

# Undiscovered progress in maternal mortality

During the early 1980s, a half-million women died every year during pregnancy, childbirth, or the postpartum period – a stunning figure in a world that had experienced so much medical advancement. In response, United Nations member countries agreed as part of the Millennium Development Goals (MDGs) to reduce maternal mortality by three-quarters between 1990 and 2015, a goal known as MDG5.

Maternal mortality has been notoriously difficult to measure. To overcome many of the challenges of earlier efforts, the Institute for Health Metrics and Evaluation (IHME) constructed a database of the widest possible range of available information. We assessed vital registration data, censuses, surveys, and verbal autopsy studies for 181 countries. We then applied newly developed analytical methods to generate estimates of maternal deaths and the maternal mortality ratio (MMR) for each year between 1990 and 2008. The resulting dataset is three times the size of previously available datasets.

Our analysis showed that, contrary to the prevailing sentiment in the global health community, the rate of maternal mortality has been dropping. Maternal deaths now claim fewer than 350,000 women every year. While the number of deaths in many countries is falling, the relatively high maternal mortality ratio in a small number of countries remains a cause for concern. Nearly 80% of all maternal deaths occur in just 21 countries.

There are many drivers of maternal health, including fertility, income levels, and education. IHME found that changes in all these areas corresponded with improvements in maternal mortality.

Part of the strategy for achieving MDG5 is the provision of high-quality care during pregnancy and at birth.

There are several ways to track this: whether a skilled birth attendant, such as a physician, nurse, or midwife, was present at birth; whether a birth took place in a medical facility; and whether a pregnant woman received antenatal care. IHME undertook the first global study of trends over time in these indicators in 136 low-, lower-middle-, and middle-income countries. The preliminary research in this area also found signs of success.

At the same time, the ongoing HIV epidemic is working against the gains being made in maternal health. IHME's findings underscore the need for a multifaceted approach to accelerate improvements in maternal mortality.

## Countries making strides in maternal mortality

Globally, fewer mothers are dying from maternal causes than at any time in recent history. IHME estimates that there were 342,900 maternal deaths worldwide in 2008 – nearly 80,000 fewer women than were dying a decade earlier and a 22% decline from IHME's 1990 estimate of 441,500.

As a percentage of overall adult mortality, maternal mortality is a tiny fraction. But the numbers are troubling for two reasons. First, maternal deaths are typically preventable, even in low-resource settings. Second, maternal mortality is a window into the overall strength of a country's health system.

A pregnancy can test nearly all aspects of a health system: preventive care, counseling, surgery, drug administration, follow-up care, and emergency treatment. The number of women dying from maternal causes has historically shown that too many countries' health systems were failing that test.

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Yet IHME's research shows that, during the past two decades, more countries saw their performance improve. The global MMR declined from 320 to 251 per 100,000 live births between 1990 and 2008. On an annual basis, the rate of decline was 1.3%. A decrease at that pace is particularly significant because it runs counter to previous assessments that declines in the MMR had stagnated.

The range among countries varies widely. Some countries have seen annual declines in their MMRs of more than 8% between 1990 and 2008, including the Maldives, Egypt, and Bhutan. Much of North Africa and the Middle East, including Lebanon, Jordan, Saudi Arabia, Libya, and Syria, have had declines of more than 5.5%. This rate of decline corresponds to the MDG5 target.

Egypt is a noteworthy success story. The country's MMR dropped from nearly 200 in 1990 to 43 in 2008 per 100,000 live births, an 8.4% annual rate of decline. Nearby Turkey, which is similar culturally and more successful economically, had a lower MMR in 1990 by a large degree at 121. It had a strong decline of 4.2% in its MMR between 1990 and 2008, but because Egypt made even greater strides, Turkey's MMR of 58 is now higher than Egypt's.

Other countries, including some middle- and high-income countries, have seen increases in their MMRs between 1990 and 2008, including Zimbabwe (from 232 to 624), the United States (from 12 to 17), and Singapore (from 12 to 16).

The global decline in maternal deaths is slower than the rate of decline in mortality for children under age 5. However, it is declining at a faster pace than overall adult

female mortality, which has dropped at an annualized rate of 0.7% since 1990.

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Countries in North Africa and the Middle East, parts of South America, and South and East Asia have had the most impressive overall declines.

#### **Maternal deaths clustered in a handful of nations**

The 21 countries with the vast majority of maternal deaths include some of the world's biggest nations, such as India, Nigeria, and China.

