (figure 2B). By 2019, an additional seven countries—Syria, Iraq, Kyrgyzstan, Uzbekistan, Morocco, Solomon Islands, and Vanuatu—had achieved an NMR below this threshold, making a total of 133 (65%).

Under-5 mortality in each analysed year was somewhat higher in males than in females, although this difference was not statistically significant at the global level (appendix p 99). USMR declined in both males and females in the periods between 2000 and 2015, and between 2015 and 2019 (appendix p 99). The 2019 male-to-female ratio of USMR does not change meaningfully with SDI; this ratio ranges from 1·08 in low-middle SDI to 1·18 in high SDI in 2019 (appendix p 99).

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Figure 2: Map of individual countries’ progress toward achieving the Sustainable Development Goals 3.2 target of (A) reducing neonatal mortality rate to the threshold of 12 neonatal deaths per 1000 livebirths, and reducing under-5 mortality rate to the threshold of 25 under-5 deaths per 1000 livebirths (B), under the reference scenario.
Levels and trends in cause-specific mortality

The leading level 3 causes of global under-5 mortality in 2019 were neonatal disorders, which accounted for 37.3% (95% UI 35.6–38.8) of deaths in children younger than 5 years, followed by lower respiratory infections (13.3% [12.1–14.4]), diarrhoeal diseases (9.9% [8.3–11.6]), congenital birth defects (9.4% [8.0–11.8]), and malaria (7.1% [3.5–12.0]; figure 3; appendix p 100). Leading subcauses of neonatal disorders and congenital birth defects and leading global aetiologies of lower respiratory infections and diarrhoeal disease can be found in the appendix (pp 106, 121).

Of the 15 level 3 causes that accounted for more than 30,000 global under-5 deaths in 2019, the greatest reduction in deaths between 2000 and 2015 was observed in measles, which saw a –9.2% (95% UI –10.4 to –8.0) mean annual percentage change (appendix p 129). Measles was followed by protein-energy malnutrition (–6.5% [–8.2 to –4.7]) and HIV/AIDS (–6.0% [–6.9 to –5.0]). Among these same 15 high-mortality causes, and for the period 2015–19, the three with the greatest reduction in deaths were measles (–11.3% [95% UI –13.7 to –9.0]), HIV/AIDS (–10.2% [–12.3 to –7.8]), and tuberculosis (–7.8 [–9.9 to –5.6]). In 2019, causes of death varied by age, sex, and SDI (figure 3; appendix p 100). The most common level 3 causes of death in children younger than 5 years were congenital birth defects, lower respiratory infections, and diarrhoeal disorders in the high SDI quintile, and neonatal disorders, congenital birth defects, and sudden infant death syndrome in the low SDI quintile (appendix p 100). The level 3 causes with the largest male-to-female ratio of mortality in the under-5 age group at the global level in 2019 were vascular intestinal disorders (5.99) and inguinal, femoral, and abdominal hernia (2.90), and those with the lowest ratio were gallbladder and biliary diseases (0.29) and pancreatitis (0.29; appendix p 100).

Scenarios for 2030 and beyond

In our reference scenario, by 2030, 154 (75%) of 204 countries are projected to have a U5MR lower than the SDG threshold of 25 under-5 deaths per 1000 livebirths, and 139 (68%) are expected to have an NMR lower than the SDG threshold of 12 neonatal deaths per 1000 livebirths (figure 2, appendix p 93).
scenario, 164 (80%) countries would reach the SDG U5MR target, and 145 (71%) countries would reach the SDG NMR target (appendix p 93). In the neonatal scenario, 155 (76%) countries would meet the U5MR target, and in the child scenario, 158 (77%) countries would meet the U5MR target. In the counterfactual scenario without the COVID-19 pandemic, our results suggest 154 (75%) countries would have a U5MR below the SDG threshold and 140 (69%) countries would have an NMR below the SDG threshold by 2030.

