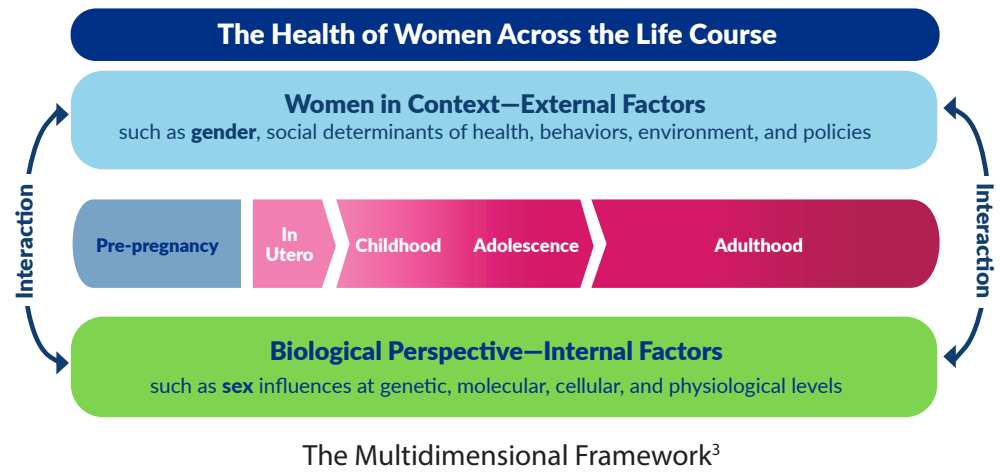




Maternal Morbidity and Mortality: What Do We Know? How Are We Addressing It?

Maternal health is defined as the health of women in the pregnancy and postpartum periods and can be influenced by pre-pregnancy health. The physical, emotional, and social changes that occur before, during, and well after the 40 weeks of gestation and the first year after childbirth can be exciting and joyful. But the physical demands of pregnancy are also intense, and complications during this period can reveal risk for the development of chronic disease in later life.¹ For example, women with early-onset hypertensive disorders of pregnancy have more than twice the risk of developing incident cardiovascular disease and more than a fourfold risk of developing incident hypertension.² During pregnancy and over the life course, the health of women can be understood using a multidimensional framework that incorporates the intersection of multiple biological factors (e.g., hormones and genetics) in the context of a woman's life (e.g., environment and policies).³ This approach is critical to improving maternal health outcomes, such as maternal morbidity and mortality (MMM), and addressing disparities.



Definitions

The Centers for Disease Control and Prevention (CDC) defines “**pregnancy-associated death**” as a death during or within one year of pregnancy, regardless of the cause. These deaths make up the universe of maternal mortality; within that universe are pregnancy-related deaths and pregnancy-associated, but not related deaths.”⁴

The CDC’s Pregnancy Mortality Surveillance System uses the term “**pregnancy-related death**” and defines it as “the death of a woman while pregnant or within 1 year of the end of a pregnancy—regardless of the outcome, duration, or site of the pregnancy—from any cause related to

or aggravated by the pregnancy or its management,” but not from an accidental or incidental cause.”⁵

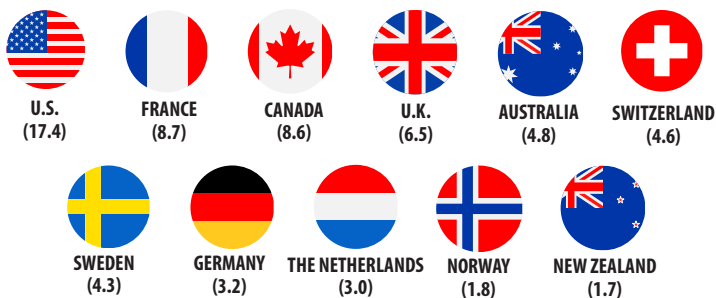
WHO defines **maternal morbidity** as “any health condition attributed to and/or aggravated by pregnancy and childbirth that has a negative impact on the woman’s wellbeing.”⁶

