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Challenges and opportunities for further reductions in infant and child mortality

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PREFACE

The Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat organized an Expert Group Meeting on "Priorities for Improved Survival: ICPD beyond 2014" at the United Nations Headquarters in New York on 21 and 22 October 2013. The meeting was convened to inform substantive preparations for the forty-seventh session of the Commission on Population and Development in April 2014. In light of the twentieth anniversary of the 1994 International Conference on Population and Development (ICPD), the Commission's theme for 2014 is an "Assessment of the status of implementation of the Programme of Action of the International Conference on Population and Development".

The meeting brought together experts from different scientific disciplines and regions of the world to address key questions about the progress in improving survival at different stages of life since the ICPD, as well as challenges and opportunities for future mortality reduction. A selection of the papers prepared by experts participating in the meeting is being issued under the Expert Paper Series published on the website of the Population Division (www.unpopulation.org).

There has been substantial progress over the last two decades in reducing under-5 mortality. The most rapid declines have been among children aged 1 to 4, and the slowest among neonates. Vaccine-preventable diseases (notably measles and tetanus) have shown the most rapid declines, while progress has been slower in reducing preterm and intrapartum complications, pneumonia and diarrhoea; in the age range 1 to 4, injury risks have been constant or rising. Further progress faces opportunities and challenges. Among opportunities, improvements in female education and rapid urbanization will contribute to future declines, as will income growth and poverty reduction, but the likely role of further fertility decline is small. Among challenges, neonatal mortality will increase as a proportion of total under-5 risk, and will require more costly interventions. The geographic distribution of children under age 5 will also shift towards higher mortality regions (particularly sub-Saharan Africa), braking mortality decline at the global level. Among children aged 1 to 4, injury mortality is constant or increasing, with a lack of proven interventions. Further progress can be accelerated by a renewed focus on cost-effective curative interventions, and on increasing both quantity and quality of facility-based delivery care.

The Expert Paper series aims at providing access to government officials, the research community, non-governmental organizations, international organizations and the general public to overviews by experts on key demographic issues. The papers included in the series will mainly be those presented at Expert Group Meetings organized by the Population Division on the different areas of its competence, including fertility, mortality, migration, urbanization and population distribution, population estimates and projections, population and development, and population policy.

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ABSTRACT

There has been substantial progress over the last two decades in reducing under-5 mortality. The most rapid declines have been among children aged 1 to 4, and the slowest among neonates. Vaccine-preventable diseases (notably measles and tetanus) have shown the most rapid declines, while progress has been slower in reducing preterm and intrapartum complications, pneumonia and diarrhoea; in the age range 1 to 4, injury risks have been constant or rising. Further progress faces opportunities and challenges. Among opportunities, improvements in female education and rapid urbanization will contribute to future declines, as will income growth and poverty reduction, but the likely role of further fertility decline is small. Among challenges, neonatal mortality will increase as a proportion of total under-5 risk, and will require more costly interventions. The geographic distribution of children under age 5 will also shift towards higher mortality regions (particularly sub-Saharan Africa), braking mortality decline at the global level. Among children aged 1 to 4, injury mortality is constant or increasing, with a lack of proven interventions. Further progress can be accelerated by a renewed focus on cost-effective curative interventions, and on increasing both quantity and quality of facility-based delivery care.

A. INTRODUCTION

1. *Trends in under-5 mortality levels since 1990*

Reduction of infant and child mortality has been one of the success stories of the last two decades. Annex table 1 shows neonatal, postneonatal, child (age 1 to age 5) and under-5 probabilities of dying by world region for 1990, 2000 and 2012 as estimated by the Inter-agency Group on Mortality Estimation in 2013 (UNICEF et al., 2013). Annex table 2 shows estimated annual average rates of decline of these indicators from 1990 to 2000 and from 2000 to 2012. Although the primary target of Millennium Development Goal 4 (to reduce under-5 mortality by two-thirds from 1990 to 2015) is unlikely to be met at the global level (or in about 80 per cent of countries tracked in the Countdown to 2015 initiative to track progress in maternal, newborn and child survival), gains have been impressive, and appear to have accelerated from 2000, when the Millennium Declaration was adopted by the United Nations General Assembly. The average annual rate of decline in the probability of dying by age 5 (U5MR) at the global level was 1.7 per cent between 1990 and 2000, accelerating to 3.8 per cent between 2000 and 2012; between 1990 and 2000, U5MR in more developed regions fell more than twice as fast as in less developed regions, whereas between 2000 and 2012 the rates of decline were essentially the same.