Population alone, though, cannot account for the concentration. Together, the countries make up only 60% of global live births and highlight a disproportionate burden of maternal mortality in Asia and sub-Saharan Africa. For example, Nigeria has 4% of total births but nearly 11% of maternal deaths. A smaller country, Chad, represents less than 0.5% of global births but 1.5% of maternal deaths. Of these 21 countries, China had the fastest annual rate of decline in its MMR at 4.3% between 1990 and 2008. Côte d'Ivoire had the biggest annual rate of increase in maternal deaths at 2.7%.

Just six countries account for half of the world's maternal deaths. The most striking example in this group is Afghanistan, which has less than 1% of global births but accounts for nearly 6% of global maternal deaths. Yet in many of these countries, maternal mortality ratios are

Figure 1:  
Maternal deaths by region, 1990 to 2008

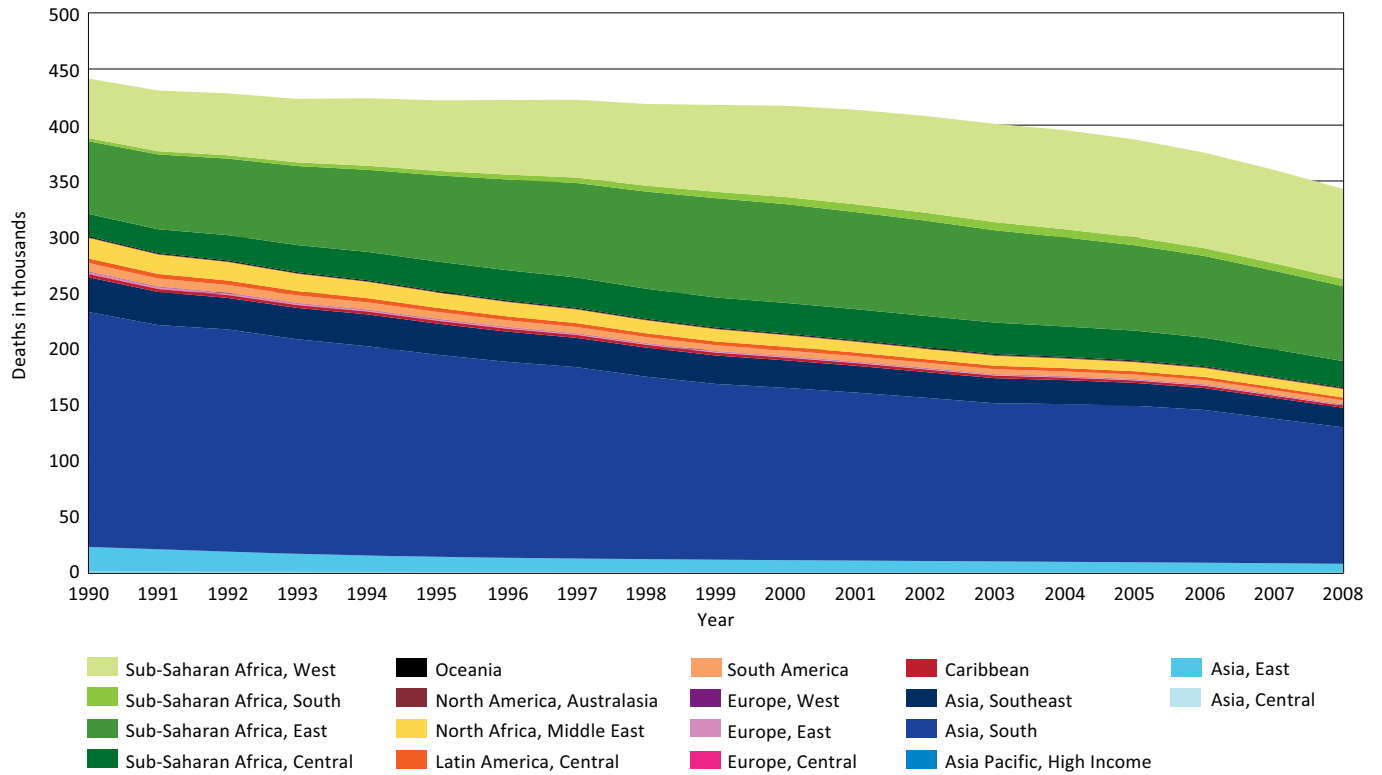


Figure 2:  
Maternal mortality ratio in Egypt and Turkey, 1990 to 2008

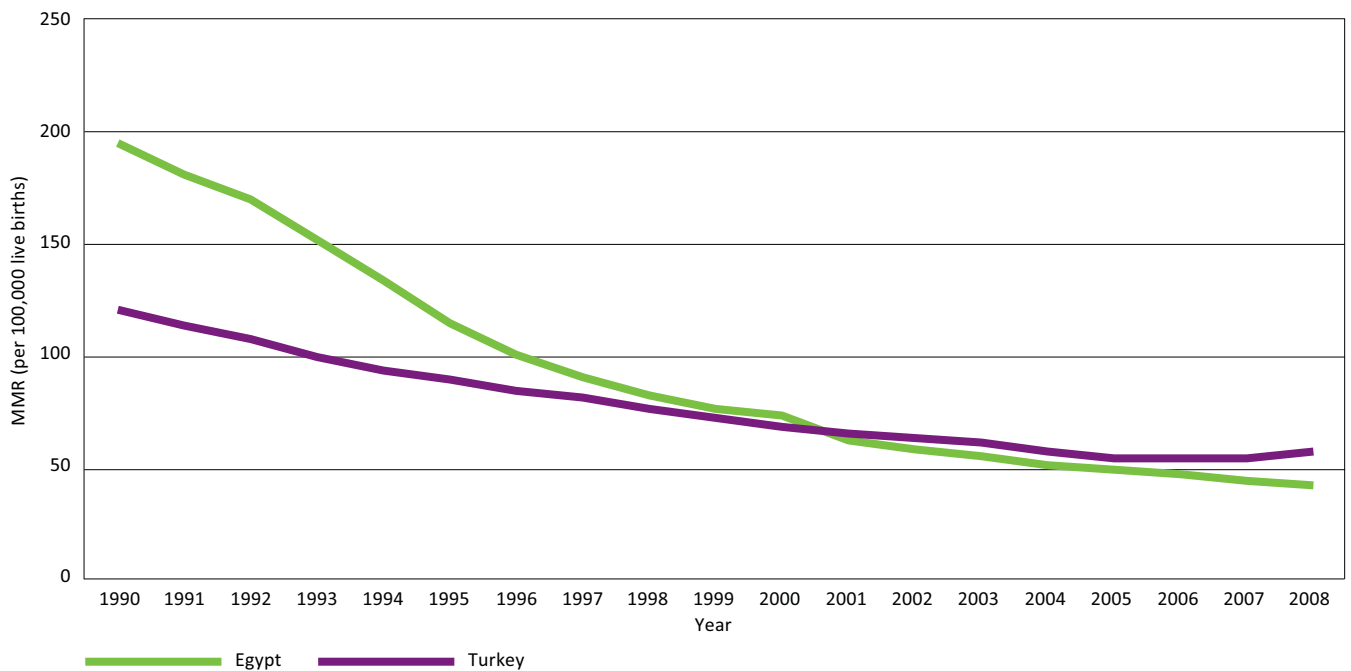


Table 1:  
**Developing countries on track to meet MDG5**  
 (reduce maternal mortality ratio by 75% between 1990 and 2015)

Country	Annualized rate of decline (%), 1990 to 2008
Maldives	8.8
Egypt	8.4
Bhutan	8.3
Tunisia	7.6
El Salvador	7.2
United Arab Emirates	7.1
Laos	7.1
Oman	7.0
Qatar	6.8
Saudi Arabia	6.7
Lebanon	6.5
Libya	6.4
Syria	6.4
Morocco	6.3
Turkmenistan	6.3
Cape Verde	6.2
Myanmar	6.1
Jordan	6.1
Algeria	5.8

improving. Mali, for example, had an MMR of 831 deaths for every 100,000 live births in 1990. Over the next 10 years, the MMR barely changed, dropping to 807. By 2008, though, the country's MMR had declined to 670 – still high by global standards but a total decrease of nearly 17% in less than a decade.

### Some high-income countries fall behind

One surprising trend is the rise in the MMR in high-income countries and the stagnation in others. The United States, Canada, Denmark, and Norway all saw increases in their

MMRs between 1990 and 2008. The United Kingdom and Switzerland essentially saw no progress.

It is likely that at least a portion of these increases is due to cause-of-death coding changes prompted by the introduction of late maternal deaths into the coding system of the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10). In the United States, the inclusion of a separate pregnancy status question on US death certificates in some states also may have contributed to the rise.