CDC defines **severe maternal morbidity (SMM)** as including “unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman’s health.”⁷

Maternal Mortality in the United States

Maternal Mortality in 11 High-Income Countries

Maternal mortality ratio (deaths per 100,000 live births), 2018 or the latest year for which data were available

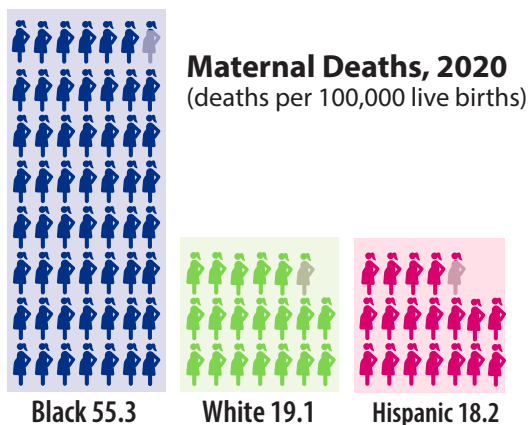


Source: Tikkanen, 2020⁸

In 2020, there were 861 maternal deaths in the United States, for an overall maternity mortality rate of 23.8 deaths per 100,000 live births, a significantly higher rate than in 2019.⁹ The U.S. maternal mortality rate is much higher than those of peer countries.⁸

Maternal mortality in the United States is characterized by marked racial and ethnic disparities.

In 2020, the maternal mortality rate for non-Hispanic Black women was 55.3 deaths per 100,000 live births, 2.9 times higher than the rate for non-Hispanic White women (19.1) and over three times higher than the rate for Hispanic women (18.2).⁹



Source: Hoyert, 2022⁹

What Factors Influence MMM?

Pre-pregnancy Health: The prevalence of pre-existing health conditions prior to pregnancy increased between 2015 and 2018, according to an analysis of data from commercially insured women ages 18–44. Increases occurred in the prevalence of depression (by 35%) and the incidences of hypertension and type 2 diabetes (by 31% and 28%, respectively). The rate of obesity doubled.¹⁴

Maternal Mental Health: Perinatal depression can affect women during pregnancy and after childbirth—with 1 in 8 women experiencing symptoms after delivery.¹⁵ It is treatable with talk therapy, medications, or a combination of the two.¹⁶

Opioid Use, Overdose, and Suicide: The number of mothers with opioid-related diagnoses documented at delivery increased by 131% between 2010 and 2017.¹⁷ Mental health conditions—including deaths by suicide, overdose, and unintentional injuries linked to these conditions—were the leading cause of pregnancy-related deaths among White women. About 15% of pregnancy-related deaths among White women were caused by mental health conditions.¹⁸

Prenatal Care: In 2019, 76.7% of pregnant women received early and adequate prenatal care.¹⁹ However, women who do not receive prenatal care are three to four times more likely to die from pregnancy-related complications.²⁰

The Right Level of Care: Regionalized systems of care—involving States, regional facilities, and providers—can reduce maternal morbidity and mortality.²¹

Are Pregnancy-Related Deaths Preventable?

An estimated 60% of maternal deaths are preventable.²² Understanding the complex social and economic determinants of health that contribute to maternal death is key in reducing poor maternal health outcomes.²³

Severe Maternal Morbidity in the United States

SMM is an important risk factor for maternal death¹⁰. Indicators of SMM include acute myocardial infarction, adult respiratory distress syndrome, cardiac arrest, eclampsia, heart attack, acute renal failure, heart failure, sepsis, blood transfusion, and many more.⁷ Research shows that 73.5% of SMM cases occur in the first 2 weeks after discharge from the hospital.¹¹ In 2014, SMM affected more than 50,000 women in the United States. In the past decade, rates of SMM have nearly doubled.⁷

Does SMM Affect Hospital Readmission?