It is also evident from annex tables 1 and 2 that progress has been uneven, both across regions and across age ranges. Asia and Latin America have performed well, with rates of change in U5MR between 2000 and 2012 approximating that required to achieve MDG 4, while sub-Saharan Africa and Oceania have tended to lag behind, with particularly slow progress between 1990 and 2000 (though the sub-Saharan Africa decline between 2000 and 2012 is very similar to the global average). By age range, there is a general pattern whereby neonatal rates have declined slowest, and child risks have declined fastest (though Europe between 1990 and 2000 is an exception).

Annex tables 3 and 4 show the same information but for numbers of deaths rather than probabilities of dying. Not surprisingly, the story is pretty much the same, with annual numbers of under-5 deaths dropping from 12.6 million in 1990 to 9.7 million in 2000 to 6.6 million in 2012. Looking at numbers of deaths rather than probabilities of dying brings home, however, the disparity between more- and less-developed regions: in 2012 98.6 per cent of global under-5 deaths occurred in the less developed regions. Rates of change of under-5 deaths also bring home the adverse effects on the global total of changing distributions of children at risk. Thus numbers of under-5 deaths declined between 2000 and 2012 by only 3.3 per cent globally, and by only 1.9 per cent in sub-Saharan Africa. The continuing concentration of births in sub-Saharan Africa, where mortality rates are highest, is slowing apparent global progress.

2. *Trends in causes of deaths of children under age 5*

A recent paper (Liu et al., 2012) provides estimates of the distribution of deaths of children under age 5 by cause of death category, by world region and by two broad age ranges: the first month of life and from age 1 month to 5 years. Annex table 5 shows numbers of deaths by cause in 2010 for the world and for WHO regions; annex table 6 shows average annual rates of change in cause-specific mortality rates between 2000 and 2010 for the world and the same WHO regions.

Neonatal mortality

Globally, deaths in the first 28 days of life are dominated by preterm birth complications and intrapartum-related complications, accounting in 2010 for 58 per cent of all neonatal deaths; other causes contributing more than 10 per cent of neonatal deaths are sepsis/meningitis and pneumonia. Not surprisingly, the cause distributions of neonatal deaths in the two regions that dominate overall global neonatal mortality closely resemble the global distribution, such that in both Africa and South-East Asia, the four causes contributing 10 per cent or more of all neonatal deaths are also preterm birth complications, intrapartum-related complications, sepsis/meningitis and pneumonia. In the region that contributes least to global neonatal deaths, Europe, neither pneumonia nor sepsis-meningitis contribute as much as 10 per cent of overall neonatal deaths, but both congenital abnormalities (21 per cent) and other disorders (13 per cent) contribute 10 per cent or more.

In terms of rates of change from 2000 to 2010 of cause-specific neonatal mortality rates at the global level, the fastest changes are in tetanus and diarrhoea (-9.5 per cent and -4.0 per cent per annum respectively); the slowest changes are for sepsis/meningitis and congenital abnormalities, both declining at less than 1 per cent per annum. The rate of change pattern in Africa is broadly reflective of the global pattern, with the most rapid declines being in tetanus and diarrhoea, and sepsis/meningitis actually increasing over the period; one difference is the fairly rapid decline of pneumonia in the Africa region. The rate of change pattern in South-East Asia shows less variation by cause, though tetanus still shows the fastest decline, followed by sepsis/meningitis.

Mortality between 1 and 60 months

The major causes of death for children aged 1 to 59 months globally in 2010 were pneumonia (24 per cent), diarrhoea (17 per cent) and malaria (12 per cent). These three causes are also the only causes that contribute at least 10 per cent of such deaths in the Africa region, though malaria is the largest single contributor (22 per cent). In South-East Asia, only pneumonia (30 per cent) and diarrhoea (22 per cent) exceed 10 per cent, though injury comes close at 8 per cent. In the Western Pacific and Europe, pneumonia is the most frequent cause (31 per cent and 18 per cent respectively), but in both cases injury is the second most common cause (16 per cent and 11 per cent respectively); in the Americas injury is easily the most common cause of death in this age range at 31 per cent, followed by pneumonia at 15 per cent. It is worth noting that in this age range of children, there is more diversity of causes of death than in the neonatal period, such that other disorders generally outnumber any of the individual causes given.

Average annual rates of change in cause-specific rates from 2000 to 2010 at the global level show the fastest decline for measles (-15 per cent), with rates of mortality from AIDS, meningitis, diarrhoea and pneumonia also declining faster than average. In Africa, the causes that decline faster than average are measles (-21 per cent), AIDS (-6 per cent) and diarrhoea (-4 per cent), while in South-East Asia, measles, meningitis, diarrhoea and pneumonia all decline faster than average; in the Americas, all causes except injuries decline faster than the all-cause average, while injuries increase at almost 6 per cent per annum.

