BEST PRACTICES SERIES: Ending preventable maternal and newborn deaths

PAPER TITLE: Evidence to inform the future for maternal and newborn health

AUTHORS
Joy E Lawn,[1] Hannah Blencowe[1], Mary V Kinney[2], Fiorella Bianchi[1], Wendy J Graham[1,3]

Author's affiliations:
[1] Centre for Maternal, Adolescent, Reproductive and Child Health, London School of Hygiene and Tropical Medicine, Keppel Street, London, United Kingdom
[2] Save the Children, Saving Newborn Lives, Edgemead, South Africa
[3] Institute of Applied Health Sciences, School of Medicine and Dentistry, University of Aberdeen, Aberdeen, United Kingdom

Corresponding author: Hannah Blencowe, London School of Hygiene and Tropical Medicine, Keppel Street, London, WC1E 7HT. Hannah.Blencowe@lshtm.ac.uk

Abstract

Despite the impressive progress gains for maternal and child health during the Millennium Development Goals era, over 5.6 million women and babies died in 2015 due to complications during pregnancy, birth and in the first month of life. In order to achieve the new mortality targets set out in the Sustainable Development Goals, there needs to be intentional efforts to maintain and accelerate efforts to end preventable maternal and newborn deaths and stillbirths. This paper outlines what progress is required to meet these new 2030 targets based on patters of progress in the recent past; where the burden is the greatest; when to focus attention along the continuum of care; and what causes of death require concerted efforts.

Priority actions include intentional and intensified political attention and investment in maternal-newborn health with particular focus on improving quality and experience of care around the time of birth with implementation at scale of integrated maternal-newborn health interventions across the continuum of care with commensurate investment targeted at the most vulnerable populations. Looking forward, improved data for decision making and accountability will required.

The health and survival of babies and their mothers are inextricably linked, and calls for coordinated efforts and innovation before and during pregnancy, in childbirth, and postnatally, in order to end preventable maternal, neonatal deaths and stillbirths.

Background

The Millennium Development Goals (MDGs) have been called the greatest global success story for health and development, with unprecedented investments in global aid since their launch in 2000 (1). With the privilege of being the focus for two of the eight goals, maternal and child survival was expected to improve markedly. Yet despite a 43% reduction in the maternal mortality ratio since 1990, progress fell far short of the target of 75% in MDG 5 and still 303,000 maternal deaths were estimated to happen in 2015 (2). Child deaths under the age of 5 years were also halved, but show uneven progress with slower progress for newborns compared to older children (3). Hence neonatal deaths now account for 2.7 million deaths a year, 45% of deaths in children under 5 globally. Newborn mortality reductions accelerated after 2000 (57% between 2000-2015), and similarly for maternal mortality progress was greater during 2005-2015 compared with 1990-2004. Absent from the MDG tracking and political visibility, stillbirths only declined by 19% between 2000 and 2015 (4). An estimated 2.6 million stillbirths occurred globally in 2015, of which over half were intrapartum (4). Almost all these were in low and middle income countries (LMICs), and just like maternal and newborn deaths, eminently preventable with improved coverage of high quality obstetric care.

As well as the variation in progress for these different outcomes, there is also a remarkable diversity of levels within individual countries between areas and populations sub-groups, and between world regions and even neighbouring countries. As the world transitions into the era of the Sustainable Development Goals (SDGs) with an end-line date of 2030, there are 17 goals of which only one is regarding health. There remains however a remarkable demand from countries for sustained commitment to the health of women, children and adolescents. It is crucial that we take stock and use the available evidence to inform national investments to achieve, whilst also continuing to strengthen the reliability and coverage of local data to guide context-specific action.

Objectives

The overall aim of this paper is to review the agreed priority actions to end preventable maternal and newborn deaths and stillbirths by 2030. The specific objectives are to:
1. Highlight the average annual rate reductions in maternal and neonatal mortality, and stillbirths, needed at global and regional levels to reach 2030 targets.
2. Summarise the available evidence to inform investment in terms of where, when and on which causes of death to focus.
3. To synthesise priority actions to accelerate progress.

Data and methods

The main sources of data used in this paper were the WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division for maternal mortality estimates (2, 5), the UN Inter-agency Group for Child Mortality Estimation for neonatal mortality estimates (3), and the Ending Preventable Stillbirths Lancet Series for stillbirth estimates (4).

Data for maternal deaths, neonatal deaths and stillbirths with time trends were used to calculate the national annual rate reduction (ARR) from 2000 to 2015 for maternal mortality ratio (MMR), neonatal mortality rate (NMR) and stillbirth rate (SBR). We present the SDGs, Ending Preventable Maternal Mortality (EPMM) (6) and Every Newborn Action Plan (ENAP) (7) targets by 2030 for

ending preventable maternal, newborn and child deaths and stillbirths with the ARRs required in order to these. Finally, we updated data on timing of death and causal categories for maternal and newborn deaths and stillbirths in the year 2015.

Panel 1 provides more details on the data sources, definitions and analyses undertaken.

Results

What progress is required to meet the 2030 targets?

Figure 1 show the trends in the global numbers and rates of maternal and neonatal deaths and stillbirths since 1990 and the projections to 2030 under two scenarios – continuation of the average ARR since 1990 and with accelerated declines. Although progress has been made, what is striking immediately is that business as usual will not achieve the global targets, and that unless efforts to reduce rates are coupled with addressing the unmet need for family planning and women's education and empowerment, the number of deaths will remain high. However, the picture is also strikingly different at a country level – in part reflecting the challenge of a universal target. Some countries have already passed the target, whilst for those with the highest mortality, the ARR needed will necessitate a major shift in the trajectory. This is most marked for stillbirths, where the ARR (2.0%) between 2000 and 2015 (ARR 2.0%) was slower than that for maternal (ARR 3.0%) and neonatal (ARR 3.1%) mortality.

For maternal mortality, the global target is an MMR of less than 70/100,000 live births by 2030 (Figure 1a). This overall aim translates into aspiration into different sub-targets for specific country contexts depending on the baseline level in 2010: countries should either reduce their MMR by at least two-thirds of their baseline, not have an MMR greater than 140/100,000 live births by 2030, or achieve reductions in inequalities in MMR at a subnational level. These sub-targets will necessitate an ARR greater than 5.5% in the countries with the highest MMRs (MMR >420) (6).

For newborn deaths, the ENAP set an absolute target of 12 or fewer neonatal deaths per 1000 live births in every country by 2030 (Figure 1b). An ARR of 4.3% will be needed to achieve the global NMR target, but this varies considerably between countries, with 29 countries needing to at least double their ARR (8, 9). Turning to stillbirths, the ENAP set an absolute target of 12 or fewer stillbirths per 1000 total births in all countries by 2030. To achieve this, a global ARR of 4.2% and 56 countries will need to at least double their ARR (4).

What do we know about patterns of progress in the recent past?

