DATA BRIEF
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Severe Maternal Morbidity in the United States: A Primer

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INTRODUCTION

Maternal mortality rates are a key indicator of the health and well-being of a society. Yet this measure does not capture everything related to maternal health and well-being. It is also crucial to track:

- "Near miss" events that could have resulted in death.
- Severe maternal morbidity, defined by the U.S. Centers for Disease Control and Prevention as "unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman's health."
- Serious illnesses that occur during pregnancy, like ectopic pregnancy, and the postpartum period, like cardiomyopathy.

A richer understanding of maternal health before, during, and after childbirth is a foundation for developing safer, more effective approaches to maternal care. While maternal deaths in the United States number about 650 to 750 annually, severe maternal morbidity affects approximately 50,000 to 60,000 women each year, and the numbers are increasing. As with maternal deaths, many cases of maternal morbidity can be avoided.

This report describes the severity and breadth of the maternal morbidity crisis in the U.S. and shows why addressing it is critical to advancing maternal health equity. A companion to Maternal Mortality in the United States: A Primer, it is the latest in a series of Commonwealth Fund publications investigating the causes of poor maternal outcomes — including stark racial inequities — and identifying potential solutions.

HIGHLIGHTS

- Maternal morbidity is emerging as an important measure in efforts to prevent maternal mortality and address maternal health inequities.
- Each year, as many as 60,000 U.S. women are affected by severe maternal morbidity — unexpected outcomes of labor or delivery that have serious short- or long-term health impacts. In most instances, these outcomes could have been avoided with timely, appropriate care.
- Broadening the definition of severe maternal morbidity to also encompass serious illnesses during pregnancy and postpartum reveals the broader scope of the problem as well as the need for further measurement efforts and policy intervention.

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The U.S. Centers for Disease Control and Prevention (CDC) and the American College of Obstetricians and Gynecologists (ACOG) have offered detailed recommendations for monitoring and review of severe pregnancy and delivery complications. Both recommend facility-level, multidisciplinary review of all cases using a two-factor scoring system that identifies severe maternal morbidity by: 1) admission to the intensive care unit (ICU) and/or 2) transfusion of four or more units of blood products at any time from conception through 42 days postpartum. The scoring system, developed by Stacie Geller and colleagues, has been validated and can be used in real time in hospital settings, unlike administrative datasets currently used for population-level surveillance. To date, severe maternal morbidity reviews remain rare, having been implemented in individual facilities in California, and Illinois recently piloted a statewide operation through its regionalized perinatal system. In the future, severe morbidity reviews may increase as more hospital systems assess their experience with severe morbidity and states expand the scope of their maternal mortality reviews.

We recognize that not all people who become pregnant and give birth identify as women. While we use the gender-inclusive term "birthing people" as much as possible, we use "woman," "women," and "maternal" to conform with the language in externally published research findings.

WHAT DO WE MEAN BY MATERNAL MORBIDITY?

Measuring severe maternal morbidity is challenging. It requires addressing not only the impact of comorbidities — whether a particular health problem results from pregnancy or from, say, a chronic health condition — but also the effects of discrimination, racism, and access to health care (see Figure B on page 12 of the National Quality Forum report). Researchers and others must also establish reliable ways to capture data on maternal health conditions across different measurement systems and care settings. Finally, they need to consider conditions that manifest during pregnancy or postpartum, not just during the birth event.

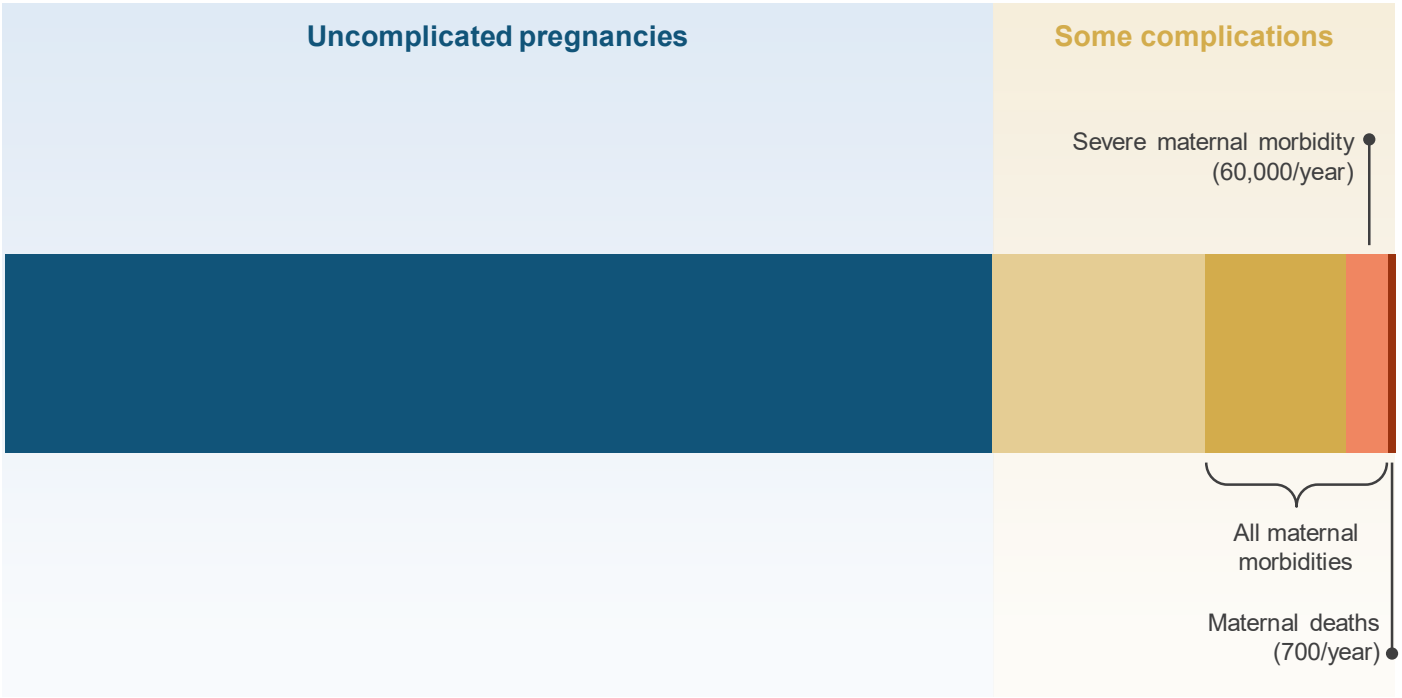
There are several levels of maternal morbidity. In decreasing order of severity, they are:

