

# Trends in maternal mortality 2000 to 2020

Estimates by WHO, UNICEF, UNFPA, World Bank Group  
and UNDESA/Population Division





# Trends in maternal mortality 2000 to 2020

Estimates by WHO, UNICEF, UNFPA, World Bank Group  
and UNDESA/Population Division



Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division

ISBN 978-92-4-006875-9 (electronic version)

ISBN 978-92-4-006876-6 (print version)

© **World Health Organization 2023**

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: “This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition”.

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization (<http://www.wipo.int/amc/en/mediation/rules/>).

**Suggested citation.** Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO.

**Cataloguing-in-Publication (CIP) data.** CIP data are available at <http://apps.who.int/iris>.

**Sales, rights and licensing.** To purchase WHO publications, see <https://www.who.int/publications/book-orders>. To submit requests for commercial use and queries on rights and licensing, see <https://www.who.int/copyright>.

**Third-party materials.** If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

**General disclaimers.** The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

# Contents

<b>Foreword</b>	<b>vii</b>
<b>Acknowledgements</b>	<b>viii</b>
<b>Abbreviations</b>	<b>x</b>
<b>Executive summary</b>	<b>xiii</b>
<b>1. Introduction</b>	<b>1</b>
1.1 Towards the Sustainable Development Goals	1
1.2 Measuring progress in reducing maternal mortality	2
1.3 Development of maternal mortality estimates 2000 to 2020	2
<b>2. Definitions and measures</b>	<b>7</b>
2.1 Definitions for key terms used in this report	7
2.2 Measures of maternal mortality used in this report	8
2.3 Definitions of reporting errors in maternal mortality measurement systems	9
<b>3. Methods</b>	<b>13</b>
3.1 Data inputs for the estimation process	13
3.2 Other data inputs to the model	15
3.3 Data processing	17
3.4 Statistical methods	17
3.5 Evolution of the United Nations and MMEIG estimation approach over time	24
<b>4. Maternal mortality estimates and trends: 2000 to 2020</b>	<b>29</b>
4.1 Maternal mortality estimates for 2020	29
4.2 Trends in maternal mortality: 2000 to 2020	35
<b>5. Assessing progress and setting a trajectory towards ending preventable maternal mortality and achieving SDG target 3.1</b>	<b>43</b>
5.1 Towards the Sustainable Development Goals	43
5.2 Target setting	44
5.3 Strategies for improving maternal health: 2016 to 2030	44
<b>6. Conclusions</b>	<b>51</b>
<b>Annexes</b>	<b>53</b>
Annex 1. Summary description of the 2022 country consultations	55
Annex 2. Bayesian maternal mortality misclassification (BMis) model to account for errors in reporting of maternal death in the civil registration and vital statistics (CRVS) system	57
Annex 3. Methods used to derive a complete series of annual estimates for each predictor variable	61

Annex 4.	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk, percentage of HIV-related indirect maternal deaths and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by country and territory, 2020	62
Annex 5.	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by World Health Organization (WHO) region, 2020	68
Annex 6.	Trends in estimates of maternal mortality ratio (MMR), by WHO region, 2000–2020	69
Annex 7.	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Children’s Fund (UNICEF) region, 2020	70
Annex 8.	Trends in estimates of maternal mortality ratio (MMR), by UNICEF region, 2000–2020	71
Annex 9:	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Population Fund (UNFPA) region, 2020	72
Annex 10.	Trends in estimates of maternal mortality ratio (MMR), by UNFPA region, 2000–2020	73
Annex 11.	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by World Bank Group region and income group, 2020	74
Annex 12.	Trends in estimates of maternal mortality ratio (MMR), by World Bank Group region and income group, 2000–2020	75
Annex 13.	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Department of Economic and Social Affairs, Population Division (UNDESA/Population Division) region and subregion, 2020	76
Annex 14.	Trends in estimates of maternal mortality ratio (MMR), by UNDESA/Population Division region and subregion, 2000–2020	78
Annex 15.	Trends in estimates of maternal mortality ratio (MMR), by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2000–2020	80
Annex 16.	Trends in estimates of maternal mortality ratio (MMR), by country and territory, 2000–2020	82

## List of tables

Table 2.1.	Types of deaths occurring during pregnancy, childbirth and the puerperium (known as “pregnancy-related deaths”)	8
Table 3.1	Country-years of observation available for a range of sources of maternal mortality data used in generating the 2000–2020 estimates for maternal mortality, by SDG region	16
Table 3.2	Country-years of observation in the BMis model, by SDG region	18
Table 4.1	Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2020	32
Table 4.2	Estimates of maternal mortality ratio (MMR), number of maternal deaths and HIV-related indirect maternal deaths, by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2020	33
Table 4.3	Comparison of maternal mortality ratio (MMR) and number of maternal deaths, and percentage change and average annual rate of reduction of MMR, by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2000 and 2020	37





# Foreword

Childbirth should be a time of life, not death. And yet, by the time you have finished reading this foreword, at least one woman will have died due to complications of pregnancy and childbirth. Nearly every death is in low- and middle-income countries, and nearly every death is preventable.

From 2000 to 2015, the era of the Millennium Development Goals, the global maternal mortality ratio fell by 33%, and by more than half in 58 countries with the highest rates of maternal mortality.

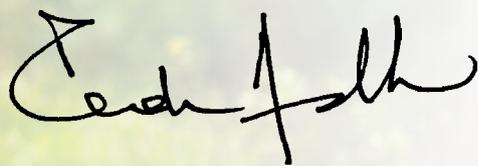
This report contains sobering news: in the first five years of the Sustainable Development Goals, maternal mortality barely declined, if at all. Put simply, we are way off track to achieve the SDG target on maternal mortality. On current trends, more than one million additional maternal deaths will occur by 2030.

The knowledge and practices for preventing maternal deaths have existed for decades, and yet far too many women – across huge swathes of the world – still lack access to these life-saving solutions. The situation is made worse for many communities by the impact of climate change and prolonged conflict, along with over-stretched health systems that lack essential supplies and medicines.

We must start by recognizing where our health systems are failing. We must invest in fortifying our health workforce with the people, tools and training they need to deliver the quality care that will make a difference. Health systems must be held accountable for providing quality, respectful and equitable care through a well-trained and supported workforce and well-stocked shelves.

At the same time, the persistent gender norms that deprioritize the health of women and girls must be addressed, to afford women respect and care during pregnancy and childbirth, along with protecting their right to access high-quality sexual and reproductive health services. The evidence is clear: investing in women's health and education results in healthier communities.

Everybody, regardless of income, education, race and ethnicity, deserves access to safe, quality and respectful birthing conditions. This report is not only a call for world leaders to take action to end maternal deaths, but also to invest in the health of women and children so that they go beyond surviving to thriving.



**Dr Tedros Adhanom Ghebreyesus**  
Director-General, World Health Organization

# Acknowledgements

The United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG) collaborated in developing these maternal mortality estimates and the independent external technical advisory group (TAG) reviewed and provided input throughout the process.

## **From each of the constituent agencies, the following individuals were members of the MMEIG:<sup>1</sup>**

- ▶ World Health Organization (WHO): Bochen Cao, Jenny Cresswell, Ann-Beth Moller, Allisyn Moran and Lale Say
- ▶ United Nations Children’s Fund (UNICEF): Liliana Carvajal Velez and Jennifer Requejo
- ▶ United Nations Population Fund (UNFPA): Witness Chirinda and Tapiwa Jhamba
- ▶ The World Bank Group: Charles Kouame, Samuel Mills and Emi Suzuki
- ▶ United Nations Department of Economic and Social Affairs, Population Division (UNDESA/Population Division): Victor Gaigbe-Togbe, Patrick Gerland and Danan Gu.

## **The members of the TAG provided independent technical advice:**

- ▶ Richard Adanu, School of Public Health, University of Ghana, Ghana
- ▶ Leontine Alkema, Department of Biostatistics, University of Massachusetts Amherst, United States of America (USA)
- ▶ Huda Alkitkat, Population Research Center, Portland State University, USA
- ▶ Charles Ameh, Liverpool School of Tropical Medicine, United Kingdom of Great Britain and Northern Ireland
- ▶ Azra Aziz, National Institute of Population Studies, Ministry of Health, Pakistan
- ▶ Yifru Berhan, St. Paul’s Hospital Millennium Medical College, Ethiopia
- ▶ Andreea Creanga, Johns Hopkins Bloomberg School of Public Health, USA
- ▶ Alison Gemmill, Johns Hopkins Bloomberg School of Public Health, USA
- ▶ Claudia Hanson, Karolinska Institutet, Sweden
- ▶ Kapila Jayaratne, Family Health Bureau, Ministry of Health, Sri Lanka
- ▶ Thomas Pullum, Demographic and Health Surveys Program, ICF, USA
- ▶ Florina Serbanescu, Division of Reproductive Health, Centers for Disease Control and Prevention, USA
- ▶ Sandhya Singh, Registrar General of India, India Ministry of Home Affairs, India.

The WHO Department of Governing Bodies and External Relations guided and supported the country consultation process. Staff at the country offices for WHO, UNICEF, UNFPA and the World Bank Group, and the maternal, child and adolescent health technical officers at the Regional Office for Africa are all gratefully acknowledged for facilitating the country consultations.

---

<sup>1</sup> All lists of names are given in alphabetical order by last name.

Thanks are due to the following WHO regional office staff for their contributions in reviewing the estimates and during the country consultations:

- ▶ Regional Office for Africa: Triphonie Nkurunziza
- ▶ Regional Office for the Americas (Pan American Health Organization [PAHO]): Bremen de Mucio, Antonio Sanhueza and Patricia Nilda Soliz
- ▶ Regional Office for South-East Asia: Chandani Anoma Jayathilaka and Neena Raina
- ▶ Regional Office for Europe: Oleg Kuzmenko
- ▶ Regional Office for the Eastern Mediterranean: Karima Gholbzouri
- ▶ Regional Office for the Western Pacific: Duan Mengjun, Sangyoun Oh, Howard Sobel, Alpha Grace Tabanao and Delgermaa Vanya.

The Office of Language Services at WHO provided translation services for documents disseminated during the country consultations. Thanks are also due to all government technical focal persons for maternal mortality and the Sustainable Development Goal (SDG) focal points, who reviewed the preliminary maternal mortality estimates and provided valuable feedback and input.

Financial support was provided by the WHO Department of Sexual and Reproductive Health and Research including HRP (the UNDP-UNFPA-UNICEF-WHO-World Bank Special Programme of Research, Development and Research Training in Human Reproduction) and the United States Agency for International Development (USAID). The participation of MMEIG members was supported through their respective organizations.

Updating of databases and data extraction were conducted by Faridah Abudullai, Sahar Ahmed, Jenny Cresswell and Ann-Beth Moller. Census data adjustment was done by Qingfeng Li. Survey data were processed by Ursula Gazeley and Laith Hussain. Data management, running statistical models and producing country profiles were undertaken by Leontine Alkema, Gregory Guranich and Emily Peterson. The country consultations were conducted by Jenny Cresswell and Ann-Beth Moller. This report was prepared by Jenny Cresswell, Ursula Gazeley, Sahar Ahmed, Ann-Beth Moller, Veloshnee Govender and Lale Say of WHO and Jane Patten of Green Ink, United Kingdom.

For any further information relating to this report, you may contact Jenny Cresswell (email: [cresswellj@who.int](mailto:cresswellj@who.int)) and Lale Say (email: [sayl@who.int](mailto:sayl@who.int)).

# Abbreviations

ARR	annual rate of reduction
BMat model	Bayesian maternal mortality estimation model
BMis model	Bayesian maternal mortality misclassification model for CRVS adjustment (previously called “the Bayesian CRVS adjustment model”)
CEMD	confidential enquiry into maternal deaths
CRVS	civil registration and vital statistics
DHS	Demographic and Health Survey
EPMM	ending preventable maternal mortality
F+/F-	false positive/false negative
GDP	gross domestic product per capita based on PPP conversion
GFR	general fertility rate
ICD	International statistical classification of diseases and related health problems <sup>1</sup>
ICD-MM	ICD-maternal mortality (refers to the WHO publication: <i>Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM</i> )
LDCs	least developed countries
LLDCs	landlocked developing countries
MDG	Millennium Development Goal
MDSR	maternal death surveillance and response
MICS	Multiple Indicator Cluster Survey
MMEIG	United Nations Maternal Mortality Estimation Inter-Agency Group
MMR	maternal mortality ratio
MMRate	maternal mortality rate
PM	proportion maternal (i.e. proportion of deaths among women of reproductive age that are due to maternal causes)
PPP	purchasing power parity
RAMOS	reproductive-age mortality study
SBA	skilled birth attendant
SDG	Sustainable Development Goal
Se	sensitivity
SIDS	small island developing States
Sp	specificity
T+/T-	true positive/true negative
TAG	technical advisory group

---

<sup>1</sup> ICD-9, ICD-10 and ICD-11 are all referred to in this document; the numbers indicate the revision (edition) number.

UHC	universal health coverage
UI	uncertainty interval
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USA	United States of America
WHO	World Health Organization

# P.M.T.C.T & POST N



# Executive summary

The Sustainable Development Goals (SDGs) were launched on 25 September 2015 and came into force on 1 January 2016 for the 15-year period until 31 December 2030. Among the 17 SDGs, the direct health-related targets come under **SDG 3: Ensure healthy lives and promote well-being for all at all ages**. With the adoption of the SDGs, the United Nations Member States extended the global commitments they had made in 2000 to the Millennium Development Goals (MDGs), which covered the period up to the end of 2015.

In anticipation of the launch of the SDGs, the World Health Organization (WHO) and partners released a consensus statement and strategy paper on ending preventable maternal mortality (EPMM). The EPMM target for reducing the global maternal mortality ratio (MMR) by 2030 was adopted as **SDG target 3.1: reduce global MMR to less than 70 maternal deaths per 100 000 live births by 2030**. In November 2021, new EPMM coverage targets were launched to meet the SDGs, and these were supplemented with a number of global, national and subnational EPMM indicators to highlight the need to increase coverage of quality maternal health care and improve women's ability to make their own decisions about their sexual and reproductive health.

## Methods and interpretation

The United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG) – comprising WHO, the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank Group and the United Nations Department of Economic and Social Affairs, Population Division (UNDESA/Population Division) – has collaborated with external technical experts on a new round of global-, regional- and country-level maternal mortality estimates covering the period 2000–2020. To provide increasingly accurate estimates of MMR, the previous estimation methods have been refined to optimize use of country-level data. Official country consultations were conducted during August and September 2022. This process generated additional

data for inclusion in the maternal mortality estimation model, demonstrating expansion of in-country efforts to monitor maternal mortality.

This report presents internationally comparable global-, regional- and country-level estimates and trends for maternal mortality between 2000 and 2020.<sup>1</sup> Countries and territories included in the analyses are limited to 183 WHO Member States that had populations over 100 000 in 2020 and two additional territories – Puerto Rico and the occupied Palestinian territory, including east Jerusalem – which also met the population criterion.<sup>2</sup> This results in a total of 185 countries and territories included in the data presented in this report.

The results described in this report are the second available set of estimates describing maternal mortality for years that fall within the SDG reporting period. This report is the first to present trends within the SDG period, for the first five years of the 15-year period, from the start of 2016 until the end of 2020. The new estimates and trends presented in this report supersede all previously published estimates for years that fall within the same time period. Care should be taken to use only these estimates for the interpretation of trends in maternal mortality from 2000 to 2020; due to modifications in methodology and changes in data availability, differences between these and previous estimates should not be interpreted as representing time trends. In addition, when interpreting changes in MMRs over time, one should take into consideration that it is easier to reduce the MMR when the level is high than when the MMR level is already low. Furthermore, at very low levels of maternal mortality, a small absolute change in the MMR can appear as a large relative difference.

<sup>1</sup> Estimates have been computed to maximize comparability across countries, thus they are not necessarily the same as official statistics of the countries, which may use alternative rigorous methods.

<sup>2</sup> Puerto Rico is an Associate Member. Occupied Palestinian territory, including east Jerusalem, is a member in the Regional Committee for the WHO Eastern Mediterranean Region.

The full database, country profiles and all model specification codes used are available online.<sup>1</sup>

For all outcomes of interest, uncertainty was assessed and reported in terms of uncertainty intervals (UIs),<sup>2</sup> which have an 80% probability of containing the true value.

## Global estimates for 2020 and trends for 2000–2020, 2000–2015 and 2016–2020

At the global level, previous successes in reducing in maternal mortality that occurred during the MDG era have stagnated in the first five years of the SDG era, from 2016 to 2020. In 2020, an estimated 287 000 women globally died from a maternal cause, equivalent to almost 800 maternal deaths every day, and approximately one every two minutes. This is more than a third lower than in 2000 when there were an estimated 446 000 maternal deaths.

The global MMR in 2020 was estimated at 223 maternal deaths per 100 000 live births (UI 202 to 255), down from 227 in 2015 (UI 211 to 246) and from 339 in 2000 (UI 319 to 360) – a reduction of one third (34.3%) over the full 20-year period. The average annual rate of reduction (ARR) in the global MMR from 2000 to 2020 was 2.1% (UI 1.3% to 2.6%), meaning that on average, the global MMR declined by 2.1% every year between 2000 and 2020, although progress was uneven throughout this period. During the MDG era – from 2000 to 2015 – the global average ARR was 2.7% (UI 2.0% to 3.2%), but this fell to -0.04% (UI -1.6% to 1.1%) during the first five years of the SDG era, between 2016 and 2020. While the negative ARR indicates an increase (worsening) in MMR, since the range of the UI crosses zero, this indicates a stagnation in the global MMR during this most recent reporting period.

Substantial shifts in focus and investment are needed now if the SDG target is to be met: if we assume that the 2016–2020 pace of progress will continue, the MMR will be 222 by 2030 – over three times the SDG global target of 70. Under a more optimistic scenario, if the MMR declines at the same average ARR as for 2000–2020, the MMR would be 180 – still more than twice the SDG target. Achieving the SDG global target by 2030 will require an average ARR of 11.6% over the 10 years remaining for observation (2021–2030). Accomplishing this rate of progress is an unprecedented challenge

– only three countries have ever achieved an ARR over 11.6% in their MMR across any of the three time periods: 2000–2020, 2000–2015 or 2016–2020.

The global lifetime risk of maternal mortality for a 15-year-old girl in 2020 was estimated at 1 in 210 – approximately half the risk faced by a 15-year-old girl in 2000 (1 in 120). The overall proportion of deaths to women of reproductive age (15–49 years) that are due to maternal causes (PM) was estimated at 9.8% in 2020 – down from 12.6% in 2000 and 10.3% in 2016. This means that, compared with non-maternal causes of death to women of reproductive age, the relative fraction attributed to maternal causes is decreasing. In addition, the effect of HIV on maternal mortality has decreased over time since the peak of the HIV epidemic in 2005: HIV-related indirect maternal deaths accounted for less than 1% of all maternal deaths in 2020, compared with approximately 2% in 2005.

## Regional and country-level estimates for 2020

Global trends obscure large inequalities in maternal survival between regions of world and countries within those regions. Looking at SDG regional groupings,<sup>3</sup> in 2020, sub-Saharan Africa was the only region with a very high<sup>4</sup> MMR – estimated at 545 maternal deaths per 100 000 live births (UI 477 to 654). This is 136 times higher than the MMR in Australia and New Zealand (4; UI 3 to 4) where MMR was lowest. From lowest to highest, the regions of Europe and Northern America (13), Eastern and South-Eastern Asia (74), Northern Africa and Western Asia (84), and Latin America and the Caribbean (88) all had low MMRs (below 100) in 2020. Sub-Saharan Africa alone accounted for approximately 70% of global maternal deaths in 2020, followed by Central and Southern Asia which accounted for almost 17%. These regional differences in the MMR correspond to substantial differences in the lifetime risk of dying from a maternal cause. A 15-year-old girl in sub-Saharan Africa in 2020 has the highest lifetime risk (1 in 40) – approximately 400 times higher than in Australia and New Zealand (1 in 16 000). Only three subregions in the world had high or very high MMR in 2020, all of them in sub-Saharan Africa (Western Africa at 754, Middle Africa at 539 and Eastern Africa at 351).

<sup>1</sup> Available at: [www.who.int/publications/i/item/9789240068759](http://www.who.int/publications/i/item/9789240068759)

<sup>2</sup> All uncertainty intervals (UIs) reported are 80% UI. The data can be interpreted as meaning that there is an 80% chance that the true value lies within the UI, a 10% chance that the true value lies below the lower limit and a 10% chance that the true value lies above the upper limit.

<sup>3</sup> These can be viewed at: <https://unstats.un.org/sdgs/indicators/regional-groups>

<sup>4</sup> For the purpose of categorization, MMR is considered to be very low if it is less than 20, low if it is less than 100, moderate if it is 100–299, high if it is 300–499, very high if it is 500–999 and extremely high if it is equal to or higher than 1000 maternal deaths per 100 000 live births.

Substantial variation in the burden of maternal mortality across regions was also apparent according to income group. Though only 13% of the world's population live in least developed countries (LDCs), this group of countries accounted for approximately 42% of all maternal deaths in 2020, with an estimated MMR of 377 (UI 338 to 431) in LDCs. This is almost 70% higher than the estimated global MMR. Maternal deaths accounted for 18.2% of all deaths to women aged 15–49 (PM) in LDCs in 2020, and lifetime risk was 1 in 66. Meanwhile, landlocked developing countries (LLDCs) in 2020 had an MMR of 368 (UI 323 to 430), corresponding to a lifetime risk of 1 in 67. Small island developing States (SIDS) in 2020 had an MMR of 206 (UI 169 to 262) and a lifetime risk of 1 in 210.

Emergent humanitarian settings, and conflict, post-conflict and disaster situations significantly hinder progress towards global goals for health and well-being, including targets for reducing maternal mortality. In 2020, according to the Fragile States Index, nine countries were “very high alert” or “high alert”<sup>1</sup> (from highest [most fragile] to lowest [least fragile]: Yemen, Somalia, South Sudan, the Syrian Arab Republic, the Democratic Republic of the Congo, the Central African Republic, Chad, Sudan and Afghanistan), and these nine countries had MMRs ranging from 30 (the Syrian Arab Republic) to 1223 (South Sudan). The average MMR for “very high alert” and “high alert” fragile States in 2020 was 551 maternal deaths per 100 000 live births – over double the world average.

The regional-level burden of maternal mortality obscures important differences between countries and territories. Three countries – all in sub-Saharan Africa – were estimated to have extremely high MMR in 2020 (over 1000): South Sudan (1223; UI 746 to 2009), Chad (1063; UI 772 to 1586) and Nigeria (1047; UI 793 to 1565). Ten other countries, all except one of which (Afghanistan) are also in sub-Saharan Africa, were estimated to have very high MMR in 2020 (500–999). In total, 117 countries were estimated to have low MMR, of which 60 had very low MMR (below 20) in 2020. Only three countries with low MMR were in sub-Saharan Africa: Mauritius (84; UI 62 to 115), Cabo Verde (42; UI 26 to 65) and Seychelles (3; UI 3 to 4). Outside the

sub-Saharan African region, only one country, Haiti, had a high MMR (350; UI 239 to 550) and one country, Afghanistan, had a very high MMR (620; UI 406 to 1050) in 2020.

Nigeria had the highest estimated number of maternal deaths, accounting for over one quarter (28.5%) of all estimated global maternal deaths in 2020, with approximately 82 000 maternal deaths. Three other countries also had more than 10 000 maternal deaths in 2020: India (24 000), the Democratic Republic of the Congo (22 000) and Ethiopia (10 000) – 8.3%, 7.5% and 3.6% of global maternal deaths, respectively. Six countries had more than 5000 maternal deaths (but less than 10 000) in 2020, and 73 countries were estimated to have just 20 or fewer maternal deaths in 2020, the majority of which were in Europe or in Latin America and the Caribbean. In Chad in 2020, a 15-year-old girl is estimated to have a 1 in 15 chance of dying of maternal causes during her lifetime – the highest lifetime risk. This risk is over 4000 times greater than in Belarus, the country with the lowest lifetime risk in 2020 (1 in 65 000).

## Regional- and country-level trends, between 2000 and 2020

With the exception of Latin America and the Caribbean, the MMR declined in all regions. Between 2000 and 2020, the region of Central Asia and Southern Asia achieved the greatest overall percentage reduction in MMR, with a reduction of 67.5%, from 397 (UI 358 to 447) to 129 (UI 114 to 149) maternal deaths per 100 000 live births, corresponding to an average ARR of 5.6% (UI 4.8% to 6.5%). In Latin America and the Caribbean, by contrast, the percentage reduction in the MMR was just 2.8%, which equates to an average ARR of 0.1% (UI -0.5% to 0.6%); as the UI crosses zero, this is interpreted as a stagnation in the MMR.

These trends varied considerably for the periods 2000–2015 and 2016–2020. During the MDG period of 2000 to 2015, MMRs significantly reduced in all regions – ranging from a 59.8% reduction in Central and Southern Asia, to a 16.4% reduction in Latin America and the Caribbean. All world regions had positive and significant average ARRs. LDCs, LLDCs and SIDS all also had significant reductions in the MMR between 2000 and 2015 – 38.8%, 41.1% and 18.3%, respectively.

Following these positive trends, however, MMRs stagnated or worsened in most regions between 2016 and 2020. Only two regions had significant declines in the MMR: 34.6% in Australia and New Zealand, and 15.7% in Central and Southern Asia. Meanwhile, in

<sup>1</sup> The Fragile States Index is an assessment of 178 countries based on 12 cohesion, economic, social and political indicators, resulting in a score that indicates their susceptibility to instability. Further information about indicators and methodology is available at: <https://fragilestatesindex.org/>. At the top of the range (most fragile), the scores are categorized as follows: > 110 = very high alert; 100–110 = high alert. These two categories include the nine most fragile countries mentioned here. There are 10 other categories ranging from “very sustainable” to “alert”.

four regions – sub-Saharan Africa, Oceania (excluding Australia and New Zealand), Northern Africa and Western Asia, and Eastern and South-Eastern Asia – declines in the MMR stagnated and average ARR were non-significant. In two regions – Europe and Northern America, and Latin America and the Caribbean – there were significant increases in the MMR between 2016 and 2020. The MMR increased (worsened) in Europe and Northern America with a change of -16.5%<sup>1</sup> (UI -33.3% to -2.4%) and in Latin America and the Caribbean with a change of -14.8% (UI -25.2% to -6.4%), corresponding to an average ARR of -3.8% (UI -7.2% to -0.6%) and -3.5% (UI -5.6% to -1.6%), respectively.

In contrast, the pace of progress between 2016 and 2020 in LDCs and LLDCs was positive and significant, with an average ARR of 2.8% (UI 1.4% to 3.9%) and 3.0% (UI 1.4% to 4.4%), respectively, for these groups of countries. However, in SIDS, the MMR stagnated during this period, with a non-significant 1.2% change in MMR (UI -9.0% to 9.2%).

The 10 countries with the largest percentage reduction in the MMR between 2000 and 2020, in order of greatest to least reduction, were: Belarus, Seychelles, Turkmenistan, Romania, Bhutan, Egypt, Estonia, the Lao People's Democratic Republic, Kazakhstan and Mozambique, ranging from a 95.5% (UI 92.6% to 97.3%) reduction in Belarus to 76.1% (UI 69.7% to 81.4%) in Mozambique. These countries had average ARRs ranging between 15.5% (Belarus; UI 13.0% to 18.1%) and 7.2% (Mozambique; UI 6.0% to 8.4%). In total, 69 countries reduced their MMRs by at least half between 2000 and 2020; in 34 countries, the MMRs declined by two thirds.

Eight countries and territories unfortunately had significant percentage increases in the MMR between 2000 and 2020, in order from the greatest to the least increase (deterioration): the Bolivarian Republic of Venezuela, Cyprus, Greece, the United States of America (USA), Mauritius, Puerto Rico, Belize and the Dominican Republic, with increases ranging from 182.8% (a change of -182.8%; UI -334.3% to -96.1%) in the Bolivarian Republic of Venezuela, to 36.0% (a change of -36.0%; UI -70.0% to -9.3%) in the Dominican Republic. With increasing MMRs, all eight countries remain at great risk. The impact of interruptions or loss of quality health services must be considered in crisis and other unstable situations. For the countries on this list that have low MMR, attention to potential disparities between subpopulations and efforts to

reduce overall PM will be important to shift back to the path of reducing MMR. The MMR stagnated (with UIs for the percentage change crossing zero) in 52 countries for the period 2000 to 2020. Of those countries, 16 were in sub-Saharan Africa, 11 in Europe and Northern America, and 10 were in Latin America and the Caribbean.

During the MDG era from 2000 to 2015, there was a significant reduction in the MMRs in 130 countries. The MMR was halved in 57 countries and reduced by two thirds in 18. Only five countries had a significant increase in the MMR during this period, in order from the greatest increase to the smallest: the USA, the Bolivarian Republic of Venezuela, the Dominican Republic, Benin and Jamaica. Stagnation in the estimated MMR was found in 46 countries – with the largest regional grouping of these countries being in sub-Saharan Africa (17 out of 46 countries).

In contrast, during the first five years of the SDG era, from 2016 to 2020, there was a significant reduction in the MMR in 31 countries. The MMR stagnated in 133 countries and there was a significant increase in the MMR in 17 countries (7 of which were located in Latin America and the Caribbean).

## Conclusions

The SDGs include a direct emphasis on reducing maternal mortality while also highlighting the importance of moving beyond the focus on survival. Despite the ambition to end preventable maternal deaths by 2030 outlined in the 2014 consensus statement on *Targets and strategies for ending preventable maternal mortality* (EPMM), the world will fall short of this target by more than 1 million lives with the current pace of progress. Earlier positive trends in the decline in maternal mortality during the MDG period have stalled on a global level – a major challenge that must be addressed with urgency. Progress is uneven, and large inequities persist both between and within regions and settings with different levels of resources. There is also a wide gap between the burden of maternal mortality in humanitarian and fragile settings, and the rest of the world. These trends are a substantial concern.

There is a continued, urgent need for maternal health and survival to remain high on the global health and development agenda. The vast majority of maternal deaths are preventable: the clinical knowledge and technology required to prevent them have existed for a long time. However, these solutions are often not available, not accessible or not implemented, especially in low-resource settings

<sup>1</sup> Negative numbers indicate an increase in the MMR and a deterioration in maternal mortality.

and/or subpopulations at greater risk due to social determinants.

This stagnation in progress can be considered in terms of proximate and distal causes of maternal deaths. Proximate causes in many low-resource settings include the high burden of direct obstetric causes (e.g. postpartum haemorrhage, pre-eclampsia and hypertensive disorders, pregnancy-related infections, complications of unsafe abortion) and indirect causes (infectious and non-communicable diseases). Beyond these, other determinants of maternal mortality include:

1. health system failures that translate to
  - (i) delay in seeking care and receiving care after reaching the health-care facility,
  - (ii) poor quality of care,
  - (iii) shortages of essential medical supplies, and
  - (iv) the poor accountability of health systems;
2. social determinants, including income, access to education, race and ethnicity, that put some subpopulations at greater risk;
3. harmful gender norms, biases and inequalities that result in a low prioritization of the rights of women and girls, including their right to safe, quality and affordable sexual and reproductive health services; and
4. external factors contributing to instability and health system fragility, such as climate and humanitarian crises.

In the remaining years of the SDG era, multisectoral action is required to target the causes of maternal mortality. This is essential to achieve not only SDG target 3.1, but also related commitments in SDGs 1 (no poverty), 3 (good health and well-being), 5 (gender equality) and 10 (reduced inequality).<sup>1</sup>

First, greater recognition and collective action is needed to address systemic health system issues that impede access to safe, quality, respectful and affordable sexual and reproductive health care. This is integral to safeguarding sexual and reproductive health and rights, and critical to improving

institutional trust and the use of sexual and reproductive health services. Improving access to quality care requires health system strengthening to increase the numbers of well trained and well supervised health workers; tackle shortages of essential medical supplies; and improve the accountability of health systems to the rights of women and girls.

Second, a lack of access to care and poor quality of care disproportionately affect already socially marginalized women and girls. Interventions must recognize and address social determinants of maternal health, including ethnicity, age, disability, and socioeconomic inequalities, which impede women's access to and use of sexual and reproductive health services. Achieving universal health coverage (UHC) – SDG target 3.8 – is critical to ensure these services are affordable and that their costs do not cause financial hardship. The 2018 Declaration of Astana identified primary health care as the most cost-effective and inclusive means of achieving UHC.<sup>2</sup>

Third, improving maternal health requires intersectoral action from a stronger gender and human-rights perspective to improve women's empowerment, eliminate poverty and reduce gender-based inequality. Gender-sensitive interventions are essential to address ingrained inequalities and achieve gender justice in health.

Finally, multisectoral approaches are urgently needed to build health system resilience to climate and humanitarian crises. We must use the remaining time in the SDG period to intensify action to mitigate and adapt to the devastating effects of climate change to safeguard and improve maternal health; this action is also integral to climate justice.

As the world approaches the mid-point of the SDG era, there is still time to mobilize and invigorate global-, regional-, national- and community-level commitment to the wide-ranging objectives and targets, including to renew the commitment to end preventable maternal mortality, and to ensure women not only simply survive a pregnancy but are healthy and thrive.