Figure 2a compares the neonatal mortality rate with the maternal mortality ratio in 2015 for 182 countries. This shows that 92 nations have achieved already the 2030 targets for NMR and MMR. Figure 2a also reveals outliers from the clear overall relationship between levels of neonatal and maternal mortality, with approximately 60% of the variation in the former explained by the variation in the latter. For example, although still among the ten countries with highest number of maternal deaths, Pakistan has managed to achieve an (ARR of 3.6% between 2000 and 2015 in its MMR, as confirmed in Figure 2b. Nevertheless, the country still has one of the highest NMRs (46 per 1000 live

births) and a lower rate of progress (ARR: 1.9). Two countries – DRC and Cameroon, have considerable lower NMRs than expected from their MMRs, suggesting potential issues of underestimation of newborn deaths and/or uncertainties in the denominator of live births. Sierra Leone stands out for having the highest maternal mortality ratio in 2015 (1,360 per 100,000 live births) reflecting the weak health care system left by a 10-year civil conflict that ended in 2002, and more recently by the Ebola outbreak. From such a high baseline situation, it has been argued that dramatic progress should be possible assuming continuing political stability and with major strengthening of health services and infrastructural developments (10).

Figure 2b shows that AARs were greater for NMR than MMR in 84 of the 163 countries for which the comparison can be made. The countries with fastest progress in reducing their NMR were Bahrain, China, Estonia and Belarus, and for MMR were Belarus, Kazakhstan and Turkey. Rates reduction for NMR ranged from 9.7% for Bahrain to - 0.75% for Zimbabwe which was the only country where the NMR increased from 2000 to 2015. For MMR, the range of rates reduction went from 12.1% for Belarus to -3.3% for South Africa. In total, 12 countries did not reduce their MMR between 2000 and 2015, including mostly middle or high-income countries such as United States of America, Venezuela, Uzbekistan and South Africa.

Where in the world to focus attention in the SDG period?

Priorities from a geographical perspective can crudely be identified by looking at world regional and national level data. In terms of proportions, the vast majority of stillbirths, neonatal deaths and maternal deaths occur in LMICs, with at least three-quarters in sub- Saharan Africa and south Asia (76%, 80%, 88%, respectively). Table 1 shows the top 10 countries with highest burden of maternal deaths, neonatal deaths and stillbirths, accounting for around 59%, 63% and 65% of their global totals, respectively. Population size is an important factor since the countries with the most deaths are also those with most births, notably India (45,000 maternal deaths, 695,900 neonatal deaths, 592,100 stillbirths) and Nigeria (58,100 maternal deaths, 240,100 neonatal deaths, 313,700 stillbirths). It is important to note that some of these countries such as India and China did in fact make rapid progress from 2000 to 2015 in reducing maternal and newborn deaths, but owing to their large population size they still contribute significantly to the global total. The variation in levels between areas and population sub-groups within their borders is also large, emphasizing the masking of inequalities when using national averages. As noted earlier, reducing inequalities is acknowledged as a sub-target in both the EPMM and ENAP strategies. Significant gaps between rich and poor groups in service uptake and in mortality outcomes have been highlighted among all recent Lancet series – for newborns, stillbirths and most recently for maternal health (4, 8, 11).

Some of the countries in the world regions with the highest mortality rates and lower progress are designated as fragile states. The concept of fragility is conventionally applied to two main population groups: those afflicted by humanitarian crises and those vulnerable because of social class, wealth, religion or ethnicity. The term "fragile state" specifically designates countries according to a broader set of factors, with the Fragile States Index (FSI) ranking countries according to their stability based on twelve indicators including deterioration of public services, security threats, and sharp economic decline (12). Given the gendered nature of many risks in these settings, such as sexual violence and a lack of routine and emergency services, these populations of women and newborns are indeed

vulnerable (11, 13, 14). A significant proportion of this vulnerability is found in fragile states in sub-Saharan Africa. Specifically, 60% of preventable maternal deaths and 53% of preventable under 5 deaths from the 50 most fragile states are in settings of conflict, war or civil disturbance, natural disasters, food insecurity or other crises resulting in excessive mortality (21-22). National planning processes for development must include humanitarian preparedness, response and recovery if the severe consequences of these emergencies on maternal, newborn health are to be mitigated. However, there is still a lack of knowledge about the burden of maternal and neonatal mortality and stillbirths in these contexts and the effective interventions that should be implemented.

When to focus attention along the continuum of care?

In terms of the most extreme outcomes for mothers and babies – death, the time of labour and the day of birth is when an estimated 43% of all maternal deaths (129,400) and 42% of all stillbirths and neonatal deaths (2.2 million) occur (Figure 3). The time between a potentially catastrophic event and death can be very short: a baby who does not breathe at birth will die within a few minutes, and a fetus with a severe hypoxic event or a woman with post-partum haemorrhage could die in less than an hour.

Maternal mortality from direct obstetric causes is highest on the first and second days after birth (15), and requires a concerted focus on quality care at birth (16). However, the proportion of indirect causes of death, both communicable and non-communicable, is increasing in most countries, reflecting the epidemiological transition described further below. This impacts upon the pattern of timing of deaths, with increasing fraction occurring during the antepartum and especially postpartum period, including late maternal deaths (11). Inevitably the indirect proportion will continue to increase in the future in response to this advancing transition and as direct causes are addressed through quality emergency obstetric care and skilled care at birth (17).

In the case of newborns, the majority of deaths also occur on their day of birth, with an estimated 73% of all neonatal deaths occurring during the first week of life and 36% occurring on the day of birth, with the highest risk for those born preterm (<37 weeks) (18). In 2015, it was estimated that about half of stillbirths, 1.3 million, occurred during labour, despite two-thirds of births worldwide now being in health facilities (4).

These data on the timing of deaths for women and their babies underlines the need to continue to improve high quality care around the time of birth for all - leaving no one behind. The equity dimension is key since marginalised groups – owing to wealth, location or cultural factors, not only have the least access to care but also currently often experience the worst quality (11).These investments in care at birth, both for normal and complicated deliveries, give a quadruple return on investment by preventing maternal and newborn lives as well as stillbirths, and also reducing severe morbidity and disability, with improvements in child development and maternal health (19, 20).

What conditions require concerted focus?

During the MDG era, the methods for data capture and analysis on causes of death have advanced and the more and more reliable evidence is available for planning, implementing and evaluation programmes as well as for prioritising research gaps (21). Policy makers may not be informed about the current cause of death structure; however this knowledge is crucial to the design of programmes

and priorities. In addition, several recent reviews have assessed the conditions that affect women, neonates and stillbirths and could be addressed together. For example, findings from the WHO Multi-country survey (15) show that 20-30% of maternal complications coincide with stillbirths and early neonatal deaths, with data from country-specific studies suggesting this is a conservative estimate (22), and thus considerable scope to bring multiple benefits by effective prevention, detection and management (23).

As noted above, an 'obstetric transition' is underway whereby countries shift from a pattern of high to low maternal mortality, from predominance of direct obstetric causes of maternal mortality to an increasing proportion of indirect causes of death (24). Attention consequently also shifts to other relevant health and non-health determinants, such as intergenerational risks and the roles of life-style factors, as well as greater attention on maternal morbidity (11, 25, 26). The global epidemiological transition for under-5 child mortality has likewise shifted from the leading causes being infections in infants and older children, such as measles, pneumonia and malaria, to almost half of child deaths occurring in the neonatal period, with preterm direct complications being the top cause of child deaths (27). This transition for early ages strengthens the need to continue to improve care at the time of birth to reduce neonatal deaths and stillbirths, and also address the long term effects of adverse birth outcomes on child development and non-communicable diseases.