Near-miss maternal morbidity	Surviving a near-death event related to a complication during pregnancy or childbirth or within 42 days of the end of pregnancy (National Quality Forum)
Severe maternal morbidity	Unexpected outcomes of labor or delivery resulting in significant short- or long-term consequences to health (CDC)
Maternal morbidity	Unexpected health condition attributed to or complicating pregnancy and childbirth that has a negative impact on well-being or functioning (World Health Organization Working Group)

Traditionally a reliable measure meets multiple criteria, such as being clinically relevant, accurately detecting true cases of a condition, and being based on data that are reliably collected across multiple settings. In the U.S., the most common definition, developed by the CDC, is based on 21 indicators (16 diagnoses and five procedures) identified by an array of diagnostic codes assigned at the time of birth. This measure has the advantage of being easily applied to hospital discharge data either locally or in national datasets. Unfortunately, it may not capture illnesses or complications that manifest before or after the birth hospitalization, with past research finding between 14 percent and 22 percent additional new cases postpartum. Expanding this measure to include assessment of severe maternal morbidity after birth and into the postpartum period is important for obtaining a true picture of maternal morbidity and crafting appropriate interventions.

Serious maternal illnesses and complications are rare.

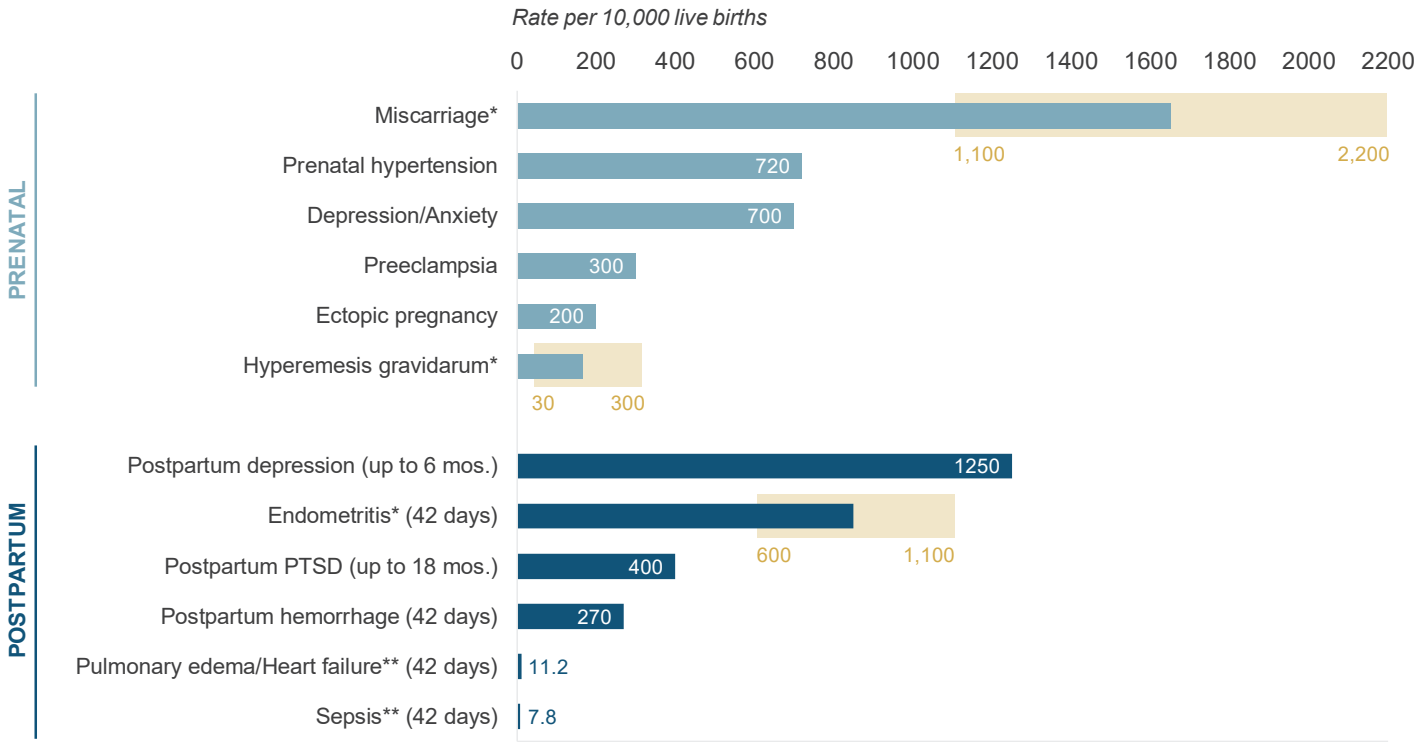
Rates of maternal illness and complication during pregnancy



Most pregnancies are uncomplicated and result in a healthy mother and baby. This exhibit illustrates the rarity of severe illness among the 3.7 million births in the U.S. annually.