<sup>1</sup> The full list of Sustainable Development Goals can be found at: <https://sdgs.un.org/goals>

<sup>2</sup> More information about the 2018 Declaration of Astana can be found at: <https://www.who.int/teams/primary-health-care/conference/declaration>



# 1. Introduction

## 1.1 Towards the Sustainable Development Goals

The Sustainable Development Goals (SDGs) were launched on 25 September 2015 with the adoption of the United Nations General Assembly resolution *Transforming our world: the 2030 Agenda for Sustainable Development* (1). They came into force on 1 January 2016 for the 15-year period until 31 December 2030. Among the 17 SDGs, the direct health-related targets come under **SDG 3: Ensure healthy lives and promote well-being for all at all ages** (2). With the adoption of the SDGs, the United Nations Member States extended the global commitments they had made in 2000 to the Millennium Development Goals (MDGs), which were established after the Millennium Declaration in September 2000, and covered the period up to the end of 2015 (3).

In 2014, in anticipation of the launch of the SDGs, the World Health Organization (WHO) released a consensus statement on *Targets and strategies for ending preventable maternal mortality* (EPMM) (4), followed by a full strategy paper in 2015 (5), endorsed by the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank Group, the United States Agency for International Development (USAID) and a number of international professional organizations and maternal health programmes. The EPMM target for reducing the maternal mortality ratio (MMR) by 2030 was adopted as the MMR target for the SDGs: **reduce the global MMR to less than 70 maternal deaths per 100 000 live births by 2030 (SDG target 3.1)** (2,5,6). A supplementary national target was also set in the EPMM strategy paper: **By 2030, no country should have an MMR greater than 140**, a number twice the global target (5). Guided by these targets, countries have been setting their own national targets for 2030, depending on whether their baseline level of MMR in 2010 was greater or less than 420: if greater than 420, their target is to reach MMR of 140 or less by 2030; if less than 420, their target is to reduce MMR by at least two thirds by 2030 (5). Countries with an MMR below 70 were also called upon to achieve equity in MMR across different population groups within each country (5).

The EPMM five strategic objectives towards achieving SDG target 3.1 are as follows:

- i. address inequities in access to and quality of sexual, reproductive, maternal and newborn health care;
- ii. ensure universal health coverage for comprehensive sexual, reproductive, maternal and newborn health care;
- iii. address all causes of maternal mortality, reproductive and maternal morbidities and disabilities;
- iv. strengthen health systems to respond to the needs and priorities of women and girls; and
- v. ensure accountability to improve quality of care and equity.

In November 2021, these strategic objectives were supplemented with a number of global, national and subnational EPMM indicators to highlight the need to increase coverage of quality maternal health care and improve women's ability to make their own decisions about their sexual and reproductive health (7).

A major initiative established to galvanize efforts in the years counting down to the conclusion of the MDGs was the United Nations Secretary-General's Global Strategy for Women's and Children's Health ("the Global Strategy"), launched in 2010 (8). At the end of the MDG era, the Global Strategy was updated to include adolescents; the Global Strategy for Women's, Children's and Adolescents' Health (2016–2030) has as its objectives "survive, thrive and transform" and is aligned with the timeline and priorities of the SDGs (8). In 2016, WHO published the *Indicator and monitoring framework for the Global Strategy for Women's, Children's and Adolescents' Health (2016–2030)*, which is aligned with and builds upon the SDG 3 targets and time frame, and its five key indicators for the "survive" objective are MMR (SDG indicator 3.1.1), under-five mortality rate (SDG indicator 3.2.1), neonatal mortality rate (SDG indicator 3.2.2), stillbirth rate and adolescent mortality rate (the last two are not SDG indicators) (9).

With 10 years of observation remaining during the SDG period – i.e. January 2021 to December 2030 – now is the time for collective action by all countries to accelerate progress towards SDG target 3.1 and other relevant SDG, EPMM and Global Strategy targets.

## 1.2 Measuring progress in reducing maternal mortality

The 2015 EPMM cross-cutting strategy to “Improve metrics, measurement systems and data quality” (5) and the 2021 EPMM milestone “Data for action” (7) established that improving the measurement of maternal mortality is a key priority for monitoring progress towards SDG target 3.1. Data for the analysis of global maternal mortality estimates come from many sources, including civil registration and vital statistics (CRVS) systems, population-based household surveys, reproductive-age mortality surveys (RAMOS), censuses and specialized maternal mortality studies. Well functioning CRVS systems are generally considered to be the gold standard for mortality measurement, but as of March 2018, the World Bank Group reported that over 110 low- and middle-income countries had deficient CRVS systems (10). Further country-driven efforts are still needed to establish and strengthen CRVS systems so that all births, deaths and causes of death are accurately recorded (11).

Across these data sources, two types of reporting error affect the accuracy of maternal mortality measurement: incompleteness and misclassification. Incompleteness (also known as missingness or underreporting) occurs when deaths are not registered or reported. This is a particular challenge where no formal CRVS system exists or where CRVS coverage is incomplete. Misclassification occurs when the cause of death (e.g. whether it is a maternal or non-maternal death) is not recorded accurately. The accurate classification of maternal deaths relies on the use of standardized cause-of-death classification according to the *International statistical classification of diseases and related health problems* (ICD) manual<sup>1</sup> and *The WHO application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM* (12).

<sup>1</sup> ICD-11 (the 11th revision of ICD) was adopted by the World Health Assembly in May 2019 and came into effect on 1 January 2022. Further information is available at: [www.who.int/classifications/icd/en/](http://www.who.int/classifications/icd/en/). As ICD-10 (the 10th revision of ICD) applied throughout the time period for this report (2000–2020), information about ICD codes relates to ICD-10. Further information for both ICD-10 and ICD-11 can be accessed at: <https://icd.who.int>

## 1.3 Development of maternal mortality estimates 2000 to 2020

The United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG) – comprising WHO, UNICEF, UNFPA, the World Bank Group and the United Nations Department of Economic and Social Affairs, Population Division (UNDESA/Population Division) – was established in 2006 to harmonize and improve estimation and modelling methods across United Nations agencies. The MMEIG collaborated with technical experts to develop this new round of global-, regional- and country-level maternal mortality estimates for the period 2000–2020. The Technical Advisory Group (TAG) on Maternal Mortality and Maternal Cause of Death Estimation<sup>2</sup> – composed of demographers, epidemiologists and statisticians from different world regions – provided technical advice. The estimates for 2000–2020 presented in this report are the 10th in a series of analyses by WHO, UNICEF and other United Nations partner agencies to examine global, regional and country progress in reducing maternal mortality (see [section 3.5](#) for further detail about the evolution of the United Nations MMEIG maternal mortality estimation methodology over time) (13–21). To provide increasingly accurate estimates of MMR, the previous estimation methods have been further refined to optimize use of country-level data. The estimates reported in this new edition for 2000–2020 supersede those and all earlier estimates.

Official WHO Member States country consultations were conducted during August and September 2022, following the development of preliminary MMR estimates for the years 2000–2020. WHO Member States that nominated technical focal persons for maternal mortality and/or that had existing SDG focal points were provided with draft estimates for their country and a detailed description of the MMEIG processes and methods for estimating levels and trends of maternal mortality. These consultations gave countries the opportunity to review the draft country estimates, data sources and methods; to provide the MMEIG with additional primary data sources that may not have been previously reported or used in the analyses; to build shared understanding of the strengths and weaknesses of the available data and the estimation process; and to establish a broad sense of ownership of the results. These country consultations generated additional data for inclusion in the estimation model, demonstrating widespread expansion of in-country efforts to monitor

<sup>2</sup> For further details, see <https://www.who.int/groups/technical-advisory-group-on-maternal-mortality-and-maternal-cause-of-death-estimation-person-role-in-groups>

maternal mortality. **Annex 1** presents a summary of the process of the country consultations.

This report presents global-, regional- and country-level estimates and trends for maternal mortality between 2000 and 2020. Chapter 2 provides the definitions of key terms and describes the key measures relevant to maternal mortality. Chapter 3 describes in detail the methodology employed to develop the estimates. Chapter 4 presents the estimates and trends at the global, regional and country levels. Chapter 5 assesses performance so far towards SDG target 3.1, discusses the implications of the estimates for future efforts towards achieving the target, and underlines the importance of improved

data quality for estimating maternal mortality. Chapter 6 presents conclusions.

**The first three annexes** to this report describe the country consultation process, present an overview of the Bayesian maternal mortality misclassification (BMis) model for CRVS adjustment, and describe the methods used to derive a complete series of annual estimates for each predictor variable. Finally, **Annexes 4–16** present the MMR estimates and trends for the different regional groupings for SDG reporting and for WHO, UNICEF, UNFPA, the World Bank Group and UNDESA/Population Division, as well as the country-level estimates and trends.

## References

1. Transforming our world: the 2030 Agenda for Sustainable Development. United Nations General Assembly, Seventieth session. New York (NY): United Nations; 2015 (A/RES/70/1; <https://sdgs.un.org/2030agenda>).
2. Goals: 3. In: SDG Knowledge [website]. New York (NY): United Nations Department of Economic and Social Affairs. undated (<https://sdgs.un.org/goals/goal3>, accessed 14 October 2022).
3. Millennium Summit, 6–8 September 2000, New York. In: United Nations: Conferences [website]. New York (NY): United Nations; undated (<https://www.un.org/en/conferences/environment/newyork2000>, accessed 14 October 2022).
4. Targets and strategies for ending preventable maternal mortality: consensus statement. Geneva; World Health Organization; 2014 (<https://apps.who.int/iris/handle/10665/130776>).
5. Strategies towards ending preventable maternal mortality (EPMM). Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/153544>).
6. Boldosser-Boesch A, Brun M, Carvajal L, Chou D, de Bernis L, Fogg K, et al. Setting maternal mortality targets for the SDGs. *Lancet*. 2017;389(10070):696–7. doi:10.1016/S0140-6736(17)30337-9.
7. Ending preventable maternal mortality (EPMM): a renewed focus for improving maternal and newborn health and well-being. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/350834>).
8. Global strategy for women’s, children’s and adolescents’ health (2016–2030) [website]. New York (NY): Every Woman Every Child; 2015 (<http://globalstrategy.everywomaneverychild.org>, accessed 14 October 2022).
9. Indicator and monitoring framework for the global strategy for women’s, children’s and adolescents’ health (2016–2030). Geneva: World Health Organization; 2016 ([https://pmnch.who.int/resources/publications/m/item/indicator-and-monitoring-framework-for-the-global-strategy-for-women-s-children-s-and-adolescents-health-\(2016-2030\)](https://pmnch.who.int/resources/publications/m/item/indicator-and-monitoring-framework-for-the-global-strategy-for-women-s-children-s-and-adolescents-health-(2016-2030))).
10. Brief: global civil registration and vital statistics: about CVRS [website]. The World Bank Group; 2018 (<https://www.worldbank.org/en/topic/health/brief/global-civil-registration-and-vital-statistics>, accessed 14 October 2022).
11. Maternal mortality measurement: guidance to improve national reporting. Geneva: World Health Organization; 2022 (<https://apps.who.int/iris/handle/10665/360576>).
12. The WHO application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM. Geneva: World Health Organization; 2012 (<https://apps.who.int/iris/handle/10665/70929>).

13. World Health Organization (WHO) Maternal Health and Safe Motherhood Programme, United Nations Children's Fund (UNICEF). Revised 1990 estimates of maternal mortality: a new approach by WHO and UNICEF. Geneva: WHO; 1996 (<https://apps.who.int/iris/handle/10665/63597>).
14. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA). Maternal mortality in 1995: estimates developed by WHO, UNICEF and UNFPA. Geneva: WHO; 2001 (<https://apps.who.int/iris/handle/10665/66837>).
15. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA). Maternal mortality in 2000: estimates developed by WHO, UNICEF and UNFPA. Geneva: WHO; 2004 (<https://apps.who.int/iris/handle/10665/42930>).
16. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank. Maternal mortality in 2005: estimates developed by WHO, UNICEF, UNFPA and the World Bank. Geneva: WHO; 2007 (<https://apps.who.int/iris/handle/10665/43807>).
17. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank. Trends in maternal mortality: 1990 to 2008: estimates developed by WHO, UNICEF, UNFPA and the World Bank. Geneva: WHO; 2010 (<https://apps.who.int/iris/handle/10665/44423>).
18. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank. Trends in maternal mortality: 1990 to 2010: WHO, UNICEF, UNFPA and the World Bank estimates. Geneva: WHO; 2012 (<https://apps.who.int/iris/handle/10665/44874>).
19. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank, United Nations Population Division. Trends in maternal mortality: 1990 to 2013: estimates by WHO, UNICEF, UNFPA, the World Bank and the United Nations Population Division. Geneva: WHO; 2014 (<https://apps.who.int/iris/handle/10665/112682>).
20. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank Group, United Nations Population Division. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: WHO; 2015 (<https://apps.who.int/iris/handle/10665/194254>).
21. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank Group, United Nations Population Division. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/327596>).





## 2. Definitions and measures

As of 1 January 2022, implementation began of the 11th revision of the *International statistical classification of diseases and related health problems* (ICD): ICD-11<sup>1</sup> (1). The mortality occurring during the period covered by these estimates (2000–2020) predates implementation of ICD-11; the earlier version – ICD-10 – was still in use. Nevertheless, ICD-11 is relevant for current mortality and thus for policy and programming, and therefore is described here along with ICD-10.

### 2.1 Definitions for key terms used in this report

In ICD-11, **maternal death** is defined as: the 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 unintentional<sup>2</sup> or incidental causes (1).

A maternal death can either be direct or indirect. **Direct obstetric deaths (or direct maternal deaths)** are those “resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), and from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above” (1). Deaths due to obstetric haemorrhage or hypertensive disorders in pregnancy, for example, or those due to complications of anaesthesia or caesarean section are classified as direct maternal deaths.

**Indirect obstetric deaths (or indirect maternal deaths)** are those maternal deaths “resulting from previous existing disease or disease that developed during pregnancy, and that were not due to direct obstetric causes but were aggravated by the physiologic effects of pregnancy” (1). For example,

deaths due to aggravation (by pregnancy) of an existing cardiac or renal disease are considered indirect maternal deaths.

**HIV-related indirect maternal deaths** are deaths to HIV-positive women caused by the aggravating effect(s) of pregnancy on HIV; the interaction between pregnancy and HIV becomes the underlying cause of death. These are counted as indirect maternal deaths. There is an ICD code for HIV disease complicating pregnancy, childbirth and the puerperium (O98.7 in ICD-10; JB63.7 in ICD-11) for identifying HIV-related indirect maternal deaths.<sup>3</sup>

**Incidental (non-maternal) HIV deaths** are deaths caused by HIV/AIDS that occur to women who happen to be pregnant, in labour or postpartum (also defined as “HIV-related deaths to women during pregnancy, delivery or puerperium” [2]); these are not maternal deaths and are not included in the numerator of MMR.

**A death occurring during pregnancy, childbirth and the puerperium (also known as a pregnancy-related death)** is defined as: “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death (obstetric and non-obstetric)” (1); this definition includes unintentional/accidental and incidental causes. This definition allows measurement of deaths that occur during pregnancy, childbirth and the puerperium while acknowledging that such measurements do not strictly conform to the standard “maternal death” concept in settings where accurate information about causes of death based on medical certification is unavailable. For instance, in some surveys (e.g. those employing the sisterhood method), relatives of a woman of reproductive age who has died are asked about her pregnancy status at the time of death without eliciting any further information on the cause or circumstances of the death. These surveys measure deaths to women during pregnancy,

<sup>1</sup> The ICD-11 rules can be accessed in the reference guide of ICD-11, at <https://icd.who.int>

<sup>2</sup> Care has been taken to ensure that the definition of maternal death used for international comparison of mortality statistics remains stable over time, but the word “unintentional” has been used in the ICD-11 definition (1) in place of the word “accidental”, which was used in ICD-10 (2).

<sup>3</sup> For HIV-related indirect maternal deaths, code O98.7 can be found in the 2019 version of ICD-10 (<https://icd.who.int/browse10/2019/en>), and code JB63.7 can be found in ICD-11 (<https://icd.who.int/browse11/l-m/en>).

childbirth and the puerperium (i.e. pregnancy-related deaths) rather than maternal deaths.<sup>1</sup>

A **late maternal death** is “the death of a woman from direct or indirect obstetric causes, more than 42 days but less than one year after termination of pregnancy” (1). Like maternal deaths, late maternal deaths also include both direct and indirect maternal/obstetric deaths. Complications of pregnancy or childbirth can lead to death beyond the six-week (42-day) postpartum period, and the increased availability of modern life-sustaining procedures and technologies enables more women to survive adverse outcomes of pregnancy and delivery, and delays some deaths beyond that postpartum period. Specific codes capturing deaths occurring beyond 42 days are included in ICD-10 (O96 and O97) (3) and ICD-11 (JB61 and JB62).<sup>2</sup> Late maternal deaths are not included in the numerator of the MMR for this report for reasons of international comparability.

Maternal deaths and late maternal deaths are combined in ICD-11 under the new grouping of “**comprehensive maternal deaths**” (1).

All the types and definitions of deaths described above (as used in this report) are summarized in **Table 2.1**.

## 2.2 Measures of maternal mortality used in this report

As indicated in ICD-11 (and previously in ICD-10), only maternal deaths occurring up to 42 days postpartum are considered relevant for the purposes of international reporting and for the calculation of maternal mortality ratios and rates (i.e. late maternal deaths are excluded from the numerator).<sup>3,4</sup>

**The number of maternal deaths** is the number of maternal deaths in a population during a specified time period, typically one calendar year.

**The maternal mortality ratio (MMR)** is defined as the number of maternal deaths during a given time period per 100 000 live births during the same time period; thus, it quantifies the risk of maternal death relative to the number of live births.

**The maternal mortality rate (MMRate)** is defined and calculated as the number of maternal deaths divided by person-years lived by women of reproductive age in a population. The MMRate captures both the risk of maternal death per pregnancy, and the level of fertility in the population.

In addition, it is possible to calculate the **adult lifetime risk of maternal death** for women in the population, defined as the probability that a 15-year-

**Table 2.1 Types of deaths occurring during pregnancy, childbirth and the puerperium (known as “pregnancy-related deaths”)**

	Maternal deaths	Non-maternal deaths
<b>Non-HIV-related deaths</b> (the woman may or may not have had HIV)	<b>Non-HIV-related maternal deaths:</b> Direct and indirect maternal deaths and late maternal deaths from either obstetric complications or a disease (other than HIV) aggravated by pregnancy	<b>Non-HIV-related, non-maternal deaths:</b> Deaths to pregnant and postpartum women from unintentional/accidental or incidental causes (other than HIV) not related to nor aggravated by pregnancy
<b>HIV-related deaths</b> (the woman was known to have had HIV)	<b>HIV-related maternal deaths:</b> Indirect maternal deaths and late maternal deaths caused by the aggravating effects of pregnancy on HIV	<b>HIV-related, non-maternal deaths:</b> Deaths to pregnant or postpartum women caused by HIV/AIDS not aggravated by pregnancy

<sup>1</sup> Some recent Demographic and Health Surveys (DHS) have added the following questions to the sisterhood questions: “Was (NAME)’s death due to an act of violence?” and “Was (NAME)’s death due to an accident?”. These allow the identification of accidental deaths and deaths from violence, but crucially they still do not allow the removal of incidental deaths from the numerator. For this reason, these observations continue to be considered pregnancy-related deaths for the purposes of the estimates presented in this report. More information can be found at: <https://blog.dhsprogram.com/dhs7-prmr/>

<sup>2</sup> In ICD-11, late maternal deaths are coded as JB61. A death from sequelae of obstetric causes that fits the definition “a death from any obstetric cause (direct or indirect) occurring one year or more after delivery” is coded as JB62 in ICD-11.

<sup>3</sup> ICD-11, Part 2, section 2.28.5.7: “International reporting of maternal mortality: For the purpose of the international reporting of maternal mortality, only those maternal deaths occurring before the end of the 42-day reference period should be included in the calculation of the various ratios and rates, although the recording of later deaths is useful for national analytical purposes” (1).

<sup>4</sup> Late maternal deaths (coded O96 in ICD-10 and JB61 in ICD-11) and death from sequelae of obstetric causes (coded O97 in ICD-10 and JB62 in ICD-11) are also of interest for national- and international-level analysis but are not reported in this publication.

old girl (in the year of the estimate) will eventually die from a maternal cause. This indicator takes into account competing causes of death (4). The formula for calculating this measure is given in [section 3.4.3](#).

The **proportion maternal (PM)** is the proportion of deaths among women of reproductive age that are due to maternal causes. PM is calculated as the number of maternal deaths in a given time period divided by the total deaths among women aged 15–49 years in that time period.

The definitions of the measures described here are summarized in [Box 2.1](#).

## 2.3 Definitions of reporting errors in maternal mortality measurement systems

Incompleteness and misclassification are often referred to collectively or individually as “underreporting”. We avoid use of the term “underreporting” due to the ambiguity over exactly which issue is being referred to – incompleteness (unregistered), misclassification, or both. Errors of reporting affect all data and the concepts are defined in [Box 2.2](#).

### BOX 2.1 ■ STATISTICAL MEASURES OF MATERNAL MORTALITY

**Maternal mortality ratio (MMR):** Number of maternal deaths during a given time period per 100 000 live births during the same time period (5).

**Maternal mortality rate (MMRate):** Number of maternal deaths during a given time period divided by person-years lived by women of reproductive age (age 15–49 years) in a population during the same time period (6).

**Adult lifetime risk of maternal death:** The probability that a 15-year-old girl will eventually die from a maternal cause (4).

**The proportion of deaths among women of reproductive age that are due to maternal causes (proportion maternal; PM):** The number of maternal deaths divided by the total deaths among women aged 15–49 years (5).

### BOX 2.2 ■ DEFINITIONS OF REPORTING ERRORS

#### Incompleteness

Incompleteness refers to incomplete death registration. This can arise due to incomplete identification/registration of individual deaths in each country and/or incomplete coverage of the national registration system within each country.

We distinguish between:

- ▶ **U– = Non-maternal deaths not registered in the CRVS system**
- ▶ **U+ = Maternal deaths not registered in the CRVS system**

#### Misclassification

Misclassification refers to incorrect classification of the underlying cause of death, due either to error in the medical certification of cause of death or error in applying the correct code.

We distinguish between:

- ▶ **F– (false negative) = True maternal death incorrectly classified as a non-maternal death**
- ▶ **F+ (false positive) = True non-maternal death incorrectly classified as a maternal death**

There are two metrics of misclassification errors:

- ▶ **Sensitivity (Se) is defined as the proportion of correctly classified maternal deaths out of all true maternal deaths.**
- ▶ **Specificity (Sp) is defined as the proportion of correctly classified non-maternal deaths out of all true non-maternal deaths.**

## References

1. 2.25.5 Standards and reporting requirements related for maternal mortality. In: ICD-11 Reference guide, Part 2 [website]. Geneva: World Health Organization; 2022 (<https://icd.who.int>, accessed 20 December 2022).
2. The WHO application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM. Geneva: World Health Organization; 2012 (<https://apps.who.int/iris/handle/10665/70929>).
3. International statistical classification of diseases and related health problems, 10th revision. Volume 2: Instruction manual. Fifth edition 2016. Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/246208>).
4. Wilmoth J. The lifetime risk of maternal mortality: concept and measurement. *Bull World Health Organ.* 2009;87(4):256–62. doi:10.2471/BLT.07.048280.
5. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank Group, United Nations Population Division. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/327595>).
6. Wilmoth JR, Mizoguchi N, Oestergaard MZ, Say L, Mathers CD, Zureick-Brown S, et al. A new method for deriving global estimates of maternal mortality. *Stat Politics Policy.* 2012;3(2):2151-7509.1038. doi:10.1515/2151-7509.1038.





# 3. Methods

Previously, the United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG) have published reports on maternal mortality trends (including estimates up to 2005, 2008, 2010, 2013, 2015 and 2017) presenting estimates developed with independent advice from the technical advisory group (TAG) of external academic experts (1–6). The methods described here for developing estimates of levels and trends of maternal mortality between 2000 and 2020 build upon the methods used in those previous rounds (7–9).

The MMEIG Bayesian maternal mortality misclassification (BMis) model for CRVS adjustment and the MMEIG Bayesian maternal mortality estimation (BMat) model (described in [sections 3.4.1 and 3.4.2](#), respectively) together provide the most up-to-date maternal mortality estimates for the 2000–2020 timespan. Due to modifications in methodology and data availability, differences between these and previous estimates should not be interpreted as representing time trends. The full database, country profiles and all model specification codes used are available online.<sup>1</sup>

The current methodology is the result of continuous innovation to develop the most robust, internationally comparable estimates with the available data. Relatively few changes have been made to the methodology for this round compared with the 2019 publication for the period 2000–2017 (6). The development of “one-country” models in the BMat allows updating of a single country estimate while leaving other country estimates unchanged (see details on the BMis and BMat one-country models in [section 3.4](#)) and has greater computational efficiency. This development reflects a change to estimation implementation but not to statistical methods.

## 3.1 Data inputs for the estimation process

### 3.1.1 Maternal mortality data sources

The input datasets for the MMEIG estimates include empirical observations from various sources. The adjustments and use of these data vary according to the type of data source. This section provides an overview of the typology the MMEIG uses to categorize and organize its input data.

#### a. Civil registration and vital statistics (CRVS)

A CRVS system is a national system that involves the routine registration of births and deaths, and the compilation of vital statistics. Civil registration is defined by the United Nations as: “the continuous, permanent, compulsory, and universal recording of the occurrence and characteristics of vital events ... and other civil status events pertaining to the population as provided by decree, law or regulation, in accordance with the legal requirements in each country” (10).

For the purposes of the MMEIG maternal mortality ratio (MMR) estimates,<sup>2</sup> the CRVS data are operationally defined as the data reported to the WHO Mortality Database.<sup>3</sup> The WHO Mortality Database is a compilation of mortality data as reported annually by Member States from their civil registration systems to WHO. Data are provided disaggregated by sex and age group. Only medically certified deaths are included; underlying cause of death is reported as per the appropriate *International statistical classification of diseases and related health problems* (ICD) rules and classification.<sup>4</sup>

<sup>1</sup> Available at: [www.who.int/publications/i/item/9789240068759](http://www.who.int/publications/i/item/9789240068759)

<sup>2</sup> Definitions of all the measures are provided in [Chapter 2](#).

<sup>3</sup> The WHO Mortality Database is available at: [www.who.int/data/data-collection-tools/who-mortality-database](http://www.who.int/data/data-collection-tools/who-mortality-database)

<sup>4</sup> Though ICD-11 came into effect on 1 January 2022, ICD-10 was in use for the period of observation in this report. The ICD-10 codes included for the purposes of the MMEIG MMR estimates are the obstetric (“O”) codes except for O96 and O97 (late maternal deaths), and A34 (maternal tetanus).

## b. Specialized studies on maternal mortality

Specialized studies on maternal mortality generally triangulate information from multiple sources, including, but not limited to, medical records, police records, surveillance systems, national registries, death certificates, censuses, medical autopsies and administrative reviews to estimate the true number of maternal deaths in a specified geographic area. The design of, and the information provided by, specialized studies vary substantially. Two of the more common examples of specialized studies on maternal mortality are **confidential enquiries into maternal deaths (CEMD) and reproductive-age mortality studies (RAMOS)**. CEMD refers to “a systematic multidisciplinary anonymous investigation of all or a representative sample of maternal deaths occurring at an area, regional (state) or national level which identifies the numbers, causes and avoidable or remediable factors associated with them” (11). RAMOS studies involve first identifying and then investigating and establishing the causes of all deaths of women of reproductive age in a defined population using multiple sources of data (12).

Occasionally, a country will perform a validation process to evaluate the completeness of reporting and the accuracy of the classification of deaths as maternal or non-maternal in their CRVS. This information is often provided to the MMEIG during the country consultation process (see **Annex 1**). The results of such validations are considered specialized studies and/or specialized studies within the CRVS.

## c. Surveys and other miscellaneous data sources for maternal mortality

The MMEIG also use population-based household surveys including the Demographic and Health Surveys (DHS)<sup>1</sup> and the Multiple Indicator Cluster Surveys (MICS),<sup>2</sup> which use the sisterhood method (13) to identify deaths of women of reproductive age and their causes. Additionally, national censuses that collect information on pregnancy-related and/or

maternal deaths are also included. Other input data sources not falling into one of the above categories are also included if they meet the eligibility criteria detailed in **section 3.1.2** and are then termed “miscellaneous”; a typical example would be national-level surveillance data from the country’s ministry of health.

### 3.1.2 Eligibility criteria for maternal mortality input data

To be eligible for inclusion:

- ▶ the data source must report data on maternal deaths occurring between 1985 and 2020<sup>3</sup> for women of reproductive age (15–49 years) – data sources reporting on a different age range were included if they described the group as women of reproductive age (e.g. aged 10–49 or 15–54 years);
- ▶ the reported data must be nationally representative; and
- ▶ the data source must provide data on maternal or pregnancy-related deaths according to WHO’s definitions or, alternatively, must allow for disaggregation of maternal or pregnancy-related deaths, to align with the WHO definitions.

Eligibility does not depend on publication language, publication status/type, or study design, as long as the inclusion criteria are met and sufficient methodological details are provided for data adjustments to be made.

Additional eligibility criteria that vary by data source are as follows.

- ▶ For CRVS, the percentage of deaths that are assigned to a well defined ICD code must be greater than 60% (ill defined must not exceed 40%). Further detail on CRVS usability can be found in the 2015 edition of this report covering the years 1990–2015 (5).
- ▶ For specialized studies **within** the CRVS (see **Box 3.1**), there must be an eligible CRVS

### BOX 3.1 ■ SPECIALIZED STUDIES WITHIN THE CRVS

A subset of specialized studies – termed by the MMEIG as “specialized studies within the CRVS” – are used to assess the extent of incompleteness and/or misclassification within a CRVS system. These studies either directly validate CRVS data or provide the number of true maternal deaths for a country-year for which there is an eligible CRVS observation. These studies are used in the MMEIG BMis model to generate CRVS adjustment factors (see **section 3.4.1**).

<sup>1</sup> Further information on the DHS Program, including data and methodology, can be found at: <https://dhsprogram.com>

<sup>2</sup> Further information on MICS, including data and methodology, can be found at: <https://mics.unicef.org>

<sup>3</sup> The BMat model MMR estimation starts from 1985, with estimates reported for the years 2000–2020 only.

observation for the corresponding country-year of the specialized study observation.

- ▶ For population-based household surveys, (i) sufficient methodological information must be provided to allow sampling variation to be captured in the model, such as standard errors; and (ii) information on the age distribution of females residing in survey households is required to allow for age standardization to the female population of households at the time of the survey (14).
- ▶ For censuses, (i) sufficient methodological information must be provided to describe the derivation of the maternal mortality data reported; and preferably (ii) information on the age distribution of females, all-cause mortality and live births are needed to allow for adjustment of the data.

### 3.1.3 Search strategies to identify relevant studies and data inputs

For the purposes of the analysis presented in this report, the CRVS data were extracted from the WHO Mortality Database on 11 May 2022.

A structured literature search was conducted to identify eligible studies indexed in bibliographic databases to identify “specialized studies”, “specialized studies on maternal mortality within the CRVS” and “miscellaneous studies”. The following bibliographic databases were searched: MEDLINE, Embase, EBSCO, Global Index Medicus (WHO) and Web of Science – Russian Science Citation Index. The searches covered publications indexed between September 2016<sup>1</sup> and March 2021.

For censuses and government reports, the MMEIG searched the websites of each ministry of health, national statistics office and other relevant institutions. DHS and MICS surveys were searched and extracted from their respective websites. The CRVS data set is replaced with each update of the estimates, since Member States may amend data submitted in previous years. For other data sources, new eligible studies were appended to the existing data sets used in previous rounds of estimates.

**Table 3.1** provides a summary of the number of country-years of maternal mortality data, by type, used to produce maternal mortality estimates in this round. It should be noted that the number of country-years is not necessarily equal to the number

<sup>1</sup> 16 September 2016 is when the searches for the 2019 update were run.

of records for each data type, as some records report on extended observation periods (e.g. censuses, DHS and MICS surveys) while others report on single years (e.g. CRVS).

### 3.1.4 Uncertainty associated with maternal mortality data inputs

All observed mortality inputs are subject to random error. The random error may include sampling error (where obtained from surveys), stochastic error (where from a small number of deaths) or non-sampling error (i.e. random errors that may occur at any point during the data-collection process). The MMEIG calculated error variances to account for these errors. Observations with smaller error variances indicate less uncertainty and hence carry a greater weight in determining estimates than observations with large error variances.

## 3.2 Other data inputs to the model

The MMEIG maternal mortality estimates use data from multiple United Nations agencies, either for the calculation of the MMR (sections 3.2.1–3.2.3) or as covariates in the model (section 3.2.4). Any comments regarding these data should be addressed to the respective agencies.<sup>2</sup>

### 3.2.1 Data on all deaths to women aged 15–49 years

For all-cause deaths to women aged 15–49, the UNDESA/Population Division 2022 revision of *World population prospects* (WPP 2022) was used (15). In countries where high-quality and reliable vital registration or estimates were available, WPP 2022 used data from countries’ CRVS systems, as well as mortality estimates from the Human Mortality Database<sup>3</sup> and Eurostat,<sup>4</sup> among others. In other countries without such data, model life tables were used. Models were chosen to fit countries’ observed patterns of child mortality, life expectancy or adult mortality. Full methodological details, including important information on the assumptions made, can be found in WPP 2022 (15).