Table 2:  
Countries with the most maternal deaths, 2008

Country	Deaths (in thousands)	Deaths, % of total	Births, % of total
India	68.3	19.9	19.7
Nigeria	36.7	10.7	4.4
Pakistan	20.1	5.9	3.9
Afghanistan	20.0	5.8	0.9
Ethiopia	18.2	5.3	2.3
Congo, Democratic Republic of the	15.4	4.5	2.1
Bangladesh	11.6	3.4	2.5
Indonesia	9.6	2.8	3.1
Tanzania	8.0	2.3	1.3
China	7.3	2.1	13.3
Malawi	6.8	2.0	0.4
Côte d'Ivoire	6.8	2.0	0.5
Kenya	6.2	1.8	1.1
Chad	5.3	1.5	0.4
Mozambique	5.2	1.5	0.6
Uganda	5.2	1.5	1.1
Cameroon	5.0	1.4	0.5
Niger	4.7	1.4	0.6
Angola	4.6	1.3	0.6
Sudan	4.0	1.2	0.9
Mali	3.6	1.1	0.4
All other countries (160)	70.3	20.5	39.3
Total	342.9	100.0	100.0

Regardless of its root cause, the trend is clear. In 2008, the UK ranked 23rd in the world based on its MMR, despite its strong economy, education system, and universal health care. Essentially, women in the UK had a higher likelihood of dying of maternal causes than women in Albania, Hungary, Slovakia, and the Czech Republic. The US ranked 39th based on its MMR of 17 – more than four times the world's lowest MMR of 4 in Italy, and more than twice as high as its neighbor, Canada, with a rate of 7. The MMR in the US was also higher than in every country in Western Europe.

### Gap widens between best- and worst-performing countries

There has been marked variation in performance across countries in reducing the MMR. In absolute numbers, countries with the highest and lowest MMRs have both improved their performance over time, yet the disparities among countries persist.

In 1990, Sweden, Australia, and Canada all had an MMR of 6 maternal deaths for every 100,000 live births. The Central African Republic had the world's highest MMR at 1,757. That meant the lowest-performing country had

Figure 3:  
Annualized rate of decline in maternal mortality ratio by country, 1990 to 2008