Data: Adapted from Lale Say et al., "Maternal Morbidity Measurement Tool Pilot: Study Protocol," *Reproductive Health* 13, no. 69 (June 9, 2016).

Neither prenatal nor postpartum morbidities are included in estimates of severe maternal morbidity.



Notes: Miscarriage is defined as the spontaneous loss of a fetus before the 20th week of pregnancy. * Best-available estimates produce a range rather than a single rate. ** Among those on Medicaid.

Data: Miscarriage: https://pubmed.ncbi.nlm.nih.gov/22511535/; Prenatal hypertension: CDC Wonder; Depression/Anxiety: https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/depression-during-pregnancy/art-20237875; Preeclampsia: https://pubmed.ncbi.nlm.nih.gov/23973398/; Ectopic pregnancy: https://pubmed.ncbi.nlm.nih.gov/32412215/; Hyperemesis gravidarum: https://pubmed.ncbi.nlm.nih.gov/28641304/; Postpartum depression: https://www.cdc.gov/prams/prams-data/mch-indicators/states/pdf/2018/All-PRAMS-Sites-2016-2017_508.pdf; Endometriosis: https://pubmed.ncbi.nlm.nih.gov/29433350/; Postpartum PTSD: https://pubmed.ncbi.nlm.nih.gov/24952134/; Postpartum hemorrhage: https://pubmed.ncbi.nlm.nih.gov/28367647/; Pulmonary edema/Heart failure & Sepsis: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7856547/.

This exhibit depicts the prevalence of various conditions that can occur during pregnancy, childbirth, and the postpartum period. Because reporting of these rates is not based on a single study, the rates are not always comparable. The studies cited here drew from different data sources and focused on different populations; they also used slightly varying definitions of measures or time periods. For some conditions, including miscarriage, hyperemesis gravidarum (extreme, persistent nausea, and vomiting during pregnancy), and endometritis (inflammation of the inner lining of the uterus), prior analyses produced only a range of estimates.

Conditions such as gestational diabetes and hypertension, hyperemesis gravidarum, and prenatal depression are not typically life-threatening. But they occur frequently and affect hundreds of thousands of women each year. If these conditions are not monitored, they can have serious consequences for birthing people and their families.

About 1.4 percent of people giving birth in 2016–17 had at least one of the conditions or procedures that indicate severe maternal morbidity.

Indicators of severe maternal morbidity

DIAGNOSES

Heart
- Acute myocardial infarction (heart attack)
- Cardiac arrest/ventricular fibrillation
- Heart failure/arrest during surgery or procedure
- Pulmonary edema/acute heart failure

Lung
- Adult respiratory distress syndrome

Blood or blood vessel
- Air and thrombotic embolism
- Disseminated intravascular coagulation
- Amniotic fluid embolism
- Aneurysm
- Puerperal cerebrovascular disorders
- Eclampsia
- Sickle cell disease with crisis

Infection
- Sepsis

Kidney
- Acute renal failure

Other
- Shock
- Severe anesthesia complications

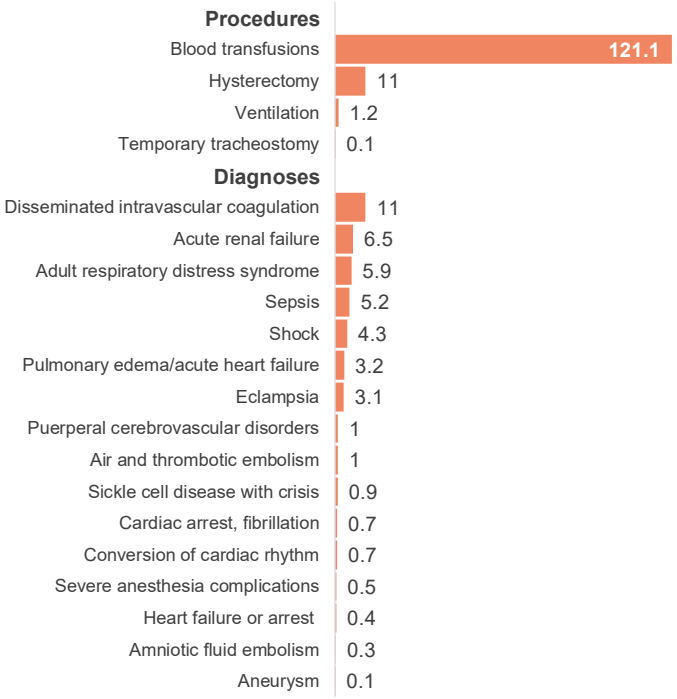
PROCEDURES

- Blood products transfusion
- Conversion of cardiac rhythm
- Hysterectomy
- Temporal tracheostomy
- Ventilation