<sup>2</sup> For UNAIDS mortality estimates: [aidsinfo@unaids.org](mailto:aidsinfo@unaids.org); for all-cause mortality to women, live births and GFR estimates from World Population Prospects 2022: [population@un.org](mailto:population@un.org); for World Bank estimates of GDP: [esuzuki1@worldbank.org](mailto:esuzuki1@worldbank.org); for joint WHO–UNICEF skilled health personnel estimates: [lcarvajal@unicef.org](mailto:lcarvajal@unicef.org) and [mollera@who.int](mailto:mollera@who.int)

<sup>3</sup> Available at: <https://www.mortality.org>

<sup>4</sup> Available at: <https://ec.europa.eu/eurostat/web/main/data/database>

**Table 3.1 Country-years of observation available for a range of sources of maternal mortality data used in generating the 2000–2020 estimates for maternal mortality, by SDG region**

SDG region	Input data source					Total number of country-years (%) <sup>a</sup>
	CRVS	Specialized studies	Population-based household surveys	Censuses	Miscellaneous	
Sub-Saharan Africa	66	1	873	25	26	991 (21.1)
Northern Africa and Western Asia	210	41	47	1	93	392 (8.4)
Central and Southern Asia	186	14	44	4	78	326 (7.0)
Eastern and South-Eastern Asia	158	36	105	10	76	385 (8.2)
Latin America and the Caribbean	571	232	163	4	81	1051 (22.4)
Oceania excluding Australia and New Zealand	18	0	7	1	13	39 (0.8)
Australia and New Zealand	26	51	0	0	0	77 (1.6)
Europe and Northern America	1037	339	0	0	50	1426 (30.4)
<b>Total number of country-years (%)<sup>a</sup></b>	<b>2272 (48.5)</b>	<b>714 (15.2)</b>	<b>1239 (26.4)</b>	<b>46 (1)</b>	<b>417 (8.9)</b>	<b>4687 (100.0)</b>

CRVS: civil registration and vital statistics; SDG: Sustainable Development Goal.

<sup>a</sup> The sum of country-years of data has been rounded to the nearest 1.

### 3.2.2 HIV-related mortality

The MMEIG used estimates of deaths due to HIV from the Joint United Nations Programme on HIV/AIDS (UNAIDS) (16). The current HIV estimates are based on the 2019 version of WPP (WPP 2019) all-cause mortality estimates, whereas our model uses the WPP 2022 version. For consistency, the proportion of deaths due to HIV/AIDS was calculated as the UNAIDS 2019 estimate of HIV-related deaths divided by the WPP 2019 all-cause mortality for women aged 15–49, and this percentage was applied to the all-cause mortality total number of deaths from the WPP 2022 estimates to obtain the number of deaths due to HIV.

### 3.2.3 Live births data

Live births were taken from WPP 2022 (15). Bayesian hierarchical models were used to estimate the annual time series of total fertility and age-specific fertility rates from 1950 to 2021 for all countries. These models incorporated available empirical evidence from vital statistics, population censuses and population-based household surveys. The preferred data source for the

estimation of fertility was CRVS systems with national coverage and over 60% completeness. In countries where registration of births is deficient or incomplete, fertility estimates were obtained from population-based household surveys, such as DHS or MICS (9).

### 3.2.4 Predictor variables in the maternal mortality model

The BMat model uses an annual time series from 1990 to 2020 of the following predictor variables.

- ▶ Gross domestic product (GDP) per capita, measured in purchasing power parity (PPP) equivalent international dollars using 2017 as the baseline, was generated based on data from the World Bank Group supplemented by MMEIG estimates (17).
- ▶ General fertility rate (GFR) was computed using data on live births and population size (number of women aged 15–49) from WPP 2022 (15).
- ▶ Skilled birth attendant (SBA) data consist of time series derived using all available data from population-based national household survey data

and countries' routine reporting mechanisms (WHO and UNICEF Joint Skilled Birth Attendant database [18]).

For further details related to the predictor variables, please refer to [Annex 3](#).

### 3.3 Data processing

An upward adjustment of 10% was applied to all observations that were not obtained from CRVS or specialized studies, to account for deaths early in pregnancy that might not have been captured.

#### 3.3.1 Converting MMR to proportion maternal (PM)

The PM (the proportion of deaths among women of reproductive age that are due to maternal causes) is preferred over observed MMRs or other summary outcomes because it is less affected by unregistered deaths: deaths to women aged 15–49 that are unregistered would potentially affect the numerator and the denominator of the PM proportionately if causes of death are not unregistered differentially. For each observed PM, the corresponding MMR is calculated based on the WPP 2022 estimates of live births and all-cause deaths among females aged 15–49 for the respective country-period (15).

If only the MMR or the number of maternal deaths was available from a given data source, they were converted into a PM, using estimates of all-cause deaths among females aged 15–49 and live births from WPP 2022. For specialized studies within the CRVS, the reported all-cause deaths are used if present. If these are missing, then the CRVS all-cause deaths are used.

#### 3.3.2 Studies using the sisterhood method

The observed PM obtained from the sisterhood method is standardized according to the age distribution of the female population of respondent households at the time of the survey. This is because the age distribution found when using the sisterhood method is different from that of the general population. Further details are described in an article by Wilmoth et al., 2012 (8).

#### 3.3.3 Studies reporting on pregnancy-related deaths

The available data sources provide calculated PMs according to two definitions: “maternal” or “pregnancy-related” deaths. The MMEIG estimates “maternal” deaths from the PM of “pregnancy-

related” deaths, based on the historical assumptions indicating that incidental and/or accidental deaths (i.e. not maternal deaths) comprise 10% of pregnancy-related deaths (excluding HIV-related deaths) in sub-Saharan African countries, and 15% in other low- and middle-income countries. The MMEIG will examine the evidence basis of these assumptions for future estimation rounds.

### 3.4 Statistical methods

Two models are used, for different purposes.

1. The BMis model: For countries that have eligible CRVS data (see [section 3.1.2](#)), the BMis model is used to account for errors in reporting of maternal death in the CRVS to obtain the BMis adjustment factors.
2. The BMat model: For all countries, the BMat model is used to estimate the MMR for each country-year of interest.

These models are broken down into global and “one-country” implementations. Model assumptions are the same for global and one-country models. The development of this new approach was motivated by the demand for computational efficiency, without loss of model accuracy, when updates for a specific country are needed due to new data availability or when data need to be corrected.

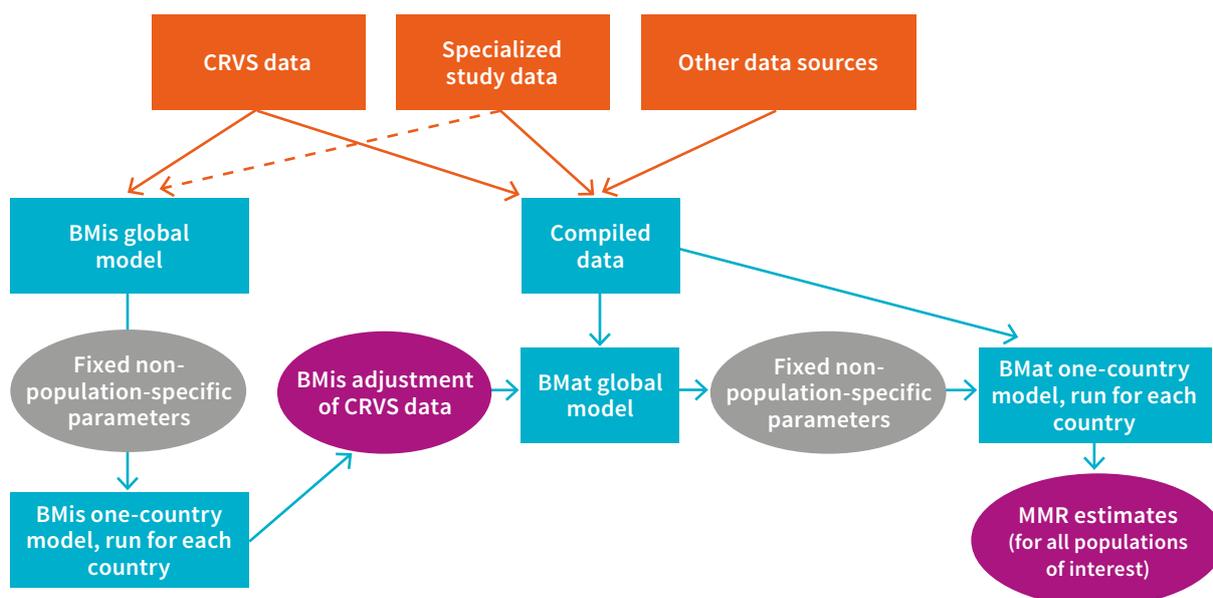
To estimate MMR for country-years, first the BMis global model is used to obtain the fixed non-population-specific parameters. Secondly, multiple instances of the BMis one-country model are used to obtain adjustment factors for each country-year of interest. These adjustment factors are then applied in BMat global and BMat one-country runs. In the next phase, the BMat global model is used to obtain the fixed non-population-specific parameters. Finally, multiple instances of the BMat one-country model are used to estimate the MMR for each country-year of interest (see [Fig. 3.1](#)).

The BMis model is described in [section 3.4.1](#), followed by the description of the BMat model in [section 3.4.2](#).

#### 3.4.1 Bayesian maternal mortality misclassification (BMis) model to account for errors in reporting of maternal death in the CRVS system

Relying on maternal deaths as reported in the CRVS system means there is a potential for error due to unregistered maternal deaths and/or misclassification of the cause of death within the CRVS system (see

**Fig. 3.1 Overview of modelling steps for MMR estimation**



Note: the link between specialized study data and the BMis global model is dotted to represent that only some specialized studies are used in BMis (specialized studies within the CRVS).

BMis: Bayesian maternal mortality misclassification model for CRVS adjustment; BMat: Bayesian maternal mortality estimation model; CRVS: civil registration and vital statistics; MMR: maternal mortality ratio.

**Table 3.2 Country-years of observation in the BMis model, by SDG region**

SDG region	Country-years of observation
Sub-Saharan Africa	0
Northern Africa and Western Asia	22
Central and Southern Asia	5
Eastern and South-Eastern Asia	33
Latin America and the Caribbean	126
Oceania (excluding Australia and New Zealand)	0
Australia and New Zealand	51
Europe and Northern America	288
<b>Total</b>	<b>525</b>

section 2.3 for definitions of reporting errors). The BMis model (previously called “the CRVS model”) produces adjustment factors derived from sensitivity and specificity estimates for all country-years of CRVS data, before the data are included in the BMat model (section 3.4.2).

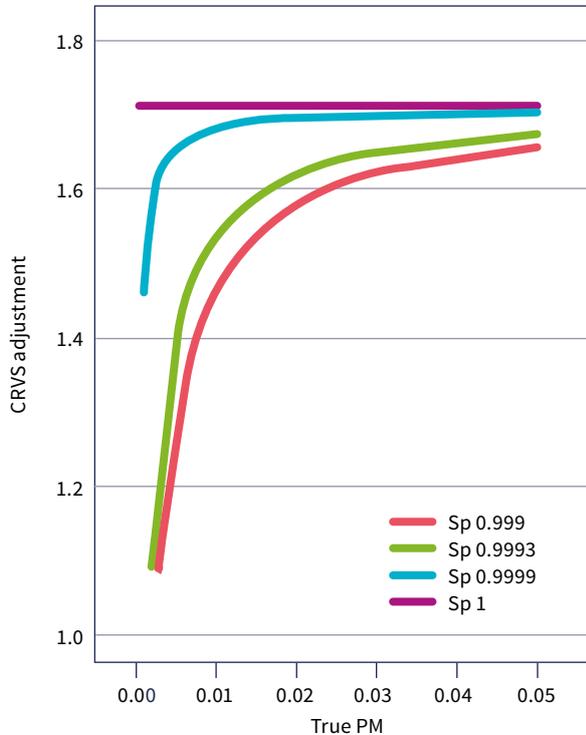
The BMis model only uses specialized studies within the CRVS (see Box 3.1) as data points. The number of country-years of observation available from such studies to use in the model is shown in Table 3.2. Several variables were tested to predict

changes in sensitivity and specificity over time within countries; however, they did not show a significant relationship and thus were not used in the model. The model produces a global estimate for sensitivity and specificity for each year of estimation, obtained by fitting the model to the global database of all specialized studies within the CRVS (see Box 3.1).

Country-estimates for sensitivity (Se) and specificity (Sp) are obtained in country-specific runs. For a country with specialized studies within the CRVS, the model is fitted to all available data. However, it is rare that a country has data from specialized studies within the CRVS for the entire estimation period. In such instances, Se and Sp values for the years before the earliest observation reference year of a specialized study are modelled to converge backwards to the global Se and Sp estimates within a five-year period. For years after the latest study observation reference year, the point estimates of Se and Sp are kept constant up to the end of the estimation period. For countries without specialized studies within the CRVS, Se and Sp are set to be equivalent to the global estimates.

Fig. 3.2 shows the relationship between true PM and the estimated CRVS adjustment factors, for different Sp values; this illustrates the effect of Sp on the CRVS adjustment factor. When Sp = 1, the CRVS adjustment factor = 1/Se, hence lower Se results in a higher

**Fig. 3.2 Bayesian maternal mortality misclassification (BMis) model CRVS adjustment for different values of specificity, calculated at different levels of true PM when sensitivity is fixed at 0.66<sup>a</sup>**



PM: proportion maternal; Sp: specificity.

<sup>a</sup> Based on the BMis model, it was estimated that 66% of maternal deaths are identified correctly in the CRVS.

adjustment factor, and conversely higher Se results in a lower adjustment factor. When  $Sp < 1$ , while keeping Se fixed, the adjustment factor decreases with decreasing true PM. This effect is due to an increasing share of false positive maternal deaths among all deaths, and a decreasing share of false negative deaths, or, in other words, as the true PM decreases, the proportion of non-maternal deaths reported as maternal increases while the proportion of maternal deaths reported as non-maternal decreases. Fig. 3.2 also illustrates that keeping Sp and Se constant in extrapolations in countries with specialized studies within the CRVS, or for countries without any such studies, will result in changing adjustment factors as the true PM changes. The BMis model is described in more detail by Peterson et al. (9).

Further detail on (i) the types of reporting errors encountered in CRVS systems, (ii) summary metrics for reporting errors, and (iii) deriving the sensitivity, specificity and CRVS adjustment factors from the BMis model can be found in Annex 2.

### 3.4.2 Bayesian maternal mortality estimation (BMat) model

Estimation and projection of maternal mortality indicators was undertaken using the BMat model. This model is intended to ensure that the MMR estimation approach is consistent across all countries but remains flexible in that it: is based on covariate-driven trends to inform estimates in countries or country-periods with limited information; captures observed trends in countries with longer time series of observations; and takes into account the differences in stochastic and sampling errors across observations.

In the BMat model, the MMR for each country-year is modelled as the sum of the HIV MMR (i.e. the portion of MMR that is due to HIV-related maternal deaths) and the non-HIV MMR (i.e. the portion of MMR that is due to non-HIV-related maternal deaths):

$$MMR = \text{non-HIV MMR} + \text{HIV MMR},$$

where non-HIV-related maternal deaths refer to maternal deaths due to direct obstetric causes or to indirect causes other than HIV/AIDS, while HIV-related maternal deaths are those maternal deaths to women with HIV/AIDS caused by the aggravating effects of pregnancy on HIV/AIDS.

The estimation of the non-HIV MMR and HIV MMR are explained below in sections a and b, respectively.

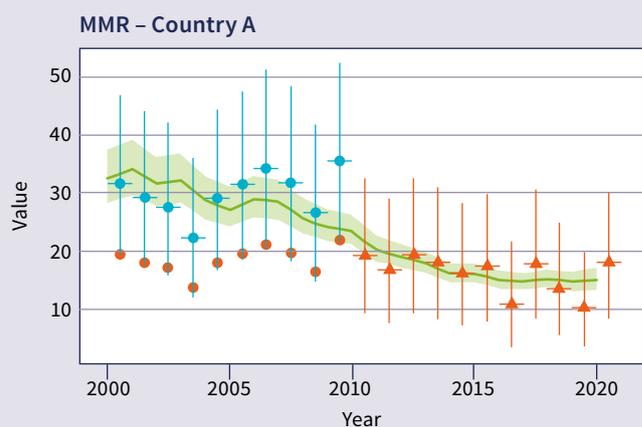
In the BMat model, the non-HIV MMR is estimated as follows:

$$\text{Non-HIV MMR}(t) = \text{expected non-HIV MMR}(t) * \text{data-driven multiplier}(t)$$

The data-driven multiplier ( $t$ ) allows for deviations away from the rate of change in MMR implied by the expected non-HIV MMR, as indicated by country-year-specific data points ( $t = \text{year}$ ). For example, if data suggest that the non-HIV MMR decreased (or increased) much faster in year  $t$  than expected based on covariates, the data-driven multiplier for that year is estimated to be greater (or smaller) than 1. This data-driven multiplier is modelled with a flexible time-series model, which fluctuates around 1, such that the covariates in the regression model determine the estimated change when data are absent.

The BMat model is fitted to all data available in the country (see Box 3.1), once adjustments have been made and uncertainty associated with the data points has been incorporated (see section 3.1.4). Observations with smaller error variances are more informative of the true PM and will thus carry a greater weight in determining the estimates as compared with observations with larger error variances.

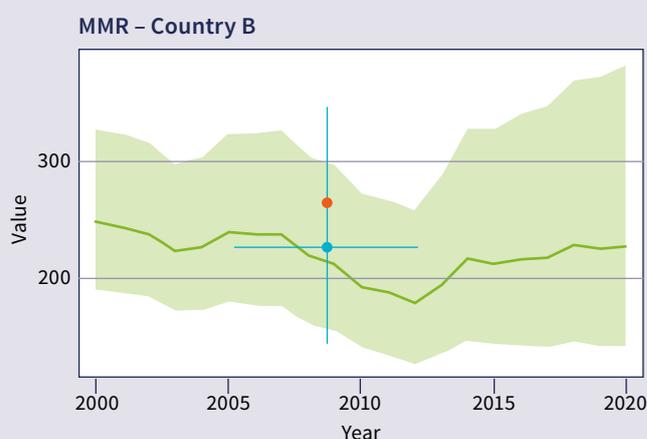
### BOX 3.1 ILLUSTRATION OF THE BMAT MODEL



**Value type**  
 ● input data  
 ● model adjusted data

**Source type**  
 ● CRVS  
 ▲ specialized study

**Estimate**  
 ■ 80% UI



**Value type**  
 ● input data  
 ● model adjusted data

**Source type**  
 ● survey

**Estimate**  
 ■ 80% UI

The first graph below shows the MMR estimates for Country A – a country with a high-quality CRVS system and data from specialized studies within the CRVS since 2000. The second graph shows MMR estimates for Country B – a country that does not have CRVS data, but has miscellaneous study data starting in 2005 (see section 3.1.1 for descriptions of these different data sources).

As shown, the estimated MMR trend line for Country A closely tracks the CRVS data points throughout the 2000–2020 time period. The shaded region around the trend line, which represents the 80% uncertainty interval (UI), remains roughly the same width throughout.

In contrast, Country B has one survey data point available reporting on a seven-year period (2005–2012). Given the lower reliability of survey data compared with CRVS data, they exert less influence, meaning that the trend line does not track them as closely as it does in the graph for Country A. For the years after 2012, the estimates are based on covariate information. The shaded region around the trend line is generally wide, and widens progressively in the years without any data, reflecting higher uncertainty.

MMR: maternal mortality ratio (maternal deaths per 100 000 live births).

In countries with high-quality data with little uncertainty, the final BMat estimates will closely track the country data and will have narrow uncertainty intervals (UIs). However, in the absence of data, or when data are very uncertain, the predictor variables (covariates) play an important role and inform the estimated trend in MMR.

The BMat provides estimates for all countries, using all available information, and inclusion of additional observations for any one country may result in very slight changes to estimates for other countries. For all outcomes of interest, uncertainty was assessed and is reported in terms of uncertainty intervals.

#### a. Estimation of expected non-HIV-related maternal deaths

A hierarchical regression model was used to obtain the expected number of non-HIV-related maternal deaths for each country-year, and the associated non-HIV MMR. The model predicts the proportion of deaths to women of reproductive age that are due to maternal causes (PM) using three predictor variables: the GDP per capita, the GFR and the presence of a skilled birth attendant (SBA) as a proportion of live births. These specific predictor variables were chosen from a broader list of potential predictor variables, which fell into three groups: indicators of social and economic development (e.g. GDP, human development index, life expectancy), process variables (e.g. SBA coverage, antenatal care, proportion of institutional births) and risk exposure variables (i.e. fertility level).

The model is summarized as follows:

$$\log(PM^{NA}) = b_0 + b_1 \log(\text{GDP}) + b_2 \log(\text{GFR}) + b_3 \text{SBA} + \gamma_j + \phi_k$$

where

$EPM^{NA}$  = the expected proportion of non-HIV-related maternal deaths among all non-HIV-related deaths to women aged 15–49 years

GDP = gross domestic product per capita (in 2017 PPP international dollars)

GFR = general fertility rate (live births per woman aged 15–49 years)

SBA = proportion of births attended by skilled health personnel

$\gamma_j$  = random intercept term for country  $j$

$\phi_k$  = random intercept term for region  $k$ .

For countries with data available on maternal mortality, the expected proportion of non-HIV-related maternal deaths was based on country and regional random effects, whereas for countries with no data available, predictions were derived using regional random effects only. The resulting estimates of the  $EPM^{NA}$  were used to obtain the expected non-HIV MMR through the following relationship.

$$\text{Expected non-HIV MMR} = EPM^{NA} \cdot (1-a) \cdot E/B$$

where

$a$  = the proportion of HIV-related deaths to women of reproductive age

$E$  = the total number of deaths to women of reproductive age

$B$  = the number of births.

### b. Estimation of HIV-related indirect maternal deaths

For countries with generalized HIV epidemics and high HIV prevalence, HIV/AIDS is a leading cause of death during pregnancy and after delivery. Furthermore, pooled evidence from community studies suggests that women with HIV infection have an eight times higher risk of pregnancy-related death compared with non-HIV infected women, although this may be offset by lower fertility (19). In places where more than 2% of the pregnant and postpartum population are living with HIV, it is predicted that 12% of all pregnancy-related deaths are attributable to HIV (19). When estimating maternal mortality in these countries, it is, thus, important to differentiate between incidental HIV deaths (non-maternal deaths) and HIV-related indirect maternal deaths (maternal deaths caused by the aggravating effects of pregnancy on HIV) among

HIV-positive pregnant and postpartum women who have died (i.e. among all HIV-related deaths occurring during pregnancy, childbirth and the puerperium).<sup>1</sup>

The number of HIV-related indirect maternal deaths ( $D^{HIV}$ ) is estimated by:

$$D^{HIV} = a \cdot E \cdot v \cdot u$$

where

$a \cdot E$  = the total number of HIV-related deaths among all deaths to women aged 15–49

$v$  = is the proportion of HIV-related deaths to women aged 15–49 that occur during pregnancy

The value of  $v$  can be computed as follows:

$$v = \frac{c \cdot k \cdot \text{GRF}}{[1 + c(k - 1) \cdot \text{GRF}]}$$

where  $c$  is the average exposure time (in years) to the risk of pregnancy-related mortality per live birth ( $c = 1$  for this analysis), and where  $k$  is the relative risk of dying from HIV/AIDS for a pregnant versus a non-pregnant woman, reflecting both the decreased fertility of HIV-positive women and the increased mortality risk of HIV-positive pregnant women ( $k = 0.3$  for this analysis) (19)

$u$  = is the fraction of pregnancy-related HIV/AIDS deaths assumed to be HIV-related indirect maternal deaths. The MMEIG/TAG reviewed available study data on AIDS deaths among pregnant women and recommended using  $= 0.3$  (19).

For observed PMs, it was assumed that the total reported maternal deaths were a combination of the proportion of reported non-HIV-related maternal deaths and the proportion of reported HIV-related (indirect) maternal deaths, where the latter is given by  $a \cdot v$  for observations with a “pregnancy-related death” definition and  $a \cdot v \cdot u$  for observations with a “maternal death” definition (see [section 2.1](#) for definitions).

### c. Estimation of maternal mortality in crisis years

Estimates in WPP 2022 account for deaths related to “crises” due to natural disasters, conflicts and epidemics, because of the potential for substantial increases in death rates during crisis-affected years – a phenomenon described as “mortality shocks” (20). WPP 2022 estimates excess mortality for each country, which is categorized as due to natural disasters (e.g. flooding, cyclones, earthquakes, famines/droughts,

<sup>1</sup> See definitions in [Chapter 2](#).

tsunami), epidemics (excluding HIV/AIDS<sup>1</sup> and COVID-19), COVID-19,<sup>2</sup> conflicts and battle deaths, and mass killings (including genocide) (20).

Some locations may experience more than one crisis event in a year; in these cases the excess deaths due to crises (or shocks) are the sum of all deaths attributed to crises (20). Negative crisis deaths were set to zero.

A “crisis year” for the purpose of estimating maternal mortality is defined in the following two ways, and all years that meet either definition are included as crisis years:

- i. a year in which (a) there are at least 10 deaths attributable to mortality shocks among women of reproductive age (i.e. 15–49 years) and (b) these deaths constitute at least 10% of the total number of deaths to women aged 15–49 in that country-year (15) and in addition (c) in the five-year period surrounding that year, there are at most two additional crisis years;
- ii. a year previously identified by the United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) as a crisis year for the estimation of child mortality (21) (this includes crises in potentially longer periods, i.e. for ongoing crises).

For a country-year that meets the definition of a crisis year, the MMEIG estimates the “crisis-free observed proportion maternal”, which is defined as the proportion of maternal or pregnancy-related deaths among the total number of crisis-free deaths to women of reproductive age.<sup>3</sup> Pregnancy-related PMs are adjusted based on the assumption that the proportion of pregnancy-related deaths among the deaths attributable to mortality shocks is equal to the proportion of women in the population who are pregnant or postpartum at the time of the crisis. The proportion of pregnant women in the population is set equal to the general fertility rate, based on the assumption of a one-year period associated with a live birth (8).

<sup>1</sup> Adult mortality is modelled in the WPP to take into account the prevalence of HIV infection and the coverage of antiretroviral therapy. For countries highly affected by HIV and AIDS, the 2022 revision of the WPP used a model life table to explicitly model the demographic impact of the HIV and AIDS epidemic on the mortality age patterns for 21 countries with generalized HIV epidemics. See the WPP 2022 methodology report for further detail (20).

<sup>2</sup> For the purpose of crisis-year estimation, COVID-19 is estimated separately from other epidemics.

<sup>3</sup> Although by definition PM refers strictly to maternal deaths (and the model is based on this definition), some observed PMs are based on the definition of pregnancy-related deaths (which includes but is not limited to maternal deaths; see definitions in [Chapter 2](#)).

Crisis-related factors may contribute to maternal mortality, but empirical evidence to distinguish maternal deaths from among pregnancy-related deaths in the context of mortality shocks is limited. To reflect the paucity of evidence on the effect of crisis on maternal mortality, UIs for crisis years are widened by multiplying the samples of maternal deaths by values between 0.9 and 1.2.

For further detail on WPP estimation of crisis years, see the WPP 2022 methodology report (20).

#### d. Estimation of maternal mortality for 2020 (COVID-19)

The estimates contained within this report for 2020 coincide with the first year of the COVID-19 pandemic. The pandemic represents a challenge to maternal mortality estimation for several reasons.

First, a proportion of total COVID-19 deaths were also indirect obstetric deaths (22) – where a woman’s death was due to the aggravation between the disease and the state of pregnancy (coded as O98.5 under ICD-10, and JB63.5 under ICD-11, consistent with ICD coding rules and procedures for other infectious conditions). There is currently limited evidence on the proportion of all COVID-19 deaths among pregnant or postpartum women where the pregnant status interacted with the progress of the disease to cause her death (i.e. those deaths where COVID-19 is an underlying cause, rather than contributing or incidental to the death).

Second, in 2020, COVID-19 vaccinations were not yet available. Pregnant women may have changed their behaviour to avoid the risk of infection, when able to do so, and these behaviour changes may have differed from the behaviour of non-pregnant women. As a simple assumption, based on the general fertility rate, around 6–8% of women of reproductive age might have been expected to be pregnant during 2020 in the countries for which the burden of COVID-19 mortality among women of reproductive age reached the threshold to be considered a crisis year. In 24 countries, in 2020, excess COVID-19 deaths alone comprised 10% of all deaths to women of reproductive age – high enough to reach the crisis-year threshold.<sup>4</sup>

Finally, given the paucity of available evidence, the MMEIG has assumed for the purposes of estimation

<sup>4</sup> The 24 countries where excess COVID-19 mortality was at least 10% of all deaths to women of reproductive age in 2020 are as follows, from highest to lowest: Peru, Mexico, Armenia, Kuwait, Ecuador, North Macedonia, Oman, Cyprus, Tajikistan, the Plurinational State of Bolivia, Algeria, Türkiye, Slovenia, Iraq, Brazil, the United States of America (USA), Kazakhstan, Belarus, Azerbaijan, the Islamic Republic of Iran, Nicaragua, the United Kingdom of Great Britain and Northern Ireland, Kyrgyzstan and the Russian Federation.

that the relative risk of death from COVID-19 among pregnant versus non-pregnant women was 1, with uncertainty bounds given by 0.9 and 1.2. This may result in a slight underestimation of the burden of COVID-19-related maternal mortality. The MMEIG preferred to use assumptions that may err on the side of underestimation given the expected population-level variation in the relative risk. Revisions to both methods and data are expected in future rounds of estimation, as the evidence base becomes clearer.

### 3.4.3 Maternal mortality indicators estimated by the model

The immediate outputs of the BMat model were estimates in the form of PMs. These values were then converted to estimates of the MMR as follows:

$$\begin{aligned} \text{MMR} &= \frac{\text{Maternal deaths}}{\text{Live births}}, \text{ was calculated using PM as:} \\ &= \text{PM} * \frac{\text{Deaths to women aged 15-49}}{\text{Live births}} \end{aligned}$$

Based on MMR estimates, the annual rate of reduction (ARR) of MMR and the maternal mortality rate (MMRate; the number of maternal deaths divided by person-years lived by women of reproductive age) were calculated. The ARR was calculated as follows:

$$\text{ARR} = \frac{\log\left(\frac{\text{MMR}_{t2}}{\text{MMR}_{t1}}\right)}{t1-t2} * 100$$

where  $t1$  and  $t2$  refer to different years with  $t1 < t2$ .

The MMRate was calculated as follows:

$$\text{MMR rate} = \frac{\text{Maternal deaths}}{\text{Women aged 15-49}}$$

The MMRate was used to calculate the adult lifetime risk of maternal mortality (i.e. the probability that a 15-year-old girl will eventually die from a maternal cause). In countries where there is a high risk of maternal death, there is also an elevated likelihood of girls dying before reaching reproductive age. For this reason, the lifetime risk of maternal mortality was considered to be conditional on the probability of a girl's survival to age 15 ( $\ell_{15}$ ). The formula used, shown below, also considers competing causes of death.

Lifetime risk of maternal mortality (LTR) =

$$\text{MMR} * \frac{\text{Live births}}{\text{Women aged 15-49}} * \frac{T_{15} - T_{50}}{\ell_{15}}$$

Substituting for the MMR gives:

$$\text{LTR} = \frac{\text{Maternal deaths}}{\text{Live births}} * \frac{\text{Live births}}{\text{Women aged 15-49}} * \frac{T_{15} - T_{50}}{\ell_{15}}$$

Which simplifies to:

$$\text{LTR} = \text{MMRate} * \frac{T_{15} - T_{50}}{\ell_{15}}$$

$T_{15}$  and  $T_{50}$  are life-table quantities for the female population during the period in question (23). The ratio  $(T_{15}-T_{50})/\ell_{15}$  was taken from life tables that include deaths due to mortality shocks, i.e. the ratio represents the average number of years lived between ages 15 and 50 years among survivors to age 15 years in the presence of the mortality shock. Hence, the lifetime risk in years with mortality shocks represents the risk of dying from a maternal cause in the presence of the mortality shock.

### 3.4.4 Aggregation of estimates

Regional maternal mortality estimates were computed, according to the United Nations SDG, UNFPA, UNICEF, UNDESA/Population Division, WHO and the World Bank Group regional groupings. The regional aggregate MMR was calculated as the weighted average of the MMR where weights are based on the number of live births.

The regional aggregate lifetime risk of maternal mortality in a given region was calculated as the weighted average of the lifetime risk where the weights are based on the number of women aged 15-49 and the probability of surviving to age 15 ( $\ell_{15}$ ).

### 3.4.5 Key reasons MMR estimates might differ from national statistics

The MMR estimates presented in this report may differ from national statistics collected using equally robust methods. This can occur for several reasons, which are detailed throughout this report. Three of the most common reasons are:

- ▶ **Differences in the denominators used:** International comparability of maternal mortality estimates for the purposes of SDG monitoring is one of the primary aims of the MMEIG. The MMEIG therefore uses common denominators to calculate maternal mortality measures from the model – namely, all-cause deaths for women of reproductive age, and total live births – from the WPP 2022 (15).
- ▶ **Differences caused by covariates-based modelling:** Not all data sources reviewed are eligible. Where there are no or few eligible data

points, the model estimates are mostly driven by covariates.