**Global optimum and survival potential frontier**

There were an estimated 9.45 million (95% UI 8.86–10.05) under-5 deaths more than the global optimum in 2000 and 4.85 million (4.09–5.80) more than the global optimum in 2019 (appendix p 130). These deaths represent 98% of all 9.65 million under-5 deaths in 2000 and 96% of all 5.05 million under-5 deaths in 2019. In 2019, only 198 000 (95% UI 169 000–224 000) under-5 deaths worldwide were below the global optimum, and of these 108 000 (93 000–122 000; 55%) were neonatal deaths. Based on this analysis, and on current technology and health delivery systems, the global optimum NMR is 0.80 (95% UI 0.71–0.86) and the global optimum U5MR is 1.44 (95% UI 1.27–1.58). Sex differences in mortality are similar below the global optimum as compared to overall mortality, with an NMR male-to-female ratio of 1.05 (95% UI 1.00–1.09) and a U5MR male-to-female ratio of 1.12 (95% UI 1.05–1.18).

16 causes of death have a global optimum of zero deaths and are therefore classified as 100% preventable by this framework. With the exceptions of forces of nature and conflict and terrorism, all of these preventable deaths are infectious conditions. If all countries reduced mortality to the global optimum, the leading level 3 global under-5 causes of death would be neonatal disorders; congenital birth defects; lower respiratory infections; sudden infant death syndrome; and endocrine, metabolic, blood, and immune disorders.

When looking at mortality along the spectrum of HAQ Index, our analysis suggests that in 2000, as many as 1.50 million (95% UI 1.31–1.72) neonatal deaths were above the survival potential frontier, accounting for 40% (95% UI 37–43) of 3.76 million neonatal deaths. In the same year, analysis suggests that 3.94 million (95% UI 3.49–4.40) under-5 deaths were above the survival potential frontier: 41% (95% UI 39–43) of 9.65 million under-5 deaths). In 2019, the number of deaths occurring...
above the survival potential frontier was smaller, but the fraction of the overall mortality above the survival potential frontier remained similar: 0·88 million (95% UI 0·62–1·20; 36% [95% UI 0·30–0·42]) of 2·42 million neonatal deaths and 1·87 million (1·35–2·58; 37% [32–43]) of 5·05 million under-5 deaths (figure 4). If all 204 countries were to improve performance to meet the survival potential frontier without changing their HAQ Index level from 2019, 143 (70%) would have mortality below the NMR SDG threshold and 149 (73%) would have mortality below the USMR SDG threshold, and 43 (70%) out of 61 countries not achieving both SDG targets would be from the sub-Saharan Africa super-region. The countries where USMR lags the most relative to HAQ Index in 2019 are Nigeria, Turkey, and Maldives. The countries where NMR lags the most relative to HAQ Index in 2019 are Maldives, Turkey, and Azerbaijan. The countries with the most success at preventing under-5 mortality and neonatal mortality relative to their HAQ Index are Cook Islands, United Arab Emirates, and Tokelau (figure 4).

Global under-5 mortality above the survival potential frontier in 2019 consisted of 1·56 million (95% UI 1·11–2·17; 83%) deaths due to communicable, maternal, neonatal, and nutritional (CMNN) diseases, 0·23 million (0·15–0·33; 12%) deaths due to non-communicable diseases, and 0·08 million (0·06–0·11; 5%) deaths due to injuries (appendix p 130). If all regions had mortality rates at their survival potential frontier levels in 2019, the distribution of under-5 deaths would skew slightly towards non-communicable diseases but would not fundamentally change; 2·58 million (95% UI 2·35–2·81; 81%) deaths would be due to CMNN diseases, 0·46 million (0·40–0·52; 15%) deaths would be due to non-communicable diseases, and 0·13 million (0·11–0·15; 4%) deaths would be due to injuries (appendix p 130). Of the 48 level 3 causes that were accountable for more than 5000 global under-5 deaths in 2019, those with the lowest proportion of cause-specific deaths above the survival potential frontier were sudden infant death syndrome (27% [95% UI 0·15–0·43] of SIDS deaths above the survival potential frontier), other malignant neoplasms (28% [21–36]), varicella and herpes zoster (29% [23–36]), and congenital birth defects (30% [23–37]; appendix p 94). Of the same 48 causes, those with the highest proportion of cause-specific deaths above the survival potential frontier were invasive non-typhoidal salmonella, other neglected tropical diseases, haemoglobinopathies and haemolytic anaemias, and malaria, all with over 50% above the survival potential frontier. The leading causes of death overall were also those with the highest above-survival potential frontier mortality rates, and the rank order would remain similar even if all regions had cause-specific mortality rates at their survival potential frontier levels in 2019: 33% of each of neonatal disorders and lower respiratory infections deaths were above the survival frontier (neonatal disorders ranked first and lower respiratory infections ranked second in both observed and expected), while 40% of diarrhoea deaths were above the frontier (ranked third in observed and fourth in expected; appendix p 94).