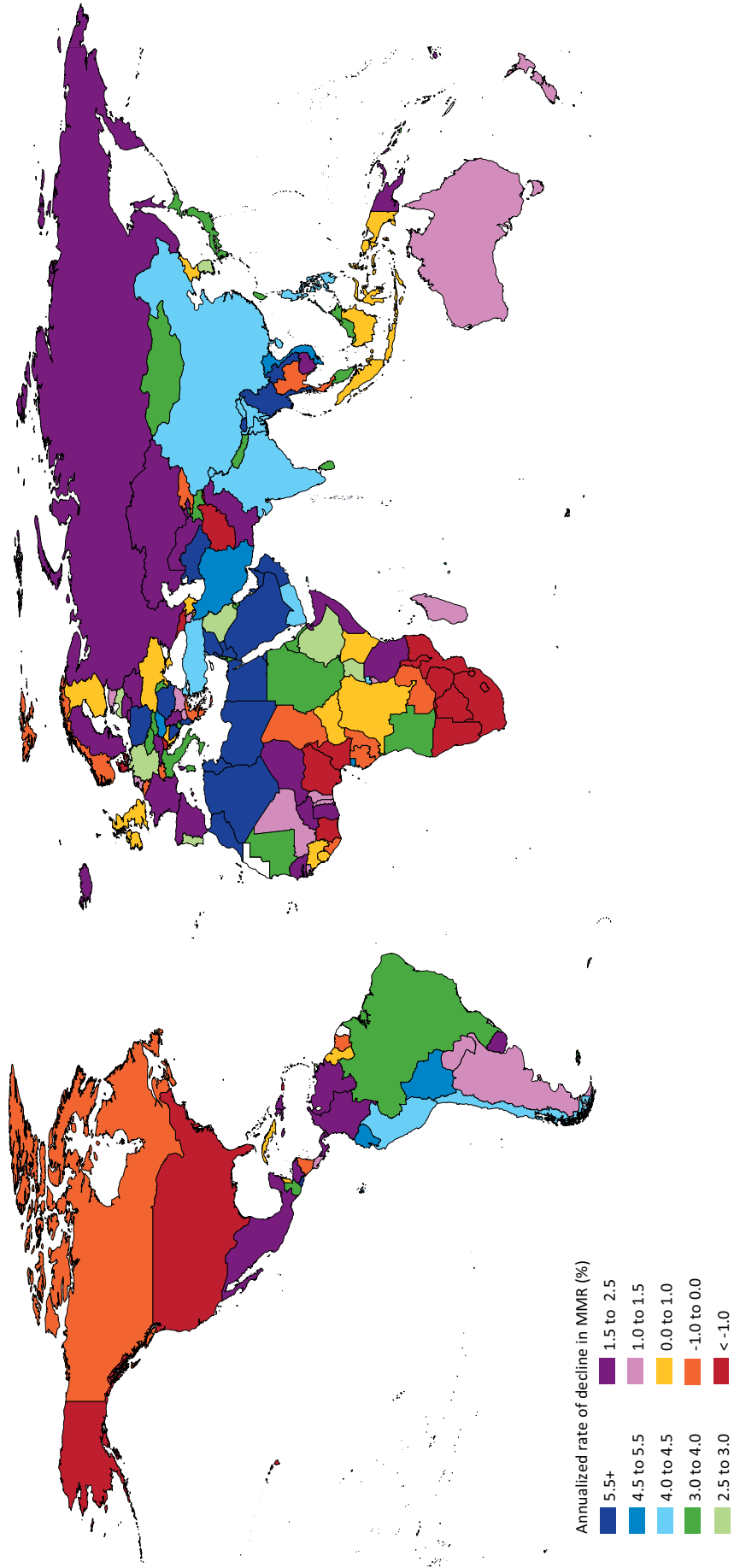
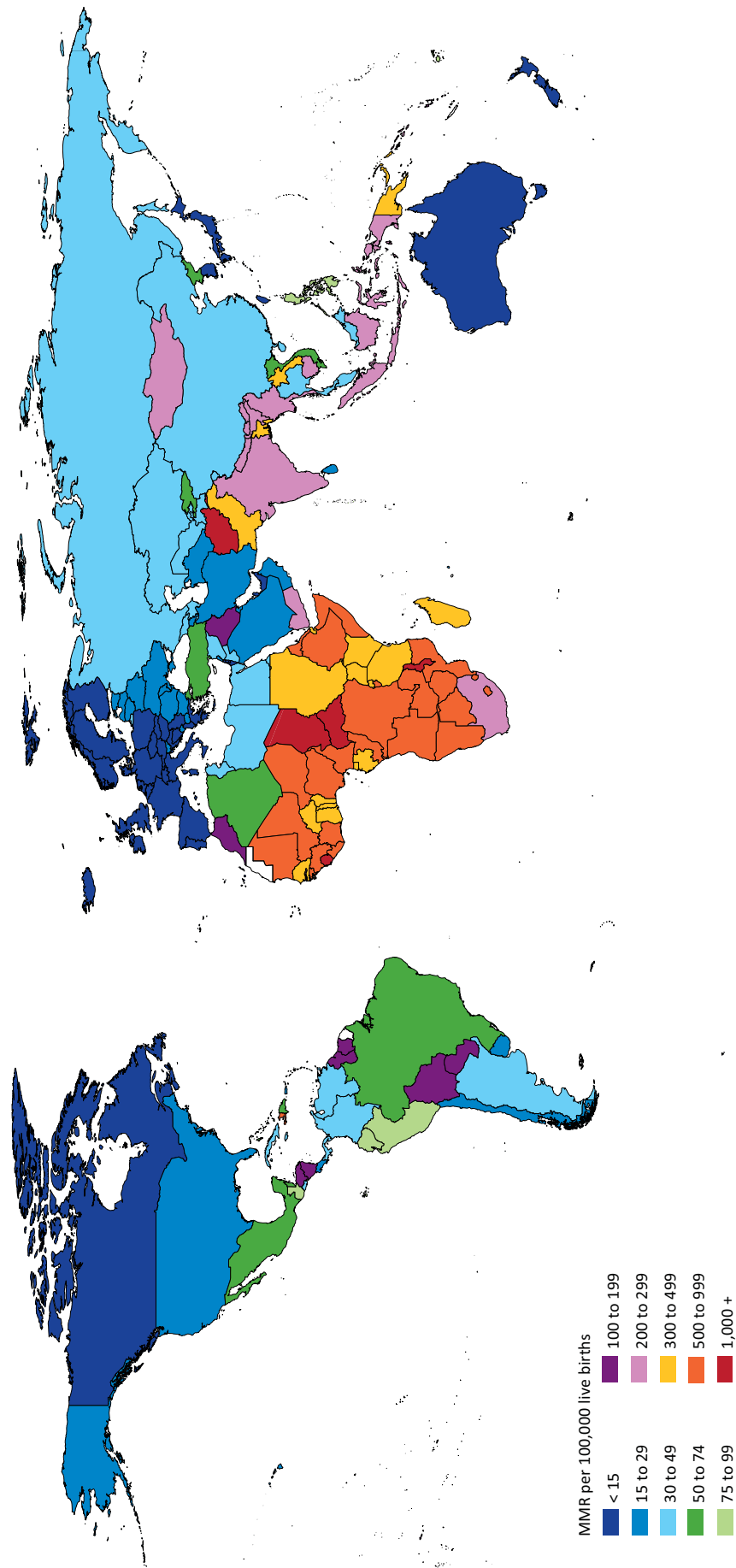