► **Adjustment for incomplete and misclassified maternal deaths:** Maternal mortality is misclassified almost everywhere, according to the BMis global sensitivity and specificity estimates. In the current round of estimates, maternal mortality sensitivity in CRVS is estimated at 66% and specificity at 99% globally. This means that 66% of true maternal deaths are correctly identified and classified as maternal deaths in the CRVS, and 99% of true non-maternal deaths are correctly classified as non-maternal deaths in the CRVS. However, these estimates of Se and Sp are derived from CRVS systems that are of relatively high quality, meaning that maternal mortality is likely to be vastly underestimated in CRVS input data. To account for this, maternal mortality estimates coming from all data sources that are not specialized studies are adjusted upwards. CRVS adjustment factors are estimated using the BMis model, while all non-CRVS data sources are adjusted upwards by 10%.

### 3.5 Evolution of the United Nations and MMEIG estimation approach

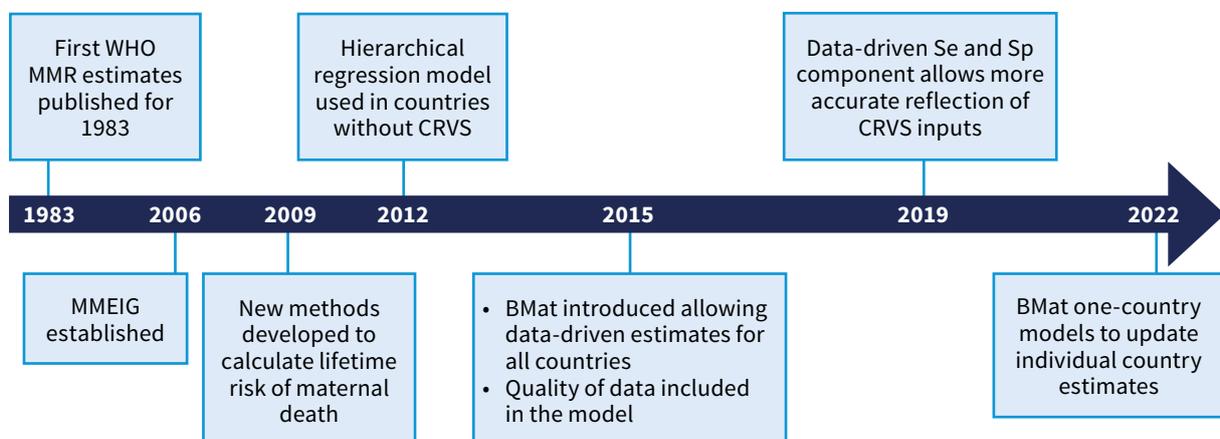
The MMEIG is committed to producing robust estimates that are comparable at the regional and global levels. This commitment is reflected in the evolution of the methodology over the years, with each round of estimates developed using improved statistical methods and incorporating the most up-to-date data sets available. The evolution in the MMEIG’s maternal mortality estimation methodology is described here in brief (and illustrated in [Fig. 3.3](#)).

The first United Nations maternal mortality estimates to be published were for the year 1983, published in 1986 (24) and for the year 1988, published in 1991 (25), and were initially developed by WHO. Subsequent estimates involved UNICEF (published in 1996 [26]) and then also UNFPA (published in 2001 and 2004 [27,28]) and were more detailed. Building on this early work, the United Nations MMEIG was established in 2006, and formalized in 2010 under the MMEIG name. MMEIG includes five United Nations agencies: WHO, UNICEF, UNFPA, the World Bank and UNDESA/ Population Division. Previous publications of maternal mortality estimates by the MMEIG were issued in 2007, 2010, 2012, 2014, 2015 and 2019 (1–6).

In 2012, the MMEIG used a hierarchical regression model to estimate MMR in countries without high-quality vital registration data (3,8). These estimates were limited in their power to capture data-driven trends, with trends determined by covariates only. From 2015 onwards, the Bayesian maternal mortality estimation (BMat) model was developed to derive data-driven estimates for all countries, combining empirical data with the hierarchical regression model covariates. For the 1990–2015 estimates, data models were also developed to account for variations in data quality (e.g. different error variances for different data sources) (5). In 2019, the Bayesian CRVS adjustment model (or just “the CRVS model”) was created to facilitate accounting for CRVS reporting errors (sensitivity and specificity) and was applied in the previous round of estimates for 2000–2017 (6).

In this current round of estimation, for the period 2000–2020, the CRVS adjustment model has been renamed as the Bayesian maternal mortality misclassification (BMis) model, and has been refined.

**Fig. 3.3 Key milestones in the evolution of United Nations and MMEIG methods, 1983 to 2022**



Se: sensitivity; Sp: specificity (see [section 2.2](#) for definitions).

The “one-country” models were developed to enable updates to estimate for single countries without affecting the estimates for other countries, in order to improve the computational efficiency of MMEIG estimation procedures.

The MMEIG estimates are unique in that direct engagement with Member States’ governments is an integral part of the estimation process. The country consultations strengthen partnerships between governments and the MMEIG and facilitate government technical capacity-building, enabling governments to review MMEIG input data sources,

methods and preliminary estimates, and giving them an opportunity to comment and provide further input. The country consultation process is described in [Annex 1](#).

Finally, the MMEIG’s commitment to improving maternal mortality measurement goes beyond estimation, with ongoing efforts to improve the reporting and classification of maternal deaths at the national level. This is reflected in the guidance and tools developed to support national-level maternal mortality reporting (29).

## References

1. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank. Maternal mortality in 2005: estimates developed by WHO, UNICEF, UNFPA and the World Bank. Geneva: WHO; 2007 (<https://apps.who.int/iris/handle/10665/43807>).
2. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank. Trends in maternal mortality: 1990 to 2008: estimates developed by WHO, UNICEF, UNFPA and the World Bank. Geneva: WHO; 2010 (<https://apps.who.int/iris/handle/10665/44423>).
3. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank. Trends in maternal mortality: 1990 to 2010: WHO, UNICEF, UNFPA and the World Bank estimates. Geneva: WHO; 2012 (<https://apps.who.int/iris/handle/10665/44874>).
4. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank, United Nations Population Division. Trends in maternal mortality: 1990 to 2013: estimates by WHO, UNICEF, UNFPA, the World Bank and the United Nations Population Division. Geneva: WHO; 2014 (<https://apps.who.int/iris/handle/10665/112682>).
5. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank Group, United Nations Population Division. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: WHO; 2015 (<https://apps.who.int/iris/handle/10665/194254>).
6. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank Group, United Nations Population Division. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/327596>).
7. Alkema L, Zhang S, Chou D, Gemmill A, Moller AB, Fat DM, et al. A Bayesian approach to the global estimation of maternal mortality. *Ann Appl Stat*. 2017;11(3):1245–74. doi:10.1214/16-aos1014.
8. Wilmoth JR, Mizoguchi N, Oestergaard MZ, Say L, Mathers CD, Zureick-Brown S, et al. A new method for deriving global estimates of maternal mortality. *Stat Politics Policy*. 2012;3(2):2151-7509.1038. doi:10.1515/2151-7509.1038.
9. Peterson E, Chou D, Moller AB, Gemmill A, Say L, Alkema L. Estimating misclassification errors in the reporting of maternal mortality in national civil registration vital statistics systems: a Bayesian hierarchical bivariate random walk model to estimate sensitivity and specificity for multiple countries and years with missing data. *Stat Med*. 2022;41(14):2483–96. doi:10.1002/sim.9335.
10. United Nations Department of Economic and Social Affairs. Principles and recommendations for a vital statistics system. Revision 3. Statistical Papers, Series M No. 19/Rev.3. New York (NY): United Nations; 2014 (<https://unstats.un.org/unsd/demographic/standmeth/principles/m19rev3en.pdf>).

11. Beyond the numbers: reviewing maternal deaths and complications to make pregnancy safer. Geneva: World Health Organization; 2004 (<https://apps.who.int/iris/handle/10665/42984>).
12. Stanton C, Abderrahim N, Hill K. DHS maternal mortality indicators: an assessment of data quality and implications for data use (DHS Analytical Report No. 4). Calverton (MD): Macro International; 1997 (<https://dhsprogram.com/pubs/pdf/AR4/AR4.pdf>).
13. Graham W, Brass W, Snow RW. Estimating maternal mortality: the sisterhood method. *Stud Fam Plann.* 1989;20(3):125–35.
14. Wilmoth JR, Mizoguchi N, Oestergaard MZ, Say L, Mathers C, Zureick-Brown S, et al. on behalf of the UN Maternal Mortality Estimation Inter-Agency Group (MMEIG). A new method for deriving global estimates of maternal mortality: supplemental report. Berkeley (CA): University of California, Berkeley; 2012 ([https://u.demog.berkeley.edu/~jrw/Biblio/Eprints/JRW/wilmoth.etal.2012\\_matmort.estimate\\_supplement.pdf](https://u.demog.berkeley.edu/~jrw/Biblio/Eprints/JRW/wilmoth.etal.2012_matmort.estimate_supplement.pdf)).
15. World population prospects 2022 [website]. New York (NY): United Nations Department of Economic and Social Affairs, Population Division; 2022 (<https://population.un.org/wpp/>, accessed 17 October 2022).
16. UNAIDS data 2021. Geneva: Joint United Nations Programme on HIV/AIDS (UNAIDS); 2021 ([https://www.unaids.org/en/resources/documents/2021/2021\\_unaids\\_data](https://www.unaids.org/en/resources/documents/2021/2021_unaids_data)).
17. World development indicators. In: The World Bank DataBank [website]. Washington (DC): World Bank; 2022 (<https://databank.worldbank.org/source/world-development-indicators>, accessed 24 October 2022).
18. World Health Organization (WHO), United Nations Children’s Fund (UNICEF). UNICEF/WHO joint database on SDG 3.1.2 Skilled Attendance at Birth. In: Delivery care [website]. New York (NY): UNICEF; 2022 (<https://data.unicef.org/topic/maternal-health/delivery-care/>, accessed 24 October 2022).
19. Zaba B, Calvert C, Marston M, Isingo R, Nakiyingi-Miiró J, Lutalo T, et al. Effect of HIV infection on pregnancy-related mortality in sub-Saharan Africa: secondary analyses of pooled community based data from the network for Analysing Longitudinal Population-based HIV/AIDS data on Africa (ALPHA). *Lancet.* 2013;381(9879):1763–71. doi:10.1016/S0140-6736(13)60803-X.
20. Methodology report: world population prospects 2022: methodology of the United Nations population estimates and projections. United Nations Department of Economic and Social Affairs, Population Division; 2022 (UN DESA/POP/2022/DC/NO.6; [https://population.un.org/wpp/Publications/Files/WPP2022\\_Methodology.pdf](https://population.un.org/wpp/Publications/Files/WPP2022_Methodology.pdf)).
21. United Nations Inter-agency Group for Child Mortality Estimation (UN IGME). Levels & trends in child mortality: report 2018: estimates developed by the UN Inter-agency Group for Child Mortality Estimation. New York (NY): United Nations Children’s Fund; 2018 (<https://www.unicef.org/media/47626/file/UN-IGME-Child-Mortality-Report-2018.pdf>).
22. Certification of deaths during pregnancy, childbirth, or the puerperium where confirmed or suspected COVID-19 is a cause of death. Geneva: World Health Organization; 2022 (<https://apps.who.int/iris/handle/10665/361417>).
23. Wilmoth J. The lifetime risk of maternal mortality: concept and measurement. *Bull World Health Organ.* 2009;87:256–62. doi:10.2471/BLT.07.048280.
24. Maternal mortality rates: a tabulation of available information, second edition. Geneva: World Health Organization; 1986.
25. Maternal mortality: ratios and rates: a tabulation of available information, third edition. Technical documents. Geneva: World Health Organization; 1991.
26. World Health Organization (WHO) Maternal Health and Safe Motherhood Programme, United Nations Children’s Fund (UNICEF). Revised 1990 estimates of maternal mortality: a new approach by WHO and UNICEF. Geneva: WHO; 1996 (<https://apps.who.int/iris/handle/10665/63597>).
27. World Health Organization (WHO), United Nations Children’s Fund (UNICEF), United Nations Population Fund (UNFPA). Maternal mortality in 1995: estimates developed by WHO, UNICEF and UNFPA. Geneva: WHO; 2001 (<https://apps.who.int/iris/handle/10665/66837>).

28. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA). Maternal mortality in 2000: estimates developed by WHO, UNICEF and UNFPA. Geneva: WHO; 2004 (<https://apps.who.int/iris/handle/10665/42930>).
29. Maternal mortality measurement: guidance to improve national reporting. Geneva: World Health Organization; 2022 (<https://apps.who.int/iris/handle/10665/360576>).



# 4. Maternal mortality estimates and trends: 2000 to 2020

This chapter presents and describes estimated maternal mortality ratios (MMRs), numbers of maternal deaths, the proportion of maternal deaths among all deaths to women of reproductive age (PM; proportion maternal), and the adult lifetime risk of maternal mortality for 2020.<sup>1</sup> This chapter also presents and examines trends in these indicators between 2000 and 2015 (the MDG era) (1) and from 2016 to 2020 (the first third of the SDG era) (2).

Countries and territories included in all the tables presented in this report are limited to the 183 WHO Member States that had populations over 100 000 in 2020 and two additional territories – Puerto Rico and the occupied Palestinian territory, including east Jerusalem – which also met the population criterion.<sup>2</sup> This results in a total of 185 countries and territories included in the data presented in the tables in this chapter and in [Annexes 4–16](#).<sup>3</sup>

The numbers provided are the most accurate point estimates possible given the available data. However, these calculations still contain a level of uncertainty that varies depending on the amount and quality of available data used to produce them. An 80% uncertainty interval (UI), which is included for each of the point estimates presented, means there is an 80% chance that the true value of the indicator falls within the upper and lower bounds of the UI; more information about how to interpret the estimates and UIs is provided in [Box 4.1](#).

The new estimates and trends presented in this report supersede all previously published estimates for years that fall within the same time period. Care should be taken to use only these estimates for the interpretation of trends in maternal mortality

between 2000 and 2020; due to modifications in methodology and changes in data availability, differences between these and previous estimates should not be interpreted as representing time trends. The full database, country profiles and all model specification codes used are available online.<sup>4</sup>

The results described in this report are the second available set of estimates describing maternal mortality for years that fall within the SDG reporting period. This report is the first to present trends within the SDG period, for the first five years of the 15-year period, from the start of 2016 until the end of 2020.

[Section 4.1](#) of this chapter presents global-, regional- and country-level estimates for 2020, and [section 4.2](#) presents trends for 2000–2020, in addition to trends disaggregated for 2000–2015 and 2016–2020.

[Annexes 5–15](#) present the MMR point estimates, range of uncertainty, numbers of maternal deaths, lifetime risk of maternal death and PM point estimates for 2020, as well as the trends in the estimates of MMR between 2000 and 2020, 2000–2015, and 2016–2020, for WHO, UNICEF, UNFPA, World Bank Group, UNDESA/Population Division and SDG regions.

## 4.1 Maternal mortality estimates for 2020

[Table 4.1](#) provides 2020 point estimates of maternal mortality indicators and the numbers of maternal deaths for the world, by United Nations Sustainable Development Goal (SDG) region, subregion and three other groupings (UNDESA/Population Division classifications of landlocked developing countries [LLDCs], least developed countries [LDCs] and small island developing States [SIDS]) (regional estimates are discussed in [section 4.1.2](#)). It also presents the range of uncertainty for each MMR point estimate. Country-level estimates for 2020 are provided in [Annex 4](#) (and discussed in [section 4.1.3](#)).

<sup>1</sup> See [Chapter 2](#) for definitions.

<sup>2</sup> Puerto Rico is an Associate Member. Occupied Palestinian territory, including east Jerusalem, is a member in the Regional Committee for the WHO Eastern Mediterranean Region.

<sup>3</sup> WHO Member States excluded due to small populations: Andorra, Cook Islands, Dominica, Marshall Islands, Monaco, Nauru, Niue, Palau, Saint Kitts and Nevis, San Marino and Tuvalu. Associate Members excluded due to small populations: Faroe Islands and Tokelau.

<sup>4</sup> Available at: [www.who.int/publications/i/item/9789240068759](http://www.who.int/publications/i/item/9789240068759)

## BOX 4.1 ■ ACCURATELY INTERPRETING POINT ESTIMATES AND UNCERTAINTY INTERVALS

All maternal mortality indicators in this report include a point estimate and an 80% uncertainty interval (UI). For those indicators where only point estimates are reported in the text or tables, UIs can be obtained from supplementary material online.<sup>a</sup>

The 80% UIs computed for all the estimates provide the 10th and 90th percentiles of the posterior distributions. This was chosen rather than the more standard 95% UIs because of the substantial uncertainty inherent in maternal mortality outcomes.

Both point estimates and 80% UIs should be taken into account when assessing estimates. Below is one example and how to interpret it.

Example: The estimated 2020 global maternal mortality ratio (MMR) is 223 (UI 202 to 255).

This means:

- ▶ **The point estimate is 223 and the 80% UI ranges from 202 to 255.**
- ▶ **There is a 50% chance that the true 2020 global MMR lies above 223, and a 50% chance that the true value lies below 223.**
- ▶ **There is an 80% chance that the true 2020 global MMR lies between 202 and 255.**
- ▶ **There is a 10% chance that the true 2020 global MMR lies above 255, and a 10% chance that the true value lies below 202.**

Other accurate interpretations include:

- ▶ **We are 90% certain that the true 2020 global MMR is at least 202.**
- ▶ **We are 90% certain that the true 2020 global MMR is 255 or less.**

The amount of data available for estimating an indicator and the quality of those data determine the width of an indicator's UI. As data availability and quality improve, the certainty increases that an indicator's true value lies close to the point estimate.

<sup>a</sup> Available at: [www.who.int/publications/i/item/9789240068759](http://www.who.int/publications/i/item/9789240068759)

For the purpose of categorization, the MMR is considered very low if it is less than 20, low if it is less than 100, moderate if it is 100–299, high if it is 300–499, very high if it is 500–999 and extremely high if it is greater than or equal to 1000 maternal deaths per 100 000 live births.

### 4.1.1 Global-level estimates

Globally, an estimated 287 000 (UI 273 000 to 343 000) maternal deaths occurred in 2020, yielding an overall MMR of 223 (UI 202 to 255) maternal deaths per 100 000 live births for the 185 countries and territories covered in this analysis (Table 4.1). This corresponds to almost 800 maternal deaths every day, and approximately one maternal death every two minutes globally.

For 2020, the global lifetime risk of maternal mortality was estimated at 1 in 210; this means for a girl aged 15 years in 2020, there is, on average, a 1 in 210 risk that she will die from a maternal cause. The overall PM was estimated at 9.8%.

An estimated 1878 HIV-related indirect maternal deaths occurred in 2020, accounting for less than 1%

of all maternal deaths. This corresponds to an MMR for HIV-related indirect maternal deaths of approximately 1 death per 100 000 live births, globally.

### 4.1.2 Regional-level estimates

There was substantial variation in the burden of maternal mortality by region. As seen according to the United Nations SDG regions and subregions (Table 4.1), sub-Saharan Africa was the only region in 2020 with a very high MMR, having an MMR point estimate of 545 (UI 477 to 654) per 100 000 live births, and the lifetime risk of maternal death there was estimated at 1 in 40. Sub-Saharan Africa alone accounted for approximately 70% of global maternal deaths in 2020, followed by Central and Southern Asia, which accounted for almost 17%. The MMR was moderate in two regions – Oceania (excluding Australia and New Zealand) at 173 (UI 120 to 255) and Central and Southern Asia at 129 (UI 114 to 149). All remaining regions had a low or very low MMR, with the lowest being in Australia and New Zealand at 4 (UI 3 to 4). This corresponds to an estimated lifetime risk of dying from a maternal cause in Australia and New Zealand in 2020 of approximately 1 in 16 000 –

approximately 400 times lower than in sub-Saharan Africa. The PM in sub-Saharan Africa in 2020 was 19.3%, compared with only 0.5% in Australia and New Zealand.

Three subregions, all in sub-Saharan Africa, had very high or high MMRs – Western Africa at 754 (UI 616 to 1024), Middle Africa at 539 (UI 430 to 742) and Eastern Africa at 351 (UI 304 to 412) per 100 000 live births. Six regions had moderate MMRs in 2020, the highest of those being the Caribbean at 188 (UI 143 to 269), followed by Melanesia at 176 (UI 121 to 262), Southern Africa at 157 (UI 131 to 186), South-Eastern Asia at 134 (UI 109 to 176), Southern Asia at 134 (UI 118 to 155) and Northern Africa at 103 (UI 76 to 144). In total, 12 subregions had low or very low MMR, the lowest being Southern Europe at 6 (UI 5 to 6). These differences correspond to vast inequities in the lifetime risk of a 15-year-old girl dying from a maternal cause in her lifetime, ranging from 1 in 27 in Western Africa to 1 in approximately 16 000 in Southern Europe.

The proportion of deaths to women of reproductive age due to maternal causes (PM) in 2020 was above 10% in three subregions: 23.9% in Middle Africa, 21.9% in Western Africa, and 15.5% in Eastern Africa. All remaining subregions had a PM below 10%, and five subregions had a PM below 1% (from lowest: Eastern Europe, Southern Europe, Western Europe, Northern Europe and Northern America).

Substantial variation in the burden of maternal mortality across regions was also apparent according to income group. Though only 13% of the world's population live in LDCs (3), this group of countries accounted for 41.8% of all maternal deaths in 2020. In LDCs, the point estimate for MMR in 2020 was 377 (UI 338 to 431) maternal deaths per 100 000 live births, the lifetime risk of maternal death was 1 in 66, and the PM was 18.2%.

Approximately 15% of the world's population live in landlocked developing countries (LLDCs) (4). LLDCs accounted for 20.6% of all maternal deaths in 2020. In 2020, LLDCs had an estimated MMR of 368 (UI 323 to 430), the lifetime risk of maternal death was 1 in 67, and the PM was 17.4%.

Another specialized grouping is the small island developing States (SIDS). The estimated MMR in 2020 in SIDS was 206 (UI 169 to 262), the lifetime risk of maternal death was 1 in 210, and the PM was 8.9%.

In 2020, according to the Fragile States Index, nine countries were categorized as “very high alert” or “high alert” (from highest to lowest: Yemen, Somalia, South Sudan, the Syrian Arab Republic, the

Democratic Republic of the Congo, the Central African Republic, Chad, Sudan and Afghanistan), and these nine countries had MMRs ranging from 30 (the Syrian Arab Republic) up to 1223 (South Sudan).<sup>1</sup> The average MMR for “very high alert” and “high alert” fragile states in 2020 was 551 maternal deaths per 100 000 live births – over double the world average.

Finally, the burden of HIV-related indirect maternal deaths<sup>2</sup> in 2020 also varied substantially by region. **Table 4.2** shows the HIV-related indirect MMR and the number and percentage of HIV-related indirect maternal deaths for the world and by SDG region and subregion and other groupings in 2020. Sub-Saharan Africa accounted for the vast majority (92.5%) of the estimated 1878 global HIV-related indirect maternal deaths in 2020, while half (51.0%) of them occurred in LDCs. Globally, just four subregions had more than 100 HIV-related indirect maternal deaths in 2020, and those were the four subregions of sub-Saharan Africa: Eastern Africa (769), Western Africa (413), Middle Africa (332) and Southern Africa (224). Across all subregions, Southern Africa had by far the highest proportion of HIV-related indirect maternal deaths as a subset of all maternal deaths (10.3%), followed by Eastern Africa (1.5%). There were no HIV-related indirect maternal deaths in Micronesia or Polynesia in 2020. The region with the highest HIV-related indirect MMR was sub-Saharan Africa (4 per 100 000 live births) and the subregion with the highest level was Southern Africa (16). This means that in Southern Africa, without HIV-related indirect maternal deaths, the MMR for 2020 would have been 141, rather than 157 per 100 000 (as shown in **Table 4.1**).

<sup>1</sup> The Fragile States Index is an assessment of 178 countries based on 12 cohesion, economic, social and political indicators, resulting in a score that indicates their susceptibility to instability. Further information about indicators and methodology is available at: <https://fragilestatesindex.org/>. At the top of the range (most fragile), the scores are categorized as follows: > 110 = very high alert; 100–110 = high alert. These two categories include the nine most fragile countries mentioned here. There are 10 other categories ranging from “very sustainable” to “alert”, which include the remaining 169 countries.

<sup>2</sup> See definitions in **Chapter 2**.

**Table 4.1 Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2020**

SDG region and subregion	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death (1 in) <sup>c</sup>	PM point estimate (%)
	Lower UI	Point estimate	Upper UI			
<b>World</b>	<b>202</b>	<b>223</b>	<b>255</b>	<b>287 000</b>	<b>210</b>	<b>9.8</b>
<b>Sub-Saharan Africa</b>	<b>477</b>	<b>545</b>	<b>654</b>	<b>202 000</b>	<b>40</b>	<b>19.3</b>
Eastern Africa	304	351	412	50 000	63	15.5
Middle Africa	430	539	742	39 000	32	23.9
Southern Africa	131	157	186	2 200	240	3.1
Western Africa	616	754	1024	111 000	27	21.9
<b>Northern Africa and Western Asia</b>	<b>68</b>	<b>84</b>	<b>107</b>	<b>9 400</b>	<b>420</b>	<b>7.1</b>
Northern Africa	76	103	144	5 900	310	8.6
Western Asia	49	63	82	3 500	600	5.5
<b>Central and Southern Asia</b>	<b>114</b>	<b>129</b>	<b>149</b>	<b>48 000</b>	<b>340</b>	<b>6.0</b>
Central Asia	21	25	30	440	1 200	1.8
Southern Asia	118	134	155	47 000	330	6.1
<b>Eastern and South-Eastern Asia</b>	<b>62</b>	<b>74</b>	<b>92</b>	<b>18 000</b>	<b>850</b>	<b>3.2</b>
Eastern Asia	20	24	29	3 300	3 100	1.1
South-Eastern Asia	109	134	176	15 000	340	5.3
<b>Latin America and the Caribbean</b>	<b>79</b>	<b>88</b>	<b>99</b>	<b>8 400</b>	<b>580</b>	<b>4.3</b>
Caribbean	143	188	269	1 300	260	7.8
Central America	56	64	75	1 900	710	3.3
South America	76	86	100	5 200	610	4.3
<b>Oceania (excluding Australia and New Zealand)</b>	<b>120</b>	<b>173</b>	<b>255</b>	<b>540</b>	<b>170</b>	<b>7.7</b>
Melanesia	121	176	262	530	170	7.8
Micronesia	44	80	140	5	400	4.5
Polynesia	46	82	162	6	300	5.7
<b>Australia and New Zealand</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>13</b>	<b>16 000</b>	<b>0.5</b>
<b>Europe and Northern America</b>	<b>11</b>	<b>13</b>	<b>15</b>	<b>1 400</b>	<b>5 100</b>	<b>0.6</b>
Eastern Europe	9	11	15	310	6 500	0.3
Northern Europe	7	8	10	89	7 100	0.6
Southern Europe	5	6	6	62	16 000	0.4
Western Europe	5	6	7	110	9 800	0.5
Northern America	16	20	26	810	2 900	0.9

*Continued*

**Table 4.1** *Continued*

SDG region and subregion	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death (1 in) <sup>c</sup>	PM point estimate (%)
	Lower UI	Point estimate	Upper UI			
<b>Small island developing States</b>	<b>169</b>	<b>206</b>	<b>262</b>	<b>2 500</b>	<b>210</b>	<b>8.9</b>
<b>Land locked developing countries</b>	<b>323</b>	<b>368</b>	<b>430</b>	<b>59 000</b>	<b>67</b>	<b>17.4</b>
<b>Least developed countries</b>	<b>338</b>	<b>377</b>	<b>431</b>	<b>120 000</b>	<b>66</b>	<b>18.2</b>

Note: The countries in each SDG regional grouping can be found at: <https://unstats.un.org/sdgs/indicators/regional-groups/>; but data are only included in this table for the 185 countries and territories that met the inclusion criteria for this analysis, i.e. 183 WHO Member States and 2 territories with populations over 100 000 in 2020.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

**Table 4.2** **Estimates of maternal mortality ratio (MMR), number of maternal deaths and HIV-related indirect maternal deaths, by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2020**

SDG region and subregion	MMR point estimate <sup>a</sup>	Number of maternal deaths <sup>b</sup>	Number of HIV-related indirect maternal deaths <sup>c</sup>	HIV-related indirect MMR	Percentage of HIV-related indirect maternal deaths <sup>d</sup> (%)
<b>World</b>	<b>223</b>	<b>287 000</b>	<b>1 878</b>	<b>1</b>	<b>0.6</b>
<b>Sub-Saharan Africa</b>	<b>545</b>	<b>202 000</b>	<b>1 738</b>	<b>4</b>	<b>0.9</b>
Eastern Africa	351	50 000	769	5	1.5
Middle Africa	539	39 000	332	4	0.9
Southern Africa	157	2 200	224	16	10.3
Western Africa	754	111 000	413	3	0.4
<b>Northern Africa and Western Asia</b>	<b>84</b>	<b>9 400</b>	<b>12</b>	<b>0</b>	<b>0.1</b>
Northern Africa	103	5 900	11	0	0.2
Western Asia	63	3 500	1	0	< 0.1
<b>Central and Southern Asia</b>	<b>129</b>	<b>48 000</b>	<b>17</b>	<b>0</b>	<b>&lt; 0.1</b>
Central Asia	25	440	1	0	0.3
Southern Asia	134	47 000	16	0	0.0
<b>Eastern and South-Eastern Asia</b>	<b>74</b>	<b>18 000</b>	<b>70</b>	<b>0</b>	<b>0.4</b>
Eastern Asia	24	3 300	0	0	< 0.1
South-Eastern Asia	134	15 000	70	1	0.5
<b>Latin America and the Caribbean</b>	<b>88</b>	<b>8 400</b>	<b>36</b>	<b>0</b>	<b>0.4</b>
Caribbean	188	1 300	8	1	0.6
Central America	64	1 900	10	0	0.5
South America	86	5 200	18	0	0.3

*Continued*

**Table 4.2 Continued**

SDG region and subregion	MMR point estimate <sup>a</sup>	Number of maternal deaths <sup>b</sup>	Number of HIV-related indirect maternal deaths <sup>c</sup>	HIV-related indirect MMR	Percentage of HIV-related indirect maternal deaths <sup>d</sup> (%)
<b>Oceania (excluding Australia and New Zealand)</b>	<b>173</b>	<b>540</b>	<b>1</b>	<b>0</b>	<b>0.1</b>
Melanesia	176	530	1	0	0.1
Micronesia	80	5	0	0	< 0.1
Polynesia	82	6	0	0	< 0.1
<b>Australia and New Zealand</b>	<b>4</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0.2</b>
<b>Europe and Northern America</b>	<b>13</b>	<b>1 400</b>	<b>4</b>	<b>0</b>	<b>0.3</b>
Eastern Europe	11	310	4	0	1.2
Northern Europe	8	89	0	0	0.1
Southern Europe	6	62	0	0	0.4
Western Europe	6	110	0	0	0.2
Northern America	20	810	0	0	< 0.1
<b>Small island developing States</b>	<b>206</b>	<b>2 500</b>	<b>15</b>	<b>1</b>	<b>0.6</b>
<b>Land locked developing countries</b>	<b>368</b>	<b>59 000</b>	<b>543</b>	<b>3</b>	<b>0.9</b>
<b>Least developed countries</b>	<b>377</b>	<b>120 000</b>	<b>958</b>	<b>3</b>	<b>0.8</b>

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Deaths to HIV-positive women caused by the aggravating effect(s) of pregnancy on HIV.

<sup>d</sup> As a percentage of all (unrounded) maternal deaths.

Note: The countries in each SDG regional grouping can be found at: <https://unstats.un.org/sdgs/indicators/regional-groups>; but data are only included in this table for the 185 countries and territories that met the inclusion criteria for this analysis, i.e. 183 WHO Member States and 2 territories with populations over 100 000 in 2020.

### 4.1.3 Country-level estimates

**Annex 4** provides 2020 point estimates and uncertainty intervals for each country's maternal mortality indicators (MMR and PM), as well as the estimates for numbers of maternal deaths, lifetime risk of maternal death, and percentage of HIV-related indirect maternal deaths. **Fig. 4.1** in this chapter displays a map with countries shaded according to MMR levels in 2020.