3. *Organization of the paper*

The remainder of this paper explores the opportunities for and challenges to further progress in reducing infant and child mortality. We will limit ourselves to changes that we can be fairly sure will happen, though we may not be sure of the magnitude of change. We will not speculate on unknowables, such as the emergence of new diseases, or new disease strains resistant to existing treatments, or the development of revolutionary new vaccines. It is not that such developments are highly unlikely—continuing problems with microbial resistance are almost certain, the slow progress of sub-Saharan Africa in the 1990s was to a substantial extent the result of the HIV epidemic, and between 2003 and 2013 the number of interventions regarded as cost-effective and feasible almost doubled—but rather that they are impossible to forecast. We will also not discuss the implications of intra-national differentials in child mortality (except for urban-rural differentials). In many countries, large differentials exist between geographic areas; it may be that pockets of high mortality represent opportunities for easy gains, though there is no evidence that we know of to support this contention.

B. OPPORTUNITIES

The period since 1990 has been marked by a number of socio-economic and demographic changes that have assisted declines in infant and child mortality. These changes can with considerable confidence be expected to continue for the foreseeable future, though their impact on mortality rates may be muted by changes in distributions of births. We illustrate them by tracking changes in proportions of births by protective or risk factors from the early 1990s to the late 2000s using Demographic and Health Survey (DHS) data on births in the 36 months before four surveys from each of four countries, one each from Latin America (Bolivia), Africa (Malawi), South Asia (Bangladesh) and South-East Asia (Indonesia)[1]. We do not claim that these four countries are representative of their respective regions, but they are broadly typical (if rather behind the regional transition curve in the case of Bolivia).

1. *Urbanization*

The world, and the less developed regions in particular, are urbanizing rapidly; recent studies indicate that living in an urban area, and especially in a large metropolitan centre, reduces infant and child mortality over and above the effects of economic condition alone (Fink and Hill, 2013). Panel 1 of table 1 shows the evolution of proportions of population and of births occurring in urban areas since around 1990 according to four repeated Demographic and Health Surveys (DHS) for each country. There was a substantial increase in the proportion of births taking place in urban areas in Bangladesh and Indonesia (over 10 percentage points in each case), but much smaller increases in Bolivia and Malawi (three percentage points or less); the increase has been slower than the increase in proportion urban because of lower fertility in urban areas. We are confident that the proportion of births occurring in urban areas will continue to increase over the next two decades, putting downward pressure on infant and child mortality rates. It is sometimes argued (for example, by Sclar et al., 2005) that possible increases in slum populations will counteract such positive effect, but these fears seem to be misplaced; children born in slums, especially slums in large urban centres, have on average clearly lower mortality risks than children born in rural areas and generally lower risks than children born in smaller cities also (Fink et al., 2013).

[1] We use data from four surveys for each country. Specifically, the surveys are: (i) for Bangladesh, 1993-94, 1999-2000, 2004 and 2007; (ii) for Bolivia, 1994, 1998, 2003 and 2008; (iii) for Indonesia, 1994, 1997, 2002-03 and 2007; and (iv) for Malawi, 1992, 2000, 2004 and 2010.

TABLE 1. CHANGES IN DISTRIBUTION OF BIRTHS BY SOCIO-ECONOMIC FACTORS, EARLY 1990S TO LATE 2000S

Country	*1992-1994*	*1997-2000*	*2002-2004*	*2007-2010*	*Percentage Point Change, Early 1990s to Late 2000s*
(a) Proportion of births to women living in urban areas					
Bangladesh	10.1	16.3	19.8	21.2	11.1
Bolivia	52.4	57.1	57.2	54.4	2.0
Indonesia	27.6	27.8	47.2	41.2	13.6
Malawi	11.3	12.6	13.5	14.4	3.1
(b) Proportion of births to women with secondary or higher education					
Bangladesh	15.3	25.1	33.7	44.9	29.6
Bolivia	37.3	41.0	32.3	42.4	4.9
Indonesia	29.5	34.5	48.9	57.0	27.5
Malawi	3.2	6.8	11.4	15.4	12.2

Source: Authors' calculations from DHS datasets.

2. *Maternal education*

An almost universal finding of studies of infant and child mortality is that children born to better educated women have lower risks than those born to less well-educated mothers (Hobcraft, et al., 1984; Rutstein, 2000; Gakidou, et al., 2010). Educational levels have been increasing across the board for several decades, and recently in many settings female educational levels have been increasing faster than male levels. The effect of increasing female education is again muted by the fact that better-educated women have fewer children, and its' effect is also delayed somewhat by the fact that they also have their children at older ages. However, the effect over time on the distribution of births by education of mother is substantial. The second panel of table 1 shows the proportions of births from the early1990s to the late 2000s to women with secondary education for the same four countries (Bangladesh, Bolivia, Indonesia and Malawi) as used in the first panel of table 1. Again, we see large percentage point increases for Bangladesh and Indonesia (nearly 30 points in each case), but smaller increases for Bolivia and Malawi (five and 12 points respectively, though it is worth noting that the relative increase in Malawi is by a factor of 5). Given that the cohorts of women currently under the age of 15 are systematically exceeding the educational levels of the women age over 35, we can confidently predict that this trend towards better educated mothers will continue for at least a couple of decades.