Among women who gave birth in 2016–2017, women who experienced any indicator of SMM were 57% more likely to be readmitted within 7 days and 69% more likely to be readmitted 8 to 42 days after delivery.¹² For women with and without SMM, the most common reasons for readmission were obstetric complications and infections.

Who Is Most Affected by SMM?

From 2012 to 2015, compared with White women, the incidence of SMM was:¹³

- 166% higher for Black women
- 148% higher for American Indian/Alaska Native women
- 122% higher for Hispanic women
- 117% higher for Asian/Pacific Islander women



NIH's Investment in Maternal Health

NIH is investing resources in maternal health research and initiatives across its Institutes and Centers (ICs) and the Office of the Director (OD) to study different aspects of MMM, with many projects leveraging the expertise of NIH research networks. NIH-wide maternal health activities focus on leading causes of maternal mortality in the U.S. (e.g., cardiovascular disease, infection, and immunity), contributing health conditions and social factors, and pregnancy-related complications. For example, projects are determining how maternal glucose levels throughout pregnancy affect risk for gestational diabetes mellitus and

infant outcomes, evaluating strategies for treating hypertension during pregnancy, identifying the mechanisms underlying adverse outcomes (e.g., preterm birth, preeclampsia, fetal growth restriction, and stillbirth), and assessing disparities in maternity care and characteristics associated with high and low rates of SMM. These are a few examples of NIH investments in comprehensive and interdisciplinary research efforts and its commitment to reducing poor maternal health outcomes for underserved and underfunded areas.

NIH Maternal Morbidity and Mortality Research by Topic, FY 2020



Source: NIH Portfolio Visualization (PVIZ) Module²⁴

Note: The NIH Office of Research on Women's Health graphic identifier shown in the bottom right corner is not a part of the PVIZ module clusters.

In FY 2020, NIH invested \$223,522,448 in support of MMM research. Using the NIH Research, Condition, and Disease Categorization (RCDC) data system and its Portfolio Visualization (PVIZ) module reveals a wide array of topic areas pursued in research projects focused on MMM. This figure includes NIH-funded MMM awards and classifies the projects into various primary clusters by topics. These topics are not mutually exclusive, and individual research projects can fit into multiple areas.

The majority of the MMM awards addressed research related to maternal mortality, maternal health, premature birth, gestational diabetes, pregnancy complications, and postpartum conditions. These scientific inquiries included basic science research, disease assessments, mental health studies, and behavioral and social determinants of health. Cross-cutting themes in the individual projects—such as the effects of SARS-CoV-2 on pregnancy, minority health, health disparities, and maternal care equity—contributed valuable insights into ways to reduce MMM.

For additional information on the primary cluster and sub-cluster categorization, please visit [here](#).

For more information about various initiatives of NIH, please visit the resources listed below. As this is not an exhaustive list, for additional maternal health-related information, please visit the [Maternal Morbidity and Mortality Web Portal](#)—an NIH resource highlighting NIH research efforts, key Federal resources, and a collection of other trustworthy, science-based resources relevant to maternal health across the lifespan, for scientists, researchers, consumers, and advocates.

Ongoing NIH Maternal Health Programs

[Addressing Racial Disparities in Maternal Mortality and Morbidity](#)

[Administrative Supplements for Research on Women's Health in the IDeA States](#)

[Advancing Clinical Trials in Neonatal Opioid Withdrawal Syndrome \(ACT NOW\)](#)

[Advancing Integrated Models \(AIM\) of Care to Improve Maternal Health Outcomes among Women Who Experience Persistent Disparities](#)

[Chronic Hypertension and Pregnancy \(CHAP\) Project](#)

[Early Intervention to Promote Cardiovascular Health of Mothers and Children \(ENRICH\)](#)

[Glycemic Observation and Metabolic Outcomes in Mothers and Offspring \(GO MOMs\)](#)

[Human Placenta Project](#)