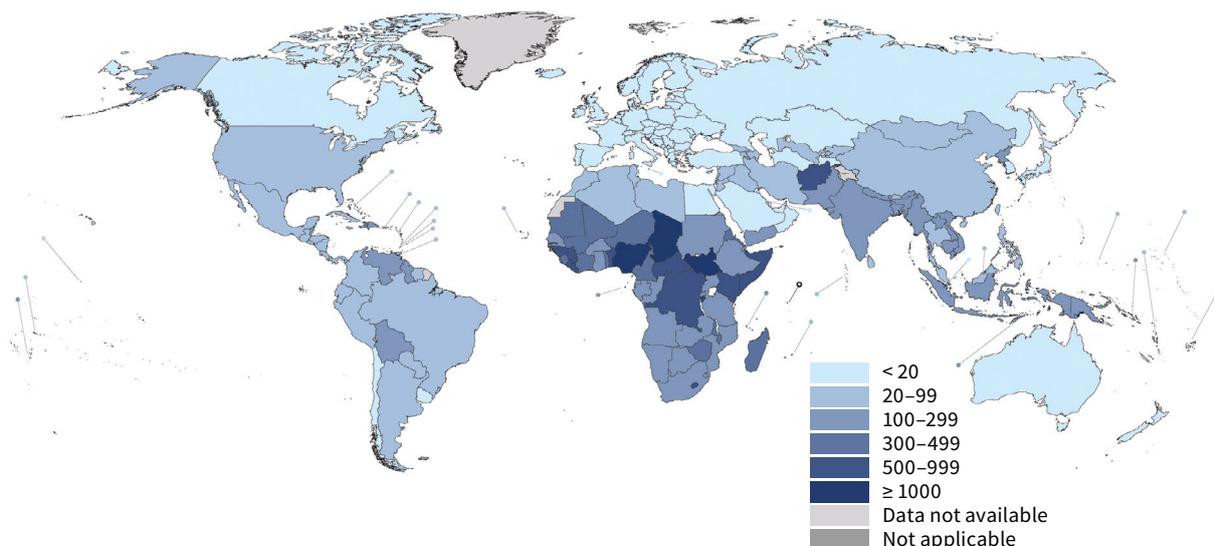
Three countries – all in sub-Saharan Africa – are estimated to have had extremely high maternal mortality in 2020 (defined as MMR of over 1000 maternal deaths per 100 000 live births), with the highest MMR being in South Sudan, at 1223 (UI 746 to 2009), followed by Chad (1063; UI 772 to 1586) and Nigeria (1047; UI 793 to 1565). Ten other countries, all except one of which are also in sub-Saharan Africa, are estimated to have had very high MMR in 2020 (defined as ranging between 500 and 999). These are: the Central African Republic (835; UI 407 to 1519), Guinea-Bissau (725; UI 475 to 1135), Liberia (652; UI 499 to 900), Somalia (621; UI 283 to 1184), Afghanistan (620;

UI 406 to 1050), Lesotho (566; UI 385 to 876), Guinea (553; UI 404 to 808), the Democratic Republic of the Congo (547; UI 377 to 907), Kenya (530; UI 382 to 750) and Benin (523; UI 397 to 768).

Fifty-five countries had a high or moderate MMR (defined as between 100 and 499), 33 of which were in the region of sub-Saharan Africa, 7 in Eastern and South-Eastern Asia, 6 in Latin America and the Caribbean, 3 in Oceania excluding Australia and New Zealand, and 2 in Northern Africa and Western Asia.

In total, 117 countries had an MMR below 100, 59 of which had a very low MMR (defined as below 20). Out of these 117 countries, 41 are in Europe and Northern America, 26 are in Latin America and the Caribbean, and 22 are in Northern Africa and Western Asia. Only three countries with an MMR below 100 are in sub-Saharan Africa: Seychelles (3; UI 3 to 4), Cabo Verde (42; UI 26 to 65) and Mauritius (84; UI 62 to 115). Outside the sub-Saharan African region, only one country, Haiti, had a high MMR (350; UI 239 to 550) and one country, Afghanistan, had a very high MMR (620; UI 406 to 1050) in 2020. Among the 60 countries

**Fig. 4.1 Maternal mortality ratio (MMR) estimates, by country, 2020**



with very low MMR, 40 are in Europe and Northern America.

Nigeria had the highest number of maternal deaths, and accounted for more than a quarter (28.5%) of all estimated global maternal deaths in 2020, with approximately 82 000. Three other countries had more than 10 000 maternal deaths in 2020: India (24 000), the Democratic Republic of the Congo (22 000) and Ethiopia (10 000), with 8.3%, 7.5% and 3.6% of global maternal deaths, respectively. Six countries had more than 5000 maternal deaths (but fewer than 10 000) in 2020, in order from highest to lowest numbers: Pakistan, Afghanistan, Indonesia, Chad, Kenya and the United Republic of Tanzania. In total, 73 countries were estimated to have had just 20 or fewer maternal deaths in 2020, the majority of which were in Europe (33 countries) or in Latin America and the Caribbean (13 countries).

PM was estimated to be highest in Afghanistan (36.5%) followed by Chad (32.6%), Mauritania (29.9%), the Central African Republic (29.7%), Niger (28.5%), Somalia (28.0%), South Sudan (27.5%) and the Democratic Republic of the Congo (25.9%). Five other countries had high PMs, in the range of 20–25%: Nigeria (24.3%), Guinea-Bissau (24.2%), Liberia (23.4%), Mali (20.3%) and Benin (20.1%). PM was less than 1% in 52 countries, the majority of which (41 countries) were in Europe and Northern America.

Regarding the estimated lifetime risk of maternal mortality for a 15-year-old girl in 2020, the countries with the highest estimated risk were Chad (1 in 15), Nigeria and the Central African Republic (1 in 19),

followed by South Sudan (1 in 20), Somalia (1 in 25) and the Democratic Republic of the Congo (1 in 29). The countries with the lowest risk were Belarus (1 in 65 000), Norway (1 in 43 000) and Poland (37 000). The lifetime risk in Chad was over 4000 greater than in Belarus.

In three countries, the percentage of all maternal deaths that were HIV-related indirect maternal deaths was 10% or greater in 2020: South Africa (12.0%), Botswana (11.5%) and Zambia (10.9%).

## 4.2 Trends in maternal mortality: 2000 to 2020

When interpreting changes in MMRs over time, one should take into consideration that it is easier to reduce the MMR when the level is high than when the MMR level is already low. Furthermore, at very low levels of maternal mortality, a small absolute change in the MMR can appear as a large relative difference.

**Negative percentage changes in the MMR and the annual rate of reduction (ARR) denote increases in the estimates, i.e. a deterioration in maternal mortality.**

Trends in maternal mortality are presented in this report for the 20-year period from 2000 to 2020. With five years of data from the SDG period now available, this report presents the first round of estimates where it is possible to disaggregate trends for 2000–2015 and trends for 2016–2020, for the MDG and SDG periods, respectively.

## 4.2.1 Global trends

### Trends between 2000 and 2020

Between 2000 and 2020, the global MMR fell by 34.3% from 339 (UI 319 to 360) maternal deaths per 100 000 live births in 2000 to 223 (UI 202 to 255) in 2020 (Table 4.3; UIs for 2020 estimates are in Table 4.1). The average ARR in the global MMR between 2000 and 2020 was 2.1% (UI 1.3% to 2.6%), meaning that on average, the global MMR declined by 2.1% every year between 2000 and 2020, although progress was uneven during this period. The global annual number of maternal deaths also fell significantly throughout this period, from 447 000 to 287 000, a decrease of more than a third. The global proportion of deaths to women of reproductive age that are due to maternal causes (PM) was estimated to be 12.7% in 2000 and this fell to 9.8% by 2020. Globally, the lifetime risk of a 15-year-old girl eventually dying from a maternal cause almost halved, from 1 in 120 in 2000 to 1 in 210 in 2020.

To assess trends in the HIV epidemic, 2005 is a more appropriate baseline, as that is when the global epidemic peaked. The total number of HIV-related indirect maternal deaths fell from an estimated 7583 in 2005 to approximately one quarter of that number (1878) in 2020. The HIV-related indirect MMR fell from 6 per 100 000 live births in 2005 to 1 in 2020.

### Trends between 2000 and 2015 (entire MDG era)

At the global level, on closer analysis, in fact almost all the progress achieved during the 2000–2020 period had occurred by 2015 (Fig. 4.2). The global MMR had already fallen from 339 maternal deaths per 100 000 live births to 227 by 2015, with a 2.7% average ARR (UI 2.0% to 3.2%). The lifetime risk had also already fallen to 1 in 189 by 2015, and the PM was 10.3% (UI 9.6% to 11.2%).

### Trends between 2016 and 2020 (start of SDG era)

The positive (declining) trends in MMR during the MDG era, however, have largely stalled in the first five years of the SDG era (Fig. 4.2). Assessed from the start of 2016 to the end of 2020, the global MMR has stagnated: it was estimated at 223 (UI 206 to 245) per 100 000 live births in 2016 and remained the same at 223 (UI 202 to 255) in 2020. This corresponds to a global average ARR of -0.03% (UI -1.6% to 1.1%). Lifetime risk also did not fall significantly in those five years, declining from 1 in 194 in 2016 to 1 in 210 in 2020. There is also little evidence of a change in the proportion of HIV-related indirect maternal deaths out of all maternal deaths: this shifted slightly from 0.8% in 2016 to 0.7% in 2020.

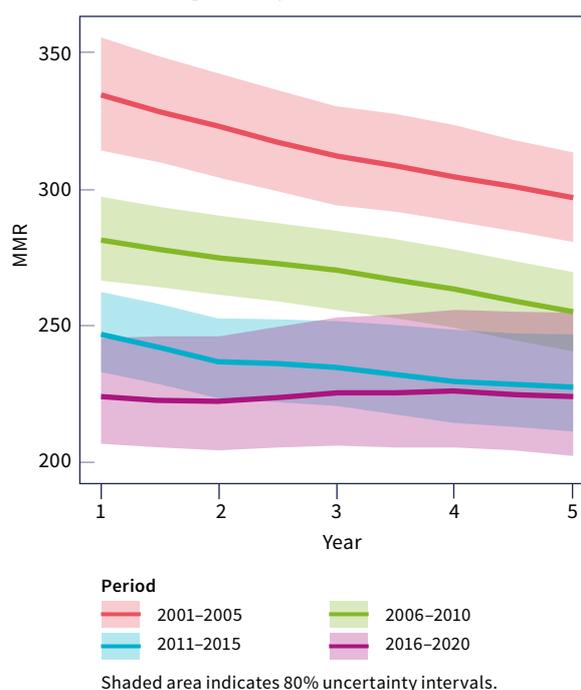
## 4.2.2 Regional-level trends

### Trends between 2000 and 2020

Between 2000 and 2020, the region of Central and Southern Asia achieved the greatest overall percentage reduction in MMR, with a reduction of 67.5%, from 397 (UI 358 to 447) to 129 (UI 114 to 149) maternal deaths per 100 000 live births, as shown in Table 4.3. This equates to an average ARR of 5.6% (UI 4.8% to 6.5%). Australia and New Zealand, and Northern Africa and Western Asia also roughly halved their MMRs in this period, with reductions of 51.2% and 46.8%, respectively. While the regional MMR in sub-Saharan Africa was still very high in 2020, it had reduced by one third from 807 (UI 737 to 879) in 2000 to 545 (UI 477 to 654) in 2020. With the exception of Latin America and the Caribbean, the MMR declined in all regions. In Latin America and the Caribbean, the percentage reduction in the MMR was just 2.8% (UI -9.7% to 12.1%), which equates to an average ARR of 0.14% (UI -0.5% to 0.6%); as the UIs cross zero, this is interpreted as stagnation in the MMR in this region.

The greatest reduction in lifetime risk during this period occurred in Central and Southern Asia, with a 79.9% fall, from a risk of 1 in 68 in 2000 to 1 in 339 in 2020. In four regions, the lifetime risk roughly halved: Northern Africa and Western Asia, Australia and New Zealand, Eastern and South-Eastern Asia, and Oceania (excluding Australia and New Zealand).

**Fig. 4.2 Global MMR stratified by five-year time period, 2000–2020**



**Table 4.3 Comparison of maternal mortality ratio (MMR) and number of maternal deaths, and percentage change and average annual rate of reduction of MMR, by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2000 and 2020**

SDG region and subregion	2000		2020		Overall change in MMR between 2000 and 2020 <sup>c</sup> (%)	Average annual rate of reduction (ARR) in MMR between 2000 and 2020 (%)		
	MMR point estimate <sup>a</sup>	Number of maternal deaths <sup>b</sup>	MMR point estimate <sup>a</sup>	Number of maternal deaths <sup>b</sup>		Lower UI	ARR point estimate	Upper UI
<b>Sub-Saharan Africa</b>	<b>807</b>	<b>215 000</b>	<b>545</b>	<b>202 000</b>	<b>33.1</b>	<b>0.9</b>	<b>2.0</b>	<b>2.7</b>
Eastern Africa	756	83 000	351	50 000	53.9	3.0	3.9	4.6
Middle Africa	795	34 000	539	39 000	33.0	0.2	2.0	3.0
Southern Africa	219	2 500	157	2 200	27.6	0.8	1.6	2.6
Western Africa	928	95 000	754	111 000	21.2	-0.9	1.2	2.1
<b>Northern Africa and Western Asia</b>	<b>159</b>	<b>15 000</b>	<b>84</b>	<b>9 400</b>	<b>46.8</b>	<b>1.9</b>	<b>3.2</b>	<b>4.3</b>
Northern Africa	240	11 000	103	5 900	57.1	2.5	4.2	5.9
Western Asia	85	4 200	63	3 500	25.2	0.2	1.5	2.9
<b>Central and Southern Asia</b>	<b>397</b>	<b>166 000</b>	<b>129</b>	<b>48 000</b>	<b>67.5</b>	<b>4.8</b>	<b>5.6</b>	<b>6.5</b>
Central Asia	52	630	25	440	52.6	2.7	3.7	4.8
Southern Asia	408	166 000	134	47 000	67.1	4.7	5.6	6.4
<b>Eastern and South-Eastern Asia</b>	<b>121</b>	<b>37 000</b>	<b>74</b>	<b>18 000</b>	<b>39.3</b>	<b>1.4</b>	<b>2.5</b>	<b>3.3</b>
Eastern Asia	57	11 000	24	3 300	57.2	3.4	4.2	5.4
South-Eastern Asia	231	26 000	134	15 000	41.8	1.4	2.7	3.7
<b>Latin America and the Caribbean</b>	<b>90</b>	<b>10 000</b>	<b>88</b>	<b>8 400</b>	<b>2.8</b>	<b>-0.5</b>	<b>0.1</b>	<b>0.6</b>
Caribbean	180	1 400	188	1 300	-3.0	-2.2	-0.1	1.1
Central America	74	2 500	64	1 900	11.8	-0.1	0.6	1.5
South America	88	6 400	86	5 200	2.1	-0.6	0.1	0.8
<b>Oceania (excluding Australia and New Zealand)</b>	<b>261</b>	<b>640</b>	<b>173</b>	<b>540</b>	<b>34.9</b>	<b>0.1</b>	<b>2.1</b>	<b>3.8</b>
Melanesia	273	620	176	530	36.6	0.2	2.3	3.9
Micronesia	87	6	80	5	8.8	-1.7	0.5	2.5
Polynesia	85	7	82	6	4.9	-2.1	0.2	2.0
<b>Australia and New Zealand</b>	<b>8</b>	<b>23</b>	<b>4</b>	<b>13</b>	<b>51.2</b>	<b>2.7</b>	<b>3.6</b>	<b>4.5</b>

*Continued*

**Table 4.3 Continued**

SDG region and subregion	2000		2020		Overall change in MMR between 2000 and 2020 <sup>c</sup> (%)	Average annual rate of reduction (ARR) in MMR between 2000 and 2020 (%)		
	MMR point estimate <sup>a</sup>	Number of maternal deaths <sup>b</sup>	MMR point estimate <sup>a</sup>	Number of maternal deaths <sup>b</sup>		Lower UI	ARR point estimate	Upper UI
<b>Europe and Northern America</b>	17	2 000	13	1 400	24.4	0.6	1.4	2.2
Eastern Europe	38	1 100	11	310	70.5	4.7	6.1	7.3
Northern Europe	11	110	8	89	21.8	0.3	1.2	2.1
Southern Europe	9	130	6	62	39.4	1.8	2.5	3.2
Western Europe	9	170	6	110	31.9	1.2	1.9	2.6
Northern America	12	510	20	810	-73.3	-4.0	-2.8	-1.5
<b>Small island developing States</b>	<b>254</b>	<b>3 200</b>	<b>206</b>	<b>2 500</b>	<b>19.3</b>	<b>-0.2</b>	<b>1.1</b>	<b>2.0</b>
<b>Land locked developing countries</b>	<b>729</b>	<b>92 000</b>	<b>368</b>	<b>59 000</b>	<b>49.6</b>	<b>2.5</b>	<b>3.4</b>	<b>4.2</b>
<b>Least developed countries</b>	<b>715</b>	<b>181 000</b>	<b>377</b>	<b>120 000</b>	<b>47.4</b>	<b>2.5</b>	<b>3.2</b>	<b>3.8</b>
<b>World</b>	<b>339</b>	<b>446 000</b>	<b>223</b>	<b>287 000</b>	<b>34.3</b>	<b>1.3</b>	<b>2.1</b>	<b>2.6</b>

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Overall change for the whole period, data from 1 January 2000 to 31 December 2020.

Note: The countries in each SDG regional grouping can be found at: <https://unstats.un.org/sdgs/indicators/regional-groups>; but data are only included in this table for the 185 countries and territories that met the inclusion criteria for this analysis, i.e. 183 WHO Member States and two territories with populations over 100 000 in 2020.

The greatest reduction in PM during this period also occurred in Central and Southern Asia, where it fell by nearly two thirds. PM fell by roughly one third in three regions: Oceania (excluding Australia and New Zealand), Eastern and South-Eastern Asia, and Northern Africa and Western Asia. The smallest reduction in PM occurred in sub-Saharan Africa, where PM was 19.9% in 2000 and 19.3% in 2020.

The MMR in LDCs almost halved, from 715 (UI 673 to 762) maternal deaths per 100 000 live births in 2000 to 377 (UI 338 to 431) in 2020, equating to a 3.2% average ARR (UI 2.5% to 3.8%). This corresponds to a reduction in the lifetime risk from 1 in 28 in 2000 to 1 in 66 in 2020. The MMR in LLDCs also roughly halved in this period (49.6% reduction; UI 39.4% to 56.5%), but was considered to have stagnated in SIDS since the UI for the 19.3% reduction spanned zero (UI -3.9% to 33.3%).

#### Trends between 2000 and 2015 (entire MDG era)

During the MDG period, MMRs significantly reduced

in all regions, though the degree of progress achieved varied. Falls in the regional MMR ranged from 59.8% (UI 54.0% to 64.8%) in Central and Southern Asia, to 16.4% (UI 10.6% to 20.8%) in Latin America and the Caribbean. These trends equated to positive average ARRs in all regions, from 6.1% (UI 5.2% to 7.0%) in Central and Southern Asia to 1.2% (UI 0.7% to 1.6%) in Latin America and the Caribbean.

LDCs, LLDCs and SIDS all had significant reductions in the MMR between 2000 and 2015: 38.8%, 41.1% and 18.3%, respectively.

#### Trends between 2016 and 2020 (start of SDG era)

Following the positive trends during the MDG period, only two regions achieved a significant reduction in the MMR (UIs not crossing zero) during the first five years (one third) of the SDG era: Australia and New Zealand (34.6%; UI 26.3% to 43.9%) and Central and Southern Asia (15.7%; UI 9.0% to 21.8%). The MMR stagnated, with UIs crossing zero, in sub-Saharan

Africa, Oceania (excluding Australia and New Zealand), Northern Africa and Western Asia, and Eastern and South-Eastern Asia. The MMR increased in this period in Europe and Northern America with a change of -16.5% (UI -33.3% to -2.4%) and in Latin America and the Caribbean with a change of -14.8% (UI -25.2% to -6.4%).<sup>1</sup> This corresponds to an average ARR of -3.8% (UI -7.2% to -0.6%) and -3.5% (UI -5.6% to -1.6%), respectively.

The pace of progress between 2016 and 2020 in LDCs and LLDCs was significant, with an average ARR of 2.8% (UI 1.4% to 3.9%) and 3.0% (UI 1.4% to 4.4%), respectively, for these groups of countries. However, in SIDS, the MMR stagnated during this period, with a non-significant 1.2% change in MMR (UI -9.0% to 9.2%).

**Annexes 6, 8, 10, 12, 14 and 15** present the MMR trends and percentage changes in MMR for the periods 2000–2020, 2000–2015, and 2016–2020, for WHO, UNICEF, UNFPA, World Bank Group, UNDESA/ Population Division and SDG regions, respectively.

#### 4.2.3 Country-level trends

##### Trends between 2000 and 2020

**Annex 16** presents the MMR trends (point estimates for five different years: 2000, 2005, 2010, 2015, 2020), the overall percentage reduction and the average ARRs in MMR between 2000 and 2020, as well as the range of the UIs on the average ARRs, for each country.

The 10 countries with the largest percentage reduction in the MMR between 2000 and 2020, in order of greatest to least reduction, were: Belarus, Seychelles, Turkmenistan, Romania, Bhutan, Egypt, Estonia, the Lao People's Democratic Republic, Kazakhstan and Mozambique, ranging from a 95.5% (UI 92.6% to 97.3%) reduction in Belarus to a 76.1% (UI 69.7% to 81.4%) reduction in Mozambique. These countries had average ARRs ranging between 15.5% (Belarus; UI 13.0% to 18.1%) and 7.2% (Mozambique; UI 6.0% to 8.4%). In total, 69 countries reduced their MMRs by at least half between 2000 and 2020; in 34 countries, the MMRs declined by two thirds.

The following eight countries and territories had significant percentage increases in the MMR between 2000 and 2020, in order from greatest to least increase (deterioration): the Bolivarian Republic of Venezuela, Cyprus, Greece, the United States of America (USA), Mauritius, Puerto Rico, Belize and the Dominican Republic, with increases ranging

from 182.8% (a change of -182.8%; UI -334.3% to -96.1%) in the Bolivarian Republic of Venezuela to 36.0% (a change of -36.0%; UI -70.0% to -9.3%)<sup>1</sup> in the Dominican Republic. With their MMRs increasing, all eight countries remain at great risk. The impact of interruptions or loss of quality health services must be considered in crisis and other unstable situations. For the countries on this list that have low MMR, attention to potential disparities between subpopulations and efforts to reduce overall PM will be important to shift back to the path of reducing MMR.

The MMR stagnated (with UIs for the percentage change crossing zero) in 52 countries for the period 2000 to 2020. Of those countries, 16 were in sub-Saharan Africa, 11 in Europe and Northern America, 10 in Latin America and the Caribbean, 6 in Northern Africa and Western Asia, 7 in Oceania (excluding Australia and New Zealand) and 2 in Eastern and South-Eastern Asia.

##### Trends between 2000 and 2015 (entire MDG era)

During the MDG era, there was a significant reduction in the MMRs in 130 countries. The MMR was halved in 57 countries and reduced by two thirds in 18 countries. Only five countries had a statistically significant increase in the MMR during this period, in order from the greatest increase to the smallest: the USA, the Bolivarian Republic of Venezuela, the Dominican Republic, Benin and Jamaica. Stagnation in the estimated MMR was found in 46 countries – with the largest regional grouping of these countries being in sub-Saharan Africa (17 out of 46 countries).

##### Trends between 2016 and 2020 (start of SDG era)

During the first five years of the SDG era, there was a significant reduction in the MMR in 31 countries, while the MMR stagnated in 133 countries and there was a significant increase in the MMR in 17 countries. Among the 17 countries where the MMR increased, 7 are located in Latin America and the Caribbean, 3 in Europe and Northern America and 3 in sub-Saharan Africa – the region where the burden of maternal mortality is the highest.

It is worth noting that across the time three periods (2000–2020, 2000–2015 and 2016–2020), only three countries have achieved a reduction in MMR above the 11.6% average ARR now required (for the period 2021–2030) to meet SDG 3.1: Australia, Belarus and Seychelles.

<sup>1</sup> Negative numbers indicate an increase in the MMR and a deterioration in maternal mortality.

## References

1. Millennium Summit, 6–8 September 2000, New York. In: United Nations Conferences [website]. New York (NY): United Nations; undated (<https://www.un.org/en/conferences/environment/newyork2000>, accessed 14 October 2022).
2. Transforming our world: the 2030 Agenda for Sustainable Development. United Nations General Assembly, Seventieth session. New York (NY): United Nations; 2015 (<https://sdgs.un.org/2030agenda>).
3. About least developed countries. In: United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States [website]. undated (<https://www.un.org/ohrlls/content/about-least-developed-countries>, accessed 21 December 2022).
4. Landlocked developing countries fact sheet 2020. United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States; 2020 ([https://www.un.org/ohrlls/sites/www.un.org.ohrlls/files/landlocked\\_developing\\_countries\\_factsheet.pdf](https://www.un.org/ohrlls/sites/www.un.org.ohrlls/files/landlocked_developing_countries_factsheet.pdf)).





# 5. Assessing progress and setting a trajectory towards ending preventable maternal mortality and achieving SDG target 3.1

## Box 5.1 ■ Global targets for reducing maternal mortality

**SDG target 3.1:** By 2030, reduce the global maternal mortality ratio (MMR) to less than 70 maternal deaths per 100 000 live births (1).

**Ending preventable maternal mortality (EPMM):** By 2030, every country should reduce its MMR by at least two thirds from the 2010 baseline, and the average global target is an MMR of less than 70 maternal deaths per 100 000 live births.

**EPMM supplementary national target:** By 2030, no country should have an MMR higher than 140 maternal deaths per 100 000 live births (twice the global target).

Country targets for 2030 depend on 2010 baseline levels of MMR, to increase equity in maternal mortality, as follows.

- ▶ **For countries with an MMR less than 420 in 2010: reduce the MMR by at least two thirds from the 2010 baseline by 2030.**
- ▶ **For countries with an MMR greater than 420 in 2010: the rate of decline should be steeper so that in 2030, no country has an MMR greater than 140.**
- ▶ **For all countries with low baseline MMR in 2010: achieve equity in MMR for vulnerable populations at the subnational level (2).**

## 5.1 Towards the Sustainable Development Goals

The Sustainable Development Goals (SDGs) came into force on 1 January 2016 and cover the 15 years until 31 December 2030. Among the 17 SDGs, the direct health-related targets come under **SDG 3: Ensure healthy lives and promote well-being for all at all ages (1)**.

With the adoption of the SDGs, the United Nations Member States extended the global commitments they had made in 2000 to the Millennium Development Goals (MDGs) (3).

In anticipation of the launch of the SDGs, WHO released a consensus statement on *Targets and strategies for ending preventable maternal mortality (EPMM) (2)*. The EPMM target for the maternal mortality ratio (MMR) for 2030 was adopted as the MMR target for the SDGs: **reduce the global MMR to less than 70 by 2030 (SDG target 3.1) (1, 2, 4)**.

The mid-point of the SDG era is fast approaching – mid-2023. The 20-year period of observation covered by this report includes the whole MDG era (September 2000 to end of 2015) and one third of the SDG era (start of 2016 to end of 2020). Earlier progress in

reducing the global MMR achieved during the MDG era appears to have stalled since 2015. In 2020, an estimated 287 000 women died from a maternal cause globally. This corresponds to almost 800 women dying every day, or approximately one woman every two minutes. The global MMR in 2020 was 223 maternal deaths per 100 000 live births; achieving a global MMR below 70 by the year 2030 (SDG target 3.1) will require an average annual rate of reduction (ARR) of 11.6% over the 10 years remaining for observation (2021–2030). Accomplishing this rate of progress is an unprecedented challenge. During the MDG period, between 2000 and 2015, the average ARR was 2.7%, and the average ARR achieved between 2016 and 2020 was -0.03% (a slight increase in estimated global MMR) – this shows the extent of acceleration in progress now required. Nonetheless, the global community has the scientific and medical knowledge to make meaningful progress to significantly reduce preventable maternal mortality this decade. Possible solutions and strategies are discussed in [section 5.3](#).

Successfully achieving an average ARR of 11.6% in the MMR for the remaining decade of the SDG period, as now required to meet SDG target 3.1, would mean

over 1 million deaths averted between 2021 and 2030, compared with a scenario where the 2016–2020 global stagnation continues. If an ARR of -0.03% (i.e. the average ARR for that recent five-year period) were to be held constant until 2030 without acceleration, the global MMR would be 222 in 2030 – three times higher than the SDG target of below 70. Under an alternative scenario, if the ARR continues at the 2000–2020 average (2.1%), the MMR is projected to be 180 by 2030 – still more than double the SDG target.

With little time remaining to meet the SDG targets, now is the time to intensify coordinated efforts, and to mobilize and reinvigorate global-, regional-, national- and also community-level commitments to end preventable maternal mortality.

## 5.2 Target setting

The intention behind setting a global target was to emphasize the need for all countries – those with a high, medium and low burden of maternal mortality at baseline, including data from humanitarian and other fragile settings within countries – to make reductions in maternal mortality. Preventable maternal deaths tragically occur across all settings.

The existence of a target at the global level has on occasion created some challenges for strategic programming at the national level. Success in

reaching the global target depends on the progress achieved in every country rather than just the actions within the control of a particular country. For this reason, the EPMM strategy (2) included national-level targets based on baseline levels (see [Box 5.1](#)).

The United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG) is developing an interactive tool to support countries in setting ambitious and achievable targets. The aim is to support countries in their planning, customized at the national level to consider baseline levels, context, historical trends and other factors.

## 5.3 Strategies for improving maternal health: 2016 to 2030

The Global Strategy for Women’s, Children’s and Adolescents’ Health describes the vision for improving the health of every woman and every child, everywhere, between 2016 and 2030 (5). Some of the drivers of success in reducing maternal mortality range from making improvements at the provider and health system level, to implementing interventions aimed at reducing social and structural barriers. These strategies are part of the EPMM strategic framework for policy and programme planning, which is informed by a set of four guiding principles (see [Box 5.2](#)) (2). Supplementary EPMM coverage targets were published in 2021 (6).

### BOX 5.2 ■ STRATEGIC FRAMEWORK FOR ENDING PREVENTABLE MATERNAL MORTALITY (EPMM)

#### Guiding principles for EPMM

- ▶ Empower women, girls and communities.
- ▶ Protect and support the mother–baby dyad.
- ▶ Ensure country ownership, leadership and supportive legal, technical and financial frameworks.
- ▶ Apply a human rights framework to ensure that high-quality reproductive, maternal and newborn health care is available, accessible and acceptable to all who need it.

#### Cross-cutting actions for EPMM

- ▶ Improve metrics, measurement systems and data quality to ensure that all maternal and newborn deaths are counted.
- ▶ Allocate adequate resources and effective health-care financing.

#### Five strategic objectives for EPMM

- ▶ Address inequities in access to and quality of sexual, reproductive, maternal and newborn health care.
- ▶ Ensure universal health coverage for comprehensive sexual, reproductive, maternal and newborn health care.
- ▶ Address all causes of maternal mortality, reproductive and maternal morbidities, and related disabilities.
- ▶ Strengthen health systems to respond to the needs and priorities of women and girls.
- ▶ Ensure accountability to improve quality of care and equity.

Source: WHO, 2015 (2).

There is a continued, urgent need for maternal health and survival to remain high on the global health and development agenda. Proximate causes of maternal mortality include direct obstetric causes (e.g. postpartum haemorrhage, pre-eclampsia and hypertensive disorders, pregnancy-related infections, complications of unsafe abortion) and indirect causes (aggravation between disease and pregnancy). The clinical knowledge and technology required to prevent the majority of deaths from these proximate causes have existed for a long time. However, these solutions are often not available, not accessible or not implemented, for various reasons, such that these proximate causes still account for a high burden of deaths in many low-resource settings and/or subpopulations at greater risk due to social determinants.

Beyond these proximate causes, other causes of maternal mortality include:

- ▶ health system failures that translate to (i) delay in seeking care and receiving care after reaching the health-care facility, (ii) poor quality of care, (iii) shortages of essential medical supplies, and (iv) poor accountability of health systems;
- ▶ social determinants, including income, access to education, race and ethnicity, that put some subpopulations at greater risk;
- ▶ harmful gender norms, biases and inequalities that result in a low prioritization of the rights of women and girls, including their right to safe, quality and affordable sexual and reproductive health services; and
- ▶ external factors contributing to instability and health system fragility, such as climate and humanitarian crises (see [section 5.3.1](#)).

In the remaining years of the SDG era, multisectoral action is required to target these causes of maternal mortality. This is essential to achieve not only SDG target 3.1, but also related commitments in SDGs 1 (no poverty), 3 (good health and well-being), 5 (gender equality) and 10 (reduced inequality).<sup>1</sup>

First, greater recognition and collective action is needed to address systemic health system failures that impede access to safe, quality, respectful and affordable sexual and reproductive health care. This is integral to safeguarding sexual and reproductive health and rights, and critical to improving institutional trust and the use of sexual and reproductive health services (7). In poorly functioning

and under-resourced health systems, over-burdened and poorly supervised frontline staff may mistreat people who need care (7). Improving access to quality sexual and reproductive health care requires health system strengthening to increase the numbers of well trained and well supervised health workers; tackle shortages of essential medical supplies; and improve the accountability of health systems to the rights of women and girls (2).

Second, a lack of access to care and poor quality of care disproportionately affect already socially marginalized women and girls (7). Interventions must recognize and address social determinants of maternal health, including ethnicity, age, disability and socioeconomic inequalities, which impede women's access to and use of sexual and reproductive health services. Achieving universal health coverage (UHC) – SDG target 3.8 – is critical to ensure these services are affordable and that their costs do not cause financial hardship (8). UHC is also required to reach at-risk populations and reduce inequities in access to maternal health services (see [section 5.3.1](#)). The 2018 Declaration of Astana (9) identified primary health care as the most cost-effective and inclusive means of delivering health services to achieve UHC (10), and thus primary health care is essential to meet the SDGs.

Third, improving maternal health requires intersectoral action from a stronger gender and human-rights perspective to improve women's empowerment, eliminate poverty and reduce gender-based inequality. Gender-sensitive interventions are essential to address ingrained inequalities and achieve gender justice in health (11).