3. *Fertility change*

Other almost universal findings of studies of differentials in child mortality risk are that births that take place a short interval after a previous birth, first births, high parity births, births to very young mothers and births to older mothers are often at excess risk (Rutstein, 2005). Declines in fertility have been universal and large in regions outside sub-Saharan Africa, where the declines have not been universal and have, in cases where they have occurred, not generally been nearly as large as elsewhere. In many less developed regions, fertility has fallen close to or below replacement, and the potential for further favourable changes is small. In sub-Saharan Africa, however, there is still plenty of scope for changing the risk profile of births through reduced fertility. Panel 1 of table 2 shows the proportions of births to women under the age of 18 by survey and country. The changes have in general been small in percentage point terms, even though there are substantial differences between countries, and in two countries high risk groups have actually increased slightly. Panel 2 of table 2 shows proportions of births to women aged 35 or over; again, the changes in percentage point terms have been small, and not in a consistent direction, although the proportion in Malawi drops substantially.

TABLE 2. CHANGES IN DISTRIBUTION OF BIRTHS BY FERTILITY RISK FACTORS, EARLY 1990S TO LATE 2000S

Country	*1992-94*	*1997-2000*	*2002-2004*	*2007-2010*	*Percentage Point Change, Early 1990s to Late 2000s*
(a) Proportion of births to women under age 18					
Bangladesh	14.4	18.3	17.5	16.5	2.1
Bolivia	5.0	5.3	6.3	7.3	2.3
Indonesia	4.6	4.2	3.6	2.8	-1.8
Malawi	7.3	7.1	6.0	6.2	-1.1
(b) Proportion of births to women age 35 or over					
Bangladesh	6.1	5.4	5.7	5.0	-1.1
Bolivia	16.0	17.1	17.3	15.7	-0.3
Indonesia	12.5	13.1	14.6	15.1	2.6
Malawi	18.3	13.1	11.3	13.2	-5.1
(c) Proportion of births following an interval of less than 24 months					
Bangladesh	12.0	11.5	11.3	9.3	-2.7
Bolivia	21.0	20.9	18.3	15.5	-5.5
Indonesia	10.6	9.9	7.7	8.0	-2.6
Malawi	15.2	13.1	10.4	11.1	-4.1
(d) Proportion of first births					
Bangladesh	25.9	29.8	30.3	34.7	8.8
Bolivia	22.8	24.4	25.3	28.4	5.6
Indonesia	29.9	33.1	34.1	36.4	6.5
Malawi	18.7	23.6	22.9	20.0	1.3
(e) Proportion of births of parity 4 or higher					
Bangladesh	35.6	27.3	26.9	21.6	-14.0
Bolivia	43.2	40.5	38.6	32.4	-11.8
Indonesia	30.5	25.5	19.9	18.6	-11.9
Malawi	52.9	41.1	40.1	43.8	-9.1

Source: Authors' calculations from DHS datasets.

One of the key rationales for family planning programmes is that they will reduce the proportion of births following shortly after a previous birth. Panel 3 of table 2 shows that these proportions have declined in all four countries, though the declines are not huge, on the order of three to five percentage points. The last two panels of table 2 examine distributions of births by parity, specifically first births and births of parity four or higher. In all four countries proportions of first births have increased, by seven or eight percentage points except in Malawi, where the change is small. Proportions of high parity births have declined substantially in all four countries, by 10 percentage points or more; these are the only substantial changes observed in birth distributions, at least for these four countries.