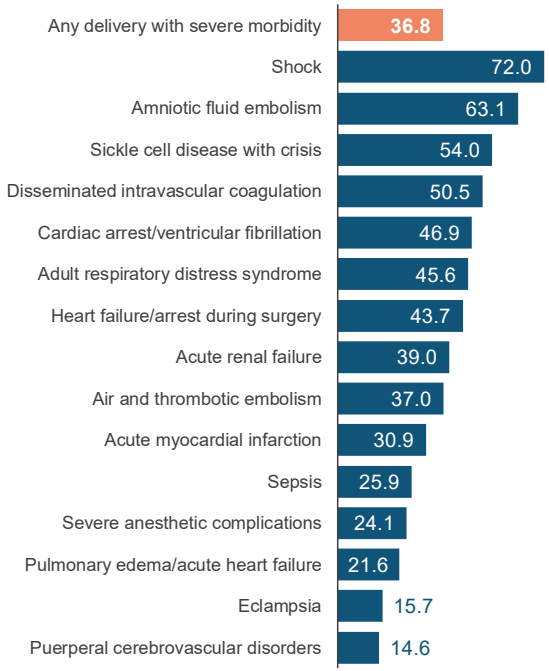
The CDC has identified 21 indicators (16 diagnoses and five procedures) drawn from hospital records at the time of childbirth, that make up the most widely used measure of severe maternal morbidity. Approximately 140 of 10,000 women (1.4%) giving birth in 2016–17 had at least one of those conditions or procedures. If that rate were applied to the 3.6 million U.S. births in 2020, the result would be approximately 50,500 women experiencing severe maternal morbidity every year.

Blood transfusions are the most common indication of severe maternal morbidity.

Severe maternal morbidity at birth, per 10,000 U.S. births, 2015



Percentage of deliveries involving blood transfusion among those with condition indicating severe maternal morbidity, 2015



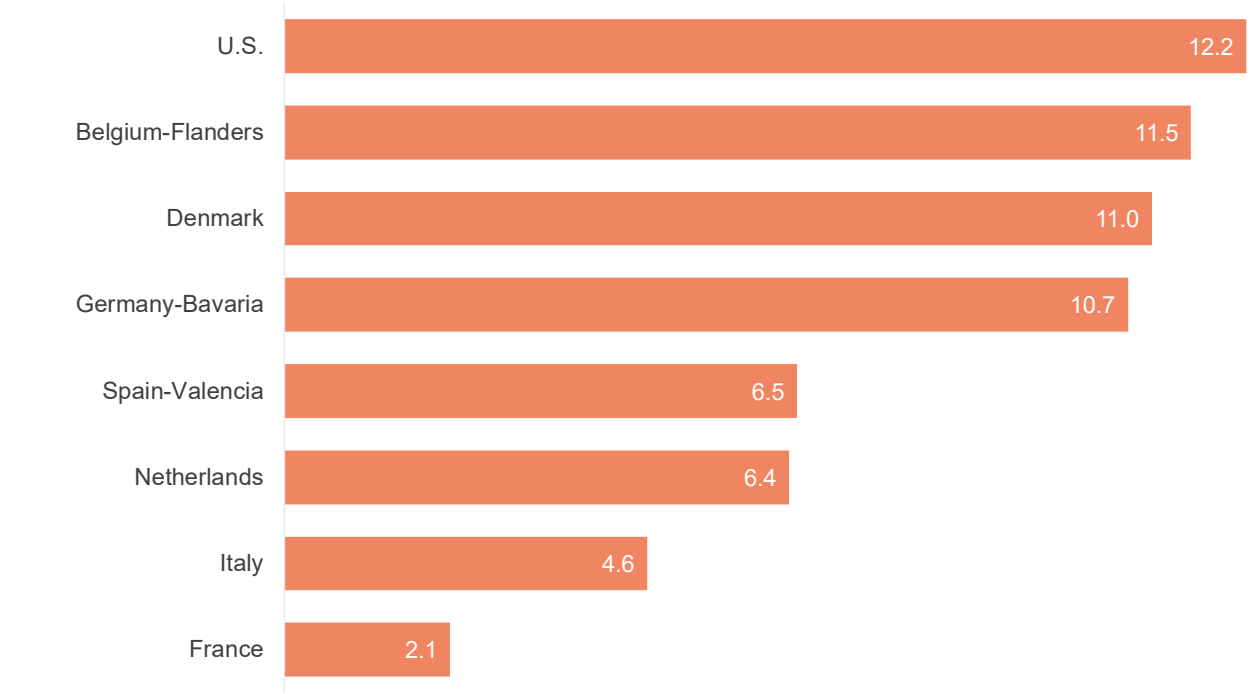
Blood transfusion is the most common marker of severe morbidity. If the rate shown here were applied to current births, transfusions would have occurred in approximately 37,000 births in 2020.

Transfusions have consistently been a significant component of severe maternal morbidity measures, in large part because the need for a transfusion distinguishes the severity of conditions that may otherwise not be considered life-threatening. Transfusions are recorded in more than half of cases of shock, amniotic fluid embolism, sickle cell disease with crisis, and disseminated intravascular coagulation. Overall, transfusions co-occur with more than a third of the conditions associated with severe morbidity. Over time, most of the increase in the severe maternal morbidity rate has come with an increase in blood loss requiring transfusions.