Finally, multisectoral approaches are urgently needed to build health system resilience to climate and humanitarian crises (see [section 5.3.1](#)). The international community must use the remaining time in the SDG period to intensify action to mitigate and adapt to the devastating effects of climate change to safeguard and improve maternal health (12). The three subsections that follow discuss some of the key remaining challenges we face.

### **5.3.1 Humanitarian and climate crises, and subpopulation inequities**

Emergent humanitarian settings, and conflict, post-conflict and disaster situations significantly hinder progress towards global goals for health and well-being. The climate crisis is the most devastating global health threat of the 21st century and has the potential to impact maternal health severely (12). The

<sup>1</sup> The full list of Sustainable Development Goals can be found at: <https://sdgs.un.org/goals>

effects of the climate crisis on maternal health may be direct (e.g. through exposure to extreme heat, extreme weather events and air pollution) or indirect (e.g. through the impact on health system functioning, reduced access to services due to infrastructure destruction, income loss, poverty and malnutrition) (12). Populations with the highest burden of maternal mortality are also those most likely to be affected by the devastating impacts of the climate crisis (12). With global emissions still rising – after a brief dip in 2020 at the start of the COVID-19 pandemic – the effects of climate change will continue to worsen in the coming decades. Therefore, multisectoral action to end preventable maternal mortality must incorporate strategies to protect maternal health, especially in the most at-risk populations, and improve health system resilience to climate-related disasters.

The MMEIG estimates for 2020 reveal the high burden of maternal mortality in fragile settings. The Fragile States Index assesses and ranks 178 countries, based on 12 cohesion, economic, social and political indicators, resulting in a score that indicates their susceptibility to instability (i.e. the higher the score, the more fragile). In 2020, according to the Fragile States Index, nine countries were “very high alert” or “high alert”<sup>1</sup> (from highest [most fragile] to lowest [least fragile]: Yemen, Somalia, South Sudan, the Syrian Arab Republic, the Democratic Republic of the Congo, the Central African Republic, Chad, Sudan and Afghanistan), and these nine countries had MMRs in 2020 ranging from 30 (the Syrian Arab Republic) to 1223 (South Sudan). The average MMR for very high and high alert fragile states in 2020 was 551 maternal deaths per 100 000 live births, over double the world average for 2020. By contrast, in the 11 countries categorized as “very sustainable” on the Fragile States Index (from highest to lowest: Ireland, Australia, Luxembourg, Canada, Sweden, New Zealand, Iceland, Denmark, Switzerland, Norway and Finland), the MMR ranged from 2 (Norway) to 11 (Canada).<sup>2</sup> In crisis and disaster settings, the breakdown of health systems can cause a dramatic rise in deaths due to complications that would be easily managed in stable settings (see [section 3.4.2.c](#) on crisis years and mortality shocks).

<sup>1</sup> Further information about indicators and methodology is available at: <https://fragilestatesindex.org/>. At the top of the range (most fragile), the scores are categorized as follows: > 110 = very high alert; 100–110 = high alert. These two categories include the nine most fragile countries mentioned here. There are 10 other categories ranging from “very sustainable” to “alert”, which include the remaining 169 countries.

<sup>2</sup> Analysis using 2020 data from this current report against the countries/categories presented in the 2020 Fragile States Index.

Finally, for many populations in vulnerable or marginalized situations there are no available input data for the estimation models. It is important to be aware, therefore, that in many countries that have made encouraging overall progress between 2016 and 2020, the national-level data often mask disparities between population groups within these countries. These disparities may not be evident without disaggregating the data, which is not always possible. This lack of accurate and representative information makes it nearly impossible to determine how to best address the maternal health needs among those most at risk.

### 5.3.2 The need for improved data sources and measurement of late maternal mortality

Ultimately, respect for human rights requires that all births, deaths and causes of death are officially counted and accounted for – and in turn this requires improved data collection, analysis and disaggregation. It follows that improving metrics, measurement systems and data quality are crucial cross-cutting actions for all strategies to improve maternal survival (2).

Progress to establish and strengthen civil registration and vital statistics (CRVS) systems and/or implement alternative methods of rigorously recording maternal deaths has been made in recent years, including the expansion of the use of confidential enquiries into maternal death (CEMD) and maternal death surveillance and response (MDSR) in an increasing number of countries. The efforts of countries to produce high-quality data and correct errors in maternal death classification have prompted the refinement of estimation methods that fully utilize country-level data to produce a more accurate and realistic picture of global maternal mortality levels and trends. The evolution in the United Nations and MMEIG methodology across estimation rounds (see [section 3.5](#)) reflects a continuous innovation process to develop the most robust, comparable estimates of maternal mortality using the data available at the time.

Yet, while the estimates presented in this report provide a valuable basis and guidance for policy and programme planning, many women who die from maternal causes remain uncounted. Further collective efforts are needed to improve data collection and recording systems. The broad uncertainty intervals associated with the estimates presented throughout this report reflect the critical need for better data on maternal mortality. Governments are called upon to establish well functioning CRVS systems with

accurate attribution of cause of death. Improvements in measurement must be driven by action at the country level, with governments creating systems to capture data specific to their information needs; systems that must also meet the standards required for international comparability. Globally, standardized methods for preventing reporting errors in CRVS data should be established to enhance international comparability.

More data disaggregated by the timing of maternal death are needed to better target interventions to improve maternal survival, including deaths that occur beyond 42 days postpartum. Late maternal deaths occurring more than 42 days but less than one year after the termination of pregnancy are captured in the ICD-11 grouping of “comprehensive maternal death” (13). Incomplete reporting and misclassification of late maternal deaths remains a substantial challenge. Nonetheless, more and more countries are collecting and reporting on this information; as of May 2022, 65 (54%) of the 120 countries and territories included in this analysis that report CRVS data to the WHO Mortality Database<sup>1</sup> recorded deaths occurring after 42 days postpartum, i.e. using ICD-10 codes O96 and/or O97. The MMEIG’s current methodology does not include these deaths within the numerator for the purpose of international monitoring of maternal mortality, due to challenges in maintaining comparability of estimates between countries. However, the recording of deaths after 42 days is recommended for national analytic purposes. The Forty-third World Health Assembly in 1990 adopted the recommendation that countries include a checkbox on death certificates for identifying whether a woman was currently pregnant or had been pregnant within the year preceding her death (14).

Finally, data that can be disaggregated to examine trends and measure the mortality burden within populations in vulnerable and marginalized situations (see [section 5.3.1](#)) are critical for implementing strategies to address inequities and accelerate progress in reducing maternal mortality. Better data are needed on the maternal mortality burden in a range of different subpopulations within countries. For example, pregnancy and childbirth complications are among the leading causes of death among adolescent girls aged 15–19 globally (15). Maternal mortality in adolescent girls is a symptom of the low prioritization of the rights of this population.

<sup>1</sup> WHO Mortality Database available at: <https://www.who.int/data/data-collection-tools/who-mortality-database>

### 5.3.3 Challenges remain: COVID-19 and maternal mortality

The estimates presented in this report include one year of observation (2020) where the COVID-19 pandemic was ongoing.<sup>2</sup> It is plausible that the COVID-19 pandemic contributed to the stagnation in progress seen in the MMR estimates for the 2016–2020 period. Increased maternal mortality during the pandemic could have occurred via two mechanisms: (i) increased indirect obstetric deaths – those where the woman had SARS-CoV-2 and her cause of death was due to the interaction between COVID-19 and her pregnant state; and/or (ii) increased direct obstetric deaths – those where pregnancy complications might have been prevented or successfully managed if there had not been the disruption to health services that led to a decline in access to and/or quality of care (16). Studies assessing population-level changes in maternal mortality throughout the pandemic are scarce. However, a 2022 systematic review found evidence of excess maternal mortality in four studies from Mexico, Peru, South Africa and Uganda (16).

A robust assessment of the impact of COVID-19 on maternal mortality is not currently possible from the data available for 2020. Input data for the MMEIG Bayesian maternal mortality estimation and misclassification (BMat and BMis) models were only available from 38 countries for 2020, the majority of which were in Europe and Northern America (18 countries) and Latin America and the Caribbean (10 countries). Furthermore, depending on region, national and subnational disease control policies, population vulnerability and health system reliance, not all countries were equally affected by the COVID-19 pandemic during 2020. Different SARS-CoV-2 variants have coexisted throughout the pandemic, and it is plausible that different variants interacted with pregnancy in different ways, the details of which are still unclear. At the end of 2020, COVID-19 vaccines were just beginning to become available. The data for 2020 should be interpreted with reasonable caution, in the knowledge that these estimates may change in future rounds as more data from more settings become available for 2020.

It is important to note that the stagnation in progress on reducing maternal mortality identified in this round of estimates preceded the start of the COVID-19 pandemic; while COVID-19 was likely a contributing factor, it is not the sole explanation for the trends observed.

<sup>2</sup> The WHO Director-General declared COVID-19 a public health emergency of international concern on 30 January 2020 (see <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline>).

## References

1. Goals: 3. In: *SDG Knowledge* [website]. United Nations Department of Economic and Social Affairs; undated (<https://sdgs.un.org/goals/goal3>, accessed 14 October 2022).
2. *Strategies towards ending preventable maternal mortality (EPMM)*. Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/153544>).
3. Millennium Summit, 6–8 September 2000, New York. In: *United Nations: Conferences* [website]. New York (NY): United Nations; undated (<https://www.un.org/en/conferences/environment/newyork2000>, accessed 14 October 2022).
4. Boldosser-Boesch A, Brun M, Carvajal L, Chou D, de Bernis L, Fogg K, et al. Setting maternal mortality targets for the SDGs. *Lancet*. 2017;389(10070):696–7. doi:10.1016/S0140-6736(17)30337-9.
5. *Global strategy for women’s, children’s and adolescents’ health (2016–2030)* [website]. New York (NY): Every Woman Every Child; 2015 (<http://globalstrategy.everywomaneverychild.org>, accessed 14 October 2022).
6. *Ending preventable maternal mortality (EPMM): a renewed focus for improving maternal and newborn health and well-being*. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/350834>).
7. Govender V, Topp SM, Tunçalp Ö. Rethinking trust in the context of mistreatment of women during childbirth: a neglected focus. *BMJ Glob Health*. 2022;7(5):e009490. doi:10.1136/bmjgh-2022-009490.
8. *Arguing for universal health coverage*. Geneva: World Health Organization; 2013 (<https://apps.who.int/iris/handle/10665/204355>).
9. World Health Organization, United Nations Children’s Fund (UNICEF). *Declaration of Astana*. Geneva and New York (NY); 2018 (WHO/HIS/SDS/2018.61; <https://www.who.int/docs/default-source/primary-health/declaration/gcphc-declaration.pdf>).
10. Binagwaho A, Ghebreyesus TA. Primary healthcare is cornerstone of universal health coverage. *BMJ*. 2019;365:l2391. doi:10.1136/bmj.l2391.
11. Horton R. Offline: gender and global health – an inexcusable global failure. *Lancet*. 2019;393(10171):511. doi:10.1016/S0140-6736(19)30311-3.
12. Roos N, Kovats S, Hajat S, Filippi V, Chersich M, Luchters S, et al. Maternal and newborn health risks of climate change: a call for awareness and global action. *Acta Obstet Gynecol Scand*. 2021;100(4):566–70. doi:10.1111/aogs.14124.
13. 2.25.5 Standards and reporting requirements related for maternal mortality. In: *ICD-11 Reference guide, Part 2* [website]. Geneva: World Health Organization; 2022 (<https://icd.who.int>, accessed 21 December 2022).
14. *Forty-third World Health Assembly, Geneva, 7–17 May 1990: resolutions and decisions, annexes*. Geneva: World Health Organization; 1990 (WHA43/1990/REC/1; <https://apps.who.int/iris/handle/10665/173422>).
15. *Adolescent and young adult health* [website]. Geneva: World Health Organization; 2022 (<https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions>, accessed 4 November 2022).
16. Calvert C, John J, Nzwere FP, Cresswell JA, Fawcus S, Fottrell E, et al. Maternal mortality in the COVID-19 pandemic: findings from a rapid systematic review. *Glob Health Action*. 2021;14(sup1). doi:10.1080/16549716.2021.1974677.





## 6. Conclusions

The Sustainable Development Goals (SDGs) include a direct emphasis on reducing maternal mortality while also highlighting the importance of moving beyond the focus on survival, as expressed by **SDG 3: Ensure healthy lives and promote well-being for all at all ages** (1). The world will fall short of SDG target 3.1, **to reduce the global maternal mortality ratio (MMR) to less than 70 maternal deaths per 100 000 live births by 2030**, by more than 1 million lives with the current pace of progress. We are currently approaching the mid-point of the SDG era, and this report covers the first third (five years) of the SDG period (January 2016 to December 2020). There remains a continued urgent need for maternal health and survival to remain high on the global health and development agenda. The state of maternal health interacts with and reflects efforts to improve on the accessibility and quality of health care. The 2018 Declaration of Astana (2) repositioned primary health care as the most cost-effective and inclusive means of delivering health services to achieve the SDGs (3). When effectively linked with higher levels of care, primary health care is the cornerstone for achieving universal health coverage (UHC), which only exists when all people receive the quality health services they need without suffering financial hardship (4).

In the remaining years of the SDG era, multisectoral action is needed to target the distal determinants of maternal mortality – including health system failures, social determinants that put some subpopulations at greater risk, harmful gender norms and biases, and both humanitarian and climate crises that lead to health system fragility. This is essential to achieve not only SDG target 3.1, but also related commitments in SDGs 1 (no poverty), 3 (good health and well-being), 5 (gender equality) and 10 (reduced inequality). Member States must intensify efforts to address health system failures that erode the provision of safe, affordable and quality sexual and reproductive health care (5). Efforts must be made to reduce health inequities by addressing the needs of populations

in vulnerable and marginalized situations. These inequities can lead to mistreatment within the health system, erode trust and impede service utilization (6).

In the face of the substantial threat of climate change to maternal health, coordinated efforts are required to build health system resilience and help communities mitigate and adapt in the coming decades (7). This is essential, to safeguard maternal health against the most devastating impacts of the climate crisis. Health system preparedness is also imperative in the context of current and future conflicts and other humanitarian emergencies.

Efforts towards achieving SDG target 3.1 require a reprioritization of the importance of gender-sensitive policies and interventions for global health – these are urgently required to reduce maternal mortality and improve sexual and reproductive health (8).

In consideration of the above, it must be noted that this report on the levels and trends of maternal mortality provides just one critical piece of information, which synthesizes and draws from the available data, to assess progress in reducing maternal mortality towards achieving SDG target 3.1. The results so far show uneven progress across the world in reducing maternal deaths between 2000 and 2020.

Substantial shifts in focus and investment are needed now if the SDG target to achieve a global MMR below 70 is to be met. If the 2016–2020 pace of progress continues, by 2030, the global MMR would still be 222 maternal deaths per 100 000 live births – the same as estimated for 2020 – due to the stagnation in the ARR observed during the first years of the SDG era.

With half of the SDG period remaining, the time is now to intensify efforts and renew the commitment to end preventable maternal mortality, and to ensure women not only simply survive a pregnancy but are healthy and thrive.

## References

1. Goals: 3. In: SDG Knowledge [website]. United Nations Department of Economic and Social Affairs; undated (<https://sdgs.un.org/goals/goal3>, accessed 14 October 2022).
2. World Health Organization, United Nations Children’s Fund (UNICEF). Declaration of Astana. Geneva and New York (NY); 2018 (WHO/HIS/SDS/2018.61 <https://www.who.int/docs/default-source/primary-health/declaration/gcphc-declaration.pdf>).
3. Binagwaho A, Ghebreyesus TA. Primary healthcare is cornerstone of universal health coverage. *BMJ*. 2019;365:l2391. doi:10.1136/bmj.l2391.
4. Arguing for universal health coverage. Geneva: World Health Organization; 2013 (<https://apps.who.int/iris/handle/10665/204355>).
5. Strategies towards ending preventable maternal mortality (EPMM). Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/153544>).
6. Govender V, Topp SM, Tunçalp Ö. Rethinking trust in the context of mistreatment of women during childbirth: a neglected focus. *BMJ Glob Health*. 2022;7(5):e009490. doi:10.1136/bmjgh-2022-009490.
7. Roos N, Kovats S, Hajat S, Filippi V, Chersich M, Luchters S, et al. Maternal and newborn health risks of climate change: a call for awareness and global action. *Acta Obstet Gynecol Scand*. 2021;100(4):566–70. doi:10.1111/aogs.14124.
8. Horton R. Offline: gender and global health – an inexcusable global failure. *Lancet*. 2019;393(10171):511. doi:10.1016/S0140-6736(19)30311-3.

# Annexes





# Annex 1.

## Summary description of the 2022 country consultations

The development of global-, regional- and country-level estimates and trends in morbidity and mortality is one of the core functions of the World Health Organization (WHO). WHO is the custodian agency for Sustainable Development Goal (SDG) indicator 3.1.1 (i.e. maternal mortality ratio, MMR) within the United Nations system that leads the development of updated maternal mortality estimates, together with the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank Group and the United Nations Department of Economic and Social Affairs, Population Division (UNDESA/Population Division), as members of the United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG).

In 2001, the WHO Executive Board endorsed a resolution (EB.107.R8) which included the proposal to “establish a technical consultation process bringing together personnel and perspectives from Member States in different WHO regions”.<sup>1</sup> A key objective of this country consultation process is “to ensure that each Member State is consulted on the best data to be used” for international estimation and reporting purposes. Since the process is an integral step in the overall maternal mortality estimation strategy, as well as an SDG requirement to consult with national focal points,<sup>2</sup> it is described here in brief.

The WHO country consultation process entails an exchange between WHO and technical focal person(s)/offices in each Member State, in addition to the territories Puerto Rico and the occupied Palestinian

territory, including east Jerusalem.<sup>3</sup> It is carried out after the development of preliminary estimates and prior to the publication of final estimates for the period of interest. During the consultation period, WHO invites technical focal person(s)/offices – who have been nominated to speak on behalf of their country about maternal mortality data – to review the MMEIG's input data sources, methods for estimation and the preliminary estimates. The focal person(s)/offices are encouraged to submit additional data that may not have been taken into account in the preliminary estimates.

The country consultation process for the 2022 round of maternal mortality estimates was initiated with an official communication from WHO to the countries on 25 June 2021. This letter informed them of the forthcoming exercise to estimate maternal mortality for the years 2000–2020 and requested the designation of an official technical focal person (typically within the national ministry of health and/or the central statistics office) to participate in the consultation. These designated officials and also the existing SDG national focal points subsequently, in August 2022, received the following items by email: (i) a copy of the official communication from WHO (CL.24.2021, dated 25 June 2021); (ii) draft estimates and data sources; and (iii) a summary of the methodology used. WHO headquarters and regional offices actively collaborated in identifying technical focal persons through their networks.

The formal consultation period started on 22 August 2022 and ran for five weeks, and the process was officially completed on 30 September 2022.

---

<sup>1</sup> Resolution of the Executive Board of the WHO: Health systems performance assessment. Geneva: World Health Organization; 2001 (EB.107.R8: <https://apps.who.int/iris/handle/10665/78684>).

<sup>2</sup> National focal points for the SDGs are contact persons within national statistics offices who facilitate discussions with countries in relation to the reporting for SDGs. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. New York (NY): United Nations; 2018 (E/CN.3/2018/2; <https://unstats.un.org/unsd/statcom/49th-session/documents/2018-2-SDG-IAEG-E.pdf>).

---

<sup>3</sup> Puerto Rico is an Associate Member, and the occupied Palestinian territory, including east Jerusalem, is a member in the Regional Committee for the WHO Eastern Mediterranean Region (EM/RC40/R.2; [https://apps.who.int/iris/bitstream/handle/10665/121332/em\\_rc40\\_r2\\_en.pdf](https://apps.who.int/iris/bitstream/handle/10665/121332/em_rc40_r2_en.pdf)). Two additional Associate Members (Faroe Islands and Tokelau) were excluded from estimates as their populations are below 100 000.

The table below provides a summary of the nominations of designated country WHO officials (technical focal persons for maternal mortality) and country SDG officials (SDG focal points), and numbers of countries providing feedback during the 2022 country consultations, by WHO region.

During the consultation period, new data submitted by countries were reviewed by the MMEIG Secretariat and statisticians to determine whether they met the inclusion criteria of this global estimation exercise. Eligibility for data inclusion can be found in [section 3.1.2](#) of the main report.

The inputs received during the 2022 country consultations were added to the input databases. The current estimates are based on 4687 country-years of information.

As in the previous country consultations, the new observations were from civil registration and vital statistics (CRVS) systems, specialized studies and household surveys. However, an increase in the number of other new observations/data points, from various sources of data, shows that countries lacking functioning CRVS systems are increasingly investing in monitoring maternal mortality with empirical data from alternative sources, such as surveillance systems.

WHO region	WHO technical focal persons (number of countries and territories)	SDG focal points (number of countries and territories)	Number of countries and territories interacting during the country consultation
African Region	16	36	18
Region of the Americas	19	25	19
South-East Asia Region	8	8	14
European Region	27	49	27
Eastern Mediterranean Region	13	21	4
Western Pacific Region	13	17	7
<b>Total</b>	<b>96</b>	<b>156</b>	<b>89</b>

# Annex 2.

## Bayesian maternal mortality misclassification (BMis) model to account for errors in reporting of maternal death in the civil registration and vital statistics (CRVS) system

Relying on maternal deaths as reported in the civil registration and vital statistics (CRVS) system means there is potential for error due to unregistered maternal deaths and/or misclassification of the cause of death within the CRVS system. Therefore, an adjustment factor is obtained for CRVS data before the data are included in the United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG) Bayesian maternal mortality estimation (BMat) model (see [section 3.4](#)).

The sections of this annex explain:

- a. Types of reporting errors encountered in CRVS systems
- b. Summary metrics for reporting errors, and
- c. Deriving sensitivity, specificity and CRVS adjustments from the MMEIG Bayesian maternal mortality misclassification (BMis) model (previously called “the Bayesian CRVS adjustment model”).

### a. Types of reporting errors encountered in CRVS systems

Definitions of reporting errors are summarized in [Box A2.1](#) and discussed further below.

#### i. Reporting errors within the CRVS system (misclassification)

Within the CRVS system, incorrect reporting of maternal deaths can be attributed to misclassification in two ways, using the following notation:

**F+ (false positive)** = non-maternal deaths misclassified in the CRVS system as maternal deaths

**F- (false negative)** = maternal deaths misclassified in the CRVS system as non-maternal deaths.

The remaining deaths are those that have been correctly classified within the CRVS system; these can also be assigned to two groups, using the following notation:

**T+ (true positive)** = maternal deaths correctly classified in the CRVS system as maternal deaths

**T- (true negative)** = non-maternal deaths correctly classified in the CRVS system as non-maternal deaths.

### BOX A2.1 ■ DEFINITIONS OF MISCLASSIFICATION, MISSED OR UNREGISTERED MATERNAL DEATHS

#### Missed or unregistered

Refers to incomplete death registration in the CRVS system, due to the incomplete identification of individual deaths in each country and/or the incomplete national coverage of the CRVS system.

We distinguish between:

- ▶ **U-** = Non-maternal deaths not registered in the CRVS system
- ▶ **U+** = Maternal deaths not registered in the CRVS system

#### Misclassification

Refers to incorrect coding of deaths in the CRVS system, due either to error in the medical certification of cause of death or error in applying the correct code.

We distinguish between:

- ▶ **F- (false negative)** = True maternal deaths incorrectly classified as non-maternal deaths
- ▶ **F+ (false positive)** = True non-maternal deaths incorrectly classified as maternal deaths

The four-box diagram in **Fig. A2.1** summarizes what is correctly classified and what is misclassified in the CRVS system, using the notation provided above.

The observed PM (the proportion of deaths among women of reproductive age that are due to maternal causes) reported in the CRVS is given by:

$$\frac{T^+ + F^+}{T^+ + F^+ + F^- + T^-}$$

while the true PM from CRVS data is:

$$\frac{T^+ + F^-}{T^+ + F^+ + F^- + T^-}$$

The MMEIG approach to adjust for this potential difference between true and observed PM is explained in **subsections b and c** later in this annex.

**ii. Deaths that are not reported in the CRVS**

In cases where the CRVS system does not capture all deaths to females of reproductive age (i.e. the CRVS is incomplete), we classify these maternal and non-maternal deaths as missed (unregistered) female deaths. The notation used is as follows:

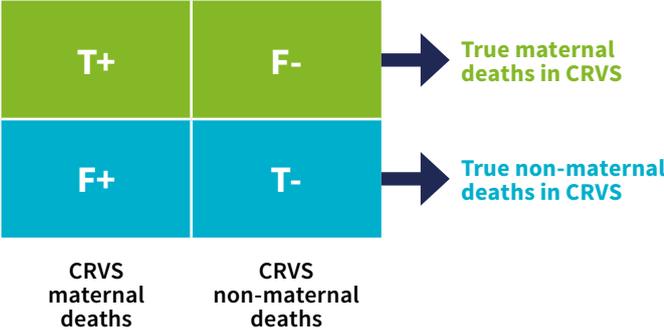
**U-** = non-maternal deaths not registered in the CRVS

**U+** = maternal deaths not registered in the CRVS.

We extend the four-box representation to also incorporate these missed maternal (U+) and non-maternal (U-) deaths using a six-box diagram, as shown in **Fig. A2.2**.

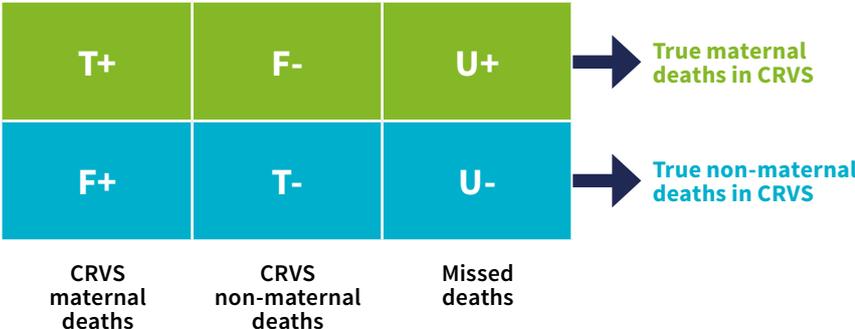
More information on the types of errors in maternal mortality measurement and ways to improve measurement are provided in the 2022 WHO

**Fig. A2.1 Four-box diagram of breakdown of the total number of deaths to females of reproductive age as reported in the CRVS, by CRVS cause-of-death classification**



F-: false negative; F+: false positive; T-: true negative; T+: true positive

**Fig. A2.2 Six-box diagram of breakdown of the total number of deaths to females of reproductive age, by CRVS cause-of-death classification (T/F) and reporting status (U)**



F-: false negative; F+: false positive; T-: true negative; T+: true positive; U+: unregistered maternal deaths; U-: unregistered non-maternal deaths

publication, *Maternal mortality measurement: guidance to improve national reporting*.<sup>1</sup>

## b. Summary metrics for reporting errors

### i. Reporting within the CRVS

We summarize the occurrence of misclassification errors in the CRVS using the following two metrics.

**Sensitivity (Se)** = proportion of correctly classified maternal deaths out of all true maternal deaths

**Specificity (Sp)** = proportion of correctly classified non-maternal deaths out of all true non-maternal deaths.

When combined, these metrics summarize the ability of the CRVS system to correctly identify a true maternal and true non-maternal death. The formulas, using the notation introduced in the previous section of this annex, are as follows:

$$\text{Sensitivity} = \frac{T^+}{T^+ + F^-}$$

$$\text{Sensitivity} = \frac{T^-}{T^- + F^+}$$

The third metric related to reporting errors in the CRVS is the following adjustment factor.

**CRVS adjustment factor** = adjustment factor associated with CRVS-reported PM, to account for the difference between CRVS-reported PM and true PM.

For country-years with complete CRVS, CRVS adjustment factors can be calculated for all country-years using their respective estimates of Se, Sp and true proportion maternal (true PM), based on the following relationship:

$$\text{Expected CRVS-reported PM} = \text{Se} * \text{true PM} + (1 - \text{Sp}) * (1 - \text{true PM}),$$

such that the CRVS adjustment factor is given by:

$$\text{CRVS adjustment factor} = \text{true PM} / [\text{Se} * \text{true PM} + (1 - \text{Sp}) * (1 - \text{true PM})].$$

### ii. Reporting in incomplete CRVS systems

Reporting errors related to missed maternal deaths are summarized in terms of the ratio between:

**True PM in (PM-in)** = the true PM among deaths captured in the CRVS (the true number of maternal deaths in the CRVS divided by the total number of deaths captured in the CRVS), and

**True PM out (PM-out)** = the true PM among deaths not captured in the CRVS,

such that:

$$\text{True PM among all deaths} = \text{COM} * \text{PM-in} + (1 - \text{COM}) * \text{PM-out},$$

where

COM = completeness of the CRVS data (in terms of reporting all deaths to females of reproductive age).

If the ratio (in particular, its upper bound when accounting for uncertainty in the ratio) is greater than 0.95 for all years with CRVS data, we assume that the CRVS is complete in the country (COM = 1). If the ratio is less than 0.95 for one or more years, the completeness is given by the ratio for each individual year (COM = ratio).

For country-years with incomplete CRVS, we investigated the feasibility of estimating the odds ratio of the two PMs, but data were too limited for inference on this ratio. Instead, we assumed that PM-in equals PM-out and accounted for additional uncertainty related to the unknown true ratio when deriving the CRVS adjustment for country-years with incomplete CRVS.

## c. Deriving sensitivity, specificity and CRVS adjustments from the BMis model

### i. BMis model estimates of sensitivity and specificity

The BMis model obtains estimates of sensitivity and specificity for all country-years with CRVS data. Based on these estimates, corresponding estimates of the adjustment factor for country-years with complete CRVS can be obtained.

For all countries with specialized studies to inform Se and Sp, we model Se and Sp with a country-specific intercept in the mid-year of their respective observation periods. The country-specific intercept is estimated with a multilevel model, such that estimates for countries with specialized studies are informed by those data, while estimates for countries with limited or no data are informed by data from other countries. Se and Sp values for the remaining years before and after the reference year were obtained through a “random walk” model set-up. In the random walk set-up, point estimates of Se and Sp are kept constant unless country-specific data suggest a change. For countries with specialized studies, the estimates are data driven and informed by the combinations of Se and Sp as indicated by the studies.

<sup>1</sup> Maternal mortality measurement: guidance to improve national reporting. Geneva: World Health Organization; 2022 (<https://apps.who.int/iris/handle/10665/360576>).

We considered predictor variables to capture changes in sensitivity and specificity over time within countries, and differences across countries. The following predictor variables were considered as candidate covariates:

- ▶ general fertility rate (GFR);
- ▶ gross domestic product (GDP) per capita;
- ▶ CRVS completeness (COM);
- ▶ proportion of causes of death in the CRVS that are ill defined (“R” codes in CRVS);<sup>1</sup>
- ▶ ICD coding (use of ICD-9 or ICD-10);
- ▶ proportion of CRVS deaths that fall under noncommunicable disease causes of death.

However, none of the candidate predictor variables showed a substantively meaningful relationship with the parameters of interest, hence no covariates were used.

## ii. BMis model estimates of CRVS adjustment factors

The BMis model was fitted to specialized study data, collected by review, and CRVS data for the corresponding periods. The CRVS yields estimates of sensitivity and specificity based on two scenarios.

- ▶ For countries with data from specialized studies, the model is fitted to the data for the years available, and the estimates for the CRVS adjustment in the corresponding years will be consistent with the data. For the years with no data available after the observation period, the sensitivity and specificity are fixed to the value estimated for the most recent year with data. For years with no data available before the observation period, sensitivity and specificity are set to increase or decrease to match the global sensitivity and specificity within a five-year period.
- ▶ For countries without specialized studies, the estimates for sensitivity and specificity are equivalent to global estimates of sensitivity and specificity, obtained from fitting the model to the global database (the “envelope” of all specialized studies). The resulting estimates of Se and Sp are constant with time, as global estimates are also constant with time.

Fig. A2.3 shows the relationship between true PM and the estimated CRVS adjustment factors, for specific

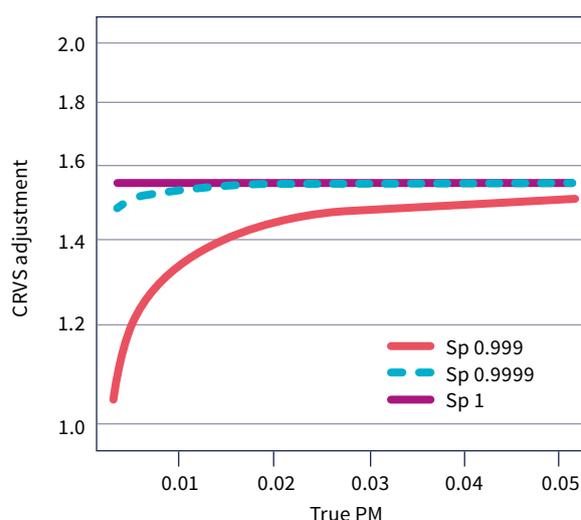
<sup>1</sup> “R” codes R95-99 in ICD cover ill-defined and unknown causes of mortality (further information is available at: <https://icd.who.int/browse10/2016/en#/R95-R99>).

values of Sp, to illustrate their effect on the CRVS adjustment factor. When  $Sp = 1$ , the CRVS adjustment factor =  $1/Se$ , hence lower Se results in a higher adjustment; conversely, higher Se results in a lower adjustment. When  $Sp < 1$ , while keeping Se fixed, the adjustment factor decreases with decreasing true PM. This effect is due to an increasing share of false positive maternal deaths among all deaths, and a decreasing share of false negative deaths, or, in other words, as the true PM decreases, the proportion of non-maternal deaths reported as maternal increases while the proportion of maternal deaths reported as non-maternal decreases.