4. *Economic growth and poverty reduction*

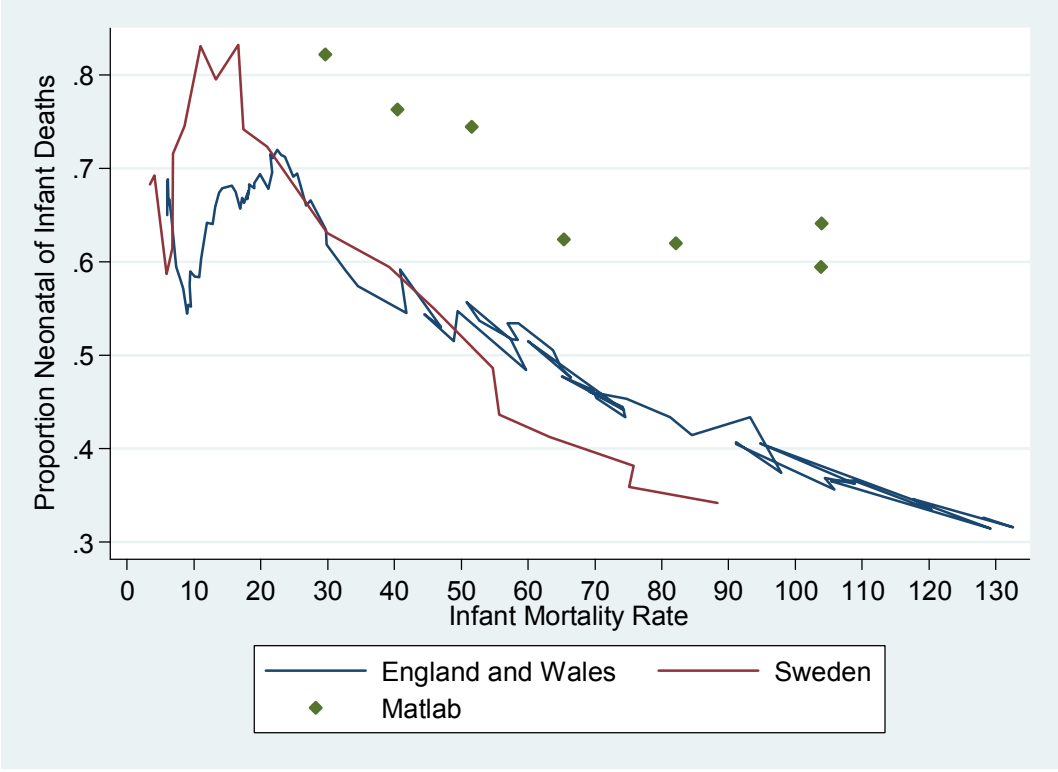
Although the direct role of economic growth in reducing child mortality remains ambiguous, one of the successes of the last two decades (and one of the MDGs with the highest success rate) has been poverty reduction. Undernutrition is estimated to contribute to approximately 45 per cent of deaths under age 5, and can reasonably be expected to decline as poverty continues to decline.

C. CHALLENGES

1. *Increasing concentration of deaths in the neonatal period*

It is frequently observed that deaths become increasingly concentrated in the neonatal period as infant or under-5 mortality declines (Hill and Choi, 2006). This pattern appears to have been widespread as mortality declined in Europe in the last century. Figure I plots the proportion neonatal of infant deaths by level of infant mortality for Sweden and England and Wales at levels of mortality still observed in less developed regions today; as can be seen, the proportion neonatal rises almost linearly from about 30 per cent until it reaches approximately 80 per cent, at which point it stabilizes or even declines slightly[2]. Figure I also shows points derived from the Matlab demographic surveillance system in Bangladesh (we use data from a surveillance system rather than surveys because it reduces possible problems of omission of early neonatal deaths or of age at death misreporting) for years from 1980 to 2009; as can be seen, the general pattern of the relationship is similar, but with higher neonatal proportions for any given infant mortality rate. Data from Demographic and Health Surveys (not shown) indicate a similar pattern, of rather higher neonatal mortality for a given IMR than the historical series from Europe. The difference can plausibly be explained by health programme success in reducing infectious disease mortality relative to reducing the main causes of neonatal mortality. To reduce these latter causes, higher proportions of facility deliveries and higher quality care within facilities are likely to be necessary, and both would require functioning health systems.

Figure I. Proportions Neonatal of Infant Deaths by Infant Mortality Rate: England and Wales, Sweden and Matlab, Bangladesh



[2] It is interesting to note that in both England and Wales and Sweden, the ratio peaks at a similar time period (around 1960) rather than at some level of IMR, suggesting a technological explanation.

2. *Increasing concentration of births in high mortality regions*

According to the most recent revision of World Population Prospects (United Nations, 2013), the next 20 years will see a major shift in the global distribution of population under age 5, away from areas with currently low child mortality (developed regions, Latin America and the Caribbean and East Asia) to those with currently high child mortality (South Asia and particularly sub-Saharan Africa). Table 3 shows the shifts in absolute and relative numbers of children under age 5 for selected regions from 2010 to 2035. Sub-Saharan Africa is the only region to increase in either number or percent, with its share of global under 5 population increasing by almost 10 percentage points from 2010 to 2035. South Asia shows declines in both absolute and relative numbers, but by 2035 still accounts for almost a quarter of global population under age 5. The shift of population under age 5 to sub-Saharan Africa will slow the reduction in global under-5 mortality unless the region significantly out-performs all other areas combined.