Figure 4:  
Maternal mortality ratio by country (per 100,000 live births), 2008



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an MMR about 300 times that of the highest-performing country. By 2008, though, Afghanistan had the world's highest MMR at 1,575 – about 400 times higher than Italy's MMR of 4.

However, in the countries of Western, Eastern, and Central Europe, the gap between the best and worst performers has started to shrink. The lowest-performing country had an MMR 16 times the rate of the top-performing country in 1990. By 2008, the difference between the best- and worst-performing countries had shrunk to just 10 times. As with most of the rest of the world, that trend has been driven by declines in countries with lower resources.

The range of MMRs is even greater throughout sub-Saharan Africa, ranging from 75 in Cape Verde to 1,570 in Central African Republic. Similarly, the range across South Asia is dramatic, from 240 in Nepal to 1,575 in Afghanistan.

#### **Four trends help push the MMR down globally**

Four factors are among the trends driving the improvements in maternal mortality in the majority of countries: fertility, income, education, and birth care.

First, the world's total fertility rate – a measure of the expected number of children born per woman in her child-bearing years – dropped from 3.3 in 1990 to 2.6 in 2008. Despite rising numbers of women in the reproductive years, the decline in the total fertility rate has kept the global birth cohort size stable. Because women are having fewer children, they are at lower risk of maternal death.

Second, income per capita has been rising, particularly in all regions of Asia and Latin America. This can influence the MMR through multiple channels, from the nutritional status of mothers to physical and financial access to health care.

Third, levels of education for women have been rising dramatically in all regions. For example, the average years of schooling for women ages 25 to 44 in sub-Saharan Africa increased from 1.5 in 1980 to 4.4 in 2008.

A fourth key factor in maternal mortality is birth care, and our preliminary research shows the scale-up in providing birth care has been steady.

IHME studied the scale-up of three specific birth care interventions in 136 countries to assess the likelihood of countries reaching MDG5 targets: limited antenatal care, full antenatal care, and skilled birth attendance. At the global level, the story in antenatal care is one of gradual, steady progress.

IHME's initial findings show that, in 2008, a higher number of women in developing countries received at least one antenatal care visit by a skilled health worker than did in 1990. However, those findings also show that too many women still do not receive the three additional skilled antenatal care visits recommended by World Health Organization guidelines.

Skilled care at birth is also considered critical for maternal health, particularly as most maternal and neonatal deaths occur around the time of delivery. In 1990, skilled birth attendance coverage was at low levels in many developing countries. IHME's preliminary research shows progress was made in many of those countries by 2008.



### HIV has slowed progress toward MDG5

While societal changes and expanding health care interventions appear to be having a positive impact on maternal mortality, the HIV epidemic is working in direct opposition to these trends and is preventing some countries from reaching MDG5 targets.

Increases in the MMR have been documented in countries in Southern Africa with large HIV epidemics, including Zimbabwe, Malawi, and Lesotho. To see whether these countries might have decreased their MMRs if they were not facing HIV, IHME modeled mortality trends excluding the effects of HIV. The results show that, globally, the HIV epidemic essentially put the brakes on improvements in the maternal mortality ratio.