Fig. A2.3 illustrates that keeping specificity and sensitivity constant in extrapolations in countries with specialized studies, or for countries without any studies, will result in changing adjustment factors as the true PM changes.

The BMis model provides estimates for all countries with CRVS data, using available information from these countries. This implies that inclusion of additional data/observations for any one country (perhaps as a result of this consultation) can potentially result in changes to estimates for other countries – especially those without specialized studies.

**Fig. A2.3 CRVS adjustment (displayed on log-scale) based on the BMis model for different values of specificity, calculated at different levels of true PM when sensitivity is fixed at 0.644<sup>a</sup>**



PM: proportion maternal; Sp: specificity.

<sup>a</sup> Based on the CRVS model, we estimated that 64.4% of maternal deaths are identified correctly in the CRVS.

# Annex 3.

## Methods used to derive a complete series of annual estimates for each predictor variable

A complete series of annual estimates for each of the three predictor variables was obtained or constructed.

**Gross domestic product (GDP) per capita**, measured in purchasing power parity (PPP) equivalent international dollars using 2017 as the baseline year, were taken from the World Bank Group (1). A five-year moving average was applied to this GDP series to smooth year-to-year GDP fluctuations (1).

**General fertility rate (GFR)** estimates were computed from data on live births and the population size (number of women aged 15–49 years), from the UNDESA/Population Division’s 2022 revision of *World population prospects* (2).

**Skilled birth attendant (SBA)<sup>1</sup> coverage** data consist of time series derived using all available data from health surveys and countries’ routine reporting mechanisms, which are compiled in a database jointly maintained by WHO and UNICEF (3). This database is primarily compiled for SDG reporting purposes. Jointly, UNICEF and WHO are co-custodians of “SDG indicator 3.1.2: Proportion of births attended by skilled health personnel” and collaborate actively in the compilation and harmonization of this database. As part of the regular consultations with countries by the custodians of the SDG indicator, UNICEF leads an annual process during which countries are consulted on each value and data source that goes into this database.

Using data from this database as input, annual series were estimated for all countries and territories by fitting a multilevel time series (AR1) model, with time as the sole predictor for the logit (or log-odds) of SBA. The model included region- and country-specific intercepts and slopes.

### References

1. World development indicators. In: The World Bank DataBank [website]. Washington (DC): The World Bank Group; 2019 (<https://databank.worldbank.org/source/world-development-indicators>, accessed 4 November 2022).
2. World population prospects 2022 [website]. New York (NY): United Nations Population Division, Department of Economic and Social Affairs; 2022 (<https://population.un.org/wpp/>, accessed 4 November 2022).
3. World Health Organization (WHO), United Nations Children’s Fund (UNICEF). UNICEF/WHO joint database on SDG 3.1.2 Skilled Attendance at Birth. In: Delivery care [website]. New York (NY): UNICEF; 2022 (<https://data.unicef.org/topic/maternal-health/delivery-care/>, accessed 4 November 2022).
4. Definition of skilled health personnel providing care during childbirth: the 2018 joint statement by WHO, UNFPA, UNICEF, ICM, ICN, FIGO, IPA. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/272818>).
5. Making pregnancy safer: the critical role of the skilled attendant: a joint statement by WHO, ICM and FIGO. Geneva: World Health Organization; 2004 (<https://apps.who.int/iris/handle/10665/42955>).

---

<sup>1</sup> The definition of this SBA coverage indicator was updated in a joint statement (and full background document) in 2018 (4), but the data used for the estimates presented in this present publication are based on application of the previous (2004) definition/joint statement (5), which was still in effect for most of the period from 2000 to 2020.

# Annex 4.<sup>1</sup>

Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk, percentage of HIV-related indirect maternal deaths and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by country and territory, 2020

Country and territory	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	% of HIV-related indirect maternal deaths	PM point estimate and range of uncertainty interval (UI: 80%)		
	Lower UI	MMR point estimate	Upper UI				Lower UI (%)	PM point estimate (%)	Upper UI (%)
Afghanistan	406	620	1 050	8 700	32	< 0.1	23.9	36.5	61.8
Albania	4	8	16	2	8 700	0.6	0.3	0.5	1.0
Algeria	41	78	164	760	410	< 0.1	4.1	7.8	16.5
Angola	148	222	330	2 900	79	3.2	8.6	12.9	19.2
Antigua and Barbuda	11	21	36	0	2 700	< 0.1	0.8	1.4	2.4
Argentina	38	45	53	290	1 100	0.4	2.0	2.4	2.8
Armenia	19	27	42	10	2 100	0.8	1.5	2.1	3.3
Australia	2	3	4	9	19 000	0.1	0.4	0.4	0.5
Austria	4	5	8	4	14 000	< 0.1	0.3	0.5	0.7
Azerbaijan	22	41	69	54	1 400	0.7	0.7	1.3	2.3
Bahamas	51	77	128	4	940	< 0.1	1.3	1.9	3.2
Bahrain	13	16	19	3	3 000	< 0.1	1.6	1.9	2.2
Bangladesh	89	123	174	3 700	390	< 0.1	4.6	6.5	9.1
Barbados	22	39	61	1	1 900	< 0.1	0.7	1.3	2.1
Belarus	1	1	2	1	65 000	7.4	< 0.1	0.1	0.1
Belgium	4	5	6	5	12 000	< 0.1	0.3	0.4	0.5
Belize	105	130	161	9	380	3.1	4.4	5.4	6.8
Benin	397	523	768	2 500	36	0.4	15.3	20.1	29.6
Bhutan	40	60	82	6	970	0.2	1.4	2.2	2.9
Bolivia (Plurinational State of)	103	161	272	420	230	0.1	4.8	7.5	12.7
Bosnia and Herzegovina	4	6	8	2	13 000	< 0.1	0.3	0.5	0.7
Botswana	151	186	230	120	180	11.5	4.9	6.1	7.5
Brazil	57	72	93	2 000	800	< 0.1	2.5	3.2	4.1
Brunei Darussalam	30	44	61	3	1 300	< 0.1	1.2	1.8	2.5

<sup>1</sup> Estimates have been computed to ensure comparability across countries, thus they are not necessarily the same as official statistics of the countries, which may use alternative rigorous methods. Countries included in all tables presented in this report (185 countries) are limited to WHO Member States with populations over 100 000, excluding those for which life tables were unavailable (Andorra, Cook Islands, Dominica, Marshall Islands, Monaco, Nauru, Niue, Palau, Saint Kitts and Nevis, San Marino, Tuvalu), plus two territories (Puerto Rico [an Associate Member], and the occupied Palestinian territory, including east Jerusalem [a member in the Regional Committee for the WHO Eastern Mediterranean Region]).

Country and territory	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	% of HIV-related indirect maternal deaths	PM point estimate and range of uncertainty interval (UI: 80%)		
	Lower UI	MMR point estimate	Upper UI				Lower UI (%)	PM point estimate (%)	Upper UI (%)
Bulgaria	5	7	10	4	10 000	< 0.1	0.2	0.3	0.4
Burkina Faso	169	264	394	2 000	77	0.4	7.0	10.9	16.3
Burundi	353	494	694	2 200	38	0.2	13.9	19.4	27.2
Cabo Verde	26	42	65	4	1 100	0.7	2.2	3.6	5.5
Cambodia	156	218	326	710	170	0.5	6.1	8.6	12.8
Cameroon	332	438	605	4 100	46	1.1	12.8	16.9	23.3
Canada	9	11	15	41	6 500	< 0.1	0.6	0.8	1.0
Central African Republic	407	835	1519	1 900	19	0.9	14.5	29.7	54.1
Chad	772	1 063	1 586	7 800	15	0.2	23.6	32.6	48.6
Chile	13	15	17	34	3 800	< 0.1	0.8	0.9	1.1
China	19	23	27	2 800	3 100	< 0.1	0.9	1.1	1.3
Colombia	65	75	86	550	780	0.1	3.0	3.5	4.0
Comoros	131	217	367	52	110	< 0.1	6.7	11.0	18.6
Congo	194	282	429	500	82	6.9	7.0	10.3	15.6
Costa Rica	18	22	26	14	2 600	3.3	1.4	1.7	1.9
Côte d'Ivoire	318	480	730	4 400	46	0.7	8.7	13.1	20.0
Croatia	3	5	7	2	15 000	< 0.1	0.3	0.4	0.6
Cuba	35	39	44	42	1 800	2.6	1.6	1.7	1.9
Cyprus	47	68	99	9	1 000	< 0.1	5.6	8.2	11.8
Czechia	2	3	5	4	17 000	< 0.1	0.2	0.2	0.3
Democratic People's Republic of Korea	46	107	249	370	550	< 0.1	1.5	3.5	8.1
Democratic Republic of the Congo	377	547	907	22 000	29	0.5	17.9	25.9	43.0
Denmark	4	5	6	3	12 000	0.4	0.4	0.5	0.6
Djibouti	105	234	530	56	160	1.4	2.5	5.5	12.4
Dominican Republic	87	107	133	220	390	1.3	4.7	5.8	7.2
Ecuador	52	66	86	200	740	0.2	3.3	4.2	5.5
Egypt	13	17	22	420	1 900	< 0.1	1.4	1.9	2.4
El Salvador	31	43	61	44	1 100	4.4	1.3	1.8	2.5
Equatorial Guinea	122	212	374	110	100	4.7	5.0	8.7	15.3
Eritrea	207	322	508	330	77	0.2	9.5	14.8	23.5
Estonia	3	5	9	1	11 000	4.5	0.2	0.4	0.6
Ethiopia	189	267	427	10 000	86	0.6	9.9	14.1	22.5
Fiji	28	38	55	7	960	0.9	1.1	1.5	2.2
Finland	6	8	13	4	8 600	< 0.1	0.4	0.6	1.0
France	6	8	10	54	7 300	< 0.1	0.5	0.7	0.9
Gabon	141	227	383	140	120	2.2	6.6	10.6	17.9
Gambia	333	458	620	400	47	1.5	12.2	16.8	22.7

Country and territory	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	% of HIV-related indirect maternal deaths	PM point estimate and range of uncertainty interval (UI: 80%)		
	Lower UI	MMR point estimate	Upper UI				Lower UI (%)	PM point estimate (%)	Upper UI (%)
Georgia	22	28	33	14	1700	0.5	1.5	1.8	2.2
Germany	4	4	5	34	13 000	0.2	0.3	0.4	0.5
Ghana	180	263	376	2 400	100	1.9	5.8	8.5	12.1
Greece	5	8	12	6	9 400	0.2	0.3	0.5	0.8
Grenada	12	21	34	0	2 300	<0.1	0.8	1.4	2.2
Guatemala	85	96	106	360	380	0.4	4.9	5.6	6.2
Guinea	404	553	808	2 600	37	0.7	14.1	19.3	28.2
Guinea-Bissau	475	725	1 135	460	32	1.1	15.9	24.2	37.9
Guyana	83	112	144	18	330	0.7	3.0	4.1	5.2
Haiti	239	350	550	950	94	0.3	8.8	12.9	20.3
Honduras	58	72	91	160	510	0.5	3.4	4.2	5.3
Hungary	11	15	21	14	4 800	<0.1	0.5	0.7	1.0
Iceland	1	3	4	0	18 000	<0.1	0.2	0.4	0.6
India	93	103	110	24 000	470	<0.1	3.7	4.1	4.3
Indonesia	121	173	271	7 800	280	0.6	3.6	5.1	8.0
Iran (Islamic Republic of)	14	22	32	270	2 600	1.0	0.7	1.2	1.7
Iraq	50	76	121	900	350	<0.1	4.2	6.4	10.2
Ireland	4	5	7	3	12 000	0.4	0.4	0.6	0.7
Israel	2	3	4	5	11 000	<0.1	0.5	0.7	1.1
Italy	4	5	6	19	21 000	<0.1	0.3	0.3	0.4
Jamaica	80	99	122	33	730	2.0	2.4	3.0	3.7
Japan	3	4	6	36	22 000	<0.1	0.2	0.3	0.4
Jordan	26	41	62	100	780	<0.1	3.0	4.9	7.3
Kazakhstan	10	13	18	57	2 400	0.4	0.7	1.0	1.4
Kenya	382	530	750	7 700	52	1.4	9.0	12.5	17.7
Kiribati	33	76	146	3	390	<0.1	1.8	4.2	8.0
Kuwait	5	7	11	4	8 000	<0.1	0.8	1.1	1.7
Kyrgyzstan	37	50	70	81	580	0.1	3.4	4.5	6.3
Lao People's Democratic Republic	92	126	185	210	280	0.3	4.8	6.7	9.5
Latvia	14	18	25	3	3 900	<0.1	0.6	0.8	1.2
Lebanon	18	21	24	18	2 300	0.2	1.7	1.9	2.2
Lesotho	385	566	876	330	55	3.3	6.0	8.9	13.7
Liberia	499	652	900	1 100	35	0.5	17.9	23.4	32.3
Libya	31	72	165	88	580	0.1	1.4	3.3	7.5
Lithuania	5	9	14	2	6 700	<0.1	0.2	0.4	0.6
Luxembourg	4	6	12	0	11 000	<0.1	0.4	0.6	1.1
Madagascar	311	392	517	3 500	59	0.2	14.5	18.3	24.2
Malawi	269	381	543	2 500	60	2.5	11.4	16.1	23.0
Malaysia	18	21	29	110	2 300	0.6	1.4	1.7	2.4
Maldives	40	57	83	4	840	<0.1	4.6	6.6	9.6

Country and territory	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	% of HIV-related indirect maternal deaths	PM point estimate and range of uncertainty interval (UI: 80%)		
	Lower UI	MMR point estimate	Upper UI				Lower UI (%)	PM point estimate (%)	Upper UI (%)
Mali	335	440	581	3900	37	0.7	15.4	20.3	26.8
Malta	2	3	5	0	25 000	< 0.1	0.3	0.6	1.0
Mauritania	337	464	655	700	45	0.2	21.7	29.9	42.2
Mauritius	62	84	115	11	860	6.9	1.8	2.5	3.4
Mexico	46	59	74	1 200	820	0.3	2.3	2.9	3.6
Micronesia (Federated States of)	32	74	169	1	490	< 0.1	1.9	4.5	10.2
Mongolia	28	39	55	29	820	0.1	1.9	2.8	3.9
Montenegro	3	6	11	0	9 300	< 0.1	0.2	0.4	0.7
Morocco	51	72	96	470	580	0.1	3.7	5.3	7.1
Mozambique	99	127	157	1 500	160	8.9	5.5	7.1	8.8
Myanmar	125	179	292	1 700	270	< 0.1	4.0	5.7	9.3
Namibia	154	215	335	150	130	8.1	4.2	5.9	9.2
Nepal	125	174	276	1 100	240	0.1	5.3	7.3	11.6
Netherlands	3	4	6	7	13 000	0.3	0.3	0.4	0.6
New Zealand	5	7	9	4	8 200	0.3	0.4	0.6	0.7
Nicaragua	54	78	109	110	470	0.4	3.8	5.4	7.6
Niger	305	441	655	4 900	31	0.1	19.7	28.5	42.4
Nigeria	793	1 047	1 565	82 000	19	0.3	18.4	24.3	36.3
Norway	1	2	3	1	43 000	1.4	0.1	0.2	0.3
Occupied Palestinian territory, including east Jerusalem <sup>d</sup>	15	20	26	30	1 200	< 0.1	2.2	2.9	3.8
Oman	12	17	25	15	1 900	< 0.1	2.4	3.3	4.8
Pakistan	109	154	226	9 800	170	0.1	8.3	11.7	17.2
Panama	46	50	54	38	840	3.0	2.9	3.1	3.4
Papua New Guinea	126	192	293	490	150	0.1	5.3	8.1	12.4
Paraguay	60	71	82	99	510	0.7	3.7	4.4	5.0
Peru	59	69	80	410	600	0.1	5.3	6.2	7.2
Philippines	67	78	96	1 900	410	< 0.1	4.5	5.3	6.4
Poland	1	2	3	7	37 000	< 0.1	0.1	0.1	0.2
Portugal	8	12	18	10	6 100	1.2	0.5	0.7	1.1
Puerto Rico	25	34	54	9	2 100	< 0.1	0.9	1.3	2.0
Qatar	5	8	11	2	6 300	< 0.1	0.8	1.3	1.9
Republic of Korea	7	8	9	24	18 000	< 0.1	0.3	0.4	0.4
Republic of Moldova	9	12	17	5	4 700	2.8	0.5	0.7	0.9
Romania	7	10	14	20	5 700	1.5	0.5	0.7	1.0
Russian Federation	9	14	20	200	5 300	< 0.1	0.2	0.3	0.5

Country and territory	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	% of HIV-related indirect maternal deaths	PM point estimate and range of uncertainty interval (UI: 80%)		
	Lower UI	MMR point estimate	Upper UI				Lower UI (%)	PM point estimate (%)	Upper UI (%)
Rwanda	184	259	383	1 000	95	0.9	9.6	13.5	19.9
Saint Lucia	44	73	127	1	790	<0.1	1.8	3.0	5.2
Samoa	26	59	137	4	380	<0.1	2.6	6.0	13.9
Sao Tome and Principe	74	146	253	9	170	0.3	3.4	6.6	11.5
Saudi Arabia	11	16	22	110	2 500	0.1	0.9	1.3	1.7
Senegal	197	261	376	1 400	80	0.2	14.8	19.5	28.1
Serbia	8	10	14	7	7 100	0.2	0.5	0.7	0.9
Seychelles	3	3	4	0	15 000	<0.1	0.1	0.2	0.2
Sierra Leone	344	443	587	1 200	52	0.3	14.1	18.2	24.1
Singapore	5	7	11	3	13 000	0.5	0.4	0.5	0.8
Slovakia	3	5	6	3	15 000	<0.1	0.2	0.3	0.4
Slovenia	3	5	7	1	16 000	<0.1	0.3	0.5	0.7
Solomon Islands	75	122	197	26	200	<0.1	5.1	8.4	13.6
Somalia	283	621	1 184	4 500	25	<0.1	12.8	28.0	53.3
South Africa	99	127	154	1 500	300	12.0	1.9	2.4	2.9
South Sudan	746	1 223	2 009	3 800	20	0.8	16.8	27.5	45.2
Spain	3	3	4	12	28 000	0.5	0.2	0.2	0.3
Sri Lanka	24	29	38	89	1 700	0.2	1.6	1.9	2.6
Saint Vincent and the Grenadines	40	62	92	1	940	<0.1	1.2	1.8	2.7
Sudan	174	270	420	4 100	78	0.2	10.3	16.0	24.9
Suriname	70	96	128	11	430	1.2	3.1	4.3	5.7
Eswatini	147	240	417	69	130	8.6	3.2	5.2	9.0
Sweden	3	5	6	5	13 000	<0.1	0.4	0.5	0.7
Switzerland	5	7	11	6	7 800	1.5	0.6	0.8	1.2
Syrian Arab Republic	19	30	47	120	1 200	<0.1	1.5	2.3	3.7
Tajikistan	9	17	31	44	1 600	1.1	0.8	1.5	2.9
United Republic of Tanzania	174	238	381	5 400	83	1.7	11.8	16.1	25.7
North Macedonia	1	3	6	1	24 000	<0.1	0.1	0.3	0.5
Thailand	24	29	34	190	2 500	6.3	0.9	1.1	1.2
Timor-Leste	147	204	283	67	140	0.1	9.0	12.4	17.2
Togo	253	399	576	1 100	59	0.9	7.2	11.4	16.4
Tonga	55	126	289	3	230	<0.1	2.0	4.5	10.3
Trinidad and Tobago	19	27	36	5	2 200	6.2	0.6	0.9	1.2
Tunisia	24	37	49	74	1 300	0.2	1.9	2.8	3.8
Türkiye	13	17	23	220	2 800	<0.1	1.5	2.0	2.7
Turkmenistan	3	5	9	7	6 300	<0.1	0.2	0.3	0.5
Uganda	191	284	471	4 700	66	2.1	9.5	14.1	23.3
Ukraine	13	17	22	56	5 800	5.7	0.3	0.4	0.5

Country and territory	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	% of HIV-related indirect maternal deaths	PM point estimate and range of uncertainty interval (UI: 80%)		
	Lower UI	MMR point estimate	Upper UI				Lower UI (%)	PM point estimate (%)	Upper UI (%)
United Arab Emirates	5	9	17	9	6 100	< 0.1	0.6	1.1	2.0
United Kingdom of Great Britain and Northern Ireland	8	10	12	67	5 800	< 0.1	0.6	0.7	0.9
United States of America	16	21	27	770	2 700	< 0.1	0.7	1.0	1.2
Uruguay	15	19	23	7	3 900	1.9	0.6	0.8	0.9
Uzbekistan	23	30	40	250	1 100	0.2	1.6	2.1	2.8
Vanuatu	43	94	211	8	260	< 0.1	3.0	6.6	14.8
Venezuela (Bolivarian Republic of)	191	259	381	1 200	160	1.1	8.0	10.9	16.0
Viet Nam	81	124	190	1 800	390	0.2	4.6	7.1	10.9
Yemen	120	183	271	1 900	130	< 0.1	8.2	12.5	18.5
Zambia	100	135	201	890	160	10.9	4.7	6.4	9.5
Zimbabwe	255	357	456	1 700	71	4.5	6.6	9.2	11.8

PM: proportion of deaths among women of reproductive age (15–49 years) that are due to maternal causes (expressed as a percentage).

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>d</sup> UNICEF, UNPFA, World Bank Group and UNDESA/Population Division refer to this territory as the State of Palestine.

## Annex 5.<sup>1</sup>

Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by World Health Organization (WHO) region, 2020

WHO region	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	PM point estimate (%)
	Lower UI	MMR point estimate	Upper UI			
African Region	464	531	639	198 000	42	19.1
Region of the Americas	62	68	76	9 200	780	3.0
Eastern Mediterranean Region	145	179	224	32 000	180	13.0
European Region	12	13	15	1 300	4 500	0.7
South-East Asia Region	106	117	133	39 000	420	4.5
Western Pacific Region	39	44	51	8 300	1 500	2.3
<b>World</b>	<b>202</b>	<b>223</b>	<b>255</b>	<b>287 000</b>	<b>210</b>	<b>9.8</b>

PM: proportion of deaths among women of reproductive age (15–49 years) that are due to maternal causes (expressed as a percentage).

A list of WHO Member States in each of the six WHO regions can be found at <https://www.who.int/countries/> (filter by region).

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>.

# Annex 6.<sup>1</sup>

## Trends in estimates of maternal mortality ratio (MMR), by WHO region, 2000–2020

WHO region	MMR <sup>a</sup> point estimates					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
African Region	788	696	647	581	531	2.0	2.1	1.9	33.2
Region of the Americas	68	64	60	58	68	< 0.1	1.1	-3.5	0.6
Eastern Mediterranean Region	356	296	231	196	179	3.5	4.0	2.3	50.2
European Region	26	20	15	12	13	3.5	5.0	-2.6	50.1
South-East Asia Region	372	289	197	148	117	5.8	6.2	4.6	68.5
Western Pacific Region	76	63	49	42	44	2.7	4.0	-2.9	42.1
<b>World</b>	<b>339</b>	<b>296</b>	<b>254</b>	<b>227</b>	<b>223</b>	<b>2.1</b>	<b>2.7</b>	<b>0.0</b>	<b>34.3</b>

ARR: annual rate of reduction.

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

A list of WHO Member States in each of the six WHO regions can be found at <https://www.who.int/countries/> (filter by region).

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

# Annex 7.<sup>1</sup>

Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Children’s Fund (UNICEF) region, 2020

UNICEF region and subregion	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	PM point estimate (%)
	Lower UI	MMR point estimate	Upper UI			
East Asia and the Pacific	63	74	92	18 000	840	3.3
Europe and Central Asia	12	13	15	1 300	4 500	0.7
Eastern Europe and Central Asia	17	19	22	1 000	2 900	0.8
Western Europe	6	6	7	290	11 000	0.5
Latin America and Caribbean	79	88	99	8 400	570	4.3
Middle East and North Africa	46	56	71	5 200	660	4.7
North America	16	20	26	810	2 900	0.9
South Asia	122	138	160	47 000	320	6.3
Sub-Saharan Africa	469	536	640	206 000	41	19.3
Eastern and Southern Africa	285	324	374	59 000	71	13.6
West and Central Africa	605	724	926	147 000	27	23.1
<b>World</b>	<b>202</b>	<b>223</b>	<b>255</b>	<b>287 000</b>	<b>210</b>	<b>9.8</b>

PM: proportion of deaths among women of reproductive age (15–49 years) that are due to maternal causes (expressed as a percentage).

Countries in each UNICEF region are listed at: <https://data.unicef.org/regionalclassifications/>.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>.

# Annex 8.<sup>1</sup>

## Trends in estimates of maternal mortality ratio (MMR), by UNICEF region, 2000–2020

UNICEF region and subregion	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
East Asia and Pacific	121	106	84	73	74	2.5	3.4	-1.5	39.0
Europe and Central Asia	27	20	16	13	13	3.5	5.0	-2.5	49.9
Eastern Europe and Central Asia	43	32	23	17	19	4.1	6.0	-3.5	56.0
Western Europe	9	8	7	6	6	1.8	2.5	-0.2	29.8
Latin America and Caribbean	90	85	79	75	88	0.2	1.2	-3.4	3.0
Middle East and North Africa	106	85	68	58	56	3.2	4.0	0.3	47.3
North America	12	13	14	17	20	-2.8	-2.5	-2.9	-73.3
South Asia	417	323	224	172	138	5.5	5.9	4.4	66.9
Sub-Saharan Africa	802	711	657	587	536	2.1	2.1	2.0	33.7
Eastern and Southern Africa	712	601	500	392	324	4.0	4.0	3.5	54.7
West and Central Africa	890	817	807	766	724	1.1	1.1	1.4	20.0
<b>World</b>	<b>339</b>	<b>296</b>	<b>254</b>	<b>227</b>	<b>223</b>	<b>2.1</b>	<b>2.7</b>	<b>0.0</b>	<b>34.3</b>

ARR: annual rate of reduction.

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

Countries in each UNICEF region are listed at: <https://data.unicef.org/regionalclassifications/>.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

# Annex 9.<sup>1</sup>

Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Population Fund (UNFPA) region, 2020

UNFPA region	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	PM point estimate (%)
	Lower UI	MMR point estimate	Upper UI			
Arab States	110	145	194	14 000	210	11.2
Asia and the Pacific	101	113	128	66 000	450	5.0
East and Southern Africa	313	360	441	72 000	61	15.1
Eastern Europe and Central Asia	19	21	25	810	2 200	1.4
Latin American and Caribbean	79	88	99	8 400	570	4.3
Non-UNFPA list <sup>d</sup>	11	12	14	1 500	5 500	0.6
West and Central Africa	625	750	986	125 000	27	22.2
<b>World</b>	<b>202</b>	<b>223</b>	<b>255</b>	<b>287 000</b>	<b>210</b>	<b>9.8</b>

PM: proportion of deaths among women of reproductive age (15–49 years) that are due to maternal causes (expressed as a percentage).

Countries in each UNFPA region are listed at: <https://www.unfpa.org/worldwide>.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>d</sup> The countries in this category are not included among the countries listed in UNFPA regions (i.e. they do not have UNFPA country offices/programmes): Australia, Austria, Bahrain, Belgium, Brunei Darussalam, Bulgaria, Canada, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, Faroe Islands, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Puerto Rico, Qatar, Republic of Korea, Romania, Russian Federation, Saudi Arabia, Seychelles, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

# Annex 10.<sup>1</sup>

## Trends in estimates of maternal mortality ratio (MMR), by UNFPA region, 2000–2020

UNFPA region	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
Arab States	260	226	182	151	145	3.0	3.6	1.0	44.6
Asia and the Pacific	292	230	162	127	113	4.8	5.6	1.9	61.4
East and Southern Africa	697	595	509	420	360	3.3	3.4	2.7	48.3
Eastern Europe and Central Asia	40	32	26	21	21	3.1	4.3	-1.3	46.5
Latin American and Caribbean	90	85	79	75	88	0.2	1.2	-3.4	3.0
Non-UNFPA list <sup>b</sup>	16	13	11	11	12	1.3	2.6	-3.2	22.2
West and Central Africa	930	850	847	799	750	1.2	1.2	1.6	21.5
<b>World</b>	<b>339</b>	<b>296</b>	<b>254</b>	<b>227</b>	<b>223</b>	<b>2.1</b>	<b>2.7</b>	<b>0.0</b>	<b>34.3</b>

ARR: annual rate of reduction.

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

Countries in each UNFPA region are listed at: <https://www.unfpa.org/worldwide>.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> The countries in this category are not included among the countries listed in UNFPA regions (i.e. they do not have UNFPA country offices/programmes): Australia, Austria, Bahrain, Belgium, Brunei Darussalam, Bulgaria, Canada, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, Faroe Islands, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Puerto Rico, Qatar, Republic of Korea, Romania, Russian Federation, Saudi Arabia, Seychelles, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

# Annex 11.<sup>1</sup>

Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by World Bank Group region and income group, 2020

World Bank Group region and income group	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	PM point estimate (%)
	Lower UI	MMR point estimate	Upper UI			
<b>Region</b>						
East Asia and Pacific	63	74	92	18 000	840	3.3
Europe and Central Asia	12	13	15	1 300	4 500	0.7
Latin America and the Caribbean	79	88	99	8 400	580	4.3
Middle East and North Africa	46	56	71	5 300	660	4.7
North America	16	20	26	810	2 900	0.9
South Asia	122	138	160	47 000	320	6.3
Sub-Saharan Africa	470	536	640	206 000	41	19.3
<b>Income group<sup>d</sup></b>						
Low income	378	430	505	99 000	49	20.5
Lower middle income	223	255	313	173 000	160	10.3
Upper middle income	41	44	48	12 000	1 400	2.0
High income	11	12	14	1 400	5 300	0.8
<b>World</b>	<b>202</b>	<b>223</b>	<b>255</b>	<b>287 000</b>	<b>210</b>	<b>9.8</b>

PM: proportion of deaths among women of reproductive age (15–49 years) that are due to maternal causes (expressed as a percentage).

Countries in each World Bank Group region are listed at: <https://www.worldbank.org/en/where-we-work>.

Countries in each World Bank Group region and income group are listed at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>d</sup> World Bank income classification data is not available for the Bolivarian Republic of Venezuela, which is therefore excluded from the income groups.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

# Annex 12.<sup>1</sup>

## Trends in estimates of maternal mortality ratio (MMR), by World Bank Group region and income group, 2000–2020

World Bank Group region and income group	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
<b>Region</b>									
East Asia and Pacific	121	106	84	73	74	2.5	3.4	-1.5	39.0
Europe and Central Asia	27	20	16	13	13	3.5	5.0	-2.7	49.9
Latin America and the Caribbean	90	85	79	75	88	0.1	1.2	-3.5	2.8
Middle East and North Africa	108	86	68	59	56	3.2	4.0	0.2	47.4
North America	12	13	14	17	20	-2.8	-2.5	-2.9	-73.3
South Asia	417	323	224	172	138	5.5	5.9	4.4	66.9
Sub-Saharan Africa	802	711	658	587	536	2.1	2.1	2.0	33.7
<b>Income group<sup>b</sup></b>									
Low income	774	670	567	491	430	3.0	3.1	2.4	44.6
Lower middle income	430	363	309	272	255	2.6	3.1	1.5	41.0
Upper middle income	68	60	50	42	44	2.1	3.2	-3.6	34.7
High income	13	12	11	11	13	0.2	0.9	-1.8	3.0
<b>World</b>	<b>339</b>	<b>296</b>	<b>254</b>	<b>227</b>	<b>223</b>	<b>2.1</b>	<b>2.7</b>	<b>0.0</b>	<b>34.3</b>

ARR: annual rate of reduction.

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

Countries in each World Bank Group region are listed at: <https://www.worldbank.org/en/where-we-work>.

Countries in each World Bank Group region and income group are listed at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> World Bank income classification data is not available for the Bolivarian Republic of Venezuela, which is therefore excluded from the income groups.