**Discussion**

**Main findings**

 Declines of U5MR and NMR have continued to accelerate worldwide. Of 204 countries, our reference scenario suggests that, by 2030, 154 (75%) are likely to meet the USMR SDG target and 139 (68%) the NMR SDG target. However, the concomitant findings of growing relative inequity and a large remaining proportion of preventable deaths shows there is much more work to be done. If every country were at the global optimum in 2019, global USMR would have been 1·44 (95% UI 1·27–1·58) deaths per 1000 livebirths and NMR would have been 0·80 (95% UI 0·71–0·86) deaths per 1000 livebirths.

Thankfully, although children have been found to be at risk of developing multisystem inflammatory syndrome as result of COVID-19, they appear to be less at risk of severe illness and death. It is important to reiterate, however, how the complex, multisector determinants of health that substantially affect child survival could be negatively affected by COVID-19, an understanding that is likely to continue to evolve in the coming months and years. Risks include, but are not limited to, the potential disruption of routine perinatal and clinical care for children, worsened in-facility outcomes due to overburdened medical systems, loss of caretakers from the pandemic impacting child health and wellbeing, suspended vaccination campaigns, financial and economic pressures leading to food insecurity and malnutrition, disruption of supply chains leading to decreased availability of highly active antiretroviral therapy medications for HIV/AIDS, interrupted prevention of mother-to-child transmission programmes, decreased malaria prevention and treatment, and disruption of domestic economies and education systems. Mitigating these risks will require even more focus and attention on an equilibrium strategy for neonatal and child health.

Our analysis suggests the need for a five-pronged strategy to optimise child survival in the SDG era that augments community-based strategies and efforts to address social determinants of health (eg, education, family planning, financial security) that proved effective during the MDG era. The central theme is that, to achieve SDG targets by 2030, investments should strive for equilibrium and overall system strengthening, with a particular focus on inequality, rather than simply shifting attention to individual priorities.

**Comprehensive neonatal care**

Neonatal deaths comprise an increasing share of global under-5 deaths, indicating a generalised need to improve...
neonatal programmes along the entire SDI spectrum. Although not explicitly stated in SDG targets or in our analysis, reductions in stillbirths should also be targeted through comprehensive maternal and neonatal care. Reducing early neonatal mortality, and stillbirth mortality, should start with expansion of community and facility-based strategies targeted towards pregnancy, labour, delivery, and the postnatal period. Nepal is an example of a country that explicitly prioritised the neonatal period and integrated community and facility-based approaches, leading to accelerated improvements in neonatal and under-5 mortality. The first step is encouraging and supporting facility-based delivery by skilled providers with the training and resources available to perform resuscitative efforts for women and neonates when needed. Basic activities include skin-to-skin contact, timely breathing assistance for intrapartum asphyxia, chlorhexidine umbilical cord cleansing for sepsis prevention, and early screening for congenital birth defects. Improvements also need to be made to neonatal care after delivery. Advancements are needed for in-hospital activities such as intensive care for prematurity, advanced resuscitation for intrapartum asphyxia, full support for sepsis beyond antibiotics, breastfeeding education and support, and surgical care for neonatal emergencies and birth defects that have been shown to be associated with improved neonatal survival. Postnatal check-ups are also required for prompt diagnosis and treatment of new illnesses that can be life-threatening in young neonates. Crosscutting, longitudinal neonatal care is not possible without augmenting hospital infrastructure, supply chains, and qualified health-care workers, and must be accounted for in national health plans.