Data: Kathryn F. Fingar et al., *Trends and Disparities in Delivery Hospitalizations Involving Sever Maternal Morbidity, 2006–2015,* HCUP Statistical Brief #243 (Agency for Healthcare Research and Quality, Sept. 2018).

Blood transfusions during childbirth in the U.S. occur at a much higher rate than in many parts of Europe.

Transfusions per 1,000 births in selected high-income countries, 2010–14

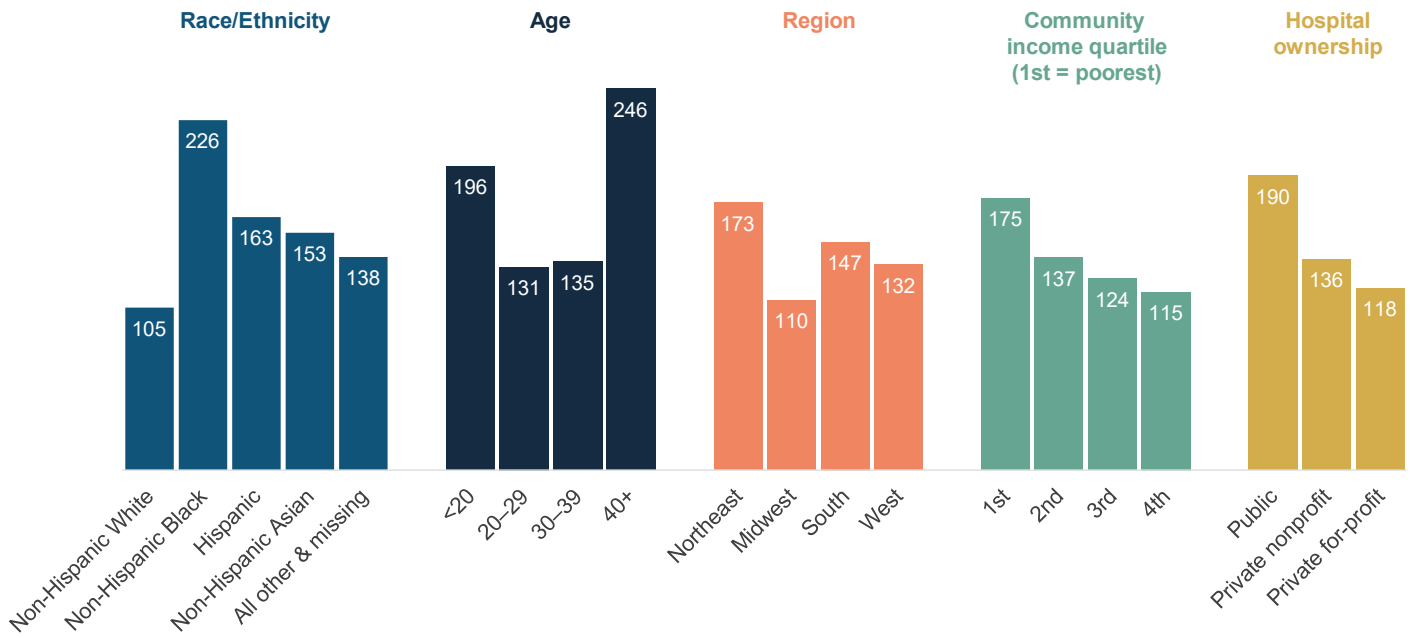


Comparative data on severe maternal morbidity across different countries are limited. However, we can compare blood transfusion rates during childbirth in the U.S. and selected European countries and regions. The U.S. reports the highest transfusion rate during childbirth among these countries.

Data: U.S.: Centers for Disease Control and Prevention, "How Does CDC Identify Severe Maternal Morbidity?," last updated Dec. 26, 2019; Other countries: Marie-Hélène Bouvier-Colle et al., "What About the Mothers? An Analysis of Maternal Mortality and Morbidity in Perinatal Health Surveillance Systems in Europe," *BJOG* 119, no. 7 (June 2012): 880–90.

There are strong relationships between severe maternal morbidity and race/ethnicity, age, region, community-level income, and hospital type.