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

# Annex 13.<sup>1</sup>

Estimates of maternal mortality ratio (MMR), number of maternal deaths, lifetime risk and proportion of deaths among women of reproductive age that are due to maternal causes (PM), by United Nations Department of Economic and Social Affairs, Population Division (UNDESA/Population Division) region and subregion, 2020

UNDESA/Population Division region and subregion	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	PM point estimate (%)
	Lower UI	MMR point estimate	Upper UI			
<b>Africa</b>	<b>428</b>	<b>488</b>	<b>581</b>	<b>208 000</b>	<b>48</b>	<b>18.7</b>
Eastern Africa	304	351	412	50 000	63	15.5
Middle Africa	430	539	742	39 000	32	23.9
Northern Africa	76	103	144	5 900	310	8.6
Southern Africa	131	157	186	2 200	240	3.1
Western Africa	616	754	1 024	111 000	27	21.9
<b>Asia</b>	<b>94</b>	<b>104</b>	<b>117</b>	<b>69 000</b>	<b>480</b>	<b>4.9</b>
Central Asia	20	24	29	3 300	3 100	1.1
Eastern Asia	21	25	30	440	1 200	1.8
South-Eastern Asia	109	134	176	15 000	340	5.3
Southern Asia	118	134	155	47 000	330	6.1
Western Asia	49	63	82	3 500	600	5.5
<b>Europe</b>	<b>7</b>	<b>8</b>	<b>10</b>	<b>570</b>	<b>8 200</b>	<b>0.4</b>
Eastern Europe	9	11	15	310	6 500	0.3
Northern Europe	7	8	10	89	7 100	0.6
Southern Europe	5	6	6	62	16 000	0.4
Western Europe	5	6	7	110	9 800	0.5
<b>Latin America and the Caribbean</b>	<b>79</b>	<b>88</b>	<b>99</b>	<b>8 400</b>	<b>580</b>	<b>4.3</b>
Caribbean	143	188	269	1 300	260	7.8
Central America	56	64	75	1 900	710	3.3
South America	76	86	100	5 200	610	4.3
<b>Northern America</b>	<b>16</b>	<b>20</b>	<b>26</b>	<b>810</b>	<b>2 900</b>	<b>0.9</b>
<b>Oceania</b>	<b>58</b>	<b>83</b>	<b>121</b>	<b>550</b>	<b>560</b>	<b>5.7</b>
Australia and New Zealand	3	4	4	13	16 000	0.5
Melanesia	121	176	262	530	170	7.8
Micronesia	44	80	140	5	400	4.5
Polynesia	46	82	162	6	300	5.7

<sup>1</sup> For countries included, refer to note "1" for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

UNDESA/Population Division region and subregion	MMR <sup>a</sup> point estimate and range of uncertainty interval (UI: 80%)			Number of maternal deaths <sup>b</sup>	Lifetime risk of maternal death <sup>c</sup> (1 in)	PM point estimate (%)
	Lower UI	MMR point estimate	Upper UI			
<b>Small Island Developing States<sup>d</sup></b>	<b>169</b>	<b>206</b>	<b>262</b>	<b>2 500</b>	<b>210</b>	<b>8.9</b>
<b>Land-Locked Developing Countries<sup>e</sup></b>	<b>323</b>	<b>368</b>	<b>430</b>	<b>59 000</b>	<b>67</b>	<b>17.4</b>
<b>Least developed countries<sup>f</sup></b>	<b>338</b>	<b>377</b>	<b>431</b>	<b>120 000</b>	<b>66</b>	<b>18.2</b>
<b>World</b>	<b>202</b>	<b>223</b>	<b>255</b>	<b>287 000</b>	<b>210</b>	<b>9.8</b>

PM: proportion of deaths among women of reproductive age (15–49 years) that are due to maternal causes (expressed as a percentage).

Countries in each UNDESA/Population Division region are listed at: <https://unstats.un.org/unsd/methodology/m49/> (select “Geographic regions” or “Other regions”).

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Numbers of maternal deaths have been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>c</sup> Lifetime risk has been rounded according to the following scheme: < 100 rounded to nearest 1; 100–999 rounded to nearest 10; 1000–9999 rounded to nearest 100; and ≥ 10 000 rounded to nearest 1000.

<sup>d</sup> Antigua and Barbuda, Bahamas, Barbados, Belize, Cabo Verde, Comoros, Cuba, Dominican Republic, Fiji, Grenada, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Mauritius, Micronesia (Federated States of), Papua New Guinea, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Seychelles, Singapore, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Vanuatu.

<sup>e</sup> Afghanistan, Armenia, Azerbaijan, Bhutan, Bolivia (Plurinational State of), Botswana, Burkina Faso, Burundi, Central African Republic, Eswatini, Ethiopia, Kazakhstan, Kyrgyzstan, Lao People’s Democratic Republic, Lesotho, Malawi, Mali, Mongolia, Nepal, Niger, Paraguay, Republic of Moldova, North Macedonia, Rwanda, South Sudan, Tajikistan, Turkmenistan, Uganda, Uzbekistan, Zambia, Zimbabwe.

<sup>f</sup> Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao People’s Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Timor-Leste, Togo, Uganda, United Republic of Tanzania, Vanuatu, Yemen, Zambia.

# Annex 14.<sup>1</sup>

## Trends in estimates of maternal mortality ratio (MMR), by UNDESA/Population Division region and subregion, 2000–2020

UNDESA/Population Division region and subregion	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
<b>Africa</b>	<b>728</b>	<b>645</b>	<b>593</b>	<b>526</b>	<b>487</b>	<b>2.5</b>	<b>2.2</b>	<b>1.7</b>	<b>33.5</b>
Eastern Africa	756	644	542	429	351	3.9	3.8	3.7	2.8
Middle Africa	795	691	632	573	539	2.0	2.3	0.9	34.3
Northern Africa	240	195	144	108	103	4.2	5.3	1.8	39.0
Southern Africa	219	258	277	183	157	1.6	1.2	0.8	66.9
Western Africa	928	853	850	807	755	1.2	1.1	1.7	39.0
<b>Asia</b>	<b>268</b>	<b>212</b>	<b>148</b>	<b>117</b>	<b>104</b>	<b>3.5</b>	<b>5.5</b>	<b>1.9</b>	<b>61.1</b>
Eastern Asia	57	44	33	26	24	4.2	5.1	-0.1	47.0
Central Asia	52	44	34	26	25	3.7	4.7	0.3	50.3
South-Eastern Asia	231	203	168	148	134	2.7	3.0	2.5	-73.3
Southern Asia	408	314	217	166	134	5.6	6.0	4.2	33.7
Western Asia	85	71	62	62	63	1.5	2.0	-1.1	50.3
<b>Europe</b>	<b>20</b>	<b>15</b>	<b>10</b>	<b>8</b>	<b>8</b>	<b>0.1</b>	<b>6.4</b>	<b>-3.8</b>	<b>58.3</b>
Eastern Europe	38	24	14	9	11	6.1	9.3	-7.9	-73.3
Northern Europe	11	10	9	8	8	1.2	2.2	-2.0	50.3
Southern Europe	9	7	6	6	5	2.5	2.6	-0.1	34.3
Western Europe	9	8	8	6	6	1.9	2.5	1.0	2.8
<b>Latin America and the Caribbean</b>	<b>90</b>	<b>85</b>	<b>79</b>	<b>75</b>	<b>88</b>	<b>3.2</b>	<b>1.2</b>	<b>-3.5</b>	<b>2.8</b>
Caribbean	180	175	191	192	188	-0.1	-0.4	0.7	34.3
Central America	74	70	63	60	64	0.6	1.3	-2.8	39.0
South America	88	82	74	70	86	0.1	1.6	-4.6	47.0
<b>Northern America</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>17</b>	<b>20</b>	<b>-2.8</b>	<b>-2.5</b>	<b>-2.9</b>	<b>-73.3</b>
<b>Oceania</b>	<b>120</b>	<b>125</b>	<b>114</b>	<b>88</b>	<b>83</b>	<b>5.5</b>	<b>2.2</b>	<b>1.5</b>	<b>32.3</b>
Australia and New Zealand	8	6	6	6	4	3.6	1.7	10.6	51.2
Melanesia	273	277	256	190	176	2.3	2.6	1.9	66.9
Micronesia	87	90	92	103	80	0.5	-1.1	5.7	33.7
Polynesia	85	78	77	73	82	0.2	1.1	-3.3	2.8

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

UNDESA/Population Division region and subregion	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
<b>Small island developing States<sup>b</sup></b>	<b>254</b>	<b>238</b>	<b>228</b>	<b>208</b>	<b>206</b>	<b>1.1</b>	<b>1.4</b>	<b>0.3</b>	<b>19.3</b>
<b>Land-locked developing countries<sup>c</sup></b>	<b>729</b>	<b>630</b>	<b>530</b>	<b>431</b>	<b>368</b>	<b>3.4</b>	<b>3.5</b>	<b>3.0</b>	<b>49.6</b>
<b>Least developed countries<sup>d</sup></b>	<b>715</b>	<b>610</b>	<b>524</b>	<b>439</b>	<b>377</b>	<b>3.2</b>	<b>3.3</b>	<b>2.8</b>	<b>47.4</b>
<b>World</b>	<b>339</b>	<b>296</b>	<b>254</b>	<b>227</b>	<b>223</b>	<b>2.1</b>	<b>2.7</b>	<b>&lt; 0.1</b>	<b>34.3</b>

ARR: annual rate of reduction.

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

Countries in each UNDESA/Population Division region are listed at: <https://unstats.un.org/unsd/methodology/m49/> (select “Geographic regions” or “Other regions”).

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Antigua and Barbuda, Bahamas, Barbados, Belize, Cabo Verde, Comoros, Cuba, Dominican Republic, Fiji, Grenada, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Mauritius, Micronesia (Federated States of), Papua New Guinea, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Seychelles, Singapore, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Vanuatu.

<sup>c</sup> Afghanistan, Armenia, Azerbaijan, Bhutan, Bolivia (Plurinational State of), Botswana, Burkina Faso, Burundi, Central African Republic, Eswatini, Ethiopia, Kazakhstan, Kyrgyzstan, Lao People’s Democratic Republic, Lesotho, Malawi, Mali, Mongolia, Nepal, Niger, Paraguay, Republic of Moldova, North Macedonia, Rwanda, South Sudan, Tajikistan, Turkmenistan, Uganda, Uzbekistan, Zambia, Zimbabwe.

<sup>d</sup> Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao People’s Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Timor-Leste, Togo, Uganda, United Republic of Tanzania, Vanuatu, Yemen, Zambia.

# Annex 15.<sup>1</sup>

Trends in estimates of maternal mortality ratio (MMR), by United Nations Sustainable Development Goal (SDG) region, subregion and other grouping, 2000–2020

SDG region and subregion	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
<b>Sub-Saharan Africa</b>	<b>807</b>	<b>716</b>	<b>668</b>	<b>598</b>	<b>545</b>	<b>2.0</b>	<b>2.1</b>	<b>1.9</b>	<b>33.1</b>
Eastern Africa	756	644	542	429	351	3.9	3.8	3.7	53.9
Middle Africa	795	691	632	573	539	2.0	2.3	0.9	33.0
Southern Africa	219	258	277	183	157	1.6	1.2	0.8	27.6
Western Africa	928	850	850	808	754	1.2	1.1	1.7	21.2
<b>Northern Africa and Western Asia</b>	<b>159</b>	<b>130</b>	<b>102</b>	<b>86</b>	<b>84</b>	<b>3.2</b>	<b>4.0</b>	<b>0.6</b>	<b>46.8</b>
Northern Africa	240	195	144	108	103	4.2	5.3	1.8	57.1
Western Asia	85	70	61	62	63	1.5	2.0	-1.0	25.2
<b>Central and Southern Asia</b>	<b>397</b>	<b>306</b>	<b>210</b>	<b>160</b>	<b>129</b>	<b>5.6</b>	<b>6.1</b>	<b>4.3</b>	<b>67.5</b>
Central Asia	52	44	34	26	25	3.7	4.7	0.3	52.6
Southern Asia	408	314	217	166	134	5.6	6.0	4.2	67.1
<b>Eastern and South-Eastern Asia</b>	<b>121</b>	<b>105</b>	<b>83</b>	<b>72</b>	<b>74</b>	<b>2.5</b>	<b>3.5</b>	<b>-1.5</b>	<b>39.3</b>
Eastern Asia	57	44	33	26	24	4.2	5.1	-0.1	57.2
South-Eastern Asia	231	203	168	148	134	2.7	3.0	2.5	41.8
<b>Latin America and the Caribbean</b>	<b>90</b>	<b>85</b>	<b>79</b>	<b>75</b>	<b>88</b>	<b>0.1</b>	<b>1.2</b>	<b>-3.5</b>	<b>2.8</b>
Caribbean	180	175	191	192	188	-0.1	-0.4	0.7	-3.0
Central America	74	70	63	60	64	0.6	1.3	-2.8	11.8
South America	88	82	74	70	86	0.1	1.6	-4.6	2.1
<b>Oceania (excluding Australia and New Zealand)</b>	<b>261</b>	<b>267</b>	<b>248</b>	<b>185</b>	<b>173</b>	<b>2.1</b>	<b>2.4</b>	<b>1.8</b>	<b>34.9</b>
Melanesia	273	277	256	190	176	2.3	2.6	1.9	36.6
Micronesia	87	90	92	103	80	0.5	-1.1	5.7	8.8
Polynesia	85	78	77	73	82	0.2	1.1	-3.3	4.9
<b>Australia and New Zealand</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>3.6</b>	<b>1.7</b>	<b>10.6</b>	<b>51.2</b>

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>

SDG region and subregion	MMR <sup>a</sup> point estimate					Average ARR in MMR between 2000 and 2020 (%)	Average ARR in MMR between 2000 and 2015 (%)	Average ARR in MMR between 2016 and 2020 (%)	Overall change in MMR between 2000 and 2020 (%)
	2000	2005	2010	2015	2020				
<b>Europe and Northern America</b>	<b>17</b>	<b>14</b>	<b>12</b>	<b>11</b>	<b>13</b>	<b>1.4</b>	<b>2.9</b>	<b>-3.8</b>	<b>24.4</b>
Eastern Europe	38	24	14	9	11	6.1	9.3	-7.9	70.5
Northern Europe	11	10	9	8	8	1.2	2.2	-2.0	21.8
Southern Europe	9	7	6	6	6	2.5	2.6	2.0	39.4
Western Europe	9	8	8	6	6	1.9	2.5	1.0	31.9
Northern America	12	13	14	17	20	-2.8	-2.5	-2.9	-73.3
<b>Small island developing States<sup>b</sup></b>	<b>254</b>	<b>238</b>	<b>228</b>	<b>208</b>	<b>206</b>	<b>1.1</b>	<b>1.4</b>	<b>0.3</b>	<b>19.3</b>
<b>Land-locked developing countries<sup>c</sup></b>	<b>729</b>	<b>630</b>	<b>530</b>	<b>431</b>	<b>368</b>	<b>3.4</b>	<b>3.5</b>	<b>3.0</b>	<b>49.6</b>
<b>Least developed countries<sup>d</sup></b>	<b>715</b>	<b>610</b>	<b>524</b>	<b>439</b>	<b>377</b>	<b>3.2</b>	<b>3.3</b>	<b>2.8</b>	<b>47.4</b>
<b>World</b>	<b>339</b>	<b>296</b>	<b>254</b>	<b>227</b>	<b>223</b>	<b>2.1</b>	<b>2.7</b>	<b>0.0</b>	<b>34.3</b>

ARR: annual rate of reduction.

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

Countries in each SDG region are listed at: <https://unstats.un.org/sdgs/indicators/regional-groups>.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Antigua and Barbuda, Bahamas, Barbados, Belize, Cabo Verde, Comoros, Cuba, Dominican Republic, Fiji, Grenada, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Mauritius, Micronesia (Federated States of), Papua New Guinea, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Seychelles, Singapore, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Vanuatu.

<sup>c</sup> Afghanistan, Armenia, Azerbaijan, Bhutan, Bolivia (Plurinational State of), Botswana, Burkina Faso, Burundi, Central African Republic, Eswatini, Ethiopia, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Lesotho, Malawi, Mali, Mongolia, Nepal, Niger, Paraguay, Republic of Moldova, North Macedonia, Rwanda, South Sudan, Tajikistan, Turkmenistan, Uganda, Uzbekistan, Zambia, Zimbabwe.

<sup>d</sup> Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao People's Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Timor-Leste, Togo, Uganda, United Republic of Tanzania, Vanuatu, Yemen, Zambia.

# Annex 16.<sup>1</sup>

## Trends in estimates of maternal mortality ratio (MMR), by country and territory, 2000–2020

Country and territory	MMR <sup>a</sup> point estimate					Overall change in MMR between 2000 and 2020 (%) <sup>b</sup>	Average annual rate of reduction <sup>c</sup> (ARR) point estimate and range of uncertainty interval on ARR between 2000 and 2020 (UI: 80%) (%)		
	2000	2005	2010	2015	2020		Lower UI	Point estimate	Upper UI
Afghanistan	1 346	1 103	899	776	620	52.9	0.4	3.8	6.4
Albania	14	11	9	7	8	42.7	-0.4	2.8	6.3
Algeria	159	144	112	89	78	51.1	0.6	3.6	6.2
Angola	860	550	367	274	222	73.9	4.9	6.7	8.7
Antigua and Barbuda	51	34	31	27	21	59.1	2.3	4.5	6.7
Argentina	72	63	55	39	45	37.0	1.3	2.3	3.3
Armenia	50	38	33	25	27	46.7	0.4	3.1	4.8
Australia	7	5	5	5	3	55.9	3.0	4.1	5.2
Austria	6	6	6	6	5	16.5	-1.6	0.9	3.1
Azerbaijan	56	44	33	29	41	27.0	-1.0	1.6	4.2
Bahamas	61	74	79	84	77	-25.0	-4.0	-1.1	0.9
Bahrain	24	21	20	16	16	34.1	1.1	2.1	3.3
Bangladesh	441	376	301	212	123	72.5	4.6	6.5	8.1
Barbados	48	43	53	49	39	17.4	-1.1	1.0	3.8
Belarus	24	11	3	1	1	95.5	13.0	15.5	18.1
Belgium	8	7	6	5	5	41.2	1.6	2.7	4.4
Belize	86	72	33	49	130	-51.3	-3.4	-2.1	-0.7
Benin	469	509	598	591	523	-9.9	-2.5	-0.5	0.9
Bhutan	305	186	117	74	60	79.5	6.7	7.9	10.3
Bolivia (Plurinational State of)	284	230	184	165	161	44.8	0.3	3.0	5.0
Bosnia and Herzegovina	16	11	8	7	6	62.6	3.3	4.9	7.2
Botswana	182	201	156	184	186	-1.5	-1.5	-0.1	1.4
Brazil	68	70	64	62	72	-5.4	-1.5	-0.3	0.9
Brunei Darussalam	50	46	42	45	44	6.5	-1.0	0.3	2.9
Bulgaria	22	14	10	8	7	67.8	3.6	5.7	8.0
Burkina Faso	506	417	357	295	264	47.9	1.3	3.3	5.4
Burundi	874	713	608	514	494	43.8	1.0	2.9	4.5
Cabo Verde	125	77	54	47	42	64.5	3.5	5.2	8.0
Cambodia	606	382	276	209	218	64.0	2.9	5.1	7.0
Cameroon	651	573	527	447	438	34.6	0.3	2.1	3.3

<sup>1</sup> For countries included, refer to note “1” for [Annex 4](#), and find lists of WHO Member States by region at: <https://www.who.int/countries/>.

Country and territory	MMR <sup>a</sup> point estimate					Overall change in MMR between 2000 and 2020 (%) <sup>b</sup>	Average annual rate of reduction <sup>c</sup> (ARR) point estimate and range of uncertainty interval on ARR between 2000 and 2020 (UI: 80%) (%)		
	2000	2005	2010	2015	2020		Lower UI	Point estimate	Upper UI
Canada	9	11	12	12	11	-17.6	-2.5	-0.8	0.6
Central African Republic	1 315	1 158	1 052	909	835	37.2	0.1	2.3	4.9
Chad	1 366	1 241	1 303	1 125	1 063	24.5	-1.0	1.4	2.7
Chile	33	27	23	16	15	53.9	2.9	3.9	4.8
China	58	46	33	26	23	60.1	3.8	4.6	5.8
Colombia	93	82	71	70	75	19.5	0.3	1.1	1.8
Comoros	456	360	316	261	217	52.7	1.4	3.7	5.8
Congo	660	488	389	360	282	58.3	2.0	4.4	6.1
Costa Rica	39	31	27	20	22	42.8	1.9	2.8	4.1
Côte d'Ivoire	473	540	604	530	480	-0.7	-2.0	<0.1	1.9
Croatia	11	9	7	6	5	56.3	2.4	4.1	6.0
Cuba	47	43	41	39	39	16.7	0.2	0.9	1.6
Cyprus	33	27	27	42	68	-107.0	-6.8	-3.6	-0.5
Czechia	8	5	4	4	3	57.4	2.4	4.3	6.5
Democratic People's Republic of Korea	186	122	130	108	107	43.3	0.3	2.8	5.4
Democratic Republic of the Congo	668	635	601	578	547	22.0	-2.1	1.2	2.7
Denmark	8	7	7	6	5	42.6	1.1	2.8	4.0
Djibouti	512	368	274	244	234	54.0	1.4	3.9	6.4
Dominican Republic	79	87	92	99	107	-36.0	-2.7	-1.5	-0.4
Ecuador	120	92	76	66	66	45.8	1.5	3.1	4.2
Egypt	79	58	38	24	17	79.0	6.0	7.8	9.6
El Salvador	49	35	36	44	43	12.2	-1.3	0.7	2.5
Equatorial Guinea	427	258	211	201	212	50.9	1.1	3.6	5.6
Eritrea	735	546	480	399	322	56.9	1.9	4.2	6.1
Estonia	25	13	8	6	5	79.0	5.2	7.8	10.7
Ethiopia	953	880	635	399	267	72.6	3.6	6.5	8.1
Fiji	49	45	42	39	38	21.2	-0.6	1.2	3.1
Finland	7	8	7	7	8	-12.4	-3.2	-0.6	1.8
France	9	9	9	8	8	16.0	-0.5	0.9	2.0
Gabon	249	239	193	212	227	8.9	-1.7	0.5	2.6
Gambia	778	718	620	535	458	40.2	0.9	2.6	4.6
Georgia	53	45	41	30	28	48.5	1.7	3.3	4.5
Germany	7	7	6	5	4	38.0	1.4	2.4	3.5
Ghana	499	390	337	286	263	46.5	1.5	3.1	5.1
Greece	4	3	3	5	8	-101.1	-6.2	-3.5	-0.9
Grenada	42	32	27	23	21	50.6	1.3	3.5	5.7
Guatemala	152	149	123	107	96	37.3	1.8	2.3	2.9
Guinea	971	846	741	649	553	43.9	0.9	2.9	4.3
Guinea-Bissau	1 300	977	795	713	725	46.0	0.3	3.1	4.8
Guyana	190	172	148	128	112	40.0	1.4	2.6	4.3
Haiti	400	363	403	391	350	14.2	-1.8	0.8	2.5

Country and territory	MMR <sup>a</sup> point estimate					Overall change in MMR between 2000 and 2020 (%) <sup>b</sup>	Average annual rate of reduction <sup>c</sup> (ARR) point estimate and range of uncertainty interval on ARR between 2000 and 2020 (UI: 80%) (%)		
	2000	2005	2010	2015	2020		Lower UI	Point estimate	Upper UI
Honduras	82	75	73	67	72	13.1	-0.7	0.7	1.8
Hungary	15	13	15	15	15	-3.1	-2.2	-0.2	1.9
Iceland	5	4	3	3	3	47.8	1.3	3.3	7.1
India	384	286	179	128	103	73.5	5.9	6.6	7.7
Indonesia	299	276	219	194	173	42.8	0.5	2.8	4.4
Iran (Islamic Republic of)	44	30	32	20	22	48.9	1.5	3.4	6.0
Iraq	117	116	115	102	76	36.0	-0.4	2.2	4.2
Ireland	10	9	7	6	5	53.8	2.1	3.9	5.0
Israel	9	4	3	3	3	66.7	3.4	5.5	7.6
Italy	10	8	7	7	5	54.3	2.7	3.9	5.4
Jamaica	83	86	88	97	99	-19.1	-2.0	-0.9	0.3
Japan	9	7	6	5	4	49.0	2.1	3.4	4.8
Jordan	64	58	47	46	41	34.5	0.4	2.1	4.6
Kazakhstan	56	36	20	13	13	76.3	5.5	7.2	8.8
Kenya	564	503	476	483	530	7.7	-1.5	0.4	2.0
Kiribati	116	118	131	121	76	34.6	-0.4	2.1	5.1
Kuwait	10	10	9	7	7	30.2	-0.5	1.8	3.2
Kyrgyzstan	87	83	72	61	50	43.0	0.7	2.8	4.2
Lao People's Democratic Republic	579	442	284	184	126	78.7	5.5	7.7	9.1
Latvia	32	28	25	22	18	43.4	0.7	2.8	4.4
Lebanon	32	25	18	19	21	36.8	0.6	2.3	3.5
Lesotho	545	563	1040	728	566	-2.2	-2.3	-0.1	1.7
Liberia	777	676	634	686	652	18.7	-1.0	1.0	2.3
Libya	57	50	57	71	72	-26.3	-3.8	-1.2	1.4
Lithuania	18	11	10	8	9	50.4	0.8	3.5	6.1
Luxembourg	9	11	8	7	6	33.0	-1.0	2.0	3.7
Madagascar	658	568	497	482	392	41.7	1.0	2.7	3.7
Malawi	573	347	513	445	381	33.8	0.2	2.1	4.0
Malaysia	40	32	25	22	21	47.0	1.5	3.2	4.1
Maldives	114	79	60	57	57	51.7	1.1	3.6	5.4
Mali	742	560	547	494	440	41.7	1.2	2.7	4.0
Malta	10	8	5	4	3	71.3	4.4	6.2	9.1
Mauritania	684	652	586	510	464	33.5	-0.1	2.0	3.7
Mauritius	52	48	55	57	84	-62.1	-4.4	-2.4	-0.4
Mexico	57	53	51	52	59	-6.2	-1.3	-0.3	1.1
Micronesia (Federated States of)	60	57	46	64	74	-23.3	-3.5	-1.0	1.7
Mongolia	158	94	65	47	39	75.0	5.1	6.9	8.9
Montenegro	11	10	7	6	6	40.9	0.3	2.6	5.5
Morocco	244	194	134	97	72	69.9	4.6	6.0	8.0
Mozambique	532	404	322	226	127	76.1	6.0	7.2	8.4
Myanmar	371	321	293	243	179	52.7	0.8	3.7	5.6

Country and territory	MMR <sup>a</sup> point estimate					Overall change in MMR between 2000 and 2020 (%) <sup>b</sup>	Average annual rate of reduction <sup>c</sup> (ARR) point estimate and range of uncertainty interval on ARR between 2000 and 2020 (UI: 80%) (%)		
	2000	2005	2010	2015	2020		Lower UI	Point estimate	Upper UI
Namibia	450	419	482	299	215	53.2	1.5	3.8	5.2
Nepal	504	380	349	252	174	66.5	2.6	5.5	7.0
Netherlands	13	10	6	5	4	66.8	3.9	5.5	7.3
New Zealand	11	10	10	9	7	35.8	1.1	2.2	4.1
Nicaragua	169	158	98	79	78	53.1	2.3	3.8	5.8
Niger	867	768	594	491	441	49.7	1.5	3.4	5.2
Nigeria	1 148	1 073	1 123	1 113	1 047	12.6	-2.3	0.7	1.9
Norway	6	6	4	2	2	70.8	3.5	6.1	8.9
Occupied Palestinian territory, including east Jerusalem <sup>d</sup>	62	54	43	26	20	67.3	3.2	5.6	8.1
Oman	20	20	18	15	17	14.4	-1.1	0.8	2.5
Pakistan	387	301	230	187	154	61.8	2.2	4.8	6.2
Panama	66	53	55	49	50	24.8	0.7	1.4	1.8
Papua New Guinea	312	314	289	208	192	39.7	0.3	2.5	4.3
Paraguay	148	127	100	80	71	51.9	2.5	3.7	5.3
Peru	113	97	76	65	69	39.4	1.6	2.5	3.4
Philippines	129	122	105	88	78	40.2	1.3	2.6	3.3
Poland	8	5	3	2	2	74.8	4.9	6.9	9.0
Portugal	11	9	10	10	12	-10.5	-2.9	-0.5	1.6
Puerto Rico	22	20	21	18	34	-55.9	-4.8	-2.2	-0.5
Qatar	28	19	10	7	8	71.4	4.8	6.3	9.1
Republic of Korea	16	12	8	6	8	47.7	2.7	3.2	4.2
Republic of Moldova	49	30	18	17	12	75.0	5.0	6.9	8.8
Romania	50	37	22	15	10	79.8	6.2	8.0	9.8
Russian Federation	52	31	17	10	14	73.6	4.6	6.7	8.7
Rwanda	1 007	533	386	312	259	74.3	4.4	6.8	8.7
Saint Lucia	87	82	73	80	73	16.8	-1.9	0.9	3.4
Samoa	75	62	62	58	59	20.7	-1.5	1.2	3.7
Sao Tome and Principe	179	160	160	139	146	17.6	-1.0	1.0	3.7
Saudi Arabia	22	17	15	16	16	22.9	<0.1	1.3	3.5
Senegal	638	519	450	321	261	60.7	2.4	4.7	5.8
Serbia <sup>e</sup>	18	16	14	13	10	42.9	0.8	2.8	4.7
Seychelles	44	15	8	5	3	92.5	10.0	13.0	16.0
Sierra Leone	1 682	1 327	837	588	443	74.4	4.7	6.8	8.0
Singapore	15	13	8	8	7	48.5	1.8	3.3	5.6
Slovakia	9	7	5	5	5	42.5	1.4	2.8	4.6
Slovenia	12	9	6	5	5	62.6	2.8	4.9	6.6
Solomon Islands	150	153	147	141	122	19.8	-1.3	1.1	3.2
Somalia	1 097	1 080	963	761	621	42.9	0.8	2.8	5.4
South Africa	173	221	219	141	127	25.5	0.6	1.5	2.9
South Sudan	1 687	1 332	1 060	1 225	1 223	29.4	-0.9	1.7	4.1
Spain	5	4	4	4	3	33.1	0.7	2.0	2.9

Country and territory	MMR <sup>a</sup> point estimate					Overall change in MMR between 2000 and 2020 (%) <sup>b</sup>	Average annual rate of reduction <sup>c</sup> (ARR) point estimate and range of uncertainty interval on ARR between 2000 and 2020 (UI: 80%) (%)		
	2000	2005	2010	2015	2020		Lower UI	Point estimate	Upper UI
Sri Lanka	61	44	37	30	29	52.7	2.4	3.7	4.8
Saint Vincent and the Grenadines	76	54	45	36	62	19.9	-1.0	1.1	3.0
Sudan	642	525	383	298	270	56.9	2.1	4.2	6.8
Suriname	278	190	138	125	96	65.4	3.4	5.3	7.7
Eswatini	588	678	672	338	240	61.0	1.8	4.7	6.4
Sweden	6	5	5	4	5	26.3	-0.4	1.5	2.9
Switzerland	8	9	8	6	7	7.5	-1.9	0.4	2.0
Syrian Arab Republic	34	23	21	30	30	14.6	-2.3	0.8	2.9
Tajikistan	68	44	32	20	17	75.2	4.0	7.0	10.0
United Republic of Tanzania	760	559	486	330	238	69.8	3.2	6.0	7.3
North Macedonia	12	9	6	5	3	75.4	4.0	7.0	10.8
Thailand	48	40	35	30	29	41.4	1.6	2.7	3.6
Timor-Leste	750	584	376	285	204	73.0	4.5	6.5	8.4
Togo	479	494	530	441	399	14.8	-0.7	0.8	3.2
Tonga	94	95	93	86	126	-32.7	-4.0	-1.4	1.1
Trinidad and Tobago	74	56	47	31	27	63.7	3.4	5.1	6.9
Tunisia	62	56	44	40	37	40.3	0.8	2.6	5.5
Turkiye	32	25	22	19	17	46.0	1.1	3.1	4.6
Turkmenistan	26	17	9	6	5	80.3	5.3	8.1	10.9
Uganda	461	435	372	319	284	38.7	-0.4	2.5	4.5
Ukraine	36	21	17	11	17	53.5	2.2	3.8	5.4
United Arab Emirates	22	13	9	9	9	57.0	2.3	4.2	6.4
United Kingdom of Great Britain and Northern Ireland	11	11	10	8	10	10.5	-0.6	0.6	1.7
United States of America	12	13	14	17	21	-77.9	-4.2	-2.9	-1.6
Uruguay	27	20	18	17	19	29.7	0.7	1.8	2.9
Uzbekistan	43	45	38	31	30	29.3	<0.1	1.7	3.4
Vanuatu	109	98	93	92	94	11.9	-1.8	0.6	3.2
Venezuela (Bolivarian Republic of)	92	95	112	126	259	-182.8	-7.3	-5.2	-3.4
Viet Nam	97	78	88	109	124	-28.0	-4.2	-1.2	1.7
Yemen	275	196	157	164	183	30.7	0.3	1.8	4.4
Zambia	419	309	268	166	135	68.9	3.6	5.8	7.0
Zimbabwe	388	533	618	408	357	5.7	-0.7	0.3	2.5

Negative numbers in the last four columns indicate increase in MMR, rather than reduction.

<sup>a</sup> MMR (maternal deaths per 100 000 live births) estimates have been rounded to the nearest 1.

<sup>b</sup> Overall percentage change (reduction) for the whole period since the first year of the millennium (from 1 January 2000).

<sup>c</sup> Average annual rate of reduction for the whole period from the first year of the millennium (1 January 2000).

<sup>d</sup> UNICEF, UNPFA, World Bank Group and UNDESA/Population Division refer to this territory as the State of Palestine.

<sup>e</sup> Data for Serbia do not include data for Kosovo (United Nations Security Council Resolution 1244 [1999]).



**For more information, please contact:**

**Department of Sexual and Reproductive Health and Research  
World Health Organization  
Avenue Appia 20  
CH-1211 Geneva 27  
Switzerland  
Email: [srhrp@who.int](mailto:srhrp@who.int)  
Website: [https://www.who.int/teams/sexual-and-reproductive-health-and-research-\(srh\)](https://www.who.int/teams/sexual-and-reproductive-health-and-research-(srh))**