[Implementing a Maternal health and PRenancy Outcomes Vision for Everyone \(IMPROVE\)](#)

[International Maternal, Pediatric, Adolescent AIDS Clinical Trials \(IMPAACT\) Network](#)

[Maternal And Developmental Risks from Environmental and Social Stressors \(MADRES\)](#)

[Maternal and Infant Environmental Health Riskscape \(MIEHR\) Research Center](#)

[Maternal and Pediatric Precision in Therapeutics \(MPRINT\) Hub](#)

[Maternal-Fetal Medicine Units \(MFMU\) Network](#)

[Medication Treatment for Opioid Use Disorder in Expectant Mothers \(MOMs\)](#)

[Mobile Health: Technology and Outcomes in Low and Middle Income Countries \(mHealth\)](#)

[MOMI-VAX](#)

[Notice of Special Interest \(NOSI\): Small Business Initiatives for Innovative Diagnostic Technology for Improving Outcomes for Maternal Health](#)

[Nulliparous Pregnancy Outcomes Study-Monitoring Mothers-to-Be \(nuMoM2b\) Heart Health Study](#)

[Pregnancy as a Vulnerable Time Period for Women's Health](#)

[PregSource](#)

[Reproductive Endocrine Related Mood Disorders Differential Sensitivity \(Postpartum Depression\)](#)

[Research on the Health of Women of Understudied, Underrepresented and Underreported \(U3\) Populations](#)

[Study of Pregnancy And Neonatal health \(SPAN\)](#)

[Surveillance Monitoring for ART Toxicities \(SMARTT\)](#)

[Task Force on Research Specific to Pregnant Women and Lactating Women \(PRGLAC\)](#)

[Women's Health Centers of Biomedical Research Excellence \(COBRE\)](#)

References

- Williams, 2003. PubMed ID: [14624211](#).
- Grandi et al., 2018. PubMed ID: [29950283](#).
- National Institutes of Health, 2019. [Advancing Science for the Health of Women: The Trans-NIH Strategic Plan for Women's Health Research](#).
- Review to Action. [Definitions](#).
- Centers for Disease Control and Prevention, 2020. [Pregnancy Mortality Surveillance System](#).
- Firoz et al., 2013. PubMed ID: [24115804](#).
- Centers for Disease Control and Prevention, 2021. [Severe Maternal Morbidity in the United States](#).
- Tikkanen et al., 2020. [Maternal mortality and maternity care in the United States compared to 10 other developed countries](#).
- Hoyert, 2022. [Maternal mortality rates in the United States, 2020](#).
- Centers for Disease Control and Prevention, 2019. [Detailed Evaluation of Changes in Data Collection Methods](#).
- Chen et al., 2021. PubMed ID: [33528553](#).
- Matas et al., 2021. PubMed ID: [33738822](#).
- Admon et al., 2018. PubMed ID: [30303912](#).
- Blue Cross Blue Shield, The Health of America Report®, 2020. [Trends in pregnancy and childbirth complications in the U.S.](#)
- Centers for Disease Control and Prevention, 2020. [Identifying Maternal Depression](#).
- National Institutes of Mental Health, 2020. [Perinatal Depression](#).
- Hirai et al., 2021. PubMed ID: [33433576](#).
- Davis et al., 2019. [Pregnancy-related deaths: Data from 14 U.S. maternal mortality review committees, 2008-2017](#).
- U.S. Department of Health and Human Services, 2020. [Healthy People 2030 \(MICH-08\)](#).
- Chang et al., 2003. PubMed ID: [12825542](#).
- American Association of Birth Centers, et al., 2019. PubMed ID: [31351999](#).
- Petersen et al., 2019. PubMed ID: [31071074](#).
- Crear-Perry et al., 2021. PubMed ID: [33181043](#).
- NIH Research, Condition, and Disease Categorization (RCDC) Database, Portfolio Visualization (PVIZ) Module.



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