Severe maternal morbidity per 10,000 births, 2016–17



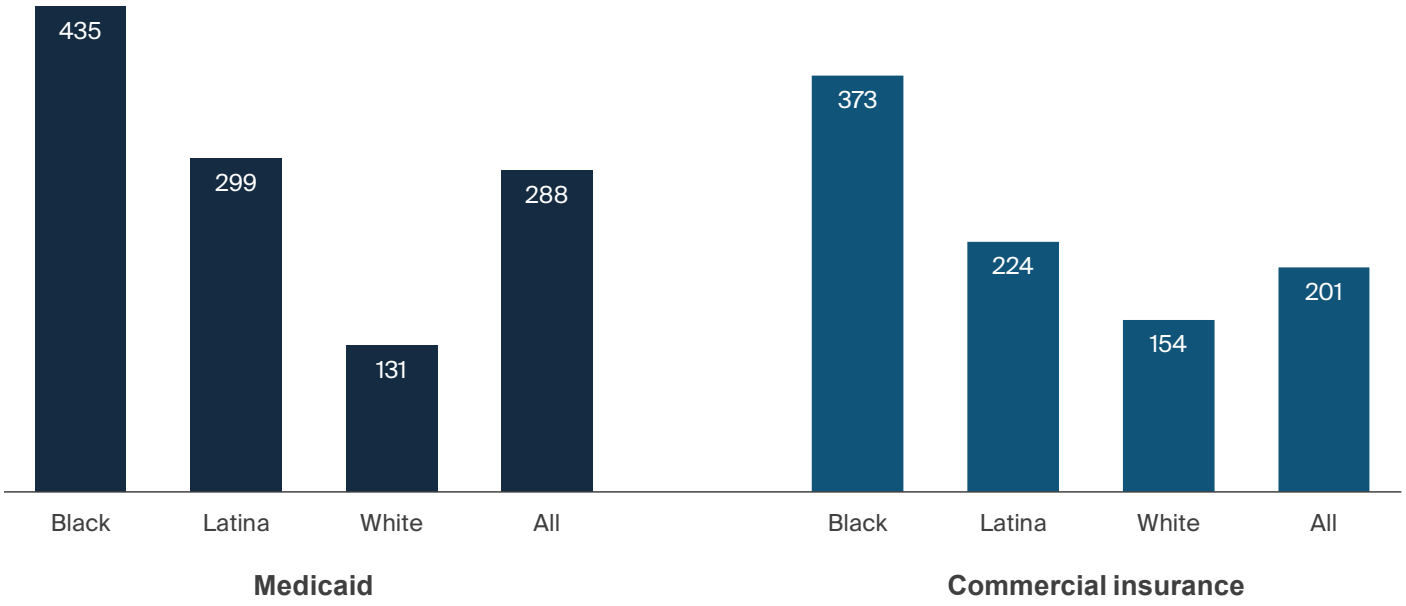
Data: Clare C. Brown et al., "Associations Between Comorbidities and Severe Maternal Morbidity," *Obstetrics and Gynecology* 136, no. 5 (Nov. 2020): 892–901.

Differences in severe maternal morbidity among races and ethnicities are particularly pronounced. Non-Hispanic Black mothers are more than twice as likely as non-Hispanic white mothers to experience severe maternal morbidity — comparable to the differences in maternal mortality rates between Black and white women.

Difference among age groups show peaks in the extremes, with a higher rate of severe illness among very young mothers, the lowest rate reported for mothers ages 25 to 29, and the highest rate for women age 40 and older. Rates of severe illness are also higher among women in the Northeast and South, those from lower-income communities, and those giving birth in public hospitals.

Racial inequities in severe maternal morbidity exist among both Medicaid and commercial insurance enrollees.

Severe maternal morbidity in New York City hospitals, per 10,000 births, by race/ethnicity and insurance type, 2010–14

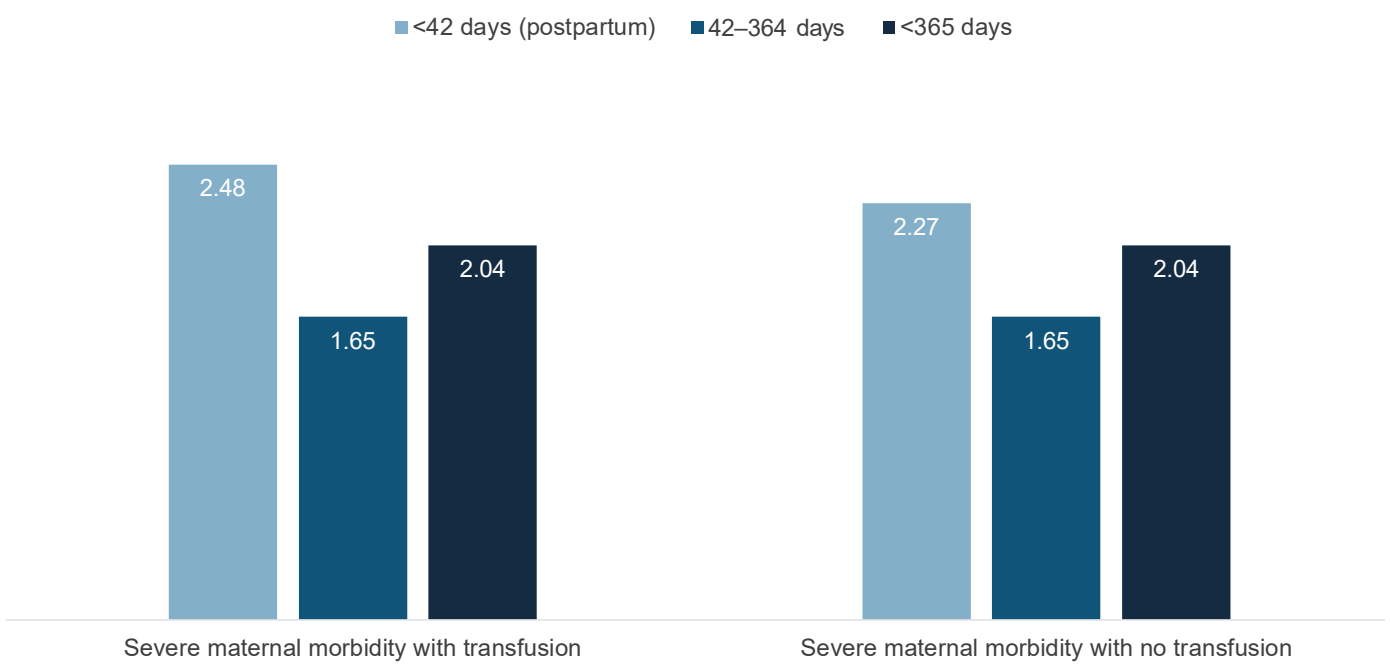


Data: Elizabeth A. Howell et al., "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities," *Obstetrics and Gynecology* 135, no. 2 (Feb. 2020): 285–93.