Optimising health systems to scale up interventions

Providing technology and supplies alone, without coordinated investment in the strengthening of health systems, will be insufficient for achieving the SDG targets. Moving beyond survival is the cornerstone of the SDGs, which requires enabling environments, as outlined in the UN Global Strategy for Women’s, Children’s and Adolescents’ Health 2016–30 agenda. Per our analysis, more than 90% of countries have the potential to achieve the SDG targets by optimising their current health systems. Efforts to counter shortages and retain skilled health-care workers, reinforce facility infrastructure and supplies including oxygen, develop and strengthen referral networks, and expand integrated services are needed to achieve access and quality of care for improving survival rates for children younger than 5 years, particularly around the time of birth. Liberia is an example of a country that has made important progress in health system strengthening. Despite the odds of civil war and the Ebola virus epidemic, Liberia heavily invested in paying and supervising community health workers, providing medical supply chains to remote areas, and creating a health information system, leading to better survival.

Continued investment and scale-up of community-based initiatives

Community-based strategies such as primary health-care promotion and integrated management of childhood illness are an important pillar of prevention. Successful community activities include vaccination campaigns, insecticide-treated bednets for malaria, and mother-to-child HIV/AIDS transmission prevention. Further efforts are required, however, to increase uptake and coverage of additional community-based activities such as ensuring optimal maternal nutrition and iron and folic acid supplementation (to target low birthweight and neural tube defects), reducing household air pollution and second-hand smoke, *Haemophilus influenzae* type B and pneumococcal vaccination, and access to antibiotics for lower respiratory infections. Similarly, treatment campaigns for diarrhoea such as oral rehydration solution, zinc, and rotavirus vaccines have been successful, but must be accompanied by reductions in malnutrition and improvements in clean water and sanitation to achieve more than 90% reduction in rates of diarrhoea from the 2015 levels.

Targeting inequity across and within countries

Relative inequity has grown over the 29 years since the first GBD study, with the 51 countries in the Countdown to 2030 initiative in sub-Saharan Africa and south Asia now accounting for 80% of all child mortality and facing stark within-country disparities. Within-country disparities exist throughout the SDI spectrum and are related to race and ethnicity, urban-rural geography, mother’s education, and income. Global and national achievement of SDG 3.2 will hinge on our collective ability to target inequality both across and within countries.

Progress for the countries in the Countdown to 2030 programme is monitored by key intervention coverage milestones, but must be met with national ownership and effective international investment. On an international level, the World Bank’s Global Financing Facility is an example of a performance-based, country-led mechanism to strengthen health systems and multisectoral approaches, but the promise of this programme has not reached countries like Central African Republic and Chad, which are not only the furthest from achieving the SDG targets with lowest key intervention coverage, but are also cited as receiving the least development assistance funding. These countries contrasts with countries like Rwanda and Bangladesh. In Rwanda, a revised national health policy successfully aligned international donors to nationally driven goals of comprehensive child health care and health system strengthening, and were associated with a dramatic reduction in under-5 mortality. In Bangladesh, the
government partnered with domestic and international non-governmental organisations to target areas of the country most in need with delivering known interventions, performing local effectiveness research, and prioritising women’s empowerment.28

Peru and Brazil are examples of middle and high-middle SDI countries that have targeted inequity internally. Peru substantially reduced under-5 mortality by adopting the 2002 Acuerdo Nacional,28 a national health policy targeting extreme poverty that deployed health workers to impoverished communities, completed community-based intervention research to increase perinatal care coverage, and codified collective responsibility for improving health outcomes. Brazil sanctioned governmental conditional cash transfers targeting prenatal care, immunisation, child health check-ups, and nutritional education.28 Although the specific solutions for targeting inequity and marginalised populations vary, the essential component is that the efforts to increase equity must be explicit, sustained, and universal because it is present throughout the world.