Table 2 categorizes the main causal groups for neonatal and maternal deaths and stillbirths as birth complications, infections, and maternal health and family planning. Whilst the "obstetric transition" in LMICs is well-established across many South Asian and Latin American countries and manifest in mortality and morbidity data, for sub-Saharan Africa the majority of maternal deaths are still reporting in hospital series to be due to direct obstetric causes, and this impact on the global picture given the large proportion of deaths still occurring in this part of the world. The recent Lancet Maternal Health series confers the continuing importance of haemorrhage, hypertensive disorders, sepsis, and complications of abortion, but also demonstrates one of the key defining characteristics for maternal health which will becoming increasingly important in the SDG era – diversity of conditions and causes (11). Both communicable and non-communicable diseases occur in pregnant and recently-delivered women and can co-exist with obstetric complications, emphasizing a projected increase in high-risk cases with implications for the whole continuum of maternity services as well as for the fetus and newborn. Such conditions include diabetes, mental ill-health, HIV, malaria, cardiovascular conditions, and obesity.

The three main causes of neonatal death globally are preterm birth complications (35%), intrapartum conditions (24%), and infections (20%) (27). (table 2) Almost 80% of newborn deaths occur among babies who weigh less than 2500g at birth, especially those born preterm (8). Countries with declining newborn mortality demonstrate that as the contribution of infections and intrapartum complications declines, the relative impact on deaths from prematurity and congenital conditions increases (28).

Finally, turning to the causes of stillbirths, developing a picture here is particularly affected by limited data and poor comparability given a multiplicity of classification systems (4). However, despite these challenges, there are enough data to be clear on the high level priorities, as underlined in the analyses regarding preventability in the recent The Lancet Ending preventable stillbirths series

(4). Nearly half of stillbirths occur during birth, of which three-quarters are preventable with equitable access to quality of care and early detection of at-risk pregnancies (20, 29, 30). Infections during pregnancy remain important preventable factors, especially in sub-Saharan Africa where malaria in pregnancy is estimated to be associated with around 20% of stillbirths and syphilis 11%. Addressing other risk factors such as non-communicable diseases, nutrition and lifestyle factors, fetal growth restriction, preterm labour, and post-term birth will also reduce preventable stillbirths. Stillbirths due to non-preventable congenital abnormalities account less than 10% of stillbirths after 28 weeks (4).

Implications

Strategies for Ending Preventable Maternal Mortality (EPMM) and the Every Newborn Action Plan (ENAP) have been important efforts to set out agreed targets and priorities, which are now also embedded in the Global Strategy for Women's Children's and Adolescent's Health, gaining political momentum in countries and shaping national strategies (31). (Panel 2) The major strides made for improving maternal health and birth outcomes during the MDG era need to continue accelerating during the SDG era. Yet the lack of focus to health or to women and children in the SDGs requires new approaches and focus. Achieving the 2030 mortality targets will also require investments to shift and target those families most at risk in every setting, with increased focus to tackle the increasing proportion of these deaths occurring in humanitarian emergency settings (32).

Practical priority actions build from the agreed strategic objectives for ENAP and EPMM (9) as well as issues identified as needing to be done to accelerate progress (16, 20, 33): political attention and investment to the time around birth, implementation of maternal-newborn health interventions, indicators and measurement, research, and empowerment. Reducing maternal and child mortality requires improved access to and quality of essential, already known interventions and services (34). Countries which have reduced their maternal, neonatal and stillbirth mortality rates faster than their neighbours have also increased coverage of key maternal–newborn interventions within the same timeframe, such as modern contraceptive use, at least four antenatal care visits, birth with a skilled attendant, essential newborn and postnatal care (4, 8). Successful measures to increase this coverage have included financial protection measures, health insurance, workforce planning and dynamic leadership (35). Linking data to action has also been important to drive the change (4, 8). However, huge inequities in coverage and quality continue, and more efforts are needed to improve the data to track specific interventions and quality of care, and then be able to use that data to close gaps in care for the poorest and most marginalised in every setting (36).

Improved quality of childbirth and newborn care for existing facility births could avert an estimated 2 million deaths in 2020 (113,000 maternal deaths, 531,000 stillbirths, and 1.3 million newborn deaths) (29) and would arguably be one of the most important ways to lower the global burden of disability from neonatal conditions and reduce maternal morbidities (25, 37). Crucially linked, addressing unmet need for family planning could prevent 29% of maternal deaths each year as well as improve perinatal outcomes and child survival and health (38, 39).

The data presented in this paper highlight common themes such as the high proportion of deaths (especially preventable deaths) around the time of birth, and also the issues of NCDs and infections.

Improved coverage and quality of data will be critical to drive targeted investment, policy and programming and to track progress towards the SDG targets. In addition, there are clearly context-specific epidemiological issues and health system barriers to address. Countries that need to achieve greater progress to meet the set targets will need political engagement, financial investment and improved data to track coverage, quality and equity gaps.

The health and survival of babies and their mothers are inextricably linked, and calls for coordinated efforts and innovation before and during pregnancy, in childbirth, and postnatally, in order to end preventable maternal, neonatal deaths and stillbirths and minimise morbidity and disability for women and their babies worldwide.

Conflict of interest
The authors declare that they have not conflict of interest.

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FIGURES, TABLES and PANELS

Figure 1. Targets in SDGs, EPMM and ENAP by 2030 for ending preventable maternal, newborn and child deaths and stillbirths.

