



April 2021

# MATERNAL MORTALITY AND MORBIDITY

## Additional Efforts Needed to Assess Program Data for Rural and Underserved Areas

Accessible Version



A Century of Non-Partisan Fact-Based Work

# GAO Highlights

Highlights of [GAO-21-283](#), a report to the Committee on Ways and Means, House of Representatives

## Why GAO Did This Study

Each year in the United States, hundreds of women die from pregnancy-related causes, and thousands more experience SMM. Research suggests there is a greater risk of maternal mortality and SMM among rural residents and that underserved areas may lack needed health services.

GAO was asked to review maternal mortality and SMM outcomes in rural and underserved areas. This report examines, among other objectives, what is known about these outcomes; selected CDC and HRSA programs that aim to reduce these outcomes, as well as actions to collect and use relevant data; and the extent to which HHS is taking actions to improve maternal health and monitoring progress on its efforts. GAO analyzed HHS data, agency documentation, literature, and interviewed officials from a non-generalizable sample of three states and stakeholders to capture various perspectives.

## What GAO Recommends

GAO is making three recommendations, including that CDC and HRSA disaggregate and analyze program data by rural and underserved areas, and that HHS's workgroups establish a formal coordinated approach for monitoring maternal health efforts. HHS concurred with GAO's

View [GAO-21-283](#). For more information, contact Alyssa M. Hundrup at (202) 512-7114 or [HundrupA@gao.gov](mailto:HundrupA@gao.gov).

April 2021

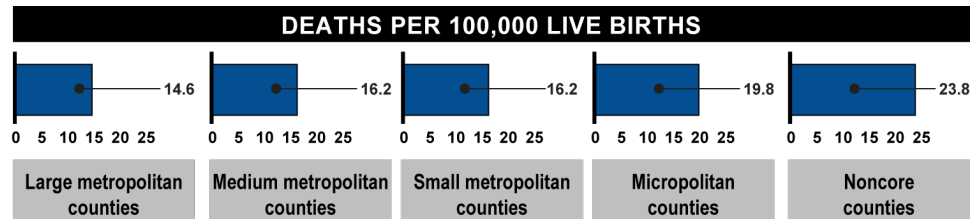
# MATERNAL MORTALITY AND MORBIDITY

## Additional Efforts Needed to Assess Program Data for Rural and Underserved Areas

### What GAO Found

Nationwide data from the Centers for Disease Control and Prevention's (CDC) Pregnancy Mortality Surveillance System from 2011-2016, the most recent data available at the time of GAO's review, indicate that deaths during pregnancy or up to 1 year postpartum due to pregnancy-related causes—are higher in rural areas compared to metropolitan areas. See figure. CDC data also showed higher mortality in underserved areas (areas with lower numbers of certain health care providers per capita).

### Pregnancy-Related Mortality Ratios in Rural and Metropolitan Areas, 2011-2016



Source: Centers for Disease Control and Prevention Pregnancy Mortality Surveillance System data. | GAO-21-283

Note: Micropolitan areas include counties with populations of 2,500 to 49,999. Noncore areas include nonmetropolitan counties that do not qualify as micropolitan.

GAO also analyzed the most recent annual data available from the Agency for Healthcare Research and Quality for 2016-2018 on severe maternal morbidity (SMM)—unexpected outcomes of labor and delivery resulting in significant health consequences. Nationwide, these data showed higher estimated rates of SMM in metropolitan areas (72.6 per 10,000 delivery hospitalizations) compared to rural areas (62.9 per 10,000).

CDC and another Department of Health and Human Services (HHS) agency, the Health Resources and Services Administration (HRSA), fund several maternal health programs that aim to reduce maternal mortality and SMM, including some that target rural or underserved areas. CDC and HRSA collect program data, such as the percentage of women who received postpartum visits, to track progress in improving maternal health, but they do not systematically disaggregate and analyze program data by rural and underserved areas. By taking these actions, CDC and HRSA could help better ensure that program funding is being used to help address any needs in these areas.

HHS has taken actions to improve maternal health through its funding of various programs and releasing an action plan in 2020. HHS also has two workgroups that aim to coordinate across HHS agencies on maternal health efforts, such as program activities that aim to reduce maternal mortality and SMM. Officials from HHS's two workgroups said they coordinated in developing the action plan, but they do not have a formal relationship established to ensure ongoing coordination. Officials from one of the workgroups noted that they often have competing priorities and do not always coordinate their efforts. By more formally coordinating their efforts, HHS's workgroups may be in a better position to identify opportunities to achieve HHS's action plan goal for reducing maternal mortality and objectives that target rural and underserved areas.

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**Abbreviations**

AHRQ	Agency for Healthcare Research and Quality
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare & Medicaid Services
COVID-19	Coronavirus Disease 2019
HHS	Department of Health and Human Services
HRSA	Health Resources and Services Administration
ICD-10-CM/PCS	International Classification of Diseases, 10 <sup>th</sup> Revision, Clinical Modification/Procedure Coding System
MUA	medically underserved area
SMM	severe maternal morbidity

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April 8, 2021

The Honorable Richard E. Neal  
Chairman  
The Honorable Kevin Brady  
Republican Leader  
Committee on Ways and Means  
House of Representatives

Every year in the United States, approximately 700 women die of complications related to pregnancy and childbirth, known as maternal mortality, while tens of thousands experience severe maternal morbidity (SMM)—an unexpected outcome of labor and delivery that results in significant short- or long-term health consequences.<sup>1</sup> Research suggests that women in rural areas, defined as areas that are less populous than metropolitan areas, may experience higher rates of maternal mortality and SMM. For example, one 2019 study found a 9 percent greater probability of maternal mortality and SMM among rural residents compared to metropolitan residents, after controlling for sociodemographic factors and clinical conditions associated with SMM and maternal mortality, including chronic heart disease, chronic hypertension, and diabetes.<sup>2</sup> Further, research demonstrates that underserved areas, such as areas with residents with lower median incomes and higher rates of the uninsured, may experience higher rates of maternal mortality and SMM.

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<sup>1</sup>M. C. Lu, "Reducing Maternal Mortality in the United States." *JAMA*. vol. 320, no. 12 (2018): p. 1237-1238. Throughout this report, we use the term "women" to describe the population affected by maternal mortality and SMM based on the definitions of the data sources we use. However, this term does not include all people who can become pregnant and may experience these outcomes. For example, people who do not identify as either male or female may become pregnant, as may some transgender men.

<sup>2</sup>K.B. Kozhimannil, J.D. Interrante, C. Henning-Smith, and L.K. Admon, "Rural-Urban Differences In Severe Maternal Morbidity And Mortality In The US, 2007–15," *Health Affairs*, vol. 38, no. 12, (2019): p. 2077-2085. This study uses a composite measure based on International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification diagnosis and procedure codes to identify cases of severe maternal morbidity and mortality in 2007-2015 National Inpatient Sample data from the Agency for Healthcare Research and Quality.



In addition, our prior work and research show disparities by race and ethnicity in rates of maternal mortality.<sup>3</sup> For example, we reported that non-Hispanic Black women were more than three times as likely to die as non-Hispanic White women from pregnancy-related causes.<sup>4</sup> Research shows that rates of SMM follow similar patterns.<sup>5</sup>

Within the Department of Health and Human Services (HHS), the Centers for Disease Control and Prevention (CDC) is the federal agency responsible for surveillance—the continuous, systematic collection of health-related data—of pregnancy-related deaths.<sup>6</sup> Also within HHS, the Agency for Healthcare Research and Quality (AHRQ) is the primary agency responsible for collecting all-payer administrative data from community acute care hospitals, which can be used to identify and analyze rates of SMM. HHS also funds various programs that aim to improve maternal health outcomes—including reducing rates of maternal mortality and SMM—that are administered through CDC, the Health Resources and Services Administration (HRSA), and other agencies. HHS has two workgroups—the Healthy People Maternal, Infant, and Child Health Workgroup and the Maternal Health Working Group—that include officials from various HHS agencies to coordinate across maternal health programs within the department.

In light of the Coronavirus Disease 2019 (COVID-19) pandemic, the examination of maternal mortality and SMM is of continued importance. CDC officials have indicated that it is too early to determine how COVID-19 may affect rates of maternal mortality and SMM. However, the agency reported that, as of November 2020, intensive care unit admission, ventilation (which is an indicator of SMM), and death were more common

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<sup>3</sup>GAO, *Maternal Mortality: Trends in Pregnancy-Related Deaths and Federal Efforts to Reduce Them*, [GAO-20-248](#) (Washington, D.C.: March 12, 2020), and A.A. Creanga, et al., “Maternal Mortality and Morbidity in the United States: Where Are We Now?” *Journal of Women’s Health*, vol. 23, no. 1 (2014): p. 3-9.

<sup>4</sup>[GAO-20-248](#).

<sup>5</sup>K.R. Fingar, M.M. Hambrick, K.C. Heslin, J.E. Moore, *Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006-2015*, Healthcare Cost and Utilization Project Statistical Brief #243 (Rockville, Md.: Agency for Healthcare Research and Quality, September 2018).

<sup>6</sup>Pregnancy-related deaths are deaths during pregnancy or within 1 year of the end of 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 accidental or incidental causes.

among pregnant women with symptomatic COVID-19 illness than non-pregnant women.<sup>7</sup> Additionally, CDC data indicate that as of December 2020, among COVID-19 cases with known race and ethnicity, Hispanic or Latino pregnant women accounted for 35 percent of COVID-19 cases among pregnant women since January 2020, although they represent 23 percent of births in the United States. In addition, non-Hispanic Black pregnant women accounted for 17 percent of COVID-19 cases among pregnant women, although they represent 15 percent of births in the United States. In contrast, non-Hispanic White pregnant women accounted for 38 percent of COVID-19 cases among pregnant women, compared to 52 percent of births in the United States.<sup>8</sup> See app. I for more information on maternal health outcomes and COVID-19.

You asked us to examine maternal mortality and SMM in rural and underserved areas. In this report, we:

1. describe what is known about maternal mortality and SMM in rural and underserved areas,
2. describe key factors that can affect maternal mortality and SMM in rural and underserved areas,
3. examine selected CDC and HRSA programs that aim to reduce maternal mortality and SMM, including in rural and underserved areas, as well as actions these agencies are taking to collect and use data related to those programs, and
4. examine the extent to which HHS is taking actions to improve maternal health and monitoring progress on its efforts.

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<sup>7</sup>L.D. Zambrano, et al. "Update: Characteristics of Symptomatic Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status — United States, January 22–October 3, 2020." *Morbidity and Mortality Weekly Report*, vol. 69 (2020).

<sup>8</sup>Non-Hispanic women of multiple races accounted for 6 percent of COVID-19 cases among pregnant women and non-Hispanic Asian women accounted for 3 percent of COVID-19 cases among pregnant women. Percentages may not add to 100 due to rounding. We compared COVID-19 case distribution data with known race and ethnicity from CDC's Data on COVID-19 during Pregnancy (accessed December 21, 2020, <https://covid.cdc.gov/covid-data-tracker/#pregnant-population>) with 2018 birth distribution data from Kaiser Family Foundation's analysis of CDC's birth data by race and ethnicity (accessed February 1, 2021, <https://www.kff.org/other/state-indicator/births-by-raceethnicity/>). Data reflect race and ethnicity of the infant's mother.

To conduct this work, we reviewed and conducted multiple data analyses of rural and underserved areas.

- To define rural areas, we used CDC's National Center for Health Statistics' 2013 Urban-Rural Classification Scheme for Counties, which assigns each county and county-equivalent entity to one of six class designations based on its population, ranging from the most populous large central metropolitan counties to the least populous noncore counties.<sup>9</sup> In most cases throughout our report, we combined all four classes of metropolitan counties—large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan—into one category to define metropolitan areas.<sup>10</sup> To define rural areas, we generally combined the non-metropolitan counties—micropolitan and noncore counties—into one category. This methodology is consistent with CDC's breakdown between metropolitan and non-metropolitan counties. When we report CDC's data on pregnancy-related mortality ratios for 2011 through 2016, we report data by five urban-rural class designations when reporting confidence intervals for data from these categories was appropriate.
- To define underserved areas, we used HRSA's medically underserved area (MUA) designation whenever possible, which is used to identify areas with a shortage of primary care services based on an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate. When analyses by MUA was not possible, such as when data on patient residence was unavailable, we relied on

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<sup>9</sup>CDC's National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties is based on the Office of Management and Budget's 2010 standards for defining metropolitan statistical areas and micropolitan statistical areas. These standards are the most recently available.

<sup>10</sup>Large metropolitan areas include large central and large fringe metropolitan counties. Large central metropolitan areas include counties in metropolitan statistical areas of 1 million or more population that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan.

definitions of underserved that considered an area's physician to population ratio.

To describe what is known about maternal mortality in rural and underserved areas, we reviewed two CDC data analyses. First, we reviewed CDC's analysis of pregnancy-related mortality ratios by the extent to which a location is rural, known as rurality, as well as by race and ethnicity from its Pregnancy Mortality Surveillance System for 2011 through 2016.<sup>11</sup> Second, we reviewed CDC's analysis of pregnancy-related mortality ratios in counties by the number of physicians, obstetrician-gynecologists, and mental health providers per capita—one measure of medical underservice—based on data from the agency's Pregnancy Mortality Surveillance System for 2011 through 2016. We also reviewed CDC's analysis of pregnancy-related mortality ratios in counties by the number of mental health providers per 100,000 population. All CDC data analyses we reviewed used the most recent data CDC analyzed as of January 2021.

To describe what is known about SMM in rural and underserved areas, we analyzed AHRQ databases by rurality, medical underservice, and related variables for 2016 through 2018—the most recent annual data available as of December 2020.<sup>12</sup> First, to determine rates of SMM in rural areas, we used data from AHRQ's National Inpatient Sample.<sup>13</sup> We used methods outlined by AHRQ to identify inpatient discharge records with indicators of SMM. According to HHS's Action Plan to Improve Maternal Health in America from December 2020, blood transfusions in pregnancy

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<sup>11</sup>CDC's Pregnancy Mortality Surveillance System is a national surveillance program of pregnancy-related deaths.

<sup>12</sup>In the last quarter of 2015, SMM indicators transitioned from the International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification to the International Classification of Diseases, 10<sup>th</sup> Revision, Clinical Modification/Procedure Coding System (ICD-10-CM/PCS). Data from 2016 is the first full calendar year of data using ICD-10-CM/PCS. Rates of SMM for prior years are not directly comparable.

<sup>13</sup>The National Inpatient Sample is an all-payer inpatient health care database that includes a stratified sample of all community hospital inpatient discharge records, excluding rehabilitation and long-term acute care hospitals. The database contains clinical and non-clinical variables from inpatient discharge records for approximately 20 percent of all community hospital discharges in the United States.

are significant events and can indicate SMM.<sup>14</sup> As noted in the action plan, including blood transfusions as the sole indicator of SMM doubled the rate of SMM in hospital births in 2017. However, following the methods adopted in HHS's action plan, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM.<sup>15</sup> As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM. Because National Inpatient Sample data are a sample of inpatient discharge records, we present estimates with associated standard errors, when applicable. In some instances, we also conducted statistical tests of differences at the 95 percent confidence level or above.

Second, to determine rates of SMM in areas that were both rural and underserved, we analyzed data extracts from AHRQ's State Inpatient Databases because data from the National Inpatient Sample do not contain patient zip code or county code variables that can be linked to identifiers of MUAs.<sup>16</sup> In contrast to data from the National Inpatient Sample, data from the State Inpatient Databases include all inpatient discharge records from non-federal, community, acute care hospitals in participating states, including patient ZIP code information.<sup>17</sup> We selected a non-generalizable sample of three states—Michigan, New Mexico, and North Carolina—to provide variation on several criteria including the percentage of residents living in rural counties in 2010, average index of

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<sup>14</sup>Department of Health and Human Services, *Healthy Women, Health Pregnancies, Healthy Futures: Action Plan to Improve Maternal Health in America*, (Washington, D.C.: December 3, 2020).

<sup>15</sup>HHS recommends focusing on an SMM measure that does not include blood products transfusions in the absence of other SMM indicators. The agency reports that blood transfusions may not always reflect cases of SMM in the absence of other indicators. They also cite changes in data reporting due to the transition from the International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification to ICD-10-CM/PCS. Research studies also show blood transfusions may not always reflect SMM in the absence of other indicators. For example, see Main, E.K., et al, "Measuring severe maternal morbidity: validation of potential measures" *American Journal of Obstetrics and Gynecology*, vol. 214, no. 5 (2016) and Himes, K. P., L.M. Bodnar, "Validation of criteria to identify severe maternal morbidity," *Paediatric and Perinatal Epidemiology* (2020).

<sup>16</sup>We did not report rates of urban and underserved areas for our selected states because not all states had counties that were both urban and underserved. See app. V for additional analysis of SMM by region for the three selected states.

<sup>17</sup>The State Inpatient Databases include data from 48 participating states and the District of Columbia.

medical underservice score among medically underserved counties, and participation in federal efforts to reduce maternal mortality and SMM.<sup>18</sup> For more information on our data analysis, see app. II.

To ensure reliability of CDC's analyses and the data we analyzed from AHRQ, we interviewed relevant agency officials from CDC and AHRQ, reviewed related documentation, compared data to previously published reports, and performed electronic testing to identify missing data and obvious errors. On the basis of these steps, we determined that the data were sufficiently reliable for the purposes of our reporting objectives.

To describe key factors that can affect maternal mortality and SMM in rural and underserved areas, we interviewed state health officials from the three states we selected. We also interviewed representatives from the American College of Obstetricians and Gynecologists, the Association of Maternal & Child Health Programs, National Association of Nurse Practitioners in Women's Health, and the University of Minnesota Rural Health Research Center. To capture a variety of perspectives, we selected these stakeholders based on several criteria, including their production of recent and relevant publications, their participation in relevant HHS events, and their organizational type. We also conducted a literature review of relevant research published between 2015 and 2020. For more information on our literature review, see app. II.

To examine selected CDC and HRSA programs that aim to reduce maternal mortality and SMM, including in rural and underserved areas, as well as actions these agencies are taking to collect and use data related to those programs, we interviewed agency officials and reviewed agencies' notices of funding opportunities and award announcements, requests for information, and other documentation. We selected CDC and HRSA programs based on those identified by agency officials as the primary programs that aim to reduce maternal mortality and SMM in rural and underserved areas. Of those programs identified, we specifically focused on the programs that provide funding or support to states to carry out efforts to reduce maternal mortality and morbidity in rural and underserved areas. We also interviewed state officials and awardees of

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<sup>18</sup>The index of medical underservice score is used by HRSA to designate medically underserved areas (MUA), which have a shortage of primary care health services for their population. The score is calculated using the area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate.

CDC and HRSA program funding for the selected programs from the three selected states to obtain their perspectives on CDC and HRSA programs that aim to reduce maternal mortality and SMM, and to obtain examples of how the programs can be used in rural and underserved areas. We compared CDC and HRSA's efforts to Office of Management and Budget guidance for analyzing data and our prior work on practices that can enhance agencies use of performance information.<sup>19</sup>

To examine the extent to which HHS is taking actions to improve maternal health and monitoring progress on its efforts, we reviewed HHS documentation and interviewed HHS officials, including officials from the Centers for Medicare & Medicaid Services (CMS), HRSA, CDC, HHS's Office on Women's Health, and the National Institutes of Health. We also interviewed state health officials from the three selected states and the four selected stakeholders to obtain perspectives on HHS's efforts to reduce maternal mortality and SMM in rural and underserved areas. We compared HHS's efforts to our prior work on leading practices in interagency coordination mechanisms.<sup>20</sup>

We conducted this performance audit from January 2020 to April 2021 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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<sup>19</sup>Office of Management and Budget, *Preparation, Submission and Execution of the Budget, Part 6, Sections 200 and 290*, OMB Circular No. A-11 (December 2020). GAO, *Managing for Results: Enhancing Agency Use of Performance Information for Management Decision Making*, [GAO-05-927](#) (Washington, D.C. September 5, 2005).

<sup>20</sup>GAO, *Managing for Results: Implementation Approaches Used to Enhance Collaboration in Interagency Groups*, [GAO-14-220](#) (Washington, D.C. February 14, 2020). GAO, *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, [GAO-12-1022](#) (Washington, D.C. September, 27, 2012).

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## Background

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### HHS Agencies Involved in Maternal Health

Multiple HHS agencies work on issues in support of maternal health. Within HHS, the Office on Women's Health leads the Coordinating Committee on Women's Health, which advises the Assistant Secretary for Health on activities across HHS that could improve the health of women in the United States. Within this committee is a Maternal Health Working Group that consists of members across HHS agencies that support maternal health programs, including programs within AHRQ, CDC, CMS, HRSA, and the National Institutes of Health. The Maternal Health Working Group is responsible for coordinating maternal health activities across HHS.

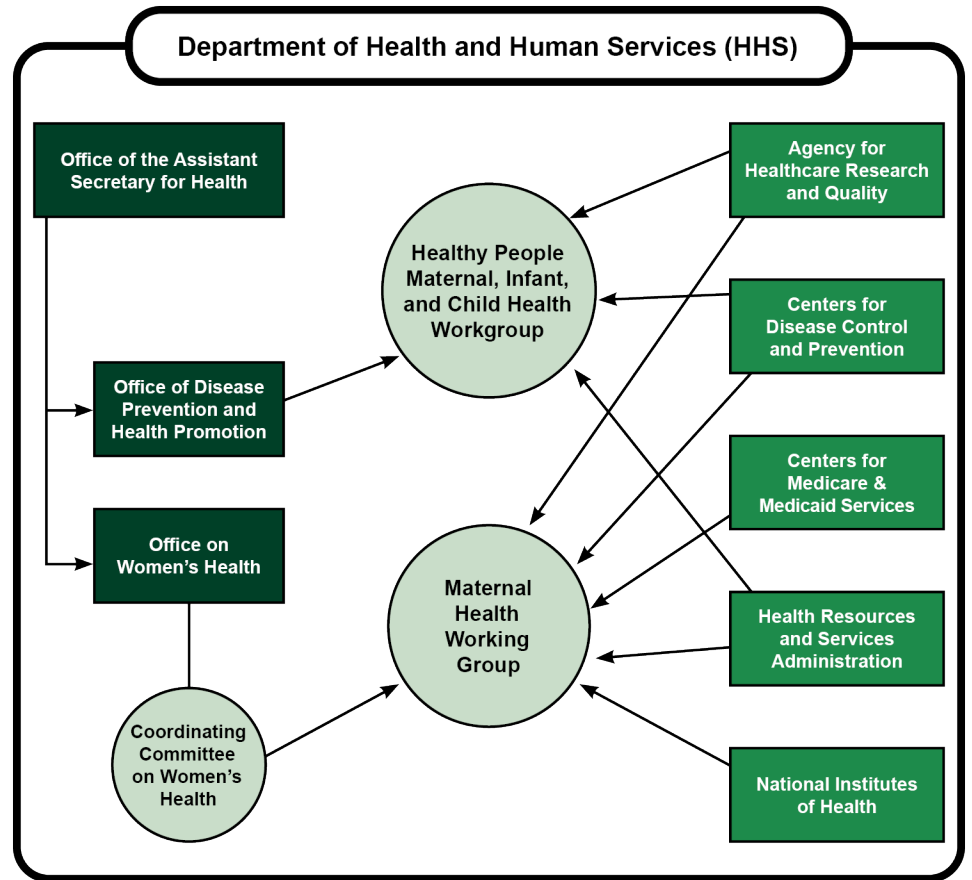
Also within HHS, the Office of Disease Prevention and Health Promotion oversees Healthy People 2030, an initiative that provides 10-year, measurable public health objectives and workgroups made up of subject matter experts to help track progress toward achieving those objectives.<sup>21</sup> As part of this initiative, the Healthy People Maternal, Infant, and Child Health Workgroup, which includes officials from AHRQ, CDC, and HRSA, works broadly across HHS on maternal health-related activities and is responsible for developing and monitoring relevant Healthy People objectives. See figure 1.

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<sup>21</sup>Department of Health and Human Services, *Healthy People 2030*, accessed January 11, 2021, <https://health.gov/healthypeople>.



**Figure 1: Department of Health and Human Services Entities That Participate in the Healthy People Maternal, Infant, and Child Health Workgroup and the Maternal Health Working Group**



Organizational structure under the Office of the Secretary (HHS)
  HHS operating division

Source: GAO analysis of HHS documentation and interviews. | GAO-21-283

Note: This figure includes the key HHS agencies that work on maternal health issues, including those that have officials serving on the Office of Disease Prevention and Health Promotion's Healthy People Maternal, Infant, and Child Health Workgroup and the Office on Women's Health's Maternal Health Working Group. Other agencies within HHS also participate in these workgroups.

HHS's Healthy People 2030 objectives include reducing the rate of maternal mortality to 15.7 maternal deaths per 100,000 live births, compared to the 2018 national rate of 17.4 per 100,000 live births, and to reduce the rate of severe maternal complications identified during delivery hospitalizations to 61.8 per 10,000 deliveries, compared to the 2017 rate of 68.7 per 10,000 deliveries.

**AHRQ.** AHRQ hosts the Healthcare Cost and Utilization Project, which coordinates the collection of data on SMM, among data on other hospitalizations through the National Inpatient Sample and State Inpatient Databases. This data can be used to identify inpatient discharge records with SMM indicators as defined by the International Classification of Diseases, 10th Revision, Clinical Modification/Procedure Coding System (ICD-10-CM/PCS) diagnosis and procedure codes. These codes can also be used to uniformly describe a patient’s medical condition and for billing and claims reimbursement.<sup>22</sup> The codes can also be used to identify rates of SMM, though there are some limitations associated with their use because of their original purpose for billing, which means that they may not include all necessary clinical data for research purposes. Incidents of SMM are identified through 21 indicators and corresponding codes, such as sepsis, shock, and acute heart failure, which are defined by CDC.<sup>23</sup> See app. III for more information.

In addition, AHRQ has efforts that aim to reduce maternal mortality or SMM, including in rural and underserved areas. For example, AHRQ officials told us that they awarded funding to winners of the Cross-Sectional Innovation to Improve Rural Postpartum Mental Health Challenge, which is intended to support local innovations to improve postpartum mental health care for rural American families. AHRQ officials also said that they developed the Safety Program for Perinatal Care toolkit to improve the patient safety culture of labor and delivery units and decrease maternal adverse events resulting from poor communication and system failures. According to AHRQ officials, they have partnered with HRSA to implement and evaluate the toolkit, which is set to operate through 2022.

**CDC.** CDC has two national surveillance systems related to maternal mortality—the National Vital Statistics System and the Pregnancy Mortality Surveillance System. According to CDC officials, the National Vital Statistics System is the source of official statistics on mortality for all causes in the United States, including maternal deaths. This system uses the term “maternal death,” as defined by the World Health Organization,

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<sup>22</sup>The Healthcare Cost and Utilization Project is a collection of health care databases, which includes information on inpatient stays, ambulatory surgery and services visits, and emergency department encounters.

<sup>23</sup>Consistent with methods recommended in HHS’s action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM. Therefore, analyses of SMM in this report include 20 indicators, rather than 21.

to mean death during pregnancy or within 42 days after the end of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.<sup>24</sup> National Vital Statistics System data are used to identify national trends and make international comparisons. The data are collected by CDC's National Center for Health Statistics, which receives copies of death certificates from all states and other jurisdictions, including Puerto Rico and Washington, D.C. Officials use this information to assign International Classification of Diseases, 10th Revision codes based on the cause of death.<sup>25</sup> According to CDC officials, the National Center for Health Statistics then uses these coded records to compile national vital statistics in the National Vital Statistics System.

CDC's other national surveillance system for maternal mortality, the Pregnancy Mortality Surveillance System, is exclusively focused on pregnancy-related deaths.<sup>26</sup> For this system, the 50 states and applicable jurisdictions, including New York City and Washington, D.C., voluntarily share data from death certificates of women who died while pregnant or within 1 year of pregnancy and link live birth or fetal death certificates to the mother's death certificate, when available. The information CDC collects is summarized and reviewed by medically trained epidemiologists to determine the cause and time of death related to pregnancy. CDC then publishes annual updates of the national data from this system on the

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<sup>24</sup>The term "maternal death" does not include "late maternal death," which occurs more than 42 days but less than 1 year after pregnancy.

<sup>25</sup>Starting in 1999, CDC began coding causes of death using the International Classification of Diseases, 10th Revision. This classification system includes a specific category (O codes) for pregnancy, childbirth, or puerperium-related causes of deaths. The puerperium period typically refers to the time after pregnancy when a woman's reproductive organs return to a non-pregnancy state. According to CDC officials, for a death to be assigned an O code, the death certificate must have indicated that the woman died during pregnancy, within 42 days of pregnancy, between 43 days to 1 year after pregnancy or included a cause of death that indicates one of these conditions. Within the O code category, there are codes for specific categories of causes of death, such as a code for postpartum hemorrhage.

<sup>26</sup>Pregnancy-related deaths, as defined by statute, are deaths during pregnancy or within 1 year of the end of 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 accidental or incidental causes. 42 U.S.C. § 247b-12(e)(3).

leading causes of pregnancy-related deaths and pregnancy-related mortality ratios.

**CMS.** CMS administers the Medicaid program, which is the primary source of medical assistance for Americans with low incomes or disabilities, providing health coverage to individuals who are otherwise unable to obtain health insurance. In 2018, Medicaid paid the medical costs for 43 percent of all births by providing coverage to pregnant women who were previously uninsured through 60 days after delivery, in addition to women who were already enrolled in Medicaid prior to becoming pregnant, according to the Medicaid and CHIP Payment and Access Commission.

In addition, CMS has various efforts underway to improve maternal health outcomes, including in rural and underserved areas. CMS has an agency-wide rural health strategy that applies a rural focus to its programs and policies, among other things.<sup>27</sup> A key objective of its strategy is to leverage partnerships with stakeholders and other federal partners to improve the quality of rural health care, which includes increasing the focus on maternal health.

**HRSA.** HRSA is the primary federal agency charged with improving health care for people who are geographically isolated, and economically or medically vulnerable, including those in need of high-quality primary health care, such as pregnant women. HRSA's role is to address maternal mortality and SMM through health promotion, risk prevention, and by training health care professionals to identify and treat early maternal warning signs of an obstetric emergency. HRSA also collects data related to health care delivery, workforce, and subpopulations, such as populations residing in MUAs, including areas with shortages of medical providers.

**National Institutes of Health.** The National Institutes of Health supports research, including on maternal mortality and SMM, through various grants, contracts, and other funding mechanisms. The agency funds

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<sup>27</sup>The CMS Rural Health Strategy aims to inform CMS's work, as it relates to rural health, and thereby help CMS achieve its vision for equitable rural health and health care. The CMS Rural Health Strategy identifies five specific objectives and supporting activities to help CMS achieve its vision for rural health: 1) apply a rural lens to CMS programs and policies; 2) improve access to care through provider engagement and support; 3) advance telehealth and telemedicine; 4) empower patients in rural communities to make decisions about their health care; and 5) leverage partnerships to achieve the goals of the CMS Rural Health Strategy.

maternal health research through a number of its institutes and centers, such as the Eunice Kennedy Shriver National Institute of Child Health and Human Development; the National Heart, Lung, and Blood Institute; the National Institute of Environmental Health Sciences; the National Institute on Minority Health and Health Disparities; and the Office of Research on Women's Health. For example, one of the research studies uses electronic health record data from women who experienced postpartum hemorrhage to identify contributing factors for racial and ethnic disparities in the frequency and severity of postpartum hemorrhage. Officials from the National Institutes of Health said they are also developing the Implementing a Maternal Health and Pregnancy Outcomes Vision for Everyone initiative, which supports research to reduce preventable causes of maternal deaths and improve health for women before, during, and after delivery. The program emphasizes mitigating health disparities in underserved and undocumented populations. NIH officials added that the agency's Office of Research on Women's Health is leading the development of a consensus conference on women's health that will be held in October 2021. Officials stated that this conference will include discussions of critical research that is needed to reduce and prevent maternal mortality and SMM, including in rural and underserved areas.

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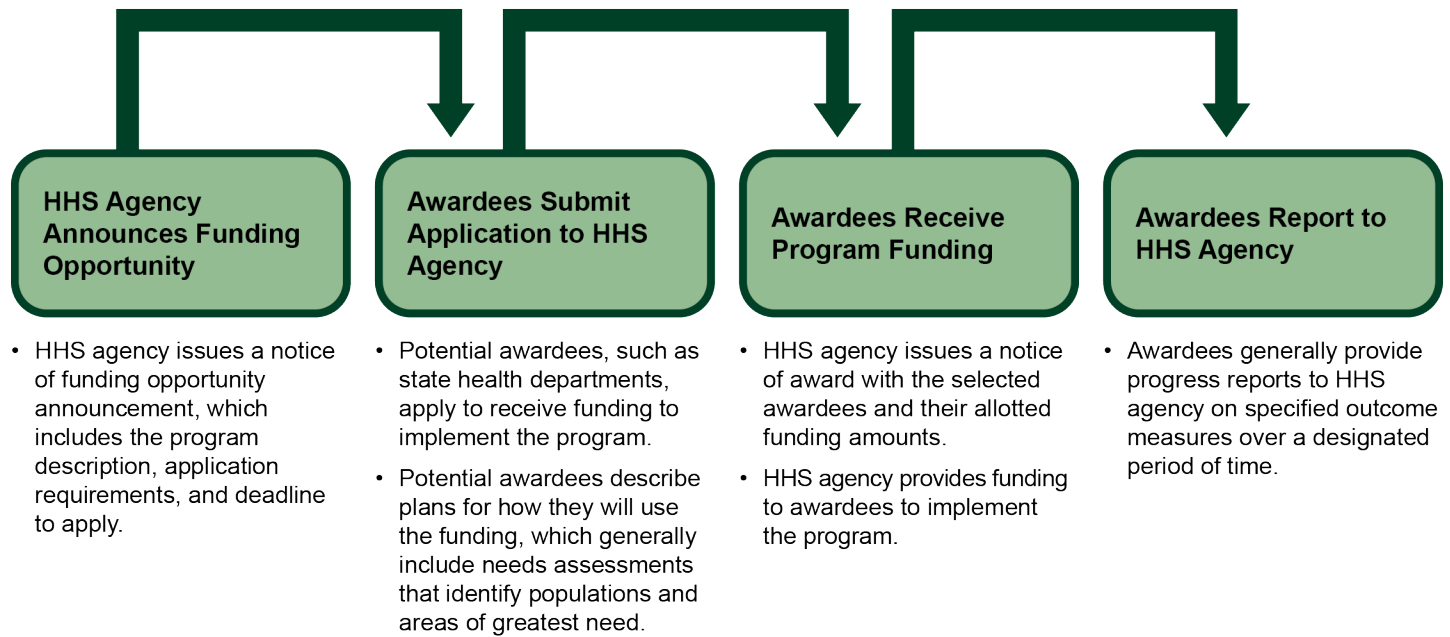
## HHS Maternal Health Program Award Process

HHS agencies, including CDC and HRSA, generally provide funding for maternal health programs through grants and cooperative agreements that are typically carried out by state health departments or other organizations.<sup>28</sup> Application requirements vary by program, but HHS agencies generally use a standard process to solicit applicants, provide program funding to selected awardees, and monitor progress reports on how awardees use program funding. See figure 2.

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<sup>28</sup>In general, federal agencies use grants and cooperative agreements to transfer a thing of value to the recipient entity to carry out a public purpose as authorized by federal law. Cooperative agreements are used when substantial involvement by the federal agency is expected in carrying out the activity, and grants are used when substantial involvement by the federal agency is not expected. See 31 U.S.C. §§ 6303-6305.

**Figure 2: Department of Health and Human Services (HHS) Maternal Health Program Award Process**



Source: GAO analysis of HHS documentation. | GAO-21-283

**Text for Figure 2: Department of Health and Human Services (HHS) Maternal Health Program Award Process**

- 1) HHS Agency Announces Funding Opportunity
  - a) HHS agency issues a notice of funding opportunity announcement, which includes the program description, application requirements, and deadline to apply.
- 2) Awardees Submit Application to HHS Agency
  - a) Potential awardees, such as state health departments, apply to receive funding to implement the program.
  - b) Potential awardees describe plans for how they will use the funding, which generally include needs assessments that identify populations and areas of greatest need.
- 3) Awardees Receive Program Funding
  - a) HHS agency issues a notice of award with the selected awardees and their allotted funding amounts.

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- b) HHS agency provides funding to awardees to implement the program.
- 4) Awardees Report to HHS Agency
- a) Awardees generally provide progress reports to HHS agency on specified outcome measures over a designated period of time.

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## HHS Data Show Pregnancy-Related Mortality Ratios Are Higher in Rural and Underserved Areas, and SMM Rates Are Higher in Metropolitan Areas and in Areas That Are Both Rural and Underserved in Selected States

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### CDC Data Indicate Pregnancy-Related Mortality Ratios Are Higher in Rural and Underserved Areas, and Disparities Exist by Race and Ethnicity

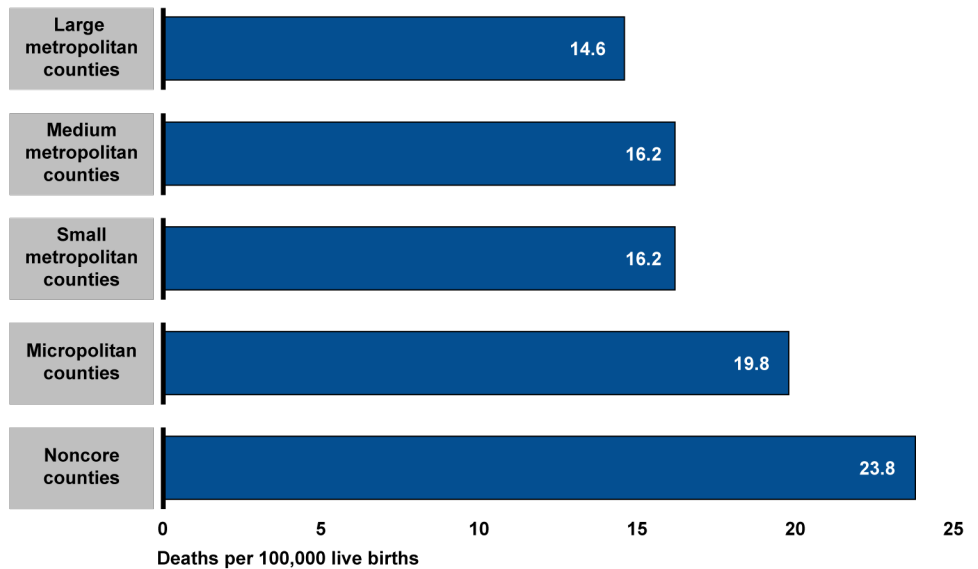
According to CDC's analysis of Pregnancy Mortality Surveillance System data for 2011 through 2016, pregnancy-related mortality ratios were higher in rural areas, including micropolitan and noncore counties, compared to metropolitan areas.<sup>29</sup> Specifically, CDC reported that over this time period, the pregnancy-related mortality ratio in the most rural areas (noncore counties) was 23.8 deaths per 100,000 live births,

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<sup>29</sup>Similarly, CDC's National Vital Statistics System, which uses death certificate information from all states and jurisdictions, reported that in 2018, the maternal mortality rate in rural areas was 21.6 maternal deaths per 100,000 live births, 30 percent higher than the rate of 16.7 deaths per 100,000 live births in metropolitan areas. The maternal mortality rate is defined as by the number of deaths during pregnancy through 42 days after the end of pregnancy, excluding those from accidental or incidental causes, per 100,000 live births. The rate is calculated based on data from the National Vital Statistics System and reported by CDC's National Center for Health Statistics. However, the maternal mortality rate is not directly comparable to the pregnancy-related mortality rate because different methods are used to calculate these statistics.

compared to a ratio of 14.6 deaths per 100,000 live births in large metropolitan counties.<sup>30</sup> See figure 3.

**Figure 3: Pregnancy-Related Mortality Ratios by Urban-Rural Classification, 2011-2016**



Source: Centers for Disease Control and Prevention Pregnancy Mortality Surveillance System data. | GAO-21-283

**Data table for Figure 3: Pregnancy-Related Mortality Ratios by Urban-Rural Classification, 2011-2016**

	Death per 100,000 live births
Large metropolitan counties	14.6
Medium metropolitan counties	16.2
Small metropolitan counties	16.2
Micropolitan counties	19.8
Noncore counties	23.8

Note: Large metropolitan areas include large central and large fringe metropolitan counties. Large central metropolitan areas include counties in metropolitan statistical areas of 1 million or more population that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the

<sup>30</sup>CDC reported that the 95 percent confidence interval is between 21.1 and 26.7 for women in noncore counties and between 13.9 and 15.2 for women in large metropolitan counties, including large central and large fringe metropolitan counties. For more information, see Merkt, P.T., et al. "Urban-Rural Differences in Pregnancy-Related Deaths, United States, 2011-2016." *American Journal of Obstetrics & Gynecology* (2021), accessed on March 2, 2021 <https://doi.org/10.1016/j.ajog.2021.02.028>.



metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan. The pregnancy-related mortality ratio is reported by the Pregnancy Mortality Surveillance System and captures deaths during pregnancy or within 1 year of the end of 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 accidental or incidental causes. Data from 2011 through 2016 are the most recent that CDC is working with, as of January 2021. Urban-rural classifications are based on the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties. For women in large metropolitan counties the 95 percent confidence interval is between 13.9 and 15.2. For women in medium metropolitan counties the 95 percent confidence interval is between 15.1 and 17.4. For women in small metropolitan counties the 95 percent confidence interval is between 14.5 and 18.0. For women in micropolitan counties the 95 percent confidence interval is between 17.9 and 22.0. For women in noncore counties the 95 percent confidence interval is between 21.1 and 26.7.

CDC reported that from 2011 through 2016, underserved areas, defined as areas that have lower numbers of physicians or obstetrician-gynecologists per capita regardless of rurality, had higher pregnancy-related mortality ratios compared to areas with higher numbers of physicians or obstetrician-gynecologists per capita. However, CDC noted that the difference in these outcomes was not statistically significant. In addition, CDC reported that from 2011 through 2016, counties with a higher number of mental health providers per capita had fewer pregnancy-related deaths compared to counties with fewer mental health providers per capita. CDC reported that this difference was statistically significant.

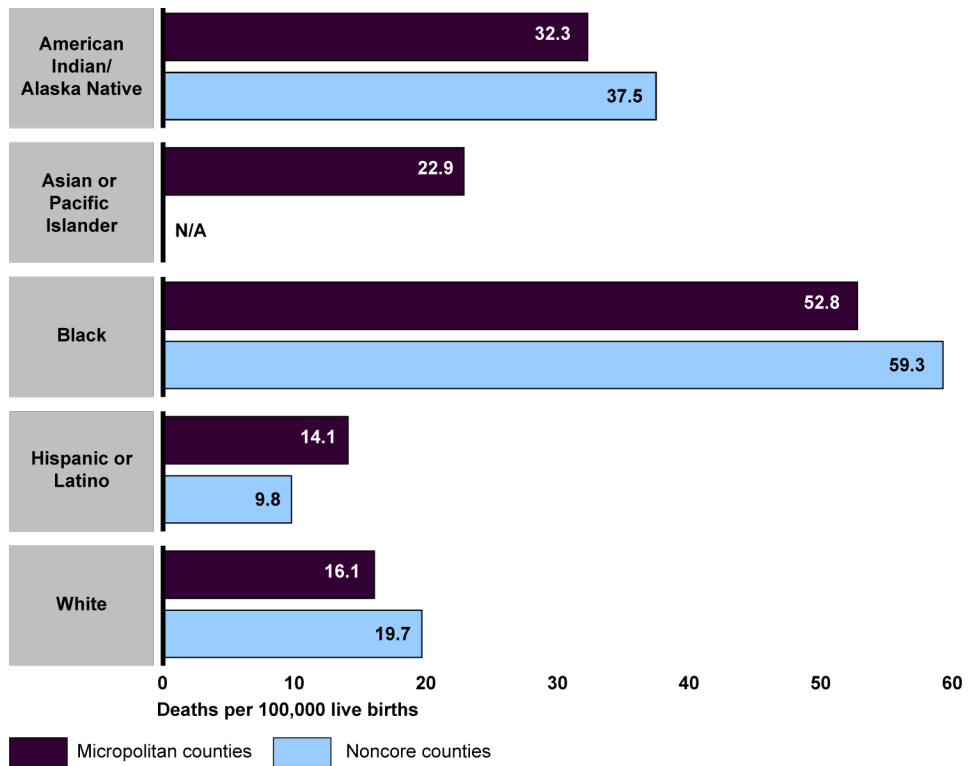
In addition, CDC's Pregnancy Mortality Surveillance System data show racial disparities in ratios of pregnancy-related deaths in rural areas, including micropolitan and noncore counties. For example, the pregnancy-related mortality ratio for non-Hispanic American Indian/Alaska Native women in the most metropolitan areas (large central and large fringe metropolitan counties) was 18.5 deaths per 100,000 live births compared to a ratio in the most rural areas (noncore counties) of 37.5 deaths per 100,000 live births.<sup>31</sup> While ratios of deaths are higher for all women in micropolitan and noncore counties compared with metropolitan counties, the ratios are highest for non-Hispanic Black women, non-Hispanic Asian or Pacific Islander women, and non-Hispanic American

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<sup>31</sup>For non-Hispanic American Indian/Alaska Native women, CDC reported that the 95 percent confidence interval is between 8.9 and 34.1 in large metropolitan counties, including large central and large fringe metropolitan counties, and between 22.6 and 58.6 in noncore counties.

Indian/Alaska Native women compared to non-Hispanic White women.<sup>32</sup> For example, CDC reported that the pregnancy-related mortality ratio in the most rural areas (noncore counties) for non-Hispanic Black women was 59.3 deaths per 100,000 live births compared to a ratio of 19.7 deaths per 100,000 live births for non-Hispanic White women in the same areas.<sup>33</sup> See figure 4.

**Figure 4: Pregnancy-Related Mortality Ratios in Rural Areas by Race and Ethnicity, 2011-2016**



Source: Centers for Disease Control and Prevention Pregnancy Mortality Surveillance System data. | GAO-21-283

<sup>32</sup>According to CDC officials, disparities by race and ethnicity also exist for pregnancy-related mortality ratios in metropolitan areas.

<sup>33</sup>In noncore counties, CDC reported the 95 percent confidence interval is between 46.2 and 74.9 for non-Hispanic Black women in noncore counties and between 16.9 and 22.8 for non-Hispanic White women.

**Data table for Figure 4: Pregnancy-Related Mortality Ratios in Rural Areas by Race and Ethnicity, 2011-2016**

	Death per 100,000 live births	
	Micropolitan counties	Noncore counties
American Indian/Alaska Native	32.3	37.5
Asian or Pacific Islander	22.9	N/A
Black	52.8	59.3
Hispanic or Latino	14.1	9.8
White	16.1	19.7

Note: The pregnancy-related mortality ratio is reported by the Pregnancy Mortality Surveillance System and captures deaths during pregnancy or within 1 year of the end of 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 accidental or incidental causes. Data from 2011 through 2016 are the most recent that CDC is working with, as of January 2021. Rural designation is based on the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties. We considered non-metropolitan counties, including micropolitan and noncore counties, as rural. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan. White, Black, American Indian/Alaska Native, and Asian or Pacific Islander women were of non-Hispanic ethnicity, and Hispanic or Latino women may be of any race. For non-Hispanic American Indian/Alaska Native women, the 95 percent confidence interval is between 18.1 and 53.2 in micropolitan counties and between 22.6 and 58.6 in noncore counties. For non-Hispanic Asian/Pacific Islander women, the 95 percent confidence interval is between 10.5 and 43.6 in micropolitan counties. Results for this group in noncore counties were not included due to small cell size. For non-Hispanic Black women, the 95 percent confidence interval is between 42.5 and 64.7 in micropolitan counties and between 46.2 and 74.9 in noncore counties. For Hispanic or Latino women, the 95 percent confidence interval is between 9.8 and 19.6 in micropolitan counties and between 4.9 and 17.5 in noncore counties. For non-Hispanic White women, the 95 percent confidence interval is between 14.1 and 18.4 in micropolitan counties and between 16.9 and 22.8 in noncore counties.

### AHRQ Data Show National Estimated Rates of SMM Are Higher in Metropolitan Areas; In Selected States, Rates of SMM Are Higher in Areas That Are Both Rural and Underserved

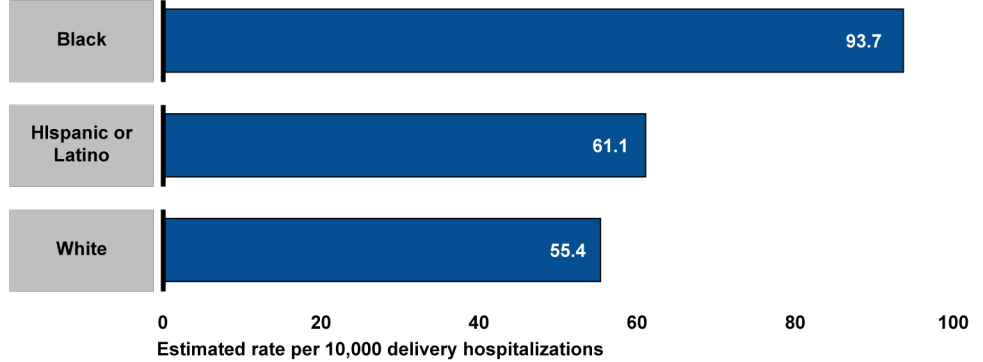
Our analysis of AHRQ data shows from 2016 through 2018, national estimated rates of SMM were higher in metropolitan areas compared to rural areas; however, rates of SMM in selected states were higher in areas that were both rural and underserved over the same time period.<sup>34</sup>

<sup>34</sup>Consistent with methods recommended in HHS’s action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

Nationally, our analysis of AHRQ data from its National Inpatient Sample for 2016 through 2018 found an estimated rate of SMM of 71.4 incidents per 10,000 delivery hospitalizations. We found higher estimated rates of SMM in metropolitan areas (72.6 per 10,000 delivery hospitalizations) compared to rural areas (62.9 per 10,000 delivery hospitalizations).<sup>35</sup>

Our analysis of national SMM data from 2016 through 2018 found that in rural areas, non-Hispanic Black women had higher estimated rates of SMM compared to non-Hispanic White and Hispanic women. See figure 5.

**Figure 5: National Estimated Rates of Severe Maternal Morbidity (SMM) in Rural Areas by Race and Ethnicity, 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-283

**Data table for Figure 5: National Estimated Rates of Severe Maternal Morbidity (SMM) in Rural Areas by Race and Ethnicity, 2016-2018**

	Estimated rate per 10,000 delivery hospitalizations
Black	93.7
Hispanic or Latino	61.1
White	55.4

Note: The standard errors of the estimated rates presented in this figure were 7.3 for Black women, 4.5 for Hispanic or Latino women, and 1.8 for White women. Rural designation is based on the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties. Counties classified as micropolitan or noncore are considered rural. White and Black women were of non-Hispanic ethnicity, and Hispanic or Latino women may be of any race. Results for Asian or Pacific Islander women, American Indian/Alaska Native women, and women in the "Other Race" categories could not be reported due to small cell size. Consistent with methods recommended in HHS's action plan from December 2020, we excluded cases of SMM where blood products transfusion was the

<sup>35</sup>See app. III for additional information on SMM, including estimated rates by expected primary payer, age, and race and ethnicity.

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sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

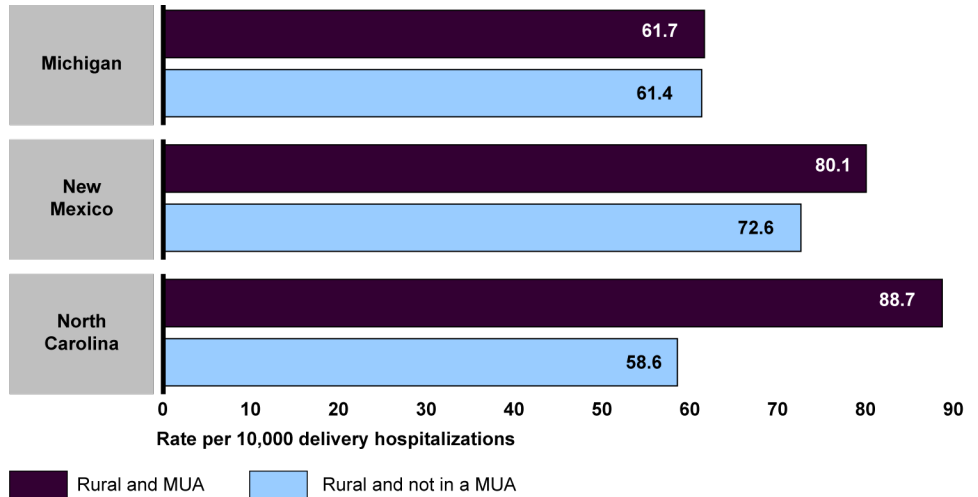
Because AHRQ's national data represent an estimate of SMM rates and do not allow for an analysis of medical underservice, we analyzed county-level data extracts from the Healthcare Cost and Utilization Project State Inpatient Databases from three selected states.<sup>36</sup> Our analysis of AHRQ data in three selected states found higher rates of SMM in areas that were both rural and underserved compared with areas that were rural and not underserved. Specifically, we found that from 2016 through 2018, rural and underserved areas had increased rates of SMM for each of the three selected states—Michigan, New Mexico, and North Carolina—compared with areas that were rural but not underserved.<sup>37</sup> The SMM rate in Michigan was slightly higher in rural and underserved areas, but the gap was larger in New Mexico and even larger in North Carolina. For example, in North Carolina, rural and underserved areas had an SMM rate of 88.7 incidents per 10,000 delivery hospitalizations, compared to a rate of 58.6 in rural areas that are not underserved. See figure 6.

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<sup>36</sup>We were unable to use AHRQ's National Inpatient Sample to conduct a national analysis of SMM rates by underservice because the data are not structured to facilitate such analyses.

<sup>37</sup>For this analysis, underserved areas were defined by HRSA's MUA designation. MUAs are geographic areas designated by HRSA as having a shortage of primary care health services based on the area's index of medical underservice score, which accounts for an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate. Our analysis did not include MUAs that were designated based on an exception requested by the relevant state's governor. We did not report rates of urban and underserved areas for our selected states because not all states had counties that were both urban and underserved. See app. V for additional analysis of SMM by region for the three selected states.

**Figure 6: Rates of Severe Maternal Morbidity (SMM) in Rural Areas of Selected States by Medically Underserved Area (MUA), 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality’s Healthcare Cost and Utilization Project State Inpatient Databases. | GAO-21-283

**Data table for Figure 6: Rates of Severe Maternal Morbidity (SMM) in Rural Areas of Selected States by Medically Underserved Area (MUA), 2016-2018**

	Rate per 10,000 delivery hospitalizations	
	Rural and MUA	Rural and not in a MUA
Michigan	61.7	61.4
New Mexico	80.1	72.6
North Carolina	88.7	58.6

Note: MUAs are geographic areas designated by the Health Resources and Services Administration as having a shortage of primary care health services based on the area’s index of medical underservice score, which accounts for an area’s provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate. Our analysis did not include MUAs that were designated based on an exception requested by the relevant state’s governor. Rural designation is based on the 2013 National Center for Health Statistics Urban-Rural Classification Scheme for Counties. Counties that are classified as micropolitan or noncore are considered rural. Consistent with methods recommended in HHS’s action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

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## Health System, Socioeconomic, and Patient Factors Can Affect Maternal Health Outcomes in Rural and Underserved Areas








Based on our literature review and interviews with officials from our three selected states and selected stakeholders, we identified factors in three broad areas that can affect maternal health outcomes in rural and underserved areas: health system factors, which include provider shortages; socioeconomic factors, such as insurance status; and patient factors, such as age.<sup>38</sup> For example, according to state officials and awardees, pregnant women living in rural and underserved areas often have limited access to care due to living long distances from facilities or having other transportation challenges. Additionally, HRSA defines underserved areas in part by their lack of available providers, and studies have found that rural areas face challenges retaining and recruiting maternal health providers.<sup>39</sup> See figure 7 for key factors we identified that can affect maternal mortality and SMM in rural and underserved areas.

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<sup>38</sup>We also reviewed select maternal mortality review committee publications. See app. VI for a summary of the factors identified in these publications.

<sup>39</sup>Kozhimannil, K.B., et al, "The Rural Obstetric Workforce in US Hospitals: Challenges and Opportunities," *Journal of Rural Health*, vol. 31, no. 4 (2015):365-372 and William F. Rayburn, *The Obstetrician-Gynecologist Workforce in the United States: Facts, Figures, and Implications*, 2017. (Washington D.C.: The American Congress of Obstetricians and Gynecologists, 2017).

**Figure 7: Key Factors That Can Affect Maternal Mortality and Severe Maternal Morbidity (SMM) in Rural and Underserved Areas**

	Factor	Examples from literature review	Examples from state official and stakeholder interviews
<b>HEALTH SYSTEM FACTORS</b>	<b>Limited Access to Care</b> 	<ul style="list-style-type: none"> <li>Access to prenatal care is associated with a decreased risk of maternal mortality</li> <li>Lack of access to prenatal care is associated with an increased risk of some complications that can cause SMM or mortality</li> </ul>	<ul style="list-style-type: none"> <li>Women in rural areas may face prohibitive costs to travel long distances for appointments</li> <li>Women in urban underserved areas may experience transportation challenges when accessing care in other areas</li> </ul>
	<b>Facility Services</b> 	<ul style="list-style-type: none"> <li>The percentage of rural counties without hospital obstetric services increased from 45 to 54 percent between 2004 and 2014</li> <li>Arriving at facilities without obstetric services is associated with a higher risk of poor outcomes due to a lack of appropriate providers or the necessary equipment</li> </ul>	<ul style="list-style-type: none"> <li>Pregnant or postpartum women in areas with facility closures may present at emergency rooms of hospitals without obstetric services, where providers may not be experienced with deliveries and may need training to identify complications that can cause maternal death</li> </ul>
	<b>Provider Shortages</b> 	<ul style="list-style-type: none"> <li>The presence of obstetrician-gynecologists and maternal fetal medicine specialists practicing in an area is associated with a lower risk of delivery complications and a lower rate of maternal mortality, respectively</li> <li>Rural areas face shortages of obstetrician-gynecologists and other providers, like delivering family physicians and obstetric nurses</li> </ul>	<ul style="list-style-type: none"> <li>Facilities in rural and underserved areas experience difficulty recruiting and retaining maternal health providers</li> <li>When hospitals or obstetric units close, rural and underserved areas lose the infrastructure that supports providers, like obstetrician-gynecologists, specialists, and licensed midwives</li> </ul>
<b>SOCIOECONOMIC FACTORS</b>	<b>Insurance Status</b> 	<ul style="list-style-type: none"> <li>Being uninsured or having Medicaid coverage is associated with greater risk of maternal mortality</li> <li>Being uninsured or having Medicaid coverage is associated with higher rates of SMM<sup>a</sup></li> <li>States with higher proportions of uninsured women have higher rates of maternal mortality</li> </ul>	<ul style="list-style-type: none"> <li>Women without insurance may have limited access to regular, pre-conception care which could affect outcomes of future pregnancies</li> <li>Women without insurance in the year after pregnancy may have limited access to postpartum care, including screening and treatment for postpartum mental health conditions</li> </ul>
	<b>Income Level</b> 	<ul style="list-style-type: none"> <li>Residence in lower income communities is associated with higher rates of maternal mortality and SMM<sup>a</sup></li> </ul>	<ul style="list-style-type: none"> <li>A low income contributes to a lack of resources that affect a person's ability to access care</li> </ul>
<b>PATIENT FACTORS</b>	<b>Comorbid Conditions</b> 	<ul style="list-style-type: none"> <li>Uncontrolled chronic comorbid conditions, like hypertension and diabetes, are associated with SMM and maternal mortality</li> <li>Women in rural areas tend to have less access to health care services, including preventive services, which may lead to worse outcomes</li> </ul>	<ul style="list-style-type: none"> <li>Women with comorbid conditions during pregnancy who lose coverage or experience barriers to accessing care in the postpartum period are more likely to suffer SMM or maternal mortality than women who are able to manage their conditions</li> </ul>
	<b>Age</b> 	<ul style="list-style-type: none"> <li>Older age is associated with increased risk of maternal mortality and SMM<sup>a</sup></li> <li>Women in rural and underserved areas may experience barriers to accessing health care and facilities necessary to manage the increased risks of pregnancy at older age</li> </ul>	<ul style="list-style-type: none"> <li>In rural areas, there may be less access to services and equipment for patients with complications, which may include older patients</li> </ul>

Source: GAO analysis of literature and interviews with officials from selected states and selected stakeholders. | GAO-21-283



**Data table for Figure 7: Key Factors That Can Affect Maternal Mortality and Severe Maternal Morbidity (SMM) in Rural and Underserved Areas**

	<b>Factors</b>	<b>Examples from Literature Review</b>	<b>Examples from state official and stakeholder interviews</b>
Health System Factors	Limited Access to Care	<ul style="list-style-type: none"> <li>Access to prenatal care is associated with a decreased risk of maternal mortality</li> <li>Lack of access to prenatal care is associated with an increased risk of some complications that can cause SMM or mortality</li> </ul>	<ul style="list-style-type: none"> <li>Women in rural areas may face prohibitive costs to travel long distances for appointments</li> <li>Women in urban underserved areas may experience transportation challenges when accessing care in other areas</li> </ul>
	Facility Services	<ul style="list-style-type: none"> <li>The percentage of rural counties without hospital obstetric services increased from 45 to 54 percent between 2004 and 2014</li> <li>Arriving at facilities without obstetric services is associated with a higher risk of poor outcomes due to a lack of appropriate providers or the necessary equipment</li> </ul>	<ul style="list-style-type: none"> <li>Pregnant or postpartum women in areas with facility closures may present at emergency rooms of hospitals without obstetric services, where providers may not be experienced with deliveries and may need training to identify complications that can cause maternal death</li> </ul>
	Provider Shortages	<ul style="list-style-type: none"> <li>The presence of obstetrician-gynecologists and maternal fetal medicine specialists practicing in an area is associated with a lower risk of delivery complications and a lower rate of maternal mortality, respectively</li> <li>Rural areas face shortages of obstetrician-gynecologists and other providers, like delivering family physicians and obstetric nurses</li> </ul>	<ul style="list-style-type: none"> <li>Facilities in rural and underserved areas experience difficulty recruiting and retaining maternal health providers</li> <li>When hospitals or obstetric units close, rural and underserved areas lose the infrastructure that supports providers, like obstetrician-gynecologists, specialists, and licensed midwives</li> </ul>
Socio Economic Factors	Insurance Stats	<ul style="list-style-type: none"> <li>Being uninsured or having Medicaid coverage is associated with greater risk of maternal mortality</li> <li>Being uninsured or having Medicaid coverage is associated with higher rates of SMM /a/</li> <li>States with higher proportions of uninsured women have higher rates of maternal mortality</li> </ul>	<ul style="list-style-type: none"> <li>Women without insurance may have limited access to regular, pre-conception care which could affect outcomes of future pregnancies</li> <li>Women without insurance in the year after pregnancy may have limited access to postpartum care, including screening and treatment for postpartum mental health conditions</li> </ul>
	Income Level	<ul style="list-style-type: none"> <li>Residence in lower income communities is associated with higher rates of maternal mortality and SMM<sup>a</sup></li> </ul>	<ul style="list-style-type: none"> <li>A low income contributes to a lack of resources that affect a person's ability to access care</li> </ul>
Patient Factors	CoMorbid Conditions	<ul style="list-style-type: none"> <li>Uncontrolled chronic comorbid conditions, like hypertension and diabetes, are associated with SMM and maternal mortality</li> <li>Women in rural areas tend to have less access to health care services, including preventive services, which may lead to worse outcomes</li> </ul>	<ul style="list-style-type: none"> <li>Women with comorbid conditions during pregnancy who lose coverage or experience barriers to accessing care in the postpartum period are more likely to suffer SMM or maternal mortality than women who are able to manage their conditions</li> </ul>
	Age	<ul style="list-style-type: none"> <li>Older age is associated with increased risk of maternal mortality and SMM/a/</li> <li>Women in rural and underserved areas may experience barriers to accessing health care and facilities necessary to manage the increased risks of pregnancy at older age</li> </ul>	<ul style="list-style-type: none"> <li>In rural areas, there may be less access to services and equipment for patients with complications, which may include older patients</li> </ul>

Note: We conducted a structured literature search and review of multiple databases for publications published between 2015 and 2020 to identify key factors that can affect maternal mortality and SMM

in rural and underserved areas. Additionally, we reviewed other articles relevant to our scope that we identified through a review of the bibliographies of those articles, searches of government agency websites, and other internet searches. We interviewed health officials and awardees from three states—Michigan, New Mexico, and North Carolina—which we selected based on several criteria. Specifically, we selected states to provide variation on the percentage of residents living in rural counties in 2010, the average index of medical underservice score among medically underserved counties, and the state's participation in federal efforts to reduce maternal mortality and SMM. We also interviewed selected stakeholders: the American College of Obstetricians and Gynecologists, Association of Maternal & Child Health Programs, National Association of Nurse Practitioners in Women's Health, and the University of Minnesota Rural Health Research Center. These stakeholders were selected based on various criteria, including their production of recent and relevant publications, their participation in relevant HHS events, and their organizational type.

<sup>a</sup>Our analysis of AHRQ National Inpatient Sample data from 2016 through 2018 found similar results. See app. III.

Research we reviewed showed that factors from all three areas disproportionately affected communities of color, especially non-Hispanic Black women. For example, one 2017 study we reviewed found that rural counties with higher proportions of non-Hispanic Black women had higher odds of losing all hospital obstetric services.<sup>40</sup> Another 2018 study found that the prevalence of diabetes and hypertension in women was highest among non-Hispanic Black women—conditions that are associated with maternal mortality and SMM.<sup>41</sup> Studies have also found that when controlling for these factors or other variables, disparities by race and ethnicity may decrease in magnitude but still persist.<sup>42</sup> Three studies we

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<sup>40</sup>P. Hung, C. E. Henning-Smith, M. M. Casey, K. B. Kozhimannil, "Access to Obstetric Services In Rural Counties Still Declining, With 9 Percent Losing Services, 2004-2014," *Health Affairs* vol. 36, no. 9 (2017): p. 1663-1671.

<sup>41</sup>C. Robbins, S.L. Boulet, I. Morgan, D.V. D'Angelo, L.B. Zapata, B. Morrow, A. Sharma, and C.D. Kroelinger, "Disparities in preconception health indicators – behavioral health risk factor surveillance system, 2013-2015, and pregnancy risk assessment monitoring system, 2013-2014," *Morbidity and Mortality Weekly Report*, vol. 67, no. 1 (2018): p. 1-10.

<sup>42</sup>For example, see K.R. Fingar, M.M. Hambrick, K.C. Heslin, J.E. Moore, *Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006-2015*, Healthcare Cost and Utilization Project Statistical Brief #243 (Rockville, Md.: Agency for Healthcare Research and Quality, September 2018); M.A. Harper, M.A. Espeland, E. Dugan, R. Meyer, K. Lane, S. Williams, "Racial disparity in pregnancy-related mortality following a live birth outcome," *Annals of Epidemiology*, vol. 14, no. 4 (2004): p. 274-279; Howell, E.A. "Reducing Disparities in Severe Maternal Morbidity and Mortality," *Clinical Obstetrics and Gynecology*, vol. 61, no. 2 (2018): p. 387-399; Kozhimannil, Interrante, Henning-Smith, Admon, "Rural-Urban Differences," p. 2077-2085; A. Moaddab, G.A. Dildy, H.L. Brown, Z.H. Bateni, M.A. Belfort, H. Sangi-Haghpeykar, and S.L. Clark, "Health care disparity and pregnancy-related mortality in the United States, 2005-2014," *Obstetrics & Gynecology*, vol. 131, no. 4 (2018): p. 707-712; D. Rosenberg, SE. Geller, L. Studee, S.M. Cox, "Disparities in mortality among high risk pregnant women in Illinois: a population based study," *Annals of Epidemiology*, vol. 16, no. 1 (2006): p. 26-32; A.F. Saftlas, L.M. Koonin, H.K. Atrash, "Racial disparity in pregnancy-related mortality associated with livebirth: can established risk factors explain it?" *American Journal of Epidemiology*, vol. 152 (2000): 413-419.

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reviewed cited various factors that could affect these disparities, such as differences in medical care received and chronic psychological and social stress.<sup>43</sup>

Officials we interviewed from two selected states and two stakeholder organizations discussed the role that racism and implicit bias may play in perpetuating these disparities. For example, officials from two stakeholder organizations stated that implicit biases and misperceptions about communities of color, especially non-Hispanic Black women, may exacerbate disparities by race and ethnicity in access to care and maternal health outcomes, including maternal mortality and SMM.<sup>44</sup> For example, officials from one stakeholder organization stated that implicit biases may affect the way providers counsel patients about treatment options, which could affect maternal health outcomes. State officials in the three states we reviewed also discussed the need for trainings in health equity, implicit biases, and systemic racism to help address disparities in maternal mortality and SMM.

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## CDC and HRSA Fund Programs to Reduce Maternal Mortality and SMM, but Do Not Systematically Analyze Program Data by Rural or Underserved Areas

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### CDC and HRSA Fund Programs That Aim to Reduce Maternal Mortality and SMM and Collect Relevant Program Data

Several HHS programs funded through CDC and HRSA aim to improve maternal health outcomes, including maternal mortality and SMM. Some

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<sup>43</sup>Harper, et al, "Racial disparity in pregnancy-related mortality," p. 274-279; Howell, "Reducing Disparities," p. 387-399; Saftlas, Koonin, Atrash, "Racial disparity in pregnancy-related mortality," p. 413-419.

<sup>44</sup>According to a systematic literature review published in April 2020, there are no current studies that explicitly consider the association of measures of individual and structural racism with maternal mortality and SMM; however, research has demonstrated this association between measures of individual and structural racism and other birth outcomes, including pre-term birth and low-birth weight. See, E. Wang, K.B. Glazer, E.A. Howell, T.M. Janevic, "Social Determinants of Pregnancy-Related Mortality and Morbidity in the United States: A Systematic Review," *Obstetrics & Gynecology* vol. 135, no. 4 (2020): p. 896-915.

of these programs require funding to be used in rural or underserved areas, as indicated in the funding announcements for the programs. For programs that do not require funding to be used in rural or underserved areas, program awardees can decide to use the funding to target these areas. CDC and HRSA collect data related to maternal mortality and SMM that can be used to track the progress of several of their programs. Below are examples of selected programs funded through CDC and HRSA that aim to improve maternal health, along with examples of data related to maternal mortality and SMM collected for these programs. (See appendices IV and V for more information on CDC and HRSA's maternity-related programs and examples of how the three selected states in our review used funding from these programs to improve maternal health in their states.)

**CDC.** CDC's Enhancing Reviews and Surveillance to Eliminate Maternal Mortality Program provides funding to states to coordinate and manage maternal mortality review committees, which convene at the state or city level to review deaths during or within a year of pregnancy and recommend actions to prevent similar deaths in the future. Awardees we spoke with from all three selected states told us they considered geographic factors and social determinants of health, such as where people live and work, in their reviews of pregnancy-related deaths.<sup>45</sup> These awardees also told us that their maternal mortality review committees had a diverse representation of participants across different health care professions, including from rural and underserved areas.

CDC collects data related to maternal mortality and SMM for several of its maternal health programs. For example, users of CDC's Levels of Care Assessment Tool collect data on the number of maternal deaths in hospitals and the number of women who were admitted to an intensive care unit. See figure 8 for examples of data CDC collects on selected maternal health programs.

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<sup>45</sup>According to CDC, social determinants of health are conditions in the places where people live, learn, work, and play that affect a wide range of health and quality-of-life risks and outcomes.

**Figure 8: Examples of Data the Centers for Disease Control and Prevention (CDC) Collects for Selected Maternal Health Programs**

Program	Program description	Data collected	Example
<b>Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM)</b>	Provides funding that supports states to coordinate and manage Maternal Mortality Review Committees (MMRC) that convene at the state or local level to comprehensively review deaths of women during or within a year of pregnancy.	✓	MMRCs share maternal mortality data through CDC's Maternal Mortality Review Information Application, which provides the repository for the collection of clinical and non-clinical information surrounding a woman's life and death and standardized indicators for common underlying causes to pregnancy-related deaths that can be used for surveillance, monitoring, and examining maternal mortality. <sup>a</sup>
<b>Levels of Care Assessment Tool (LOCATE)</b>	Provides technical assistance to states to implement a web-based instrument to classify birthing facilities based on the level of risk-appropriate care they can provide and help them to identify quality improvement opportunities or generate measures used for monitoring performance of risk-appropriate care systems.	✓ ✓	LOCATE's maternal section includes the number of maternal deaths at a health care facility and the number of women who were admitted to an intensive care unit or received four or more units of blood during labor and delivery.
<b>National Network of Perinatal Quality Collaboratives (PQC)</b>	Provides funding to PQCs nationwide to improve care and programming related to maternal health broadly including through promoting collaborative learning, through providing technical assistance in the use of rapid response data and quality improvement support, and through providing resources to states.	✓	PQCs typically use outcome measures to understand the initiative's effect on a health outcome or other outcomes of interest. PQCs conduct a variety of quality initiatives related to severe maternal morbidity, including reducing hypertensive disorders during pregnancy and reducing obstetric hemorrhage.

✓ Maternal mortality    ✓ Severe maternal morbidity

Source: GAO analysis of information from CDC. | GAO-21-283

**Data table for Figure 8: Examples of Data the Centers for Disease Control and Prevention (CDC) Collects for Selected Maternal Health Programs**

Program	Program description	Data collected	Example
Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM)	Provides funding that supports states to coordinate and manage Maternal Mortality Review Committees (MMRC) that convene at the state or local level to comprehensively review deaths of women during or within a year of pregnancy.	<ul style="list-style-type: none"> <li>Maternal mortality</li> </ul>	MMRCs share maternal mortality data through CDC's Maternal Mortality Review Information Application, which provides the repository for the collection of clinical and non-clinical information surrounding a woman's life and death and standardized indicators for common underlying causes to pregnancy-related deaths that can be used for surveillance, monitoring, and examining maternal mortality. <sup>a</sup>
Levels of Care Assessment Tool (LOCATE)	Provides technical assistance to states to implement a web-based instrument to classify birthing facilities based on the level of risk-appropriate care they can provide and help them to identify quality improvement opportunities or generate measures used for monitoring performance of risk-appropriate care systems.	<ul style="list-style-type: none"> <li>Maternal mortality</li> <li>Severe maternal morbidity</li> </ul>	LOCATE's maternal section includes the number of maternal deaths at a health care facility and the number of women who were admitted to an intensive care unit or received four or more units of blood during labor and delivery.
National Network of Perinatal Quality Collaboratives (PQC)	Provides funding to PQCs nationwide to improve care and programming related to maternal health broadly including through promoting collaborative learning, through providing technical assistance in the use of rapid response data and quality improvement support, and through providing resources to states.	<ul style="list-style-type: none"> <li>Severe maternal morbidity</li> </ul>	PQCs typically use outcome measures to understand the initiative's effect on a health outcome or other outcomes of interest. PQCs conduct a variety of quality initiatives related to severe maternal morbidity, including reducing hypertensive disorders during pregnancy and reducing obstetric hemorrhage.

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<sup>a</sup>According to CDC the Maternal Mortality Review Information Application is a data system designed to facilitate MMRC functions through a common data language, which includes helping MMRCs organize available data and begin the critical steps necessary to comprehensively identify and assess maternal mortality cases.

**HRSA.** HRSA funds several programs that specifically target maternal mortality and SMM in rural and underserved areas by requiring the inclusion of these areas in its funding announcements. These programs aim to reduce maternal mortality and SMM through a variety of methods such as by increasing health care provider capacity, and establishing networks to support state maternal health programs and surveillance efforts. For example, HRSA's Rural Maternity and Obstetrics Management Strategies program provides funding to awardees to develop models of strategies and approaches that aim to improve access to maternal and obstetrics care in rural areas. Awardees from one state said that they planned to use this funding to establish two prenatal clinics in rural areas that did not previously have local access to prenatal care services. These awardees also planned to increase access to obstetric care by expanding telehealth services and establishing a partnership between the network of clinical and social support services and high-risk pregnancy providers.

In addition, HRSA collects data related to efforts to reduce maternal mortality and SMM for selected maternal health programs. For its Maternal, Infant, and Early Childhood Home Visiting Program, HRSA collects from its awardees data on the percentage of mothers enrolled who received a postpartum visit with a health care provider within 56 days of delivery, among other things. See figure 9 for examples of data HRSA collects for selected maternal health programs.

**Figure 9: Examples of Data the Health Resources and Services Administration (HRSA) Collects for Selected Maternal Health Programs**

Program	Program description	Data collected	Example
<b>Alliance for Innovation on Maternal Health (AIM)</b>	Provides support to reduce maternal mortality and SMM by engaging provider organizations, state-based public health systems, consumer groups and other stakeholders in a national partnership to develop and implement maternal safety bundles. <sup>a</sup>	✔	AIM awardees collect and analyze outcome measures data to track improvement in the implementation of the maternal safety bundles related to leading causes of maternal mortality and SMM, such as obstetric hemorrhage, hypertensive emergencies, thromboembolism, cesarean births, opioid use disorder, and racial/ethnic disparities. <sup>b</sup>
<b>Healthy Start Initiative: Eliminating Disparities in Perinatal Health</b>	Provides funding for recipients to hire clinical providers to provide maternity care and support to health educators by conducting training on the identification of maternal early warning signs in order to prevent obstetric emergencies often related to maternal mortality and SMM.	✔	Healthy Start awardees report on a variety of different performance measures, such as the percentage of program participants who are covered by health insurance, receive a postpartum visit, and are screened for depression and intimate partner violence.
<b>Maternal, Infant, and Early Childhood Home Visiting (MIECHV)</b>	Provides funding to states, territories, and tribal entities to provide voluntary, evidence-based home visiting services for pregnant women and parents with young children up to kindergarten entry.	✔	MIECHV awardees report on a variety of different performance measures, such as the percentage of program participants who receive a postpartum visit with a health care provider and who are screened for depression and intimate partner violence.
<b>Rural Maternal and Obstetrics Management Strategies (RMOMS)</b>	Provides funding to entities to develop models of strategies and approaches to improve access to and continuity of maternal and obstetrics care in rural communities.	✔ ✔	RMOMS awardees establish various performance measures that they are expecting to report on, such as the number of women who receive obstetric services and case management, prenatal visits per delivery, and maternal deaths.
<b>State Maternal Health Innovation (MHI)</b>	Provides funding to states to strengthen partnerships and collaboration by establishing a state-focused Maternal Health Task Force, improving state-level data surveillance on maternal mortality and SMM, and promoting and executing innovation in maternal health service delivery.	✔ ✔	State MHI awardees report on performance data, such as the percentages of women who are covered by health insurance, receive prenatal and postpartum care, and are screened for depression. They also report the rate of pregnancy-associated deaths, and associated racial, ethnic, and/or geographic disparities.
<b>Supporting Maternal Health Innovation (MHI)</b>	Provides funding to a single entity to support efforts to reduce and prevent maternal mortality and SMM by providing capacity-building assistance to State MHI and RMOMS Programs awardees to implement innovative and evidence-informed strategies, and by establishing a resource center to provide national guidance in improving maternal health.	✔	The Supporting MHI awardee reports on measures related to the educational attainment of other HRSA awardees who received capacity-building assistance, and increased dissemination of resources to support the adoption of AIM patient safety bundles (see above), as well as other evidence-informed strategies to serve communities experiencing disparities that contribute to maternal mortality and SMM.
<b>Title V Maternal and Child Health (MCH) Services Block Grant<sup>c</sup></b>	Provides funding to states and jurisdictions to, among other things, support promotion of health and wellbeing before, during, and after pregnancy. Commonly cited activities supported or complemented by the block grants include other federal initiatives such as MMRCs, PQCs, and implementation of AIM maternal safety bundles. In addition, the block grants support direct and enabling services, workforce training, health promotion education campaigns, and family engagement.	✔ ✔ ✔	The Title V MCH Services Block Grant, through its national performance measure framework tracks 15 national performance measures and 25 national outcome measures that cross all MCH population domains with four national performance measures reflecting maternal health, which include: well-woman visit, low-risk cesarean delivery, preventive dental visit during pregnancy, and smoking during pregnancy.

✔ Maternal mortality    ✔ Severe maternal morbidity    ✔ Other maternal health performance measure

Source: GAO analysis of information from HRSA. | GAO-21-283

**Data table for Figure 9: Examples of Data the Health Resources and Services Administration (HRSA) Collects for Selected Maternal Health Programs**

Program	Program description	Data collected	Example
Alliance for Innovation on Maternal Health (AIM)	Provides support to reduce maternal mortality and SMM by engaging provider organizations, state-based public health systems, consumer groups and other stakeholders in a national partnership to develop and implement maternal safety bundles. <sup>a</sup>	<ul style="list-style-type: none"> <li>Severe maternal morbidity</li> </ul>	AIM awardees collect and analyze outcome measures data to track improvement in the implementation of the maternal safety bundles related to leading causes of maternal mortality and SMM, such as obstetric hemorrhage, hypertensive emergencies, thromboembolism, cesarean births, opioid use disorder, and racial/ethnic disparities. <sup>b</sup>
Healthy Start Initiative: Eliminating Disparities in Perinatal Health	Provides funding for recipients to hire clinical providers to provide maternity care and support to health educators by conducting training on the identification of maternal early warning signs in order to prevent obstetric emergencies often related to maternal mortality and SMM.	<ul style="list-style-type: none"> <li>Other maternal health performance measure</li> </ul>	Healthy Start awardees report on a variety of different performance measures, such as the percentage of program participants who are covered by health insurance, receive a postpartum visit, and are screened for depression and intimate partner violence.
Maternal, Infant, and Early Childhood Home Visiting (MIECHV)	Provides funding to states, territories, and tribal entities to provide voluntary, evidence-based home visiting services for pregnant women and parents with young children up to kindergarten entry.	<ul style="list-style-type: none"> <li>Other maternal health performance measure</li> </ul>	MIECHV awardees report on a variety of different performance measures, such as the percentage of program participants who receive a postpartum visit with a health care provider and who are screened for depression and intimate partner violence.
Rural Maternal and Obstetrics Management Strategies (RMOMS)	Provides funding to entities to develop models of strategies and approaches to improve access to and continuity of maternal and obstetrics care in rural communities.	<ul style="list-style-type: none"> <li>Maternal mortality</li> <li>Other maternal health performance measure</li> </ul>	RMOMS awardees establish various performance measures that they are expecting to report on, such as the number of women who receive obstetric services and case management, prenatal visits per delivery, and maternal deaths.
State Maternal Health Innovation (MHI)	Provides funding to states to strengthen partnerships and collaboration by establishing a state-focused Maternal Health Task Force, improving state-level data surveillance on maternal mortality and SMM, and promoting and executing innovation in maternal health service delivery.	<ul style="list-style-type: none"> <li>Maternal mortality</li> <li>Other maternal health performance measure</li> </ul>	State MHI awardees report on performance data, such as the percentages of women who are covered by health insurance, receive prenatal and postpartum care, and are screened for depression. They also report the rate of pregnancy-associated deaths, and associated racial, ethnic, and/or geographic disparities.
Supporting Maternal Health Innovation (MHI)	Provides funding to a single entity to support efforts to reduce and prevent maternal mortality and SMM by providing capacity-building assistance to State MHI and RMOMS Programs awardees to implement innovative and evidence-informed strategies, and by establishing a resource center to provide national guidance in improving maternal health.	<ul style="list-style-type: none"> <li>Severe maternal morbidity</li> <li>Other maternal health performance measure</li> </ul>	The Supporting MHI awardee reports on measures related to the educational attainment of other HRSA awardees who received capacity-building assistance, and increased dissemination of resources to support the adoption of AIM patient safety bundles (see above), as well as other evidence-informed strategies to serve communities experiencing disparities that contribute to maternal mortality and SMM.
Title V Maternal and Child Health (MCH) Services Block Grant <sup>c</sup>	Provides funding to states and jurisdictions to, among other things, support promotion of health and wellbeing before, during, and after pregnancy. Commonly cited activities supported or complemented by the block grants include other federal initiatives such as MMRCs, PQCs, and implementation of AIM maternal safety bundles. In addition, the block grants support direct and enabling services, workforce training, health promotion education campaigns, and family engagement.	<ul style="list-style-type: none"> <li>Maternal mortality</li> <li>Other maternal health performance measure</li> </ul>	The Title V MCH Services Block Grant, through its national performance measure framework tracks 15 national performance measures and 25 national outcome measures that cross all MCH population domains with four national performance measures reflecting maternal health, which include: well-woman visit, low-risk cesarean delivery, preventive dental visit during pregnancy, and smoking during pregnancy.



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<sup>a</sup>Maternal safety bundles are sets of evidence-based practices that when implemented collectively and reliably in the delivery setting may improve patient outcomes and reduce maternal mortality and SMM.

<sup>b</sup>Obstetric hemorrhages includes placental abruption (when the placenta partially or completely separates from the inner wall of the uterus before delivery), ruptured ectopic pregnancy (when a fertilized egg implants outside of the uterus, such as in a fallopian tube, and ruptures as it grows), and hemorrhage due to retained placenta (generally when the placenta is not expelled within 30 minutes of delivery of the infant). Hypertensive emergencies of pregnancy include conditions such as preeclampsia (high blood pressure during pregnancy or postpartum and other organ damage). Thrombotic, pulmonary, or other embolisms include deep vein thrombosis (when a blood clot forms in a deep vein, usually in the lower leg, thigh, or pelvis).

<sup>c</sup>See Title V of the Social Security Act (codified as amended at 42 U.S.C. §§ 701-710).

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## CDC and HRSA Do Not Systematically Analyze Maternal Health Program Data by Rural or Underserved Areas

As discussed above, CDC and HRSA collect data related to efforts to reduce maternal mortality and SMM for selected maternal health programs. CDC and HRSA officials analyze such data to assess their programs related to maternal mortality and SMM. However, we found these agencies do not systematically disaggregate and analyze these data by rural and underserved areas to determine the extent to which program resources are provided to these areas. For example, HRSA officials analyze data on maternal mortality and SMM reported through its Title V MCH Services Block Grant program on an annual basis and present national and state-level rates of maternal mortality and SMM in an annual report.<sup>46</sup> However, the data they present are disaggregated by rural areas for SMM but not for maternal mortality, and neither measure is disaggregated by underserved areas to determine the extent to which program resources are provided to these specific areas.

In our prior work, we have identified leading practices for using performance information. For example, our prior work identified practices that can enhance agencies' use of performance information by disaggregating data to identify specific aspects of performance and to analyze the information as needed to focus on particular problem areas.<sup>47</sup> The Office of Management and Budget guidance also states that agency leaders should improve program outcomes by collecting and analyzing

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<sup>46</sup>See Title V of the Social Security Act (codified as amended at 42 U.S.C. §§ 701-710).

<sup>47</sup>See GAO, *Enhancing Agency Use of Performance Information For Management Decision Making*, [GAO-05-927](#) (Washington, D.C. September 9, 2005).

data in ways that inform targeting, identifying, and promoting the adoption of effective practices.<sup>48</sup>

CDC officials said they do not systematically disaggregate or analyze maternal health program data by rural and underserved areas because the agency defers to states to conduct more granular analyses based on their identified priorities. HRSA officials said they do not systematically disaggregate or analyze maternal health program data because there are differences in the availability and granularity of program data, making it challenging to conduct these analyses for some programs.

In the absence of disaggregating and analyzing maternal health program data by rural and underserved areas, CDC and HRSA may be missing an opportunity to assess key information on the extent to which these programs are reaching these areas. Further, without such analyses, CDC and HRSA may not be able to track the needs, trends, and potential disparities in rural and underserved areas as our analyses have shown, and use that information to inform evidence-based responses.

Conducting these types of analyses and sharing the results, could also help awardees, such as states, better focus their maternal health program efforts at the local level. Officials and awardees from two states we interviewed said that it would be useful to conduct analyses on maternal health program data by different geographic areas or subpopulations since states may not have sufficient resources to track outcomes for rural and underserved areas or various populations, such as American Indian/Alaska Natives and migrant workers. By systematically disaggregating and analyzing maternal health program data by rural and underserved areas, CDC and HRSA would be better positioned to help ensure that program funding is being used to help address any needs in these areas.

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<sup>48</sup>See Office of Management and Budget, *Preparation, Submission and Execution of the Budget, Part 6, Sections 200 and 290*, OMB Circular No. A-11 (December 2020). In addition, Federal Standards for Internal Control call for agencies to use quality information to achieve the agencies' objectives and use the information to identify and address risk. [GAO-14-704G](#) (Washington, D.C. September 10, 2014).

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## HHS Has Taken Actions to Improve Maternal Health, but Could Benefit from Additional Coordination to Monitor Maternal Health Efforts

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### HHS Funds Various Programs and Released an Action Plan in December 2020 to Improve Maternal Health

In addition to programs funded by CDC and HRSA that aim to reduce maternal mortality and SMM, HHS has taken actions to help improve maternal health outcomes, in part by funding various campaign initiatives and programs broadly related to maternal health. For example, HHS's Office on Women's Health implemented the following campaigns:

- **The It's Only Natural Campaign** provides educational tools, resources and materials to community-based organizations, women's health programs, and local hospitals to increase breastfeeding rates, as a part of a larger strategy to improve blood pressure control among women of reproductive age. The It's Only Natural Campaign provides lactation consulting, peer support groups, materials with tips and benefits of breastfeeding, and information on local community services and resources. According to HHS, this effort is especially relevant for Black women, who have lower rates of breastfeeding compared to women in other racial and ethnic groups and who are at increased risk of hypertension. This campaign could contribute to decreasing SMM as breastfeeding is associated with a reduced risk of hypertension and diabetes, which are associated with SMM.<sup>49</sup>
- **The Move Your Way Maternal Health Campaign** aims to increase physical fitness in pregnant and postpartum women through a community-based prevention marketing campaign that was developed by conducting research on pregnant and postpartum women and their health care providers to create targeted tools and resources for these

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<sup>49</sup>Rameez RM, et al. *Association of Maternal Lactation With Diabetes and Hypertension: A Systematic Review and Meta-analysis*, JAMA Network Open, accessed June 12, 2020, <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/10.1001/jamanetworkopen.2019.13401>. Kozhimannil, K.B., J.D. Interrante, C. Henning-Smith, and L.K. Admon, "Rural-Urban Differences In Severe Maternal Morbidity And Mortality In The US, 2007–15," *Health Affairs*, vol. 38, no. 12, (2019): p. 2077-2085.

specific audiences. In 2021, the HHS Office on Women’s Health, with the Office of Disease Prevention and Health Promotion, has begun piloting a demographically targeted implementation strategy of the campaign for women who are pregnant and postpartum. According to HHS officials, the pilot studies include women in underserved and rural areas.

- **The Postpartum Depression Campaign** will aim to improve provider and patient knowledge about postpartum depression and mental health issues that occur after giving birth, which are contributing factors to pregnancy-associated deaths.<sup>50</sup> The campaign will feature testimonials of women who were treated for postpartum depression to help empower other women to seek resources if they are experiencing symptoms after giving birth. According to research, women in communities of color, residents in rural areas, and women of lower socioeconomic status may be more likely to experience postpartum depression symptoms and may be less likely to seek treatment for those symptoms.<sup>51</sup> According to HHS officials, the Office on Women’s Health will coordinate with HRSA’s Maternal Infant and Early Childhood Home Visiting program to promote the campaign in rural and underserved areas.

In October 2020, HHS’s Office on Women’s Health also announced two challenge competitions for programs that work to improve maternal health by focusing on hypertension and breastfeeding. The first challenge competition sought programs to provide care for women with hypertension who are pregnant or postpartum, and the second challenge competition sought programs that aim to address disparities among breastfeeding mothers. In the same month, HHS’s Office on Women’s Health announced that it entered into a contract to improve the quality of nationwide maternal health data and create a network of at least 200 hospitals across all census regions in the United States to deploy clinical, evidence-based practices in maternity care. HHS officials stated that the

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<sup>50</sup>Pregnancy-associated deaths are deaths during pregnancy or within 1 year of the end of pregnancy, regardless of the outcome, duration, or site of the pregnancy. Unlike pregnancy-related deaths, these may arise from accidental causes. See 42 U.S.C. § 247b-12(e)(2).

<sup>51</sup>Dolbier CL, et al. “*Relationships of Race and Socioeconomic Status to Postpartum Depressive Symptoms in Rural African American and Non-Hispanic White Women.*” *Maternal Child Health Journal.* vol. 17, no. 7 (2013): p.1277-1287.

Cannon C, et. al. “*A focus on postpartum depression among African American women: A literature review.*” *Annals of Clinical Psychiatry.* vol. 31, no. 2 (2019): p.138-143.

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contractor will provide ongoing quarterly reports to HHS starting in the fall or winter of 2021, and the Office on Women’s Health will use data analysis software to examine maternal health trends, including in rural and underserved areas. HHS also noted that this data will inform policy and validate evidence-based practice to improve maternal and infant health outcomes.

Further, in December 2020, HHS issued an action plan to improve maternal health in the United States, which includes objectives that target women in rural and underserved areas.<sup>52</sup> This action plan includes a goal for reducing the U.S. maternal mortality rate by 50 percent by 2025 and notes that addressing geographic disparities is critical to achieving the target goals to improve maternal health outcomes. HHS also announced in December 2020 that it is beginning a public-private partnership with the March of Dimes to help address the disparity gap in maternal health outcomes for Black women through the implementation of evidence-based practices in hospital settings.

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### HHS Has Two Maternal Health Workgroups That Could Benefit from Additional Coordination on Monitoring Maternal Health Efforts

HHS has two workgroups—the Healthy People Maternal, Infant, and Child Health Workgroup and the Maternal Health Working Group—that aim to improve maternal health outcomes, including reducing the incidence of maternal mortality and SMM, by coordinating across federal agencies within HHS on maternal health efforts. Specifically:

- **The Healthy People Maternal, Infant, and Child Health Workgroup** includes representatives from AHRQ, CDC, HRSA, and other entities within HHS. This workgroup develops and tracks data for Healthy People objectives related to maternal, infant, and child health, including those for maternal mortality and SMM.
- **The Maternal Health Working Group** includes representatives from AHRQ, CDC, HRSA, CMS, and the National Institutes of Health. According to HHS officials, the Maternal Health Working Group is

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<sup>52</sup>Department of Health and Human Services, *Healthy Women, Healthy Pregnancies, Healthy Futures: Action Plan to Improve Maternal Health in America* (Washington, D.C.: December 3, 2020).

responsible for coordinating maternal health activities across HHS.

As noted, in December 2020, HHS issued an action plan to improve maternal health that includes a goal for reducing maternal mortality and objectives that target women in rural and underserved areas. The action plan does not specify how HHS's two workgroups will be involved in coordinating activities or tracking progress toward meeting this goal and these objectives. However, these two workgroups are uniquely positioned to coordinate across the department's maternal health programs to determine how program data could be considered in light of HHS's goal and objectives. For example, representatives from AHRQ, CDC, and HRSA are included in both workgroups and therefore would be well-positioned to coordinate on maternal health efforts across HHS.

Officials from HHS's two workgroups said they coordinated in developing the action plan and plan to continue to coordinate in implementing the plan going forward, but they do not have a formal relationship established for doing so, or for coordinating broadly on maternal health efforts across HHS. Rather, officials explained that members from each workgroup attend the others' regular monthly or biweekly standing meetings and they informally coordinate on particular efforts, as appropriate. However, without a more formalized approach to coordination, the two workgroups may each independently review maternal health program data, discuss potential changes to programs, or initiate agency-wide efforts to help HHS achieve its action plan goal and objectives that could be duplicative of each of the respective workgroup's efforts.

In our prior work, we have reported that effective coordination can help reduce overlap and have identified practices that can enhance and sustain collaboration among federal agencies through working groups, including developing mechanisms to monitor, evaluate, and report on results.<sup>53</sup> For example, we previously reported that working groups can ensure accountability by considering ways to track and monitor progress, such as by identifying and sharing relevant agency performance data.<sup>54</sup> We also previously reported on leading practices in interagency

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<sup>53</sup>GAO, *Fragmentation, Overlap, and Duplication: An Evaluation and Management Guide*, [GAO-15-49SP](#) (Washington, D.C.: Apr. 14, 2015).

<sup>54</sup>GAO, *Managing for Results: Implementation Approaches Used to Enhance Collaboration in Interagency Groups*, [GAO-14-220](#) (Washington, D.C. February 14, 2020).

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coordination mechanisms, such as establishing clearly defined outcomes and a coordinated approach to track and monitor their progress.<sup>55</sup>

Officials from the Healthy People Maternal, Infant, and Child Health Workgroup said they did not establish a formal relationship with the Maternal Health Working Group to coordinate their respective efforts because both groups have representatives from several of the same HHS agencies, which inherently allows for coordination. However, Maternal Health Working Group officials noted that agency officials have competing priorities and their respective work does not always get communicated to other groups, which can sometimes result in duplication of effort. For example, both workgroups could take steps to monitor how various HHS efforts contribute to improving maternal health outcomes, such as reducing the national rate of maternal mortality in accordance with HHS's action plan.

Awardees and officials from the three states and three of the four stakeholder organizations we interviewed said that enhanced HHS coordination on its maternal health programs would be beneficial for maternal health program awardees. For example, officials and awardees from two states mentioned that such coordination could lead to exchanging best practices for implementation and oversight of programs and developing and promoting maternal health policies to reduce maternal mortality and SMM in rural and underserved areas.

By more formally coordinating their monitoring of maternal health efforts across HHS programs—such as using standing meetings to exchange information and discuss relevant program efforts and outcomes across HHS—HHS's two workgroups may be in a better position to identify opportunities to achieve HHS's action plan goal for maternal mortality and objectives that target rural and underserved areas. Further, with a more formal coordinated approach to monitoring, the two workgroups together may be able to identify actions, such as developing new programs or strategies, needed to address identified issues or areas that need improvement as a result of such monitoring.

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<sup>55</sup>GAO, *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, [GAO-12-1022](#) (Washington, D.C. September, 27, 2012).

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## Conclusions

Maternal mortality and SMM affect tens of thousands of women in the United States every year, and HHS has prioritized reducing maternal mortality and SMM nationwide. However, 2018 rates of maternal mortality and 2016-2018 rates of SMM lag behind HHS's Healthy People objectives and HHS's action plan goal for maternal mortality. CDC and HRSA have various programs that aim to improve maternal health, but the agencies do not systematically disaggregate or analyze program data by rural and underserved areas. By systematically disaggregating and analyzing maternal health program data by rural and underserved areas, CDC and HRSA would be better positioned to help ensure that program funding is being used to help address any needs in these areas.

Additionally, HHS has two workgroups focused on maternal health that are uniquely positioned to coordinate across relevant agencies. By establishing a more formalized approach for coordinating among its workgroups to monitor maternal health efforts, HHS's workgroups may be in a better position to understand the extent to which its programs are helping to reach the goal of reducing maternal mortality and objectives that target rural and underserved areas. This, in turn, would better position HHS's workgroups to identify actions, such as developing new programs or strategies, needed to address identified issues or areas that need improvement as a result of such monitoring.

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## Recommendations for Executive Action

We are making the following three recommendations:

The Director of CDC should take steps to systematically disaggregate and analyze maternal health program data by rural and underserved areas, and make adjustments to program efforts, as needed.

(Recommendation 1)

The Administrator of HRSA should take steps to systematically disaggregate and analyze maternal health program data by rural and underserved areas and make adjustments to program efforts, as needed.

(Recommendation 2)

The Secretary of Health and Human Services should direct the Healthy People Maternal, Infant, and Child Health Workgroup and the Maternal



Health Working Group to establish a formal coordinated approach for monitoring maternal health efforts across HHS, including in rural and underserved areas. Such an approach could include establishing a process for exchanging information and discussing relevant program efforts and outcomes across HHS during regular standing meetings on a routine basis. (Recommendation 3)

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## Agency Comments

We provided a draft of this report to HHS, including CDC and HRSA, for review and comment. In its written comments, which are reproduced in appendix VII, HHS concurred with our recommendations. Regarding our recommendations related to systematically disaggregating and analyzing maternal health program data by rural and underserved areas, CDC stated that the agency will be implementing new activities with its fiscal year 2021 appropriation for Maternal Mortality Review Committees to improve available data, including implementing a Community Vital Signs Dashboard. HRSA stated that the agency will review its maternal health programs to identify ways to disaggregate and analyze program data by rural and underserved areas. HRSA added that the agency will take necessary steps to identify health disparities, monitor efforts to address them, and make adjustments to program data collection and analysis, as appropriate.

Regarding our recommendation on establishing a formal approach for coordinating efforts, we refined our recommendation in response to HHS's comments on clarifying the recommendation. Specifically, we clarified that HHS's maternal health workgroups should establish a more formalized approach to monitoring maternal health efforts, including in rural and underserved areas and provided an example of what that could entail. In response to our recommendation, HHS's Office of the Assistant Secretary for Health stated that it will review the communication between the Healthy People Maternal, Infant, and Child Health Workgroup and the Maternal Health Working Group and identify ways to formalize methods to track and monitor maternal health efforts and share best practices, including in rural and underserved areas. In addition, HHS provided technical comments, which we incorporated as appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the congressional addresses, the Secretary of Health and Human Services,

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and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at 202-512-7114 or [hundrupa@gao.gov](mailto:hundrupa@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in app. VIII.



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## Appendix I: COVID-19 and Maternal Health

As an emerging public health issue, there are limited data on risks to pregnant women with Coronavirus Disease 2019 (COVID-19) and its effect on adverse maternal health outcomes. However, a Centers for Disease Control and Prevention (CDC) study from November 2020 found that pregnant women with COVID-19 have an increased risk of being admitted to an intensive care unit and of requiring mechanical ventilation, an indicator of SMM.<sup>1</sup> Research also suggests that influenza and other viruses that cause severe respiratory illness disproportionately affect pregnant women.<sup>2</sup>

HHS agencies have several efforts related to addressing maternal health concerns during the COVID-19 pandemic. For example, CDC officials said that they have developed the COVID-19 Pregnancy Module as an optional surveillance component in which state and jurisdictional health departments can participate. The COVID-19 Pregnancy Module collects data on pregnant women's obstetric history and pregnancy complications, as well as the outcomes of the pregnancy. According to CDC officials, they are also in the process of analyzing electronic health record data from a database of 693 hospitals across the United States to assess complications, including SMM, in delivery hospitalizations in 2020 among women with and without a COVID-19 diagnosis at the time of hospitalization. Lastly, CDC stated that a workgroup consisting of CDC subject matter experts and officials from nine states is meeting to develop guidance based on state-tested best practices for identifying pregnancy-associated deaths with a history of COVID-19 infection.

The National Institutes of Health has funded various research studies aimed at understanding effects of the COVID-19 pandemic during and after pregnancy. In a study launched in May 2020, researchers plan to

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<sup>1</sup>Zambrano, L.D., et al. "Update: Characteristics of Symptomatic Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status — United States, January 22–October 3, 2020." *Morbidity and Mortality Weekly Report*, vol. 69 (2020). CDC also makes data available on maternal and infant characteristics among women with confirmed or presumed cases of COVID-19 during pregnancy. See <https://www.cdc.gov/nchs/covid19/technical-linkage.htm>, accessed on March 22, 2021.

<sup>2</sup>Sedigheh Hantoushzadeh, MD., et al. "Maternal Death Due to COVID-19." *American Journal of Obstetrics & Gynecology* vol. 223, no.109 (2020): p.1 -16.

analyze the medical records of up to 21,000 women to evaluate whether changes to health care delivery that were implemented as a result of the pandemic have led to higher rates of pregnancy-related complications and cesarean delivery. In addition, the study will track more than 1,500 pregnant women confirmed with COVID-19 infection, monitoring their health for 6 weeks after childbirth. The National Institutes of Health also launched the Rapid Acceleration of Diagnostics initiative to speed development, commercialization, and implementation of technologies for COVID-19 testing. Part of this initiative aims to understand the factors associated with disparities in COVID-19 testing in underserved and vulnerable populations, including pregnant and postpartum women.

During our interviews with state health department officials and Department of Health and Human Services awardees in three different states—Michigan, North Carolina, and New Mexico—we obtained information regarding how COVID-19 has affected maternal health outcomes and care.<sup>3</sup> We also reviewed literature to identify key categories and factors affecting maternal health during the COVID-19 pandemic. We identified relevant literature through internet searches, and searches of government agency websites, such as CDC. See below for a bibliography of the articles we reviewed.

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Bender W. et al. “The Psychological Experience of Obstetric Patients and Health Care Workers After Implementation of Universal SARS-CoV-2 Testing.” *Am J Perinatol*. 2020; Epub 2020, accessed on October 8, 2020, <https://doi.org/10.1055/s-0040-1715505>.

Centers for Disease Control and Prevention, *Data on COVID-19 During Presidency: Severity of Maternal Illness*, accessed on February 16, 2021,

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<sup>3</sup>We selected states for interviews and analysis to provide variation on the percentage of residents living in rural counties in 2010, the average index of medical underservice score among medically underserved counties, and the state’s participation in federal efforts to reduce maternal mortality and SMM.

<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/special-populations/pregnancy-data-on-covid-19.html>.

Centers for Disease Control and Prevention, *Prenatal Care, January through April, Provisional 2019 and 2020*, last reviewed on June 30, 2020, [https://www.cdc.gov/nchs/health\\_policy/prenatal-covid.htm](https://www.cdc.gov/nchs/health_policy/prenatal-covid.htm).

Ellington, S., et al. “Characteristics of Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status — United States, January 22–June 7, 2020.” *Morbidity and Mortality Weekly Report*, vol. 69, no.25 (2020): p. 769–775.

Fryer, K., et al. “Implementation of Obstetric Telehealth During COVID-19 and Beyond.” *Maternal and Child Health Journal* (2020), accessed on October, 21, 2020 <https://doi.org/10.1007/s10995-020-02967-7>.

GAO, COVID-19: *Federal Efforts Could Be Strengthened by Timely and Concerted Actions*, [GAO-20-701](https://www.gao.gov/products/GAO-20-701) (Washington, D.C.: September 2020).

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National Association of Nurse Practitioners in Women’s Health, *COVID-19 Provider Survey*, Washington, D.C.: March 2020.

Sedigheh Hantoushzadeh, MD., et al. “Maternal Death Due to COVID-19.” *American Journal of Obstetrics & Gynecology*, vol. 223 (2020): P109.E1-109.E16.

Yusuf, K. et al. “Expected Surge in Maternal Mortality and Severe Morbidity among African-Americans in the Era of COVID-19 Pandemic.” *International Journal of Maternal and Child Health and AIDS*, vol. 9,3 (2020): 386-389, accessed on October 7, 2020, <https://pubmed.ncbi.nlm.nih.gov/33014625/>.

Based on our analysis of state interviews and our literature review, we identified factors in three main categories—health system factors, socioeconomic factors, and patient factors. See table 1 for key factors we identified related to COVID-19 and maternal health within these categories and examples we identified in our literature review and from our interviews with selected states.

Appendix I: COVID-19 and Maternal Health

**Table 1: Key Factors That May Affect Maternal Health during the Coronavirus Disease 2019 (COVID-19) Pandemic**

Category	Factor	Examples from Literature	Examples from State Official Interviews
Health Systems Factors	Deferred Maternal and Preventive Health Care	<ul style="list-style-type: none"> <li>According to the Centers for Disease Control and Prevention (CDC), pregnant women and/or health care providers may have canceled or postponed prenatal care visits due to COVID-19, potentially affecting the timing of initiation and adequacy of care.</li> <li>In a survey conducted by Nurse Practitioners in Women’s Health, respondents reported seeing a decrease of 48 percent of gynecologic-oncology, 38 percent in prenatal care, 35 percent in chronic disease follow-up, and 16 percent in high-risk prenatal/postpartum visits.</li> </ul>	<ul style="list-style-type: none"> <li>Officials we spoke with from all three of the states said they observed a decrease in pregnant women receiving prenatal care and other preventive care services, including immunizations and dental care.</li> <li>Officials from one state said that fewer women are getting pregnancy risk screenings, which is an important first step for getting into the high-risk pregnancy program.</li> </ul>
Health Systems Factors	Health Care Delivery Changes	<ul style="list-style-type: none"> <li>Health care facilities may encounter barriers to rapid implementation of prenatal telehealth visits, including lack of technology and high startup costs.</li> <li>Medicare temporarily expanded coverage for telehealth visits; however, there is still a lack of coverage, or clarity surrounding coverage of telehealth visits by other insurance providers, including Medicaid.<sup>a</sup></li> <li>In April 2020, the American College of Obstetricians and Gynecologists issued a statement on birth settings, affirming that hospitals and accredited birth centers are the safest places to give birth, and home births are associated with a more than twofold increased risk of perinatal death.</li> </ul>	<ul style="list-style-type: none"> <li>Officials from two of the three states discussed their experiences transitioning delivery of obstetric care to telehealth. For example, officials and awardees from one state said it was challenging for rural areas due to poor cell phone service and limited access to broadband Internet.</li> <li>Officials from two of the three states anticipated a rise in homebirths in order to avoid potential exposure to COVID-19 at health care facilities.</li> </ul>
Socioeconomic Factors	Racial and Ethnic Disparities	<ul style="list-style-type: none"> <li>Though limited, available data from CDC demonstrate racial and ethnic disparities in indicators of COVID-19 burden, with communities of color bearing a disproportionate burden of COVID-19 cases, hospitalizations, and deaths.</li> <li>As of February 8, 2021, 58 percent of pregnant women with COVID-19 were racial and ethnic minorities.<sup>b</sup></li> </ul>	<ul style="list-style-type: none"> <li>Officials from all three of the states expressed concern that the disproportionately higher rates in positive COVID-19 cases and deaths in Black, Hispanic, and American Indian/Alaska Native persons, would affect existing disparities in maternal mortality and severe maternal morbidity (SMM) rates.</li> </ul>

**Appendix I: COVID-19 and Maternal Health**

<b>Category</b>	<b>Factor</b>	<b>Examples from Literature</b>	<b>Examples from State Official Interviews</b>
Patient Factors	Mental Health	<ul style="list-style-type: none"> <li>Research suggests that increased childcare and homeschool responsibilities, along with social isolation and job security and unemployment as a result of COVID-19, may exacerbate mental health or stress issues during pregnancy.</li> <li>In a cohort study of 318 pregnant women, the majority who tested positive for COVID-19 reported negative in-hospital experiences and perceived lack of provider and partner support. About a third of those who tested negative for COVID-19 reported increased postpartum anxiety compared with their prior deliveries due to concerns about COVID-19 exposure in the hospital and lack of social support.</li> </ul>	<ul style="list-style-type: none"> <li>Officials from two of the three states said that stress due to the COVID-19 pandemic could negatively impact maternal health outcomes.</li> <li>Officials from one state said that COVID-19 may contribute to increased levels of postpartum depression due to social isolation. An official from another state said that COVID-19 has increased concerns about depression and intimate partner violence.</li> <li>The same official said that increased levels of stress, as well as access to care, food, and income security, might play a role in increased pre-term births.</li> </ul>

Source: GAO analysis of literature and interviews with officials from selected states. | GAO-21-283

Note: We selected three states—Michigan, New Mexico, and North Carolina—based on several criteria. Specifically, we selected states to provide variation on the percentage of residents living in rural counties in 2010, the average index of medical underservice score among medically underserved counties, and the state’s participation in federal efforts to reduce maternal mortality and SMM.

<sup>a</sup>The Centers for Medicare & Medicaid Services developed a Medicaid & CHIP Telehealth toolkit to help states accelerate adoption of broader telehealth coverage policies during the COVID-19 pandemic. For more information see <https://www.medicare.gov/medicaid/benefits/telemedicine/index.html>, accessed on March 25, 2021.

<sup>b</sup>Of the data CDC obtained for pregnant women with COVID-19 where race and ethnicity was recorded, 31 percent of the cases were Hispanic or Latino, 15 percent were non-Hispanic Black, 7 percent were multiple or other race, which includes non-Hispanic American Indian/Alaska Native or non-Hispanic Native Hawaiian or Other Pacific Islander, and 4 percent were non-Hispanic Asian or Pacific Islander.

## Appendix II: Scope and Methodology

This appendix provides additional details regarding our definition of rural and underserved areas and our analysis of (1) severe maternal morbidity (SMM) by rurality using data from the Agency for Healthcare Research and Quality's (AHRQ) National Inpatient Sample, (2) SMM by rurality and medical underservice using data from AHRQ's State Inpatient Databases and the Health Resources and Services Administration's (HRSA) medically underserved area (MUA) designation, and our review of (3) literature to identify key factors affecting maternal mortality and SMM in rural and underserved areas.<sup>1</sup>

To ensure reliability of the data, we interviewed relevant agency officials from the Centers for Disease Control and Prevention (CDC) and AHRQ, reviewed related documentation, compared data to previously published reports, and performed electronic testing to identify missing data and obvious errors. On the basis of these steps, we determined that the data were sufficiently reliable for the purposes of our reporting objectives.

**Definition of rural and underserved areas.** For our analysis of SMM data by rurality, we used CDC's National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties, which assigns each county one of six class designations based on its population, ranging from the most populous large central metropolitan counties to the least populous noncore counties.<sup>2</sup> Consistent with the categories used by CDC's National Center for Health Statistics, we combined all four classes of metropolitan counties—large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan—into one category to define metropolitan areas. To define rural areas, we combined the non-metropolitan counties—micropolitan and noncore

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<sup>1</sup>MUAs are geographic areas designated by HRSA as having a shortage of primary care health services based on the area's index of medical underservice score, which accounts for an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate.

<sup>2</sup>CDC's National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties is based on the Office of Management and Budget's 2010 standards for defining metropolitan statistical areas and micropolitan statistical areas. These standards are the most recently available.



counties—into one category.<sup>3</sup> For our review of literature to identify key factors affecting maternal mortality and SMM in rural and underserved areas, we used key words to identify articles that focused on rural areas.

For our analysis of SMM data by underservice, we used HRSA's medically underserved area (MUA) designation, which is used to identify areas with a shortage of primary care services based on an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate. In addition, we developed an operational definition of underserved areas based on a review of relevant academic literature and government sources. For purposes of our report, a source or program will be considered relevant to the scope of underserved areas if it either a) relates to a specific geography that lacks health care providers, such as primary care physicians, and/or facilities appropriate for medical care, as identified by designation as an MUA, a health provider shortage area, or other distinctions, or b) relates to an area with a population that has been demonstrated to face challenges in accessing appropriate medical care. These populations may include medically underserved populations (i.e., the homeless, the Medicaid-eligible population, the low-income population, American Indian/Alaska Natives, or migrant workers); however, they may also include other populations that research or Department of Health and Human Services's (HHS) programs demonstrate have lower rates of access to health care (including women receiving prenatal care, postpartum care, or other medical care).

**Analysis of SMM by rurality using AHRQ's National Inpatient Sample.** To describe what is known about SMM in rural areas, we analyzed data from AHRQ's National Inpatient Sample for 2016 through

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<sup>3</sup>Large central metropolitan areas include counties in metropolitan statistical areas of 1 million or more population that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan.

2018, the most recent years available as of December 2020.<sup>4</sup> The National Inpatient Sample, which is part of the Healthcare Cost and Utilization Project databases, is an all-payer inpatient health care database that includes a stratified sample of community hospital inpatient discharge records, excluding rehabilitation and long-term acute care hospitals. The database contains clinical and non-clinical variables from inpatient discharge records for approximately 20 percent of all community hospital discharges in the United States.

We used methods outlined by AHRQ to identify a universe of delivery hospitalizations in the National Inpatient Sample by isolating records for patients coded as female, aged 12 to 55, with an International Classification of Diseases, 10th Revision, Clinical Modification/Procedure Coding System (ICD-10-CM/PCS) procedure or diagnosis code related to delivery. From this universe of delivery hospitalizations, we identified records that indicated SMM using CDC's list of 21 SMM indicators and their corresponding ICD-10-CM/PCS diagnosis and procedure codes.<sup>5</sup> Any inpatient discharge record with one or more of the SMM diagnosis or procedure codes was classified as a case of SMM. However, consistent with methods recommended in HHS's action plan from December 2020 to improve maternal health in America, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM.<sup>6</sup> As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM. As of January 2021, CDC officials said that AHRQ and CDC are working to update the SMM

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<sup>4</sup>In the last quarter of 2015, SMM indicators transitioned from the International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification to ICD-10-CM/PCS. Data from 2016 is the first full calendar year of diagnosis and procedure codes reported using ICD-10-CM/PCS codes.

<sup>5</sup>See app. III for more information on the SMM indicators.

<sup>6</sup>Department of Health and Human Services, *Healthy Women, Health Pregnancies, Healthy Futures: Action Plan to Improve Maternal Health in America*, (Washington, D.C.: December 3, 2020). HHS recommends focusing on an SMM measure that does not include blood products transfusions in the absence of other SMM indicators. The agency reports that blood transfusions may not always reflect cases of SMM in the absence of other indicators. They also cite changes in data reporting due to the transition from the International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification to ICD-10-CM/PCS. Research studies also show blood transfusions may not always reflect SMM in the absence of other indicators. For example, see Main, E. K., et al, "Measuring severe maternal morbidity: validation of potential measures" *American Journal of Obstetrics and Gynecology*, vol. 214, no. 5 (2016) and Himes, K. P., L.M. Bodnar, "Validation of criteria to identify severe maternal morbidity," *Paediatric and Perinatal Epidemiology* (2020).

definition, including determining how to consider blood products transfusions.

To understand the characteristics of SMM in rural areas, we reviewed estimated rates of SMM by the following variables: SMM indicator, urban-rural classification for patient residence, age group, race or ethnicity, expected primary payer, quartile of median household income for patient ZIP code, and length of stay.<sup>7</sup> We also conducted bivariate analyses on SMM by rurality and by some of the variables listed above. Because the National Inpatient Sample is a sample of inpatient discharge records, we present estimates with associated standard errors, when applicable. In some instances we also conducted statistical tests of differences at the 95 percent confidence level or above. See app. III for additional information on national estimated rates of SMM by these variables.

**Analysis of SMM by medical underservice and rurality using AHRQ's State Inpatient Databases and HRSA's MUAs.** To describe what is known about SMM in rural and underserved areas, we analyzed county-level data extracts from the Healthcare Cost and Utilization Project State Inpatient Databases from non-federal, community, acute care hospitals in participating states for 2016 through 2018, the most recent years available, and from HRSA's MUA data.<sup>8</sup> The State Inpatient Databases are part of AHRQ's Healthcare Cost and Utilization Project databases and include inpatient discharge records across all payers from community hospitals from participating states. AHRQ translates the data received from the participating states into a uniform format. Areas in a state may be designated as an MUA based on the area's index of medical underservice score. States calculate this score using four demographic and health indicators—(1) selected providers per 1,000 population ratio, (2) percentage of population below the federal poverty level, (3)

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<sup>7</sup>For analysis by race and ethnicity, we used the following mutually exclusive categories: non-Hispanic American Indian/Alaska Native, non-Hispanic Asian or Pacific Islander, non-Hispanic Black, Hispanic or Latino, non-Hispanic Other Race, and non-Hispanic White. Urban-rural classification based on patient residence does not take into account whether the hospital that a patient delivered at was located in an urban or rural area.

<sup>8</sup>In the last quarter of 2015, SMM indicators transitioned from the International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification to ICD-10-CM/PCS. Data from 2016 is the first full calendar year of diagnosis and procedure codes reported using ICD-10-CM/PCS.

percentage of population over age 65, and (4) infant mortality rate.<sup>9</sup> The score is out of 100, with zero representing completely underserved. Scores of 62.0 or below are considered underserved. HRSA approves these designations based on its review of relevant state documentation.

We requested county-level data extracts from the Healthcare Cost and Utilization Project State Inpatient Databases from Michigan, New Mexico, and North Carolina for delivery hospitalizations and deliveries with SMM by the following stratified groups: patient's county of residence reported by federal information processing standards code and assigned by the geographic centroid of reported ZIP code, expected primary payer, urban-rural classification for patient ZIP code, race and ethnicity, calendar year, and quartile of median household income for patient ZIP code.

To analyze data from the State Inpatient Databases by MUAs, we downloaded publicly available data from HRSA's web-based MUA Find data tool for Michigan, New Mexico, and North Carolina. We then added MUA data to the state databases based on the variable for patient's county of residence and created a new variable that indicated whether the patient's county of residence was designated as an MUA or not. Counties that are not designated as MUAs in the HRSA data (including those with a status of "withdrawn" and "proposed for withdrawal"), were coded as "non-MUA." Our analysis did not include MUAs that were designated based on an exception requested by the relevant state's governor. Instances in which the counties could not be linked between both files were coded as "missing."

To understand the characteristics of SMM in rural and underserved areas for each selected state, we reviewed the following variables: urban-rural classification for patient's county of residence, MUA designation for patient's county of residence, race and ethnicity, and expected primary payer. We then conducted bivariate analyses on incidents of SMM by MUA designation for patient's county of residence and by urban-rural classification for patient's residential ZIP code. Additionally, we conducted a multivariate analysis of a patient's county of residence, MUA designation for patient's county of residence, and urban-rural classification for patient's county of residence. See app. V. for these geographic analyses.

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<sup>9</sup>According to HRSA officials selected providers include primary care physicians, including those in family practice, general internal medicine, obstetrician-gynecologists, pediatricians, and geriatricians.

**Literature search and review on maternal mortality and SMM in rural and underserved areas.** To identify key factors that can affect maternal mortality and SMM in rural and underserved areas, we conducted a literature search and review. Specifically, we conducted a structured search of multiple databases, including BIOSIS Previews®, Embase®, MEDLINE®, NTIS, PAIS International, APA PsycINFO, Scopus, ProQuest, CINAHL Plus, EconLit, Index to Legal Periodicals and Books, Business Abstracts with Full Text, Business Continuity & Disaster Recovery Reference Center, Risk Management Reference Center, WorldCat, and Harvard Think Tank Search. Our searches included various terms related to our objectives, including “maternal,” “mortality,” “morbidity,” “rural,” “underserved,” among others. Search results were limited to English language materials, focused on the United States, and published from 2015 through 2020. Materials included peer-reviewed articles, conference papers, government reports, and association/non-profit/think tank publications. The structured search identified 54 articles. An analyst reviewed summary information from the articles to determine their relevance to our scope. Of the 54 articles, 49 articles were selected for full-text review.

To review the 49 selected articles for inclusion, we used a structured format to identify (1) the outcome being studied (maternal mortality or SMM), (2) the area or population being studied (rural or underserved), (3) the facts presented about maternal mortality or SMM, (4) the key factors identified affecting maternal mortality and SMM, and (5) the methodology used.<sup>10</sup> One analyst completed the initial review and another analyst independently reviewed their results. Of the 49 articles reviewed, 24 were found to be methodologically sound and relevant to our objectives. To determine whether articles were methodologically sound for purposes of inclusion in our review, we considered the data used, study limitations, and the treatment of confounding variables.

We identified additional articles through internet searches, a review of the bibliographies of articles we obtained, and searches of government agency websites. We used the same structured format to review the 37 additional articles identified for inclusion, and 22 were found to be methodologically sound and relevant to our objectives. See below for a

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<sup>10</sup>Some, but not all, articles controlled for confounding factors that may also influence the outcomes being studied, such as demographic information and clinical conditions.

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bibliography of the articles from our structured search and additional searches.

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## Appendix III: Supplemental Information on Severe Maternal Morbidity

This appendix presents supplemental information and national estimated rates of severe maternal morbidity (SMM). SMM is defined as an unexpected outcome of labor and delivery that results in significant short- or long-term health consequences. National estimated rates of SMM can be identified using hospital administrative data from the Agency for Healthcare Research and Quality’s (AHRQ) National Inpatient Sample within the Healthcare Cost and Utilization Project databases. However, researchers have noted limitations of using hospital administrative data, which can be used to identify cases of SMM because of their original purpose for billing, which means that they may not include all necessary clinical data for research purposes. As of January 2021, HHS officials stated that AHRQ, the Centers for Disease Control and Prevention (CDC), and the Health Resources and Services Administration (HRSA) have efforts underway to consider revisions to the SMM algorithm.

CDC identifies SMM using a list of 21 indicators and corresponding International Classification of Diseases, 10th Revision, Clinical Modification/Procedure Coding System (ICD-10-CM/PCS) diagnosis and procedure codes, which are codes used to uniformly describe a patient’s medical condition and the treatment provided. See table 2 for more information on these indicators.

**Table 2: Indicators of Severe Maternal Morbidity**

Indicator	Definition
Acute myocardial infarction	A heart attack or acute myocardial infarction occurs when one of the arteries that supplies the heart muscle becomes blocked.
Aneurysm	An aneurysm is a bulge or “ballooning” in the wall of an artery.
Acute renal failure	Acute renal failure is the rapid loss of the kidneys’ ability to remove waste and help balance fluids and electrolytes in the body. Acute kidney damage can be caused by pregnancy complications like placenta abruption or placenta previa.
Adult respiratory distress syndrome	Acute respiratory distress syndrome in adults is a life-threatening lung condition that prevents enough oxygen from getting to the lungs and into the blood.
Amniotic fluid embolism	An amniotic fluid embolism occurs when amniotic fluid enters the bloodstream, and can cause organ dysfunction, excessive bleeding, and cardiovascular collapse.

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<b>Indicator</b>	<b>Definition</b>
Cardiac arrest/ventricular fibrillation	Ventricular fibrillation is a severely abnormal heart rhythm (also known as arrhythmia) that is life threatening. During ventricular fibrillation, blood is not pumped from the heart.
Conversion of cardiac rhythm	Cardioversion is a method to bring an abnormal heart rhythm back to normal. Cardioversion can be done using an electric shock or with drugs.
Disseminated intravascular coagulation	Disseminated intravascular coagulation is a disorder in which proteins that control blood clotting become overactive. Risk factors include pregnancy complications, such as placenta left behind after delivery.
Eclampsia	Eclampsia is the new onset of seizures or coma in a pregnant woman with preeclampsia, a complication of pregnancy in which a woman has high blood pressure and other findings, including headaches, abdominal pain, and abnormal blood tests. These seizures are not related to an existing brain condition.
Heart failure/arrest during surgery or procedure	Heart failure occurs when the heart is not able to pump enough oxygen-rich blood to the rest of the body efficiently, and heart arrest occurs when the heart suddenly stops beating and blood flow to the rest of the body, including the brain, stops.
Puerperal cerebrovascular disorders	Suffering a cerebrovascular disorder, or having a stroke, occurs when blood flow to a part of the brain stops. A puerperal stroke occurs in the 6 weeks after delivery.
Pulmonary edema/acute heart failure	A pulmonary edema is an abnormal buildup of fluid in the lungs. It is often caused by congestive heart failure and causes shortness of breath.
Severe anesthesia complications	Severe complications from spinal and epidural anesthesia include complications in the cardiac, pulmonary, and central nervous systems.
Sepsis	Sepsis is an illness in which the body has a severe, inflammatory response to bacteria or other germs.
Shock	Shock is a life-threatening condition that occurs when the body is not getting enough blood flow to provide needed oxygen and nutrients to cells and organs.
Sickle cell disease with crisis	Sickle cell disease occurs when the red blood cells that carry oxygen throughout the body take on a sickle shape. The disease causes painful crises that can last from hours to days and cause pain in the lower back, leg, joints, and chest.
Air and thrombotic embolism	An air and thrombotic embolism occurs when an air bubble enters and travels through the bloodstream, causing a blockage of an artery.
Blood products transfusion <sup>a</sup>	Blood products transfusion includes transfusion of whole blood or parts of blood, like red blood cells, platelets, or plasma. During delivery, a transfusion may be necessary in a variety of cases and may co-occur with another indicator of severe maternal morbidity.
Hysterectomy	Hysterectomy is surgery to remove a person's womb. During childbirth, uncontrolled bleeding can necessitate the procedure.
Temporary tracheostomy	A tracheostomy is a procedure to create an opening through the neck into the trachea to place a tube for use as an airway and to remove secretions from the lungs.
Ventilation	A ventilator is a machine that breathes for a person through a breathing tube that is placed in the mouth or in an opening through the neck into the trachea.

Source: Centers for Disease Control and Prevention and National Library of Medicine. | GAO 21-283

<sup>a</sup>Methods recommended in the Department of Health and Human Services' action plan from December 2020 to improve maternal health in America exclude cases of SMM where blood products transfusions was the sole indicator of SMM. The agency reports that blood transfusions may not always reflect cases of SMM in the absence of other indicators. They also cite changes in data reporting due to the transition from the International Classification of Diseases, 9th Revision, Clinical Modification to the 10th Revision, Clinical Modification/Procedure Coding System. Ongoing work is studying the impact of this change on blood transfusion documentation and SMM.

According to CDC, blood products transfusion was the most commonly experienced indicator from 1993 through 2014. For example, in 2015, 83

percent of all SMM cases involved a blood products transfusion.<sup>1</sup> In addition, HHS's Action Plan to Improve Maternal Health in America from December 2020 noted that including blood transfusions as an indicator of SMM doubled the rate of SMM in hospital births in 2017.<sup>2</sup> However, following the methods adopted in HHS's action plan, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM.<sup>3</sup> As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM. The following figure identifies the most commonly experienced SMM indicators. See figure 10.

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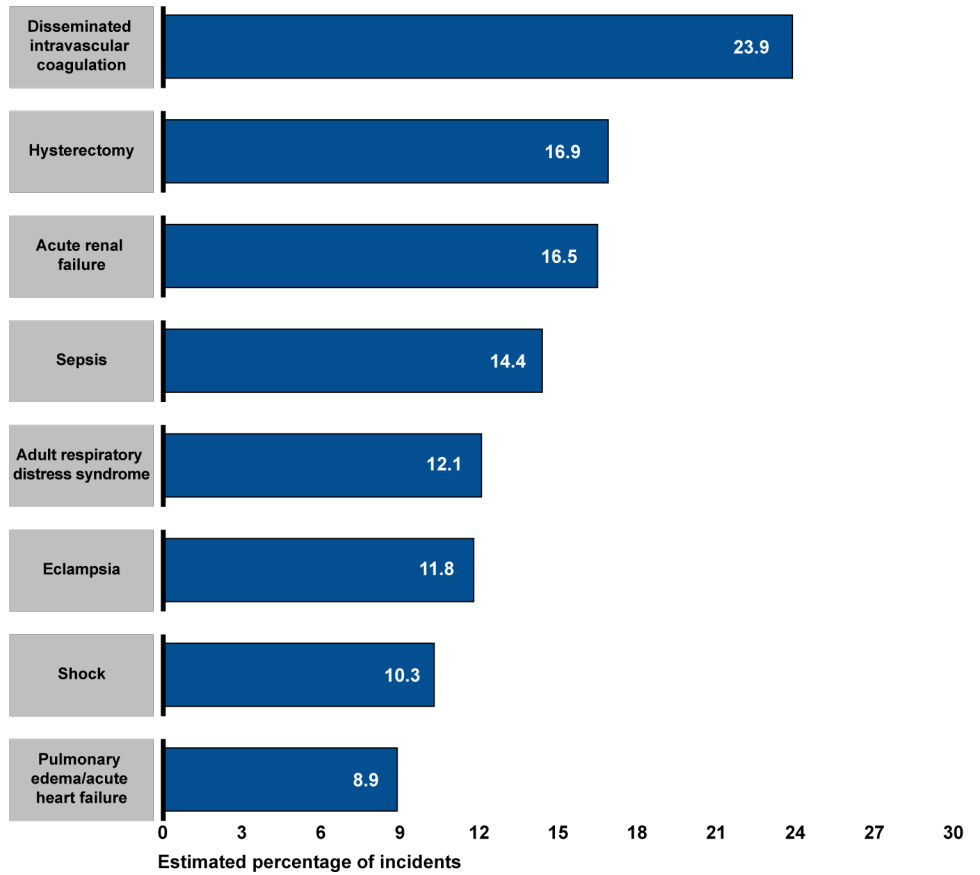
<sup>1</sup>K.R. Fingar, M.M. Hambrick, K.C. Heslin, J.E. Moore, *Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006-2015*, Healthcare Cost and Utilization Project Statistical Brief #243 (Rockville, Md.: Agency for Healthcare Research and Quality, September 2018).

<sup>2</sup>Department of Health and Human Services, *Healthy Women, Health Pregnancies, Healthy Futures: Action Plan to Improve Maternal Health in America*, (Washington, D.C.: December 3, 2020).

<sup>3</sup>HHS recommends focusing on an SMM measure that does not include blood products transfusions in the absence of other SMM indicators. The agency reports that blood transfusions may not always reflect cases of SMM in the absence of other indicators. They also cite changes in data reporting due to the transition from the International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification to ICD-10-CM/PCS. Research studies also show blood transfusions may not always reflect SMM in the absence of other indicators. For example, see Main, E. K., et al, "Measuring severe maternal morbidity: validation of potential measures" *American Journal of Obstetrics and Gynecology*, vol. 214, no. 5 (2016) and Himes, K. P., L.M. Bodnar, "Validation of criteria to identify severe maternal morbidity," *Paediatric and Perinatal Epidemiology* (2020).

Appendix III: Supplemental Information on Severe Maternal Morbidity

**Figure 10: Most Common Indicators of Severe Maternal Morbidity (SMM), 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-283

**Data table for Figure 10: Most Common Indicators of Severe Maternal Morbidity (SMM), 2016-2018**

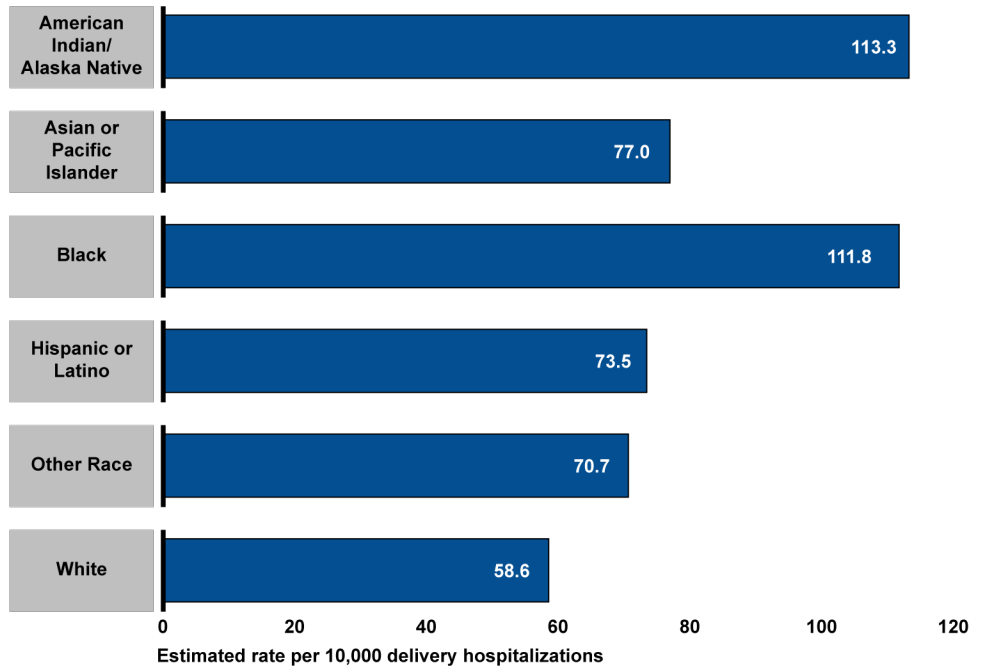
	Estimated percentage of incidents
Disseminated intravascular coagulation	23.9
Hysterectomy	16.9
Acute renal failure	16.5
Sepsis	14.4
Adult respiratory distress syndrome	12.1
Eclampsia	11.8
Shock	10.3
Pulmonary edema/acute heart failure	8.9

**Appendix III: Supplemental Information on Severe Maternal Morbidity**

Notes: This figure presents the top eight indicators of SMM across delivery hospitalizations from 2016 to 2018. Estimates presented in this figure had standard errors ranging from 0.2 to 0.5. A patient may have more than one SMM indicator during their delivery hospitalization. Consistent with methods recommended in HHS’s action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

We have previously reported on racial and ethnic disparities in maternal mortality, and research from AHRQ also demonstrated disparities in SMM rates by race and ethnicity.<sup>4</sup> Our analysis showed that estimated rates of SMM among non-Hispanic Black and non-Hispanic American Indian/Alaska Native women were significantly higher than the estimated rate of SMM among non-Hispanic White women. See figure 11.

**Figure 11: Estimated Rates of Severe Maternal Morbidity (SMM) by Race and Ethnicity, 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality’s Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-283

<sup>4</sup>GAO, *Maternal Mortality: Trends in Pregnancy-Related Deaths and Federal Efforts to Reduce Them*, [GAO-20-248](#) (Washington, D.C.: March 12, 2020) and K.R. Fingar, M.M. Hambrick, K.C. Heslin, and J.E. Moore, *Trends and Disparities in Delivery Hospitalizations*.



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**Appendix III: Supplemental Information on  
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**Data table for Figure 11: Estimated Rates of Severe Maternal Morbidity (SMM) by Race and Ethnicity, 2016-2018**

	<b>Estimated rate per 10,000 delivery hospitalizations</b>
American Indian/Alaska Native	113.3
Asian or Pacific Islander	77.0
Black	111.8
Hispanic or Latino	73.5
Other Race	70.7
White	58.6

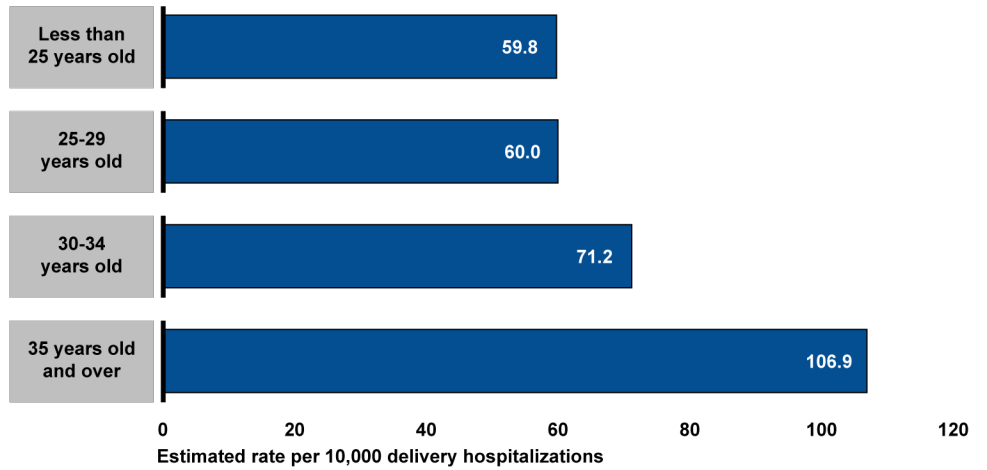
Note: Estimated rates presented in this figure had standard errors ranging from 0.9 to 3.1, except for the category of American Indian/Alaska Native women, which had a standard error of 11.8. American Indian/Alaska Native, Asian or Pacific Islander, Black, and White women, and women of Other Race were of non-Hispanic ethnicity, and Hispanic or Latino women may be of any race. According to the Agency for Healthcare Research and Quality, the National Inpatient Sample does not receive data from Indian Health Service hospitals or tribally-operated facilities. Consistent with methods recommended in HHS's action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

In addition, researchers found that increased maternal age is associated with a higher risk of SMM.<sup>5</sup> Our analysis similarly found that the oldest age group (35 years old and over) had the highest estimated rate of SMM. See figure 12.

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<sup>5</sup>K.R. Fingar, M.M. Hambrick, K.C. Heslin, and J.E. Moore, *Trends and Disparities in Delivery Hospitalizations*.

**Figure 12: Estimated Rates of Severe Maternal Morbidity (SMM) by Age Group, 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-283

**Data table for Figure 12: Estimated Rates of Severe Maternal Morbidity (SMM) by Age Group, 2016-2018**

	Estimated rate per 10,000 delivery hospitalizations
Less than 25 years old	59.8
25-29 years old	60.0
30-34 years old	71.2
35 years old and over	106.9

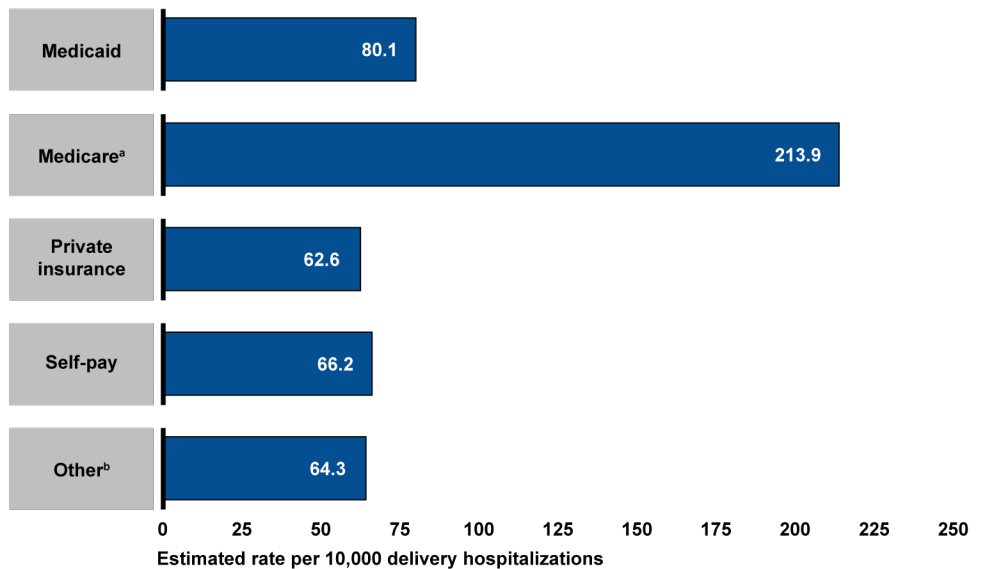
Note: Estimated rates presented in this figure had standard errors ranging from 1.1 to 1.8. Consistent with methods recommended in HHS's action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

In our analysis of the length of stay for delivery hospitalizations, we found that generally women who experienced SMM had longer stays in the hospitals than women who did not. For example, while an estimated 13.7 percent of delivery hospitalizations require a stay of 4 or more days, an estimated 62.1 percent of delivery hospitalizations with SMM incidents require such a stay. The average estimated stay for a delivery

hospitalization with SMM was 6 days compared to an average estimated stay for delivery hospitalizations without SMM of 2.6 days.<sup>6</sup>

Existing research shows that Medicaid paid for over 40 percent of births in 2018.<sup>7</sup> Our analysis by expected primary payer showed higher estimated rates of SMM among women with an expected primary payer of Medicaid or Medicare compared to privately insured women and women in the self-pay and other categories. See figure 13.

**Figure 13: Estimated Rates of Severe Maternal Morbidity (SMM) by Expected Primary Payer, 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-283

**Data table for Figure 13: Estimated Rates of Severe Maternal Morbidity (SMM) by Expected Primary Payer, 2016-2018**

	Estimated rate per 10,000 delivery hospitalizations
Medicaid	80.1
Medicare <sup>a</sup>	213.9

<sup>6</sup>The estimates for delivery hospitalizations by length of stay and the average length of stay had standard errors ranging from 0.1 to 0.5.

<sup>7</sup>Medicaid and CHIP Payment and Access Commission (MACPAC), "Medicaid's Role in Financing Maternity Care," (2020).

**Appendix III: Supplemental Information on Severe Maternal Morbidity**

	<b>Estimated rate per 10,000 delivery hospitalizations</b>
Private insurance	62.6
Self-pay	66.2
Other <sup>b</sup>	64.3

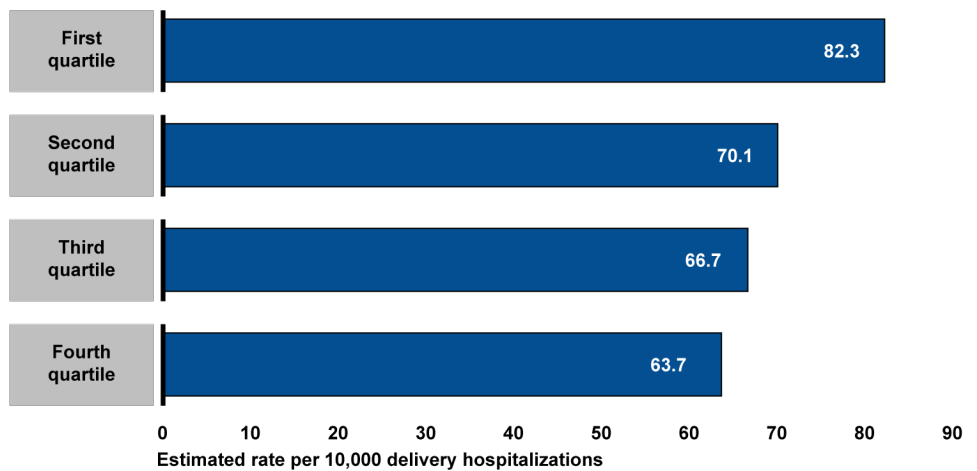
Note: Estimated rates presented in this figure had standard errors ranging from 1.0 to 3.6, except for the category of Medicare, which had a standard error of 10.9. Results for the no charge category could not be reported due to small cell size. Consistent with methods recommended in HHS's action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

<sup>a</sup>The Medicare payer category includes delivery hospitalizations of reproductive aged women, including those with disabilities, who have an expected primary payer of Medicare.

<sup>b</sup>The Other category includes women receiving services paid for by Worker's Compensation, TRICARE, Title V, and other government programs.

Our analysis by median household income quartile of patient's ZIP code showed that women living in ZIP codes within the lowest median household income quartile had the highest estimated rates of SMM. See figure 14.

**Figure 14: Estimated Rates of Severe Maternal Morbidity (SMM) by Median Household Income of Patient ZIP Code, 2016-2018**



Source: GAO analysis of Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample data. | GAO-21-283

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**Appendix III: Supplemental Information on  
Severe Maternal Morbidity**

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**Data table for Figure 14: Estimated Rates of Severe Maternal Morbidity (SMM) by  
Median Household Income of Patient ZIP Code, 2016-2018**

	<b>Estimated rate per 10,000 delivery hospitalizations</b>
First quartile	82.3
Second quartile	70.1
Third quartile	66.7
Fourth quartile	63.7

Note: Estimated rates presented in this figure had standard errors ranging from 1.2 to 1.6. The first quartile included incomes from ZIP codes in which the median household income was \$42,999 or less in 2016, \$43,999 or less in 2017, and \$45,999 or less in 2018; the second quartile included incomes from \$43,000 to \$53,999 in 2016, \$44,000 to \$55,999 in 2017, and \$46,000 to \$58,999 in 2018; the third quartile included incomes \$54,000 to \$70,999 in 2016, \$56,000 to \$73,999 in 2017, and \$59,000 to \$78,999 in 2018; and the fourth quartile included incomes \$71,000 or greater in 2016, \$74,000 or greater in 2017, and \$79,000 or greater in 2018. Consistent with methods recommended in HHS's action plan from December 2020, we excluded cases of SMM where blood products transfusion was the sole indicator of SMM because they may not always reflect SMM in the absence of other indicators and due to changes in data reporting. As a result, our analysis does not include SMM cases in which women received blood products transfusions in response to excessive bleeding around delivery but did not experience any other indicators of SMM.

## Appendix IV: Programs That Aim to Reduce Maternal Mortality and Severe Maternal Morbidity in Selected States

Within the Department of Health and Human Services (HHS), the Centers for Disease Control and Prevention (CDC) and the Health Resources and Services Administration (HRSA) provide funding to various programs that aim to reduce maternal mortality and severe maternal morbidity (SMM). We selected CDC and HRSA programs based on those identified by agency officials as the primary programs that aim to reduce maternal mortality and SMM in rural and underserved areas. Of those programs identified, we specifically focused on the programs that provide funding or support to states to carry out efforts to reduce maternal mortality and morbidity in rural and underserved areas. CDC and HRSA generally release funding announcements for programs through grants and cooperative agreements and then award funding to awardees, such as state health departments or non-profit organizations, to carry out the programs.<sup>1</sup> Some of the programs have specific funding announcements that require awardees to address needs in rural or underserved areas.

We interviewed a nongeneralizable selection of awardees of relevant maternal health programs funded by HHS in three different states—Michigan, North Carolina, and New Mexico—to obtain examples of how these programs can be used in rural and underserved areas.<sup>2</sup> See figure 15 for a list of selected states' participation in relevant HHS maternal health programs that were discussed during our interviews.

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<sup>1</sup>In general, federal agencies use grants and cooperative agreements to transfer a thing of value to the awarded entity to carry out a public purpose as authorized by federal law. Cooperative agreements are used when substantial involvement by the federal agency is expected in carrying out the activity, and grants are used when substantial involvement by the federal agency is not expected. See 31 U.S.C. §§ 6303-6305.

<sup>2</sup>We selected three states based on several criteria. Specifically, we selected states to provide variation on the percentage of residents living in rural counties in 2010, the average index of medical underservice score among medically underserved counties, and the state's participation in federal efforts to reduce maternal mortality and SMM.

**Appendix IV: Programs That Aim to Reduce Maternal Mortality and Severe Maternal Morbidity in Selected States**

**Figure 15: Selected States' Participation in Relevant Department of Health and Human Services (HHS) Maternal Health Programs**

		Michigan	New Mexico	North Carolina
<b>Department of Health and Human Services Maternal Health Program</b>	Maternal Mortality Review Committees <sup>a</sup>	X	X	X
	Perinatal Quality Collaboratives <sup>b</sup>	X	X	X
	Title V Maternal and Child Health Services Block Grant <sup>c</sup>	X	X	X
	Alliance for Innovation on Maternal Health	X	X	X
	Healthy Start: Eliminating Disparities in Perinatal Health	X	X	X
	Rural Maternity and Obstetrics Management Strategies		X	
	State Maternal Health Innovation			X
	Supporting Maternal Health Innovation			X
	Levels of Care Assessment Tool	X <sup>d</sup>	X	X

Source: GAO analysis of HHS documentation and interviews with state officials. | GAO-21-283

**Appendix IV: Programs That Aim to Reduce Maternal Mortality and Severe Maternal Morbidity in Selected States**

**Data table for Figure 15: Selected States' Participation in Relevant Department of Health and Human Services (HHS) Maternal Health Programs**

	Michigan	New Mexico	North Carolina
Maternal Mortality Review Committees <sup>a</sup>	Yes	Yes	Yes
Perinatal Quality Collaboratives <sup>b</sup>	Yes	Yes	Yes
Title V Maternal and Child Health Services Block Grant <sup>c</sup>	Yes	Yes	Yes
Alliance for Innovation on Maternal Health	Yes	Yes	Yes
Healthy Start: Eliminating Disparities in Perinatal Health	Yes	Yes	Yes
Rural Maternity and Obstetrics Management Strategies	No	Yes	
State Maternal Health Innovation	No	No	Yes
Supporting Maternal Health Innovation	No	No	Yes
Levels of Care Assessment Tool	Yes	Yes	Yes

<sup>a</sup>All three states have Maternal Mortality Committees, but Michigan's is not funded through an HHS program.

<sup>b</sup>All three of the states have Perinatal Quality Collaboratives, but none of them are funded through an HHS program.

<sup>c</sup>See Title V of the Social Security Act (codified as amended at 42 U.S.C. §§ 701-710).

<sup>d</sup>Michigan's Detroit metropolitan region (see region 10 for Michigan in app. V) uses the Levels of Care Assessment Tool, but the other regions of the state do not.

Table 3 lists 10 programs funded by CDC and HRSA that aim to reduce maternal mortality and SMM and examples of how states have used the funding to improve these outcomes in rural and underserved areas. Of these programs, four of the HRSA-funded programs specifically target rural or underserved areas through their funding announcements, as indicated in gray.

**Table 3: Department of Health and Human Services (HHS) Programs That Aim to Reduce Maternal Mortality and Severe Maternal Morbidity**

	HHS Programs	Purpose
<b>Centers for Disease Control and Prevention</b>	Enhancing Reviews and Surveillance to Eliminate Maternal Mortality	<p><b>Purpose:</b> Provides funding that supports states to coordinate and manage Maternal Mortality Review Committees (MMRC) that convene at the state or local level to comprehensively review deaths of women during or within a year of pregnancy.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> Officials from all three of the states we spoke to reported considering geographic factors and social determinants of health in their MMRCs' reviews of maternal deaths. They also reported that their MMRCs had a diverse representation of participants across different health care professions, as well as rural and underserved areas.</p>



**Appendix IV: Programs That Aim to Reduce  
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<b>HHS Programs</b>	<b>Purpose</b>
Levels of Care Assessment Tool (LOCATe) <sup>a</sup>	<p><b>Purpose:</b> Provides support to implement a web-based instrument to classify birthing facilities based on the level of risk-appropriate care they can provide. LOCATe’s maternal section addresses medical facilities’ current protocols and drills performed for three major causes of maternal mortality including obstetric hemorrhage, hypertensive emergency, and thromboembolism.<sup>b</sup></p> <p><b>State example of how program has been used in rural and underserved areas:</b> Officials and awardees from two of the three states participating in LOCATe said they used the tool to assess the maternal care capabilities in all of their hospitals with obstetric services, which include several in rural and underserved areas, to identify gaps.</p>
Perinatal Quality Collaboratives (PQC)	<p><b>Purpose:</b> Provides support for states’ ability to enhance the capacity of PQCs—networks of multidisciplinary teams that work to improve measurable outcomes for maternal health, which include reduction of maternal morbidity and mortality.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> Officials from all three of the states we spoke to said that their PQCs are tasked with the implementation of AIM maternal safety bundles in hospitals (see below). Awardees from two of the three states told us that they structure their PQCs by region, which ensures that efforts are being carried out throughout the state, including in rural and underserved areas.</p>
<b>Health Resources and Services Administration</b>	<p>Alliance for Innovation on Maternal Health (AIM)</p> <p><b>Purpose:</b> Provides support to provider organizations, state-based public health systems, consumer groups, and other stakeholders in a national partnership to develop and implement maternal safety bundles, which are sets of evidence-based practices that when implemented collectively and reliably in the delivery setting may improve patient outcomes and reduce maternal mortality and SMM.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> Officials from all three of the states we spoke to reported implementing AIM patient safety bundles in hospitals in rural and underserved areas, which include the Obstetric Hemorrhage, Obstetric Care for Women with Opioid Use Disorder, Reduction of Peripartum Racial/Ethnic Disparities, and the Safe Reduction of Primary Cesarean Birth bundles.</p>
Healthy Start: Eliminating Disparities in Perinatal Health	<p><b>Purpose:</b> Provides funding to improve health outcomes before, during, and after pregnancy, and to reduce racial and ethnic differences in rates of infant death and adverse perinatal outcomes. In addition, awardees can apply for funding to hire clinical providers to provide maternity care and support to health educators by conducting training on the identification of maternal early warning signs in order to prevent obstetric emergencies often related to maternal mortality and SMM.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> Awardees from all three of the states we spoke to reported using the Healthy Start Initiative funding to support maternal care services in rural and underserved areas. For example, Michigan awardees stated that they hired advanced nurse practitioners to work in the remote geographic areas of the state to address some of the needs of women before, during, and after pregnancy, such