Prioritising research into specific causes of child mortality

Many of the leading causes of death are also the source of the most mortality above both the global optimum and the survival potential frontier, include neonatal disorders, congenital birth defects, sudden infant death syndrome, many childhood cancers, and important infections like lower respiratory infections, diarrhoea, and meningitis. These causes are prime targets for additional dedicated primary research on disease mechanisms for effective prevention, detection, and treatment. Sudden infant death syndrome is particularly notable as only 27% of the mortality burden is above the survival potential frontier, it is the top cause of death in older infants and children in the high SDI quintile, and comparatively little is known about its pathophysiology.

This entire analysis draws on the overall strength and rigour of GBD 2019, the only comprehensive analysis of fertility, population, mortality, and outcomes for specific diseases and injuries that currently exists. The UN Inter-agency Group for Child Mortality Estimation last published estimates for 201723 but has not reported on causes of mortality since 2015,21,22 at which time there was broad agreement in the top causes of death globally, but some important differences existed in cause categories that limited our ability to make direct comparisons.

Measuring preventable death with the intersection of HAQ Index and SDG targets has not been explored in previous literature and necessarily extends beyond the scope of the OECD and Eurostat taskforce that only focuses on adult health outcomes.39 This method is more holistic than previous avertable mortality frameworks such as the Countdown to 2030 report that analysed only a composite coverage index of specific interventions, but did not measure the health system performance as a whole.4 Uses of our preventable mortality analyses include being able to identify the causes with the most potential for improvement (largest proportion above the global optimum or stochastic frontier analysis), the regions with potential imbalances in health priorities (largest ratio above frontier or discrepancies in ratio between neonates and children aged 1–59 months), causes where there are needs for better distributional allocation of resources, expertise, or delivery (those where the frontier is largely flat until decreasing sharply in high HAQ Index settings), and the causes where there is the greatest need for basic research into prevention and treatment (largest proportion below the global optimum). This preventable death framework thus introduces a novel, useful, and potentially powerful tool for developing comprehensive, evidence-based strategies for advancing child survival on multiple fronts.

Limitations

This analysis has several limitations. First, it shares the limitations of the overall GBD analysis,7 including it being a descriptive study; limitations on data availability because of reporting lags or because of disruptions in settings with conflict, natural disasters, or domestic governance crises; variable data granularity with respect to age, sex, and cause detail; varying quality and completeness of mortality reporting systems; and the core GBD assumption of each death having only a single underlying cause, where, clinically, there is close interrelatedness of many causes, especially in the very young.

Second, our future health scenario analyses are benchmarked against past trends and are ecological in nature. This limits the ability of the analysis to be used for causal inference, and also means it is limited in its ability to capture disruptions that could arise as a consequence of future crises, such as the COVID-19 pandemic. Third, although our framework for preventable mortality is conceptually simple, reproducible, and a powerful tool for tracking context-specific progress, it is also limited by its inherently retrospective nature, its inability to parse competing risks or factors that might influence geographical variability, and that it does not make special consideration for causes like vaccine-preventable diseases that some experts contend are entirely preventable.

Finally, the definition of livebirth has varied in countries and over time. Although our study has utilised a large amount of empirical data on death in the under-5 age groups, directly or indirectly measured, such information is based on potentially different definitions of livebirths, thus affecting the accuracy of our results. Although we do account for source specific biases, difference in definitions of livebirths as one of them, in our USMR estimation process, future model development should be done to explicitly account for the effect of definition of livebirths on the accurate estimation of mortality in the under-5 age groups.

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Future directions

Future work is required to measure and understand the direct (severe illness and death) and indirect (determinants of health) effects of COVID-19 on child mortality. First, this work will include collecting data on disruptions in basic childhood health services (eg, vaccines, integrated management of childhood illness, well-child visits), nutritional status (eg, food supply and distribution), perinatal health (eg, maternal and neonatal care), and socioeconomic indicators such as fertility, education, and household income. A second direction is to work towards an integrated framework for women’s, maternal, and child health because of the inherent links between the health of mothers and their children. Third, integrating information from prevention and intervention trials into developing future health scenarios is a priority in order to provide information to motivated policy makers as to what their most effective options might be. Fourth, following the momentum of the Institute for Health Metrics and Evaluation’s Local Burden of Disease project, developing increasing local estimates of cause-specific and age-specific disease burden is crucial to guide local efforts at improving child survival, and assess within-country disparities further.