TABLE 3. NUMBERS AND PERCENTAGES OF CHILDREN UNDER AGE 5 IN 2010, 2020, 2030 AND 2035; WORLD AND SELECTED REGIONS

Region		*2010*	*2020*	*2030*	*2035*
(a) Millions					
More developed		69	70	67	67
Less developed		573	598	596	602
Of which:					
	South Asia	175	173	165	160
	Sub-Saharan Africa	140	168	196	210
	Other	258	257	235	232
Total		642	668	664	669
(b) Percent					
More developed		10.7	10.5	10.1	10.0
Less developed		89.3	89.5	89.8	90.0
Of which:					
	South Asia	27.3	25.9	24.8	23.9
	Sub-Saharan Africa	21.8	25.1	29.5	31.4
	Other	40.2	38.5	35.4	34.7
Total		100.0	100.0	100.0	100.0

Source: United Nations, 2013.

3. *Failure to deliver cost-effective services*

The Bellagio Group in 2003 demonstrated the potential of 16 preventive and 8 treatment interventions of proven effectiveness and feasible for delivery at high levels to reduce under 5 deaths by 63 per cent (Jones et al, 2003). A further study (Friberg et al., 2010) estimated that as many as 4 million deaths of women and children in sub-Saharan Africa could be averted if high impact interventions reached 90 percent of families. A recent WHO review has extended the list of interventions meeting these requirements to 52 (PMNCH, 2011). Bryce et al. (2013) observe that utilization of several of these

interventions has increased only slowly since 2003, with particularly slow progress in sub-Saharan Africa and with oral rehydration for diarrhoea and antibiotics for pneumonia. Walker et al. (2013) develop estimates of rates of increase of a broad range of effective interventions, and conclude that at recent rates of change only 12 per cent of Countdown countries will achieve the new target of a U5MR under 20 by 2035, and 50 per cent will still have U5MR's in excess of 50 per 1000 live births. If instead of progress as usual, intervention coverage increases to the highest level achieved by a similar country, 20 per cent of countries would reach a U5MR of 20 or less by 2035, and only 16 per cent would still have a U5MR above 50. Failure to implement interventions of known effectiveness has clearly been a major barrier to past progress, and is likely to remain a barrier to future reductions in U5MR without a change of focus in intervention strategies.

4. *Rise of injuries*

As communicable disease mortality recedes, injury mortality increases at least proportionately and in some cases in absolute terms as well. Drowning has become the largest cause of death between the ages of 1 and 5 in Bangladesh, and rates of injury mortality have increased by about 6 per cent per annum in the age range 1 to 59 months in the Americas (annex table 6). Interventions in this area are not well-developed, and will require imaginative thinking.

D. CONCLUSIONS

Mortality in the first 5 years of life has fallen sharply since 1990, and the pace of decline has accelerated since 2000, but only about 20 of the 74 Countdown countries are "on track" to achieve the MDG-4 target. The proximate cause of this weak performance is a failure to implement preventive and curative interventions of known efficacy at high levels, though progress against vaccine-preventable diseases (notably measles and tetanus) has been spectacular. Success stories suggest that one or more of political will (e.g. Rwanda, Farmer et al. 2013), social movements (Bangladesh, Phillips et al. 2003) or highly focused programmes (Niger, Amouzou et al. 2012) can reduce childhood mortality rapidly. It is not clear that an equity strategy will be successful at increasing rates of decline because of the inherent problems of identifying under-served populations and serving them cost-effectively. Nor is it clear that family planning programs will have a big payoff in reducing high-risk births, though lower fertility can be expected to limit growth of the population under age 5 and thus (if funding levels are not affected) increase resource availability per child. In the near term, a renewed emphasis on community delivery of curative interventions for pneumonia and diarrhoea would have a large payoff in sub-Saharan Africa.

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ANNEX TABLE 1. PROBABILITIES OF DYING IN CHILDHOOD BY DEVELOPMENT GROUP AND MAJOR AREA: 1990, 2000 AND 2012

	1990				*2000*				*2012*			
Region	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*
More developed regions	7.6	4.7	2.3	14.6	5.3	3.1	1.6	10	3.5	1.8	1.0	6.3
Less developed regions	36	32.6	32.7	99.1	31.7	26.1	26.6	82.9	22.8	15.5	14.9	52.6
Africa	42.9	56.4	72.5	161.9	39.6	48.4	55.3	142.8	30.2	28.9	28.8	89.7
Sub-Saharan Africa	*45.3*	*62.3*	*25.2*	*179.2*	*42*	*53.3*	*19.4*	*156.9*	*32.5*	*31.9*	*10.9*	*98.5*
Asia	35.5	27.4	39.1	86.5	30.6	19.5	30.3	66.5	20.6	10.2	17.1	38.7
Europe	9.3	5.5	80.2	17.5	6.4	3.8	68.1	11.9	3.6	1.9	36.4	6.5
Latin America and the Caribbean	22.1	20.6	69.5	53.9	15.3	11.5	60.1	32.3	9.8	6.2	32.5	19
Northern America	5.6	3.6	25.2	10.9	4.5	2.5	17.3	8.2	4	1.9	8.2	6.9
Oceania	12.9	13.2	2.7	34.5	12.9	12.7	1.7	33.3	10.5	9.4	1.0	25.5
World	33	29.5	11.7	89.8	29	23.8	5.7	75.4	20.8	14.1	3.0	47.8