a. Maternal mortality ratio target in EPMM and ENAP, and set in the SDGs
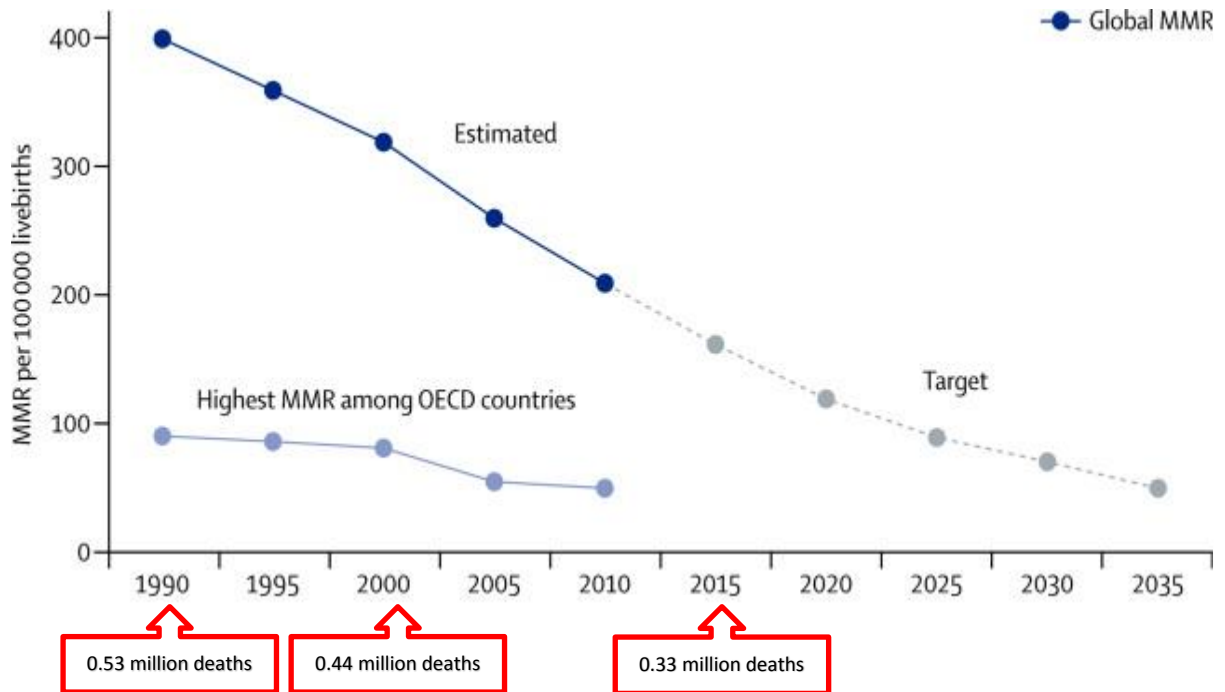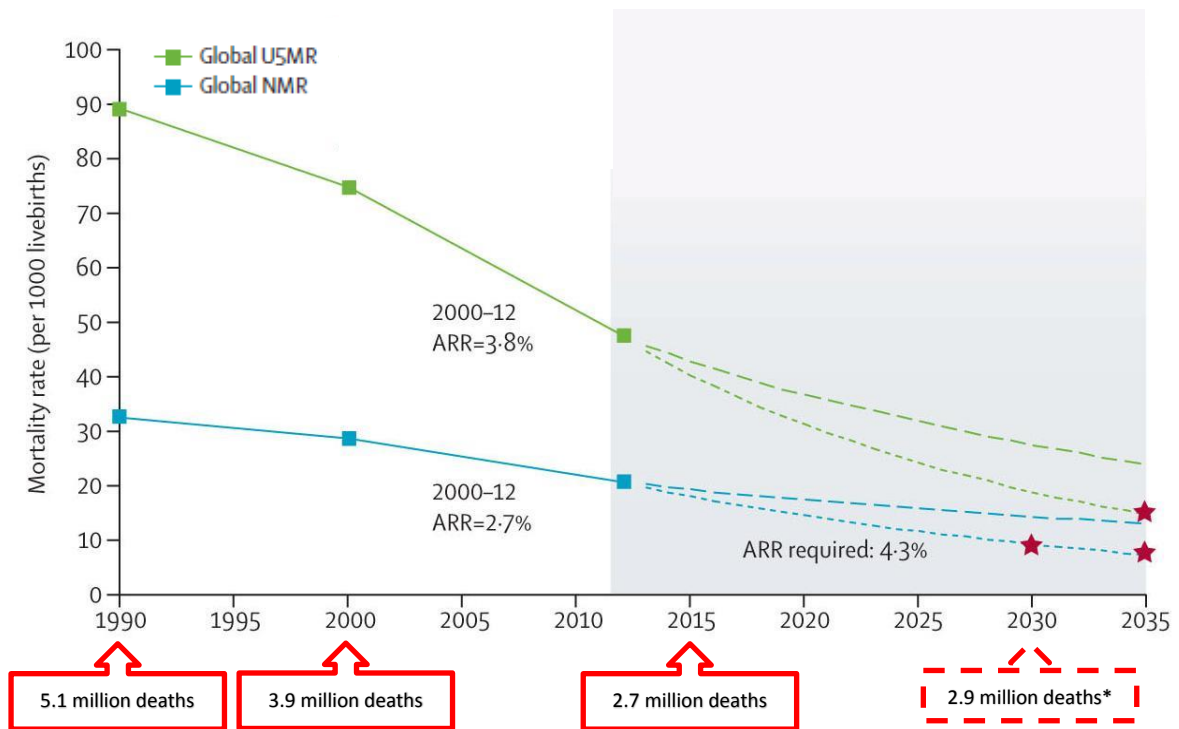

TARGET
Every country should reduce its maternal mortality ratio by at least two thirds from the 2010 baseline, and no country should have a rate higher than 140 deaths per 100,000 live births (twice the global target). The global average* target of maternal mortality ratio should be <70 maternal deaths per 100,000 live births
*Global average refers to the mathematical mean maternal mortality ratio as tabulated by International Classification of Diseases, based upon the global population **http://www.bmj.com/content/bmj/351/bmj.h4255.full.pdf**

Source: WHO, UNICEF, UNFPA, World Bank Group, UN Population Division (5).

b.   Neonatal mortality rate target in Every Newborn and SDG 3

TARGET
Every country should have a national neonatal mortality rate of ≤12 per 1000 live births. This would result in global neonatal mortality total of 0.8 million and an average global neonatal mortality rate of 9 per 1000 live births

*Predicted for 2030 if no acceleration and progress in neonatal mortality rate reduction continues at 2000 – 2012 ARR

Source: Lawn JE, Blencowe H, Oza S, et al (8).

c. Stillbirth rate target in Every Newborn but not included in SDGs
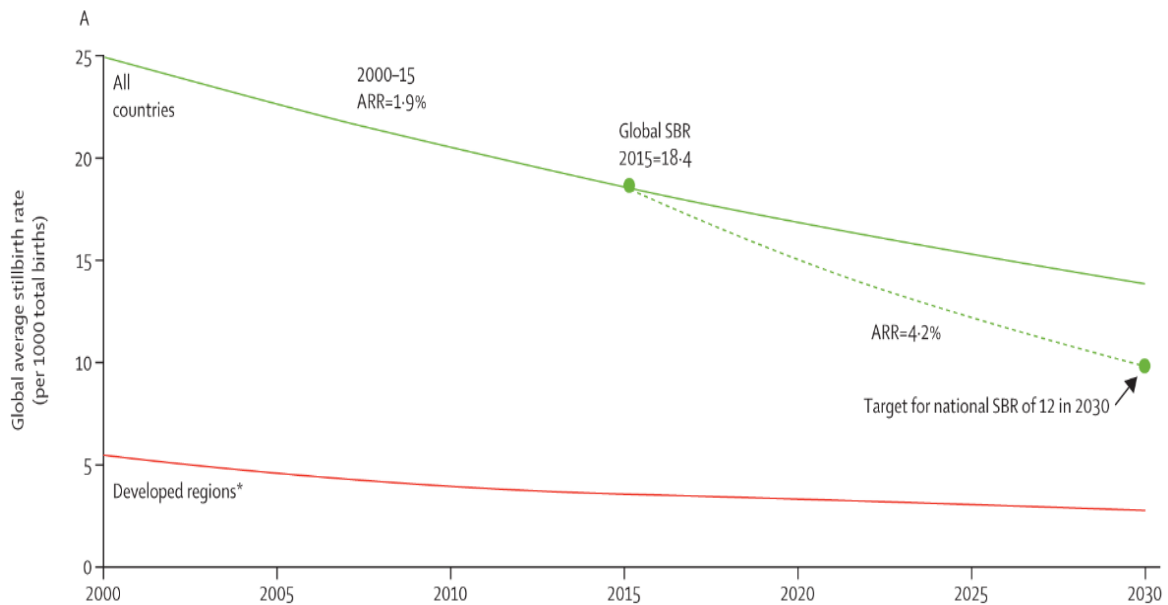
TARGET

Every country should have a stillbirth rate of ≤12 per 1000 total births. The global stillbirths would be 1.1 million with an average global stillbirth rate of 9 per 1000 total births

*Predicted for 2030 no acceleration and progress in stillbirth rate reduction continues at 2000 – 2015 ARR

Source: Lawn JE, Blencowe H, Waiswa P, et al, (4).