Achieving SDG 3.2 will require focus on equilibrium, which will involve balancing early newborn care with continuing prenatal and older child health initiatives, strengthening quality health systems, scaling up interventions, addressing within-country disparities, and pursuing integrative action on social determinants of health. All these steps forward promote the SDG agenda as to what their most effective options might be. Fourth, following the momentum of the Institute for Health Metrics and Evaluation’s Local Burden of Disease project, developing increasing local estimates of cause-specific and age-specific disease burden is crucial to guide local efforts at improving child survival, and assess within-country disparities further.

GDH 2019 Under-S Mortality Collaborators

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Declaration of interests

Robert Ancuceanu reports consulting fees from AbbVie and AstraZeneca; payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from Sandoz and AbbVie; support for attending meetings and/or travel from AbbVie and AstraZeneca, all outside the submitted work. Marcel Ausloos reports grants or contracts from Romanian National Authority for Scientific Research and Innovation, CNDS-UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0084, outside the submitted work. Ettore Beghi reports grants or contracts paid to their institutions from ALSA, the Italian Ministry of Health and SOBI; payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from Arvel/Therapeutics; support for attending meetings and/or travel from ILAE and EAN, all outside the submitted work. Reinhard Busse reports leadership or fiduciary role in other board, society, committee, or advocacy group, paid or unpaid with the Robert Koch Institute as member of the scientific advisory committee, German Burden 2020 project, all outside the submitted work. Joao Conde reports grants or contracts from the European Research Council grant agreement No 848325 (ERC starting grant); patents planned issued or pending for TRPV2 antagonists WO2019054891 - Instituto de Medicina Molecular (PT), Hydrogel Particles, Compositions, and Methods- WO US US2017033304A1 - Massachusetts Institute of Technology (USA), and Theranostic nanoprobe for overcoming cancer multidrug resistance and methods- WO US WO2016134232A1 - Massachusetts Institute of Technology (USA), all outside the submitted work. Irina Filip reports payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from Ancivena Medical and Clinical Research Institute. Claudius Herteliu reports grants or contracts from Romanian National Authority for scientific research and innovation, CNDS-UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0084, research grant (October, 2018, to September, 2022), understanding and modelling time-space patterns of psychology-related inequalities and polarisation, and project number PN-III-P2-2.1-SOL-2020-2-0351, research grant (June, 2021, to October, 2021), approaches within public health management in the context of COVID-19 pandemic, and from the Ministry of Labour and Social Justice Romania, project number 30/PSCD/2018, research grant (September, 2018 to June, 2019), agenda for skills Romania 2020–25, all outside the submitted work. Sheikh Mohammed Shariful Islam reports grants or contracts from National Health and Medical Research Council (NHMRC) and National Heart Foundation of Australia Fellowships, outside the submitted work. Jacke Jerzy Jozwiak reports payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from Teva, AstraZeneca, and Toshiba, all outside the submitted work.

Nicholas Kassebaum reports support for the present manuscript from the Bill & Melinda Gates Foundation as grant funding for the GBD. Kewal Krishnan reports grant support from the UK Crossroads Project, all outside the submitted work. Seithikurippu R Pandi-Perumal reports payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from the Italian Ministry of Health and SOBI; payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from Arvel/Therapeutics; support for attending meetings and/or travel from ILAE and EAN, all outside the submitted work. Shuhei Nomura reports support for the present manuscript from the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) as grant funding. Adrian Pana reports grants or contracts from Romanian National Authority for Scientific Research and Innovation, CNDS-UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0084, research grant (October, 2018, to September, 2022), understanding and modelling time-space patterns of psychology-related inequalities and polarisation, and project number PN-III-P2-2.1-SOL-2020-2-0351, research grant (June, 2021, to October, 2021), approaches within public health management in the context of COVID-19 pandemic, all outside the submitted work.