Source: UNICEF, WHO, World Bank and United Nations Population Division, 2013.

ANNEX TABLE 2. ANNUAL RATES OF CHANGE IN PROBABILITIES OF DYING IN CHILDHOOD BY DEVELOPMENT GROUP AND MAJOR AREA: 1990 TO 2000 AND 2000 TO 2012

	1990 to 2000				*2000 to 2012*			
Region	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*
More developed regions	-3.6	-4.2	-3.7	-3.8	-3.5	-4.5	-3.9	-3.9
Less developed regions	-1.3	-2.2	-2.1	-1.8	-2.7	-4.3	-4.9	-3.8
Africa	-0.8	-1.5	-2.7	-1.3	-2.3	-4.3	-5.5	-3.9
Sub-Saharan Africa	-0.8	-1.6	-2.7	-1.3	-2.1	-4.3	-4.8	-3.9
Asia	-1.5	-3.4	-2.6	-2.6	-3.3	-5.4	-4.7	-4.5
Europe	-3.7	-3.7	-1.6	-3.9	-4.8	-5.8	-5.2	-5.0
Latin America and the Caribbean	-3.7	-5.8	-1.5	-5.1	-3.7	-5.1	-5.1	-4.4
Northern America	-2.2	-3.6	-3.8	-2.8	-1.0	-2.3	-6.3	-1.4
Oceania	0.0	-0.4	-4.7	-0.4	-1.7	-2.5	-4.5	-2.2
World	-1.3	-2.1	-7.3	-1.7	-2.8	-4.4	-5.1	-3.8

Source: UNICEF, WHO, World Bank and United Nations Population Division, 2013.

ANNEX TABLE 3. NUMBERS OF DEATHS IN CHILDHOOD BY DEVELOPMENT GROUP AND MAJOR AREA: 1990, 2000 AND 2012

Region	*1990*				*2000*				*2012*			
	Neonatal Mortality Rate	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*
More developed regions	116	72	37	225	70	40	20	130	50	26	14	89
Less developed regions	4,508	4,155	3,732	12,396	3,634	3,046	2,888	9,569	2,802	1,924	1,738	6,464
Africa	1,078	1,413	1,550	4,040	1,185	1,446	1,589	4,220	1,141	1,082	1,111	3,333
Sub-Saharan Africa	936	1,285	1,450	3,671	1,080	1,367	1,526	3,972	1,055	1,031	1,070	3,157
Asia	3,173	2,498	2,050	7,722	2,263	1,458	1,233	4,954	1,551	769	593	2,913
Europe	88	53	27	168	48	28	13	89	29	15	8	52
Latin America and the Caribbean	255	241	131	627	182	138	64	383	106	68	32	206
Northern America	24	15	8	47	18	10	6	34	18	8	5	32
Oceania	6	7	4	17	7	7	4	18	7	6	4	17
World	4,625	4,227	3,769	12,621	3,704	3,086	2,909	9,699	2,852	1,949	1,752	6,553

Source: UNICEF, WHO, World Bank and United Nations Population Division, 2013.

ANNEX TABLE 4. ANNUAL RATES OF CHANGE IN NUMBERS OF DEATHS IN CHILDHOOD BY DEVELOPMENT GROUP AND MAJOR AREA: 1990 TO 2000 AND 2000 TO 2012

Region	*1990 to 2000*				*2000 to 2012*			
	Neonatal Mortality Rate	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*	*Neonatal Mortality Rate*	*Post-neonatal Mortality Rate*	*Probability of Dying from 1 to 5*	*U5MR*
More developed regions	-5.1	-5.7	-6.0	-5.5	-2.8	-3.8	-3.3	-3.2
Less developed regions	-2.2	-3.1	-2.6	-2.6	-2.2	-3.8	-4.2	-3.3
Africa	1.0	0.2	0.3	0.4	-0.3	-2.4	-3.0	-2.0
Sub-Saharan Africa	1.4	0.6	0.5	0.8	-0.2	-2.3	-3.0	-1.9
Asia	-3.4	-5.4	-5.1	-4.4	-3.2	-5.3	-6.1	-4.4
Europe	-6.1	-6.3	-7.1	-6.3	-4.1	-5.0	-4.4	-4.4
Latin America and the Caribbean	-3.4	-5.6	-7.2	-4.9	-4.5	-5.9	-5.8	-5.2
Northern America	-2.5	-4.4	-3.1	-3.2	0.0	-1.4	-1.2	-0.6
Oceania	1.0	0.5	0.2	0.6	-0.3	-1.1	-1.5	-0.8
World	-2.2	-3.1	-2.6	-2.6	-2.2	-3.8	-4.2	-3.3