Figure 2. Comparison among countries of maternal and neonatal rates and progress

a.   Comparison of rates (MMR vs NMR) in 2015
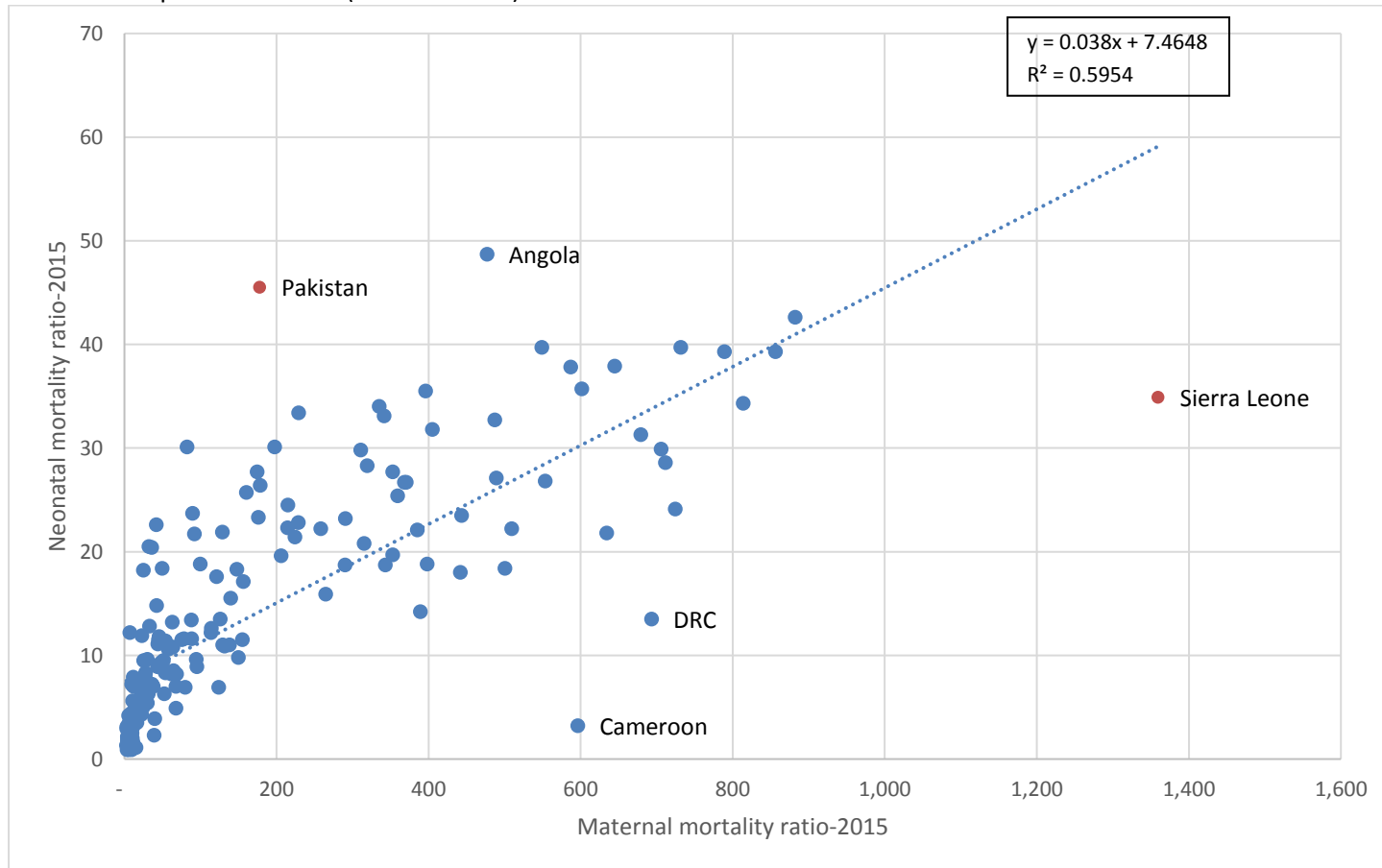
b. Comparison of ARR (for MMR vs NMR) for 2000-2015*

Figure shows a scatter plot. Y-axis: "Average annual rate of NMR reduction 2000-2015" ranging from -2.00 to 12.00. X-axis: "Average annual rate of MMR reduction 2000-2015" ranging from -6.0 to 14.0.

Trendline equation: y= 0.3033x + 2.3215, R^2=0.1649

Labeled points: Bahrain, Estonia, China, Belarus, Kazakhstan, Turkey, Hungary, South Africa, USA, Zimbabwe.
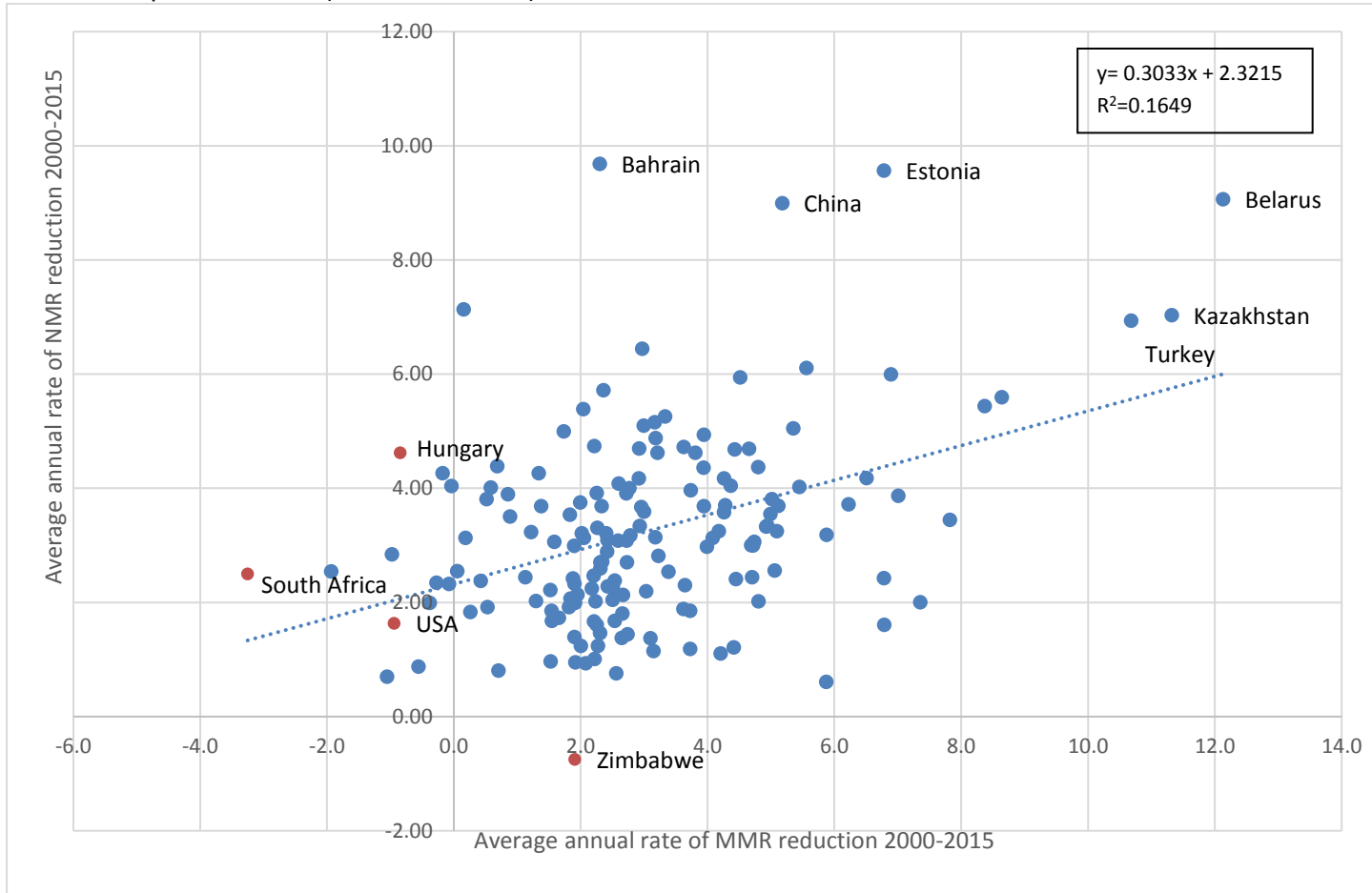
*All countries with less than 10,000 live births per year were excluded from analysis.
Sources: WHO, UNICEF, UNFPA, World Bank Group, UN Population Division (5).