Combining data on women's race and type of health insurance reveals even more pronounced disparities. A study based on New York City hospital data found wide disparities in maternal morbidity between races. It also found disparate maternal morbidity rates among women with different types of insurance — and startling disparities when taking the two factors into consideration. Additional studies indicate that these inequities persist into the postpartum period.

Women who experience a severe maternal morbidity are much more likely to be readmitted to the hospital during the postpartum period than women who do not experience one.

Likelihood (risk ratio) of postpartum hospitalization with and without severe maternal morbidity, Massachusetts, 2002–11

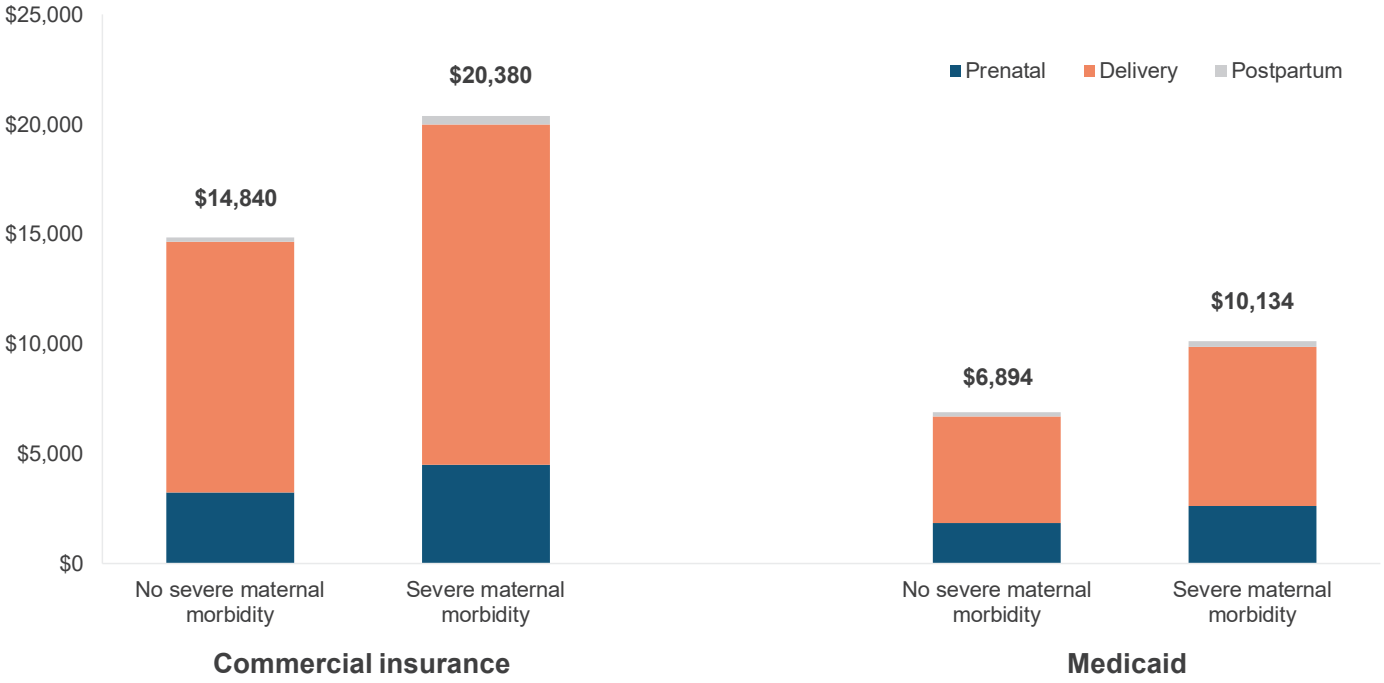


A study of Massachusetts women found the likelihood of returning to the hospital in the six weeks following birth was more than twice as high among women who experienced severe maternal morbidity, regardless of whether they had required a transfusion. This pattern held even after controlling for a wide range of possible factors, including race/ethnicity, pregnancy-related conditions, education, method of delivery, insurance status, and whether it was their first birth or not. The differences in rehospitalizations for women with severe maternal morbidity were smaller, but still pronounced between six weeks and one year after birth.

Data: Elizabeth M. Harvey et al., "Severe Maternal Morbidity at Delivery and Risk of Hospital Encounters Postpartum," *Journal of Women's Health* 27, no. 2 (Feb. 2018): 140–47.

Births that involve severe maternal morbidity are far more expensive than births that do not.

U.S. mean costs without and with severe maternal morbidity, by timing and insurance type, 2013



The much higher cost of births involving severe maternal morbidity is mostly because of expenses related to birth. During the prenatal and postpartum periods, births that involve severe maternal morbidity cost about 40 percent more than births that do not. This is true regardless of whether one has commercial insurance or Medicaid.

Data: Kimberly K. Vesco et al., "Costs of Severe Maternal Morbidity During Pregnancy in U.S. Commercially Insured and Medicaid Populations: An Observational Study," *Maternal and Child Health Journal* 24, no. 1 (Jan. 2020): 30–38.

DISCUSSION

An examination of severe maternal morbidity reveals the much broader scope of challenges associated with improving maternal health in the United States than does a focus on maternal mortality alone. For every maternal death, there are 70 to 80 cases of severe illness — and that includes only cases identified at the time of birth. And expanding the perspective to the prenatal and postpartum periods shows that problems run even deeper.

Many health conditions related to pregnancy, childbirth, and the postpartum period can be prevented with timely care. Yet for many birthing people, especially those of color and those with public health coverage, such care has not been readily available or affordable. Inconsistencies in coverage have been linked to gaps in perinatal care. Systems established to prevent severe maternal morbidities will have the added effect of reducing maternal deaths.

There is also a pressing need for more comprehensive and culturally appropriate maternal care at the community and hospital levels and more intentional focus on subdomains that incorporate the role of health equity and intervening in structural racism. A focus on a reproductive justice framework in clinical training and practice has been proposed as one approach to addressing long-standing inequities in our system. The goal is to address issues in women's health before pregnancy so they enter pregnancy healthier, begin prenatal care earlier, and are less likely to develop the conditions that lead to severe morbidity.

Policies that extend pregnancy-related coverage for a year after childbirth, a change made more feasible for state Medicaid programs since enactment of the American Rescue Plan, would also provide critical protection. Finally, the adoption of "high value" models of care, such as greater reliance on birth centers, midwifery care, and use of doulas, hold promise for improving maternal health outcomes.

Improving Measurement

Policies that promote more rigorous health equity measurement are also important. With funding from the Centers for Medicare and Medicaid Services (CMS), a National Quality Forum (NQF) committee assessed the state of maternal morbidity and mortality measurement and developed the following recommendations, among others:

- Use stratified measurement approaches focused on patient experience by race and ethnicity.
- Develop clear evidence-based screening protocols and monitor protocol compliance.
- Develop a quality dashboard to share data and report family experiences in a transparent manner.
- Track outcomes of uninsured populations and the impact of Medicaid eligibility expansion on outcomes.

To accelerate measurement related to reducing severe maternal morbidity, CMS adopted two new maternal morbidity structural measures (effective October 2, 2021). To report on these measures, hospitals will respond annually to a two-part question:

1. Does your hospital or health system participate in a statewide and/or national perinatal quality improvement collaborative program aimed at improving maternal outcomes during inpatient labor, delivery and postpartum care?

2. Has your hospital implemented patient safety practices or bundles related to maternal morbidity to address complications, including, but not limited to, hemorrhage, severe hypertension/preeclampsia or sepsis?

HOW WE CONDUCTED THIS STUDY

These exhibits are based on data from a wide range of sources. There is no single international standard for the measurement of severe maternal morbidity (SMM), but within the U.S. an algorithm developed by the Centers for Disease Control and Prevention (CDC) is most widely used in large part because it is relatively easy to apply to a wide range of datasets. As a result, many researchers have used it as a foundation for studies of different aspects of severe maternal morbidity and these various studies are the foundation for this primer. Of particular importance were recent studies from Brown et al. looking at SMM nationally for 2016–17 and Fingar et al. examining national data from 2015 on SMM. Because there isn't comprehensive, national reporting on the frequency of conditions manifested during pregnancy and in the postpartum period, rates of such conditions were identified from individual studies. Since these studies involved different datasets and periods, the findings are not necessarily comparable. However, they do provide an overview of the prevalence of these conditions.

We are grateful to those researchers who compiled the studies and to Ebere Obaraeke who assisted with the collection and presentation of these data.

ABOUT THE AUTHORS

Eugene Declercq, Ph.D., M.B.A., is a professor of community health sciences at the Boston University School of Public Health and professor on the faculty of Obstetrics and Gynecology at the Boston University School of Medicine. His current research focuses primarily on maternal mortality and morbidity. He is part of the team that has produced six reports on women's experiences in childbirth, Listening to Mothers. Declercq is a current member of the Massachusetts Maternal Mortality Review Committee and is on the board of March for Moms. He is the founder of the website www.birthbythenumbers.org, where additional data on maternal mortality and other maternal and infant health outcomes can be found. Declercq has Ph.D. and M.S. degrees from Florida State University and an M.B.A. from University of Massachusetts at Amherst.

Laurie Zephyrin, M.D., M.P.H., M.B.A., is vice president for Health System Equity at the Commonwealth Fund. She has extensive experience leading the vision, design, and delivery of innovative health care models across national health systems. From 2009–2018, Zephyrin was the first national director of the Reproductive Health Program at the Department of Veterans Affairs. In 2016–2017, she served as acting assistant deputy under secretary for Health for Community Care, and later in 2017, as acting deputy under secretary for Health for Community Care. While directing the VA's Community Care program, she spearheaded efforts to implement legislation, develop internal governance structures, and address patient outcomes through systemwide optimization of care delivery. Zephyrin is a board-certified clinician. She is a clinical assistant professor of Obstetrics and Gynecology at NYU Langone School of Medicine (2013–present) and was previously an assistant professor at Columbia University, College of Physicians and Surgeons (2007–2012). She earned her M.D. from the New York University School of Medicine, M.B.A. and M.P.H. from Johns Hopkins University, and B.S. in Biomedical Sciences from the City College of New York. She completed her residency training at Harvard's Integrated Residency Program at Brigham and Women's Hospital and Massachusetts General Hospital.

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