The rate of decline in maternal deaths between 1980 and 1990 was 1.8%, but that rate slowed to 1.4% from 1990 to 2008 as HIV started to take a more serious toll. Instead of continuing downward, the global trend in

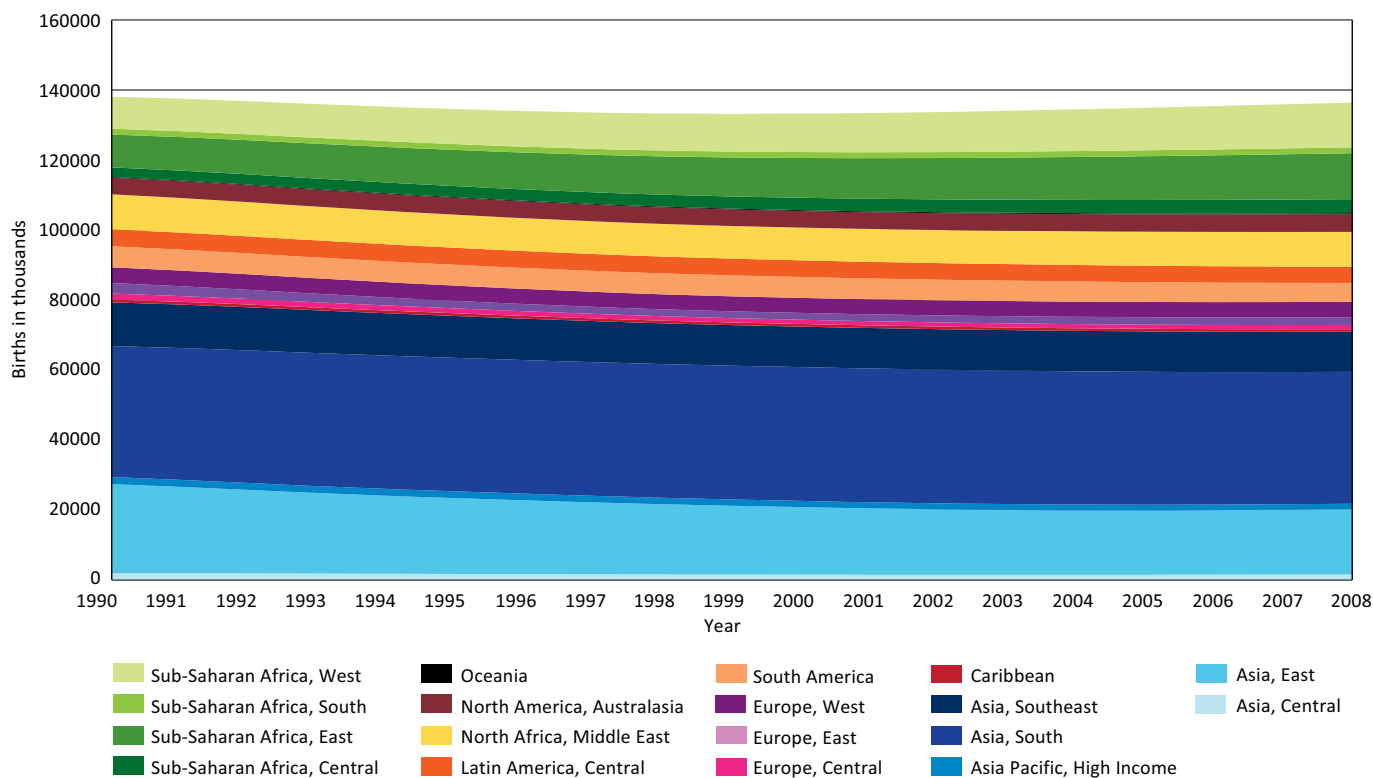
maternal deaths started to flatline in the 1990s and only more recently began to drop again.

HIV was responsible for nearly 20% of all maternal deaths in 2008. It appears to be having an effect both directly and indirectly. HIV can directly complicate pregnancy and put a pregnant woman at higher risk of death from other conditions. Pregnancy may also worsen the progression of HIV.

In addition, HIV puts an enormous strain on a country's health system, particularly in low-income countries. An overburdened system is less likely to provide the type of skilled care necessary during pregnancy, delivery, and the postnatal period. Declines in prenatal care in several sub-Saharan African countries are likely due to the impact of HIV.

IHME's analysis shows that were HIV to have been reduced to zero cases globally, the maternal mortality ratio would have improved worldwide at an annualized rate of 2.3% since 1990 instead of 1.3%, putting the

Figure 5:  
Births by region, 1990 to 2008



decline in maternal mortality ratio ahead of the pace of decline in the under-5 mortality rate for that period. Many Southern African countries would have experienced MMR declines instead of increases. But IHME also found that increases in many parts of Central and West Africa are not solely related to the HIV epidemic.