Source: UNICEF, WHO, World Bank and United Nations Population Division, 2013.

ANNEX TABLE 5. NUMBERS OF DEATHS IN CHILDHOOD BY WHO REGION AND CAUSE OF DEATH: 2010

Region									
a) 0-27 Days	*Total*	*Pneumonia*	*Preterm Birth Complications*	*Intrapartum Related Complications*	*Sepsis/ Meningitis*	*Other Disorders*	*Congenital Abnormalities*	*Tetanus*	*Diarrhoea*
Africa	1064	109	364	288	156	41	60	27	19
Americas	137	5	48	21	16	19	27	1	0
Eastern Mediterranean	444	43	164	111	57	14	35	14	6
Europe	78	4	29	12	6	10	16	0	0
Southeast Asia	1096	153	402	219	145	42	99	15	20
Western Pacific	252	11	70	66	12	55	33	1	4
World	3072	325	1078	717	393	181	270	58	50

b) 1 to 59 Months	*Total*	*Diarrhoea*	*Measles*	*Injury*	*Malaria*	*AIDS*	*Meningitis*	*Other Causes*	*Pneumonia*
Africa	2488	385	45	129	540	142	90	659	499
Americas	147	12	0	45	0	2	4	63	22
Eastern Mediterranean	617	116	8	54	10	3	31	230	165
Europe	82	6	0	9	0	2	2	47	15
Southeast Asia	1000	216	58	81	12	8	44	277	304
Western Pacific	215	17	2	35	2	2	10	81	66
World	4550	751	114	354	564	159	180	1356	1071

Source: Liu et al., 2012.

ANNEX TABLE 6: AVERAGE ANNUAL RATES OF CHANGE IN CAUSE-SPECIFIC MORTALITY RATES UNDER AGE 5 BY WHO REGION: 2000 TO 2010

Region									
a) 0-27 Days	*Total*	*Pneumonia*	*Preterm Birth Complications*	*Intrapartum Related Complications*	*Sepsis/ Meningitis*	*Other Disorders*	*Congenital Abnormalities*	*Tetanus*	*Diarrhoea*
Africa	-1.5	-2.8	-1.4	-1.1	1.7	-1.1	-1.3	-11.1	-4.1
Americas	-3.9	-6.3	-5.1	-4.6	-3.6	-2.1	-1.3	-8.4	-12.3
Eastern Mediterranean	-1.4	-3.3	-1.2	-1.3	7.1	0.1	-0.7	-12.1	-5.7
Europe	-4.1	-5.9	-4.3	-4.6	-5.5	-2.7	-2.4	-17.8	-6.1
Southeast Asia	-2.3	-1.1	-2.1	-2.9	-3.9	-2.4	-0.3	-5.5	-3.4
Western Pacific	-4.4	-7.8	-4.7	-7.0	-3.8	-1.0	0.0	-14.3	-5.4
World	-2.1	-2.2	-2.0	-2.4	-0.7	-1.7	-0.7	-9.5	-4.0

b) 1 to 59 Months	*Total*	*Diarrhoea*	*Measles*	*Injury*	*Malaria*	*AIDS*	*Meningitis*	*Other Causes*	*Pneumonia*
Africa	-2.9	-3.7	-20.9	1.2	-2.7	-6.4	-2.8	1.0	-1.8
Americas	-3.9	-10.1	na	5.8	-6.3	-8.4	-9.4	-4.8	-7.2
Eastern Mediterranean	-2.1	-3.2	-17.3	0.4	-1.8	10.1	-3.4	-0.5	-2.2
Europe	-4.9	-7.7	-27.2	-5.1	-68.4	9.6	-10.1	-3.1	-7.9
Southeast Asia	-4.5	-5.2	-6.2	-1.6	-2.0	-2.7	-6.1	-3.7	-4.7
Western Pacific	-7.1	-9.9	-14.5	-4.7	-3.4	-0.1	-9.2	-4.6	-9.2
World	-2.9	-4.0	-14.6	0.0	-1.4	-4.8	-4.1	-0.9	-3.3

Source: Liu et al., 2012.