Figure 3. Timing of death for stillbirths, maternal and newborn deaths in the year 2015
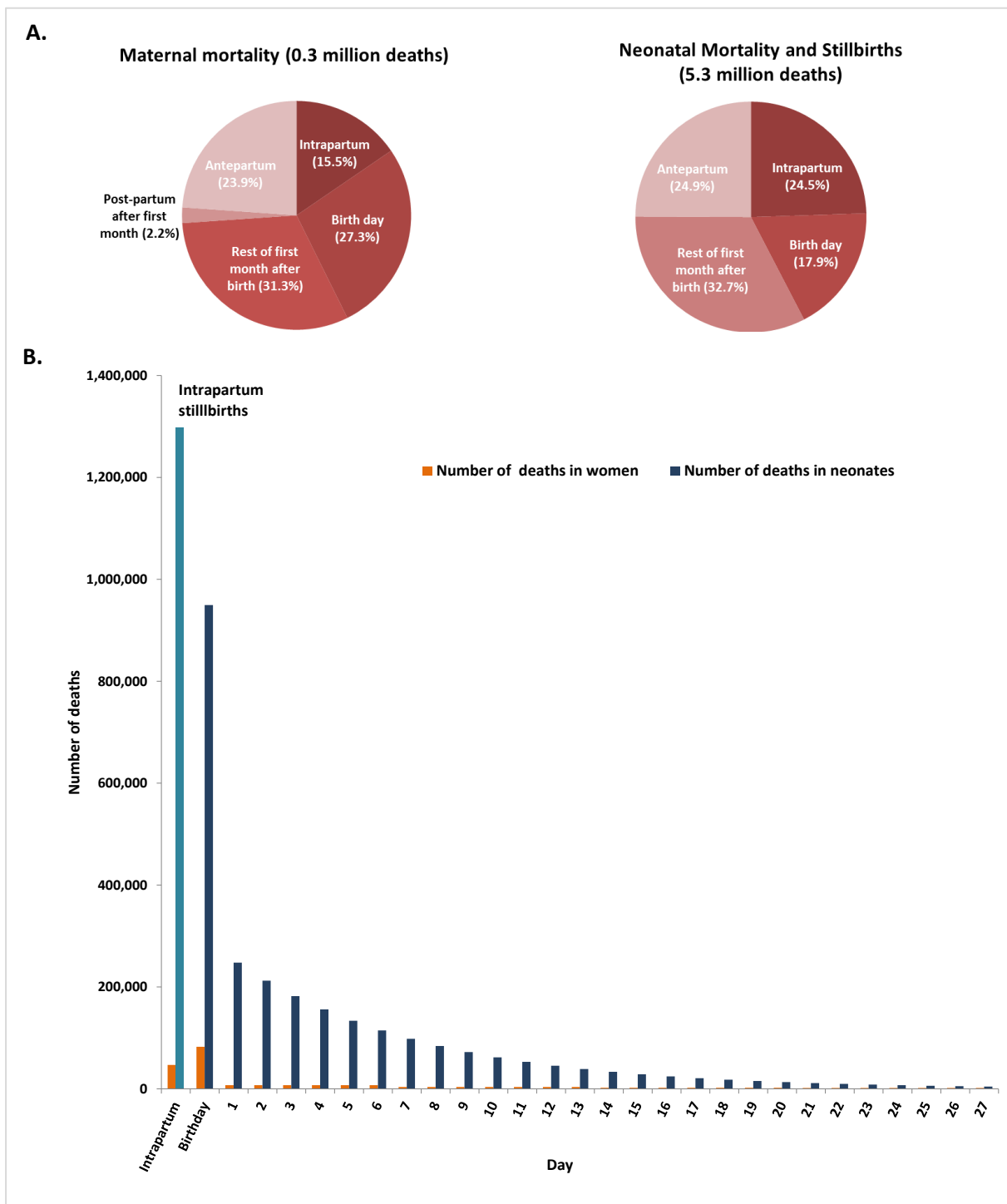
Sources: updated from Lawn et al (8) using UN estimates for 2015 (3-5)

Table 1. The ten countries with highest burden of stillbirths, maternal and neonatal deaths in 2015

Maternal deaths		Stillbirths		Neonatal deaths	
Country	**No of maternal deaths** *(ARR:2000-15)*	**Country**	**No of stillbirths** *(ARR:2000-15)*	**Country**	**No of neonatal deaths** *(ARR:2000-15)*
Nigeria	58,100 (-2.4)	India	592,100 (-2.4)	India	695,900 (-2.4)
India	45,000 (-5.0)	Nigeria	313,700 (-1.3)	Pakistan	244,700 (-1.9)
Dem Rep Congo	22,300 (-1.5)	Pakistan	242,600 (-1.4)	Nigeria	240,100 (-2.3)
Ethiopia	11,200 (-6.0)	China	122,300 (-4.6)	Dem Rep Congo	94,300 (-1.7)
Pakistan	9,700 (-3.6)	Ethiopia	96,500 (-1.8)	China	93,400 (-8.6)
United Rep Tanzania	8,200 (-4.9)	Dem Rep Congo	87,800 (-1.5)	Ethiopia	87,400 (-3.7)
Kenya	8,000 (-2.6)	Bangladesh	83,100 (-3.4)	Bangladesh	74,400 (-3.9)
Indonesia	6,400 (-4.8)	Indonesia	73,400 (-1.9)	Indonesia	73,900 (-3.3)
Uganda	5,700 (-3.9)	United Rep Tanzania	47,100 (-2.3)	Angola	53,200 (-1.2)
Bangladesh	5,500 (-5.3)	Niger	36,200 (-0.4)	United Rep Tanzania	38,600 (-3.5)
Total	180,000 maternal deaths (59% world total)		1.7 million stillbirths (65% world total)		1.7 million neonatal deaths (63% world total)