**Lessons learned:**

- Our assessment suggests that we should be optimistic about our ability to improve maternal mortality. The dramatic progress occurring in some countries should be more closely examined to learn how these successes could be replicated in countries where the MMR is either stagnant or even increasing.
- The high concentration of maternal deaths in a small group of countries offers an important opportunity. It shows that targeted interventions in a selected number of high-priority countries could have a major impact on the number of maternal deaths worldwide.

- Even if part of the negative trend in the MMR in high-income countries is due to better reporting, it merits further research to determine why such large disparities between high-income countries remain.
- Comparing countries and regions highlights important differences in progress. For example, Brazil and Mexico have both seen declines in the MMR, but progress has been much steeper in Brazil. While Mexico’s MMR dropped from 73 to 52 between 1990 and 2008, Brazil’s MMR fell from 112 to 55 in that period. Understanding why countries with demographic and geographic similarities have such varied progress in reducing maternal mortality will be essential to achieving further reductions.
- Targeting antiretroviral treatment toward pregnant women with HIV could have a major impact on maternal mortality, but the treatment is not currently considered a typical maternal health intervention.

Figure 6:  
Global maternal deaths, including and excluding HIV, 1980 to 2008

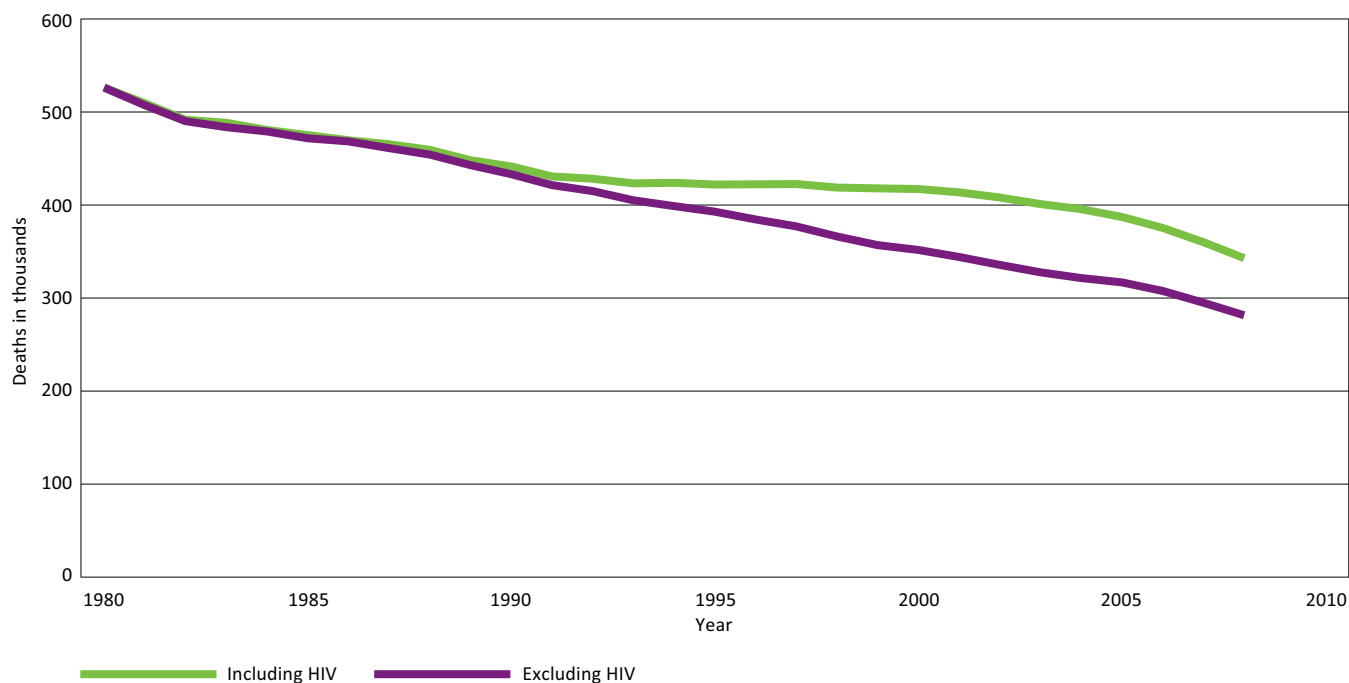


Figure 7:  
Annualized rate of decline in maternal mortality ratio by country, excluding HIV, 1990 to 2008