Senthikurippu R Pandi-Penumula reports payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events for the volumes he edited; leadership or fiduciary role in other board, society, committee, or advocacy group, paid or unpaid, with Somnogen Canada, Toronto, Canada, as the President and Chief Executive Officer, all outside the submitted work. Thomas Pilgrim reports grants or contracts from Biotronik, Boston Scientific, and Edwards Lifesciences; payment or honoraria for lectures, presentations, speakers’ bureaus, manuscript writing, or educational events from Biotronik, Boston Scientific, and HighLifeSAS; and being proctor for Medtronic and Boston Scientific, all outside the submitted work.
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P119/00588, P119/00815, DTS18/00032, ERA-PerMed-JTC2018 (KIDNEY-ATTACK AC18/00664 and PERSTIGAN AC18/00071, ISC11-BETIC RED/REN RD16/00099, Sociedad Española de Nefrología, FRIAT, Comunidad de Madrid en Biomedicina B2017/BMD-368 CIFRA2-CA. Jagdish Rao Padubidri acknowledges the Manipal Academy of Higher Education Mangalore, Mangalore, India for their constant support. George C Patton is supported by an NHMRC senior principal research fellowship. Albertro Raggi is supported by a grant from the Italian Ministry of Health (Ricerca Corrente, Fondazione Istituto Neurologico C. Besta, Linea 4 Outcome Research: dagli Indicatori alle Raccomandazioni Cliniche). Bhageerathy Reshmi acknowledges support from Manipal College of Health Professions, Manipal, India. Daniela Ribeiro acknowledges the financial support from the European Union (FEDER funds through COMPETE, POCI-01-0145-FEDER-029253). Abdallah M Sany acknowledges the support from the Egyptian Fullbright Mission Program, and being a member of the Egyptian Young Academy of Sciences and Technology. Davide Satin and Silvia Schizavolin acknowledge support from a grant by the Italian Ministry of Health (Ricerca Corrente, Fondazione Istituto Neurologico C Besta, Linea 4 Outcome Research: dagli Indicatori alle Raccomandazioni Cliniche). Francesca Giulia Magnani acknowledges support by a grant from the Italian Ministry of Health GR2016-02163049. Peng Sha and Bingyu Li acknowledge support by the Shenzhen Social Science Fund (Grant No SZ2020CD015) and the Shenzhen Science and Technology Program (Grant QGTD2019092172815662). Azziz Sheikh acknowledges the support of the Health Data Research UK BREATHE Hub. João Pedro Silva acknowledges support from grant number UIDB/04378/2020 from the Applied Molecular Biosciences Unit (UCIBIO), supported through Portuguese national funds via FCT/MCTES. David A Fleet acknowledges support from the James F and Sarah T Fries Foundation, The Bizzell Group. Mohammad Reza Sohghiyeh acknowledges support from the Clinical Research Development center of Imam Reza Hospital Kermanshah University of Medical Sciences, Iran. Joan B Soriano acknowledges support from the Centro de Investigación en Red de Enfermedades Respiratorias (CIBERES). Instituto de Salud Carlos III (ISCIII), Madrid, Spain. Gizachew Assefa Tessema is a recipient of the Australian National Health and Medical Research Council (NHMRC) investigator grant (APP1193716). Riaza Uddin is supported by an Alfred Deakin Postdoctoral Research Fellowship. Bhaskarun Unnikrishnan acknowledges Katurba Medical College, Mangalore, India. Charles Shay Wyssonge is supported by the South African Medical Research Council. Sojib Bin Zaman received a scholarship from the Australian Government Research Training Program (RTF) in support of his academic career. Yunguan Zhang acknowledges the Science and Technology Research Project of Hubei Provincial Department of Education (grant number Q2020104) and Middel Aged Technology Innovation Team Project of Hubei Provincial Department of Education (grant number T20200013).

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