Sources: (3-5)

Table 2. What are the main causal groups for 5.6 million neonatal and maternal deaths and stillbirths

	Maternal deaths				**Stillbirths**			**Neonatal deaths**			
	Cause of death	Number of deaths (2015)	Proportion of deaths (%)	Cause of death	Number of deaths (2015)	Proportion of deaths (%)	Cause of death	Number of deaths (2015)	Proportion of deaths (%)	**Total**
Pregnancy and Intrapartum complications	Haemorrhage	82,100	27.1	Intrapartum stillbirths	1,300,000	49.6	Intrapartum complications	627,700	23.4	
	Hypertension	42,400	14				Preterm birth complications	957,600	35.7	
	Other direct causes	29,100	9.6							
	Sub-total	*153,600*	*50.7*		*1,300,000*	*49.6*		*1,585,300*	*59.1*	*3,038,900*
Infections	Sepsis	32,400	10.7	Malaria	209,600	8	Sepsis	418,500	15.6	
				Syphilis	201,700	7.7	Pneumonia	131,400	4.9	
				HIV	7,900	0.3	Tetanus	45,600	1.7	
							Diarrhoea	16,100	0.6	
	Sub-total	*32,400*	*10.7*		*419,200*	*16*		*611,600*	*22.8*	*1,063,200*
Maternal health and family planning	Other indirect causes	83,300	27.5	Other ante-partum	900,800	34.4	Congenital disorders	281,700	10.5	
	Abortion	23,900	7.9				Other causes	201,200	7.5	
	Embolism	9,700	3.2							
	Sub-total	*117,000*	*38.6*		*900,800*	*34.4*		*482,300*	*18*	*1,500,590*
Total		**303,000**	**100**		**2,620,000**	**100**		**2,679,700**	**100**	**5,602,700**

All numbers presented are rounded to nearest 100. Totals may not add due to rounding

Sources: Maternal: Say et al. Lancet 2014, Neonatal: Oza et al. 2015-Bull, WHO; Stillbirths: Lawn et al. Lancet 2016

Panel 1: Data sources and methods

Maternal deaths estimates

Data source

Data was taken from the latest maternal mortality estimates from the Maternal Mortality Estimation Inter-Agency Group (MMEIG) integrated by the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank Group and the United Nations Population Division (UNPD) (5). For data on causes of maternal deaths we used findings on the global distribution of causes of maternal death from Say et al (40).

Definitions

Maternal deaths were defined according to the definition of the International Classification of Diseases (ICD: 10th edition): "death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes". Maternal mortality ratio was defined as maternal deaths, per 100,000 live births.

Neonatal deaths estimates

Data source

Data was taken from the most recent report on neonatal, infant, and under-five mortality levels and trends presented by the United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) for all United Nations member states—195 countries or entities at the time of the most recent estimation (3). For the neonatal causes of death we used the global distribution for neonatal deaths presented by Oza et al (28).

Definitions

Neonatal deaths were defined as any live born children who die during the first 28 days after birth. Neonatal Mortality Rate was defined as the number of neonatal deaths, per 1000 live births.

Stillbirth estimates

Data source

Data on stillbirths, their trends from 2000 to 2015 and risk factors were taken from the Ending Preventable Stillbirths Lancet Series (4).

Definitions

According to the International Classification of Diseases, definitions include:

- Late fetal death 1000 g or more, or 28 weeks or more, or 35 cm or more
- Early fetal death 500 g or more, or 22 weeks or more, or 25 cm or more
- Miscarriage as a pregnancy loss before 22 completed weeks of gestational age

The Ending Preventable Stillbirths Lancet Series used the 28 weeks or more definition, which represents third trimester stillbirths and hence undercounts the true burden if early stillbirths were included. Stillbirth rate was calculated as number of stillbirths per 1000 total births.

Methods

Annual rate of reduction was calculated with the formula: (((rate in endline year/ rate in baseline year) ^(1/(endline year-baseline year))-1)x100.

Panel 2: Strategies for ending preventable maternal and newborn mortality and stillbirths

Every Woman Every Child (EWEC) puts into action the *Global Strategy for Women's, Children's and Adolescents' Health* (Global Strategy), a roadmap for ending all preventable deaths of women, children and adolescents within a generation (41). Ending preventable maternal and newborn mortality and stillbirths is a high priority within this movement, requiring a highly coordinated advocacy campaign to mobilize partners and resources. Two strategies were developed to support this movement: the Every Newborn Action Plan (ENAP), launched in 2014 (7), and Ending Preventable Maternal Mortality (EPMM), launched in 2015 (6). Together these strategies have each galvanized attention and resources, resulting in dedicated targets in the Sustainable Development Goals, greater visibility in national plans and programmes, and identification of priorities needing further investment with some dedicated resources.

ENAP and EPMM are based on scientific evidence, and underwent wide expert consultation with inputs from national, regional, and global meetings, and an official online consultation. The mortality targets were endorsed by countries, including at the 67th World Health Assembly in 2014. The maternal and newborn mortality targets were included in the SDGs targets.

In September 2015, combined strategies from both initiatives were summarized as part of a supplement in support of the Global Strategy. The combined priority strategic objectives include:
• Invest in care around the time of birth, with a focus on improving quality and experience of care, while ensuring full integration of services for mothers and babies across the continuum of care
• Strengthen health systems to optimise the organisation and delivery of care, the workforce, commodities, and innovation
• Reach every woman and newborn by minimising inequities in access to and coverage of care
• Harness the power of parents, families, and communities, and engage with society
• Improve data for decision making and accountability.

The Global Strategy was adapted as a World Health Assembly Resolution in 2016 (A69/A/CONF./2) with plans in development to support national implementation. Activities already underway for ENAP and EPMM will link to this broader process. For example, to improve data, an Every Newborn measurement improvement roadmap focuses on collecting data and establishing standardised indicators to monitor coverage and track scale up of newborn related interventions and will link to the EPMM process for developing a standardised list of indicators for maternal health.

Key practice points

Improving maternal-newborn health and meeting 2030 targets will require:

- Intentional and intensified political attention and investment in maternal-newborn health with particular focus on improving quality and experience of care around the time of birth
- Implementation at scale of integrated maternal-newborn health interventions across the continuum of care, including family planning, with commensurate investment targeted at the most vulnerable populations;
- Indicators to measure impact, inform practice and monitor progress;
- Investigation of critical knowledge gaps.
- Increased voice, especially of women, supporting families and communities to speak up for mothers and newborn babies and to challenge social norms that accept these deaths as inevitable

Research agenda:

- Improved understanding of how to implement effective, known interventions at scale, such as simplified neonatal resuscitation program and clinical algorithms and improved skills of community health workers, and how to target the most vulnerable populations (42).
- Implementation of care at all stages of the obstetric transition, including effective integration of interventions for women and their babies.
- Development research to strengthen reporting of impact indicators, especially stillbirths, and to define, test and scale-up use of indicators to measure coverage to inform policy and practice and to monitor progress (42).
- Research on measurement – specifically of the morbidity and mortality burden and causes, vulnerable groups, and indicators to measure progress of policies and promote accountability, health system capability, the content of intrapartum care, and women's satisfaction.
- Discovery research to identify new, more effective and less expensive medicines for preventing preterm birth and treating sepsis, point of care diagnostics for infections, maternal vaccines to prevent newborn infections, and basic science work on causal pathways for identifying intervention targets and biomarkers for preterm birth, IUGR, and antepartum stillbirths (42).

KEY READINGS

Add
The Lancet Every Newborn Series: http://www.thelancet.com/series/everynewborn
The Lancet Ending Preventable Stillbirths Series: http://www.thelancet.com/series/ending-preventable-stillbirths
The Lancet Maternal (upcoming September 2016)
The Lancet Midwifery series http://www.thelancet.com/series/midwifery
Every newborn: an action plan to end preventable newborn deaths- UNICEF, WHO:
http://www.everynewborn.org/Documents/Every_Newborn_Action_Plan-ENGLISH_updated_July2014.pdf
Strategies toward ending preventable maternal mortality- WHO, UNICEF, UNFPA:
http://who.int/reproductivehealth/topics/maternal_perinatal/epmm/en
Every Woman, Every Newborn series, BMC Pregnancy and Childbirth:
http://bmcpregnancychildbirth.biomedcentral.com/articles/supplements/volume-15-supplement-2
Towards a new Global Strategy for Women's, Children's and Adolescent's health, BMJ:
http://www.bmj.com/content/women%E2%80%99s-children%E2%80%99s-and-adolescents%E2%80%99-health-0
Beyond Newborn Survival, Pediatric Research
http://www.nature.com/pr/journal/v74/n1s/index.html
Global Perinatal Medicine http://www.seminperinat.com/issue/S0146-0005(15)X0005-X

MULTIPLE CHOICE QUESTIONS

Question 1
2030 global targets for ending preventable deaths in women, newborns and stillbirths include:
   a. Attaining a global average of maternal mortality ratio of <70 maternal deaths per 100,000 live births
   b. Every country attaining a neonatal mortality rate of ≤21 per 1000 live births
   c. Eliminating all deaths during pregnancy and childbirths
   d. Every country attaining a stillbirth rate of ≤12 per 1000 total births
   e. Every country reducing its maternal mortality ratio by at least two thirds from the 2010 baseline, and no country having a rate higher than 140 deaths per 100,000 live births

Answers to question 1:
   (a) T   (b) F   (c) F   (d) T   (e) T

Explanation to the answers to question 1
   (a) True. The 2030 target for maternal mortality as included in Sustainable Development Goal 3 is every country should reduce its maternal mortality ratio by at least two thirds from the 2010 baseline, and no country should have a rate higher than 140 deaths per 100,000 live births (twice the global target). The global average target of maternal mortality ratio should be <70 maternal deaths per 100,000 live births.
   (b) False. The Every Newborn Action Plan target as included in Sustainable Development Goal 3 is every country should have a national neonatal mortality rate of ≤12 per 1000 live births (not ≤21)
   (c) False: These targets aim to end all maternal and neonatal deaths and stillbirths from preventable causes, for example lack of access to high quality intrapartum care and infections. Even with the highest level of health and health care, some deaths will still occur, for example some stillbirths due to complex congenital disorders.
   (d) True. The target is that every country should have a stillbirth rate of ≤12 per 1000 total births.
   (e) True. See explanation from **(a)**.

Question 2
The leading causes of maternal deaths worldwide in 2015 include:
   a. Complications of abortion
   b. Post-partum haemorrhage
   c. Hypertensive disorders of pregnancy
   d. Other direct causes
   e. Other indirect causes

Answers to question 2:
   (a) T   (b) T   (c) T   (d) T   (e) T

Explanation to the answers to question 2
All answers are true. However, as highlighted in the recent Lancet Maternal Health series that whilst haemorrhage, hypertensive disorders, sepsis, and complications of abortion remain important causes of maternal death, there is an increasing diversity of conditions and causes. Both communicable and non-communicable diseases occur in pregnant and recently-delivered women and can co-exist with obstetric complications, emphasizing a projected increase in high-risk cases with implications for the whole continuum of maternity services as well as for the fetus and

newborn. Such conditions include diabetes, mental ill-health, HIV, malaria, cardiovascular conditions, and obesity.

Question 3
The top three leading causes of neonatal deaths worldwide in 2015 include:
    a. Complications of preterm birth
    b. Congenital malformations
    c. HIV and syphilis
    d. Intrapartum related complications
    e. Neonatal sepsis and pneumonia

Answers to question 3:
    (a) T   (b) F   (c) F   (d) T   (e) T

Explanation to the answers to question 3
    (a) True. Complications of preterm birth is the leading cause of both neonatal and total under 5 child deaths.
    (b) False. Whilst the relative importance of congenital disorders increases as the absolute numbers of deaths due to readily preventable neonatal deaths, such as deaths due to intrapartum complications in term babies or sepsis in late preterm babies, reduces; currently globally these are the leading causes of death. Policy and programs should hence target these causes for maximum impact, especially in high burden settings.
    (c) False. Whilst efforts to eliminate mother to child transmission of both HIV and syphilis are required to improve overall maternal and child health especially in high prevalence areas, neither are a leading cause of neonatal death (reducing HIV has the greatest effect on infant deaths and reducing syphilis has largest impact on stillbirths).
    (d) True. Intrapartum related complications are the second leading cause of neonatal death worldwide.
    (e) True. Infections such as neonatal sepsis and pneumonia remain an important cause of neonatal death worldwide.

Question 4
The majority of maternal, stillbirth and newborn deaths occur around the time of labour and the day of birth. Adverse outcomes at this time include:

    a.   an estimated 43% of all maternal deaths (129,400)
    b.   an estimated 50% of stillbirths (1.3 million)
    c.   an estimated 73% of all neonatal deaths
    d.   3 million stillbirths and newborn deaths
    e.   severe maternal and newborn morbidity and disability

Answers to question 3:
    (a) T   (b) T   (c) F   (d) F   (e) T

Explanation to the answers to question 4
    a.   **True**: Maternal mortality from direct obstetric causes is highest on the first and second days after birth, and requires a concerted focus on quality care at birth. However, the proportion

of indirect causes of death, both communicable and non-communicable, is increasing in most countries, reflecting an epidemiological transition.

b. **True**: In 2015, it was estimated that about half of stillbirths, 1.3 million, occurred during labour, despite two-thirds of births worldwide now being in health facilities.

c. **False**: In the case of newborns, 36% of deaths occur on their day of birth, with an estimated 73% of all neonatal deaths occurring during the first week of life. Babies born preterm (<37 weeks) are at the highest risk of mortality.

d. **False:** Analyses presented in The Lancet Every Newborn Series found that 42% of all stillbirths and neonatal deaths occur during this period resulting in 2.2 million child deaths.

e. **True**: Although not yet fully quantified at a global level, there is an increasing recognition of that there are a substantial burden of morbidity and long term disability both for mothers and their children resulting from intrapartum and immediate post-partum complications. Many of these could be averted with improved coverage of high quality intrapartum and immediate post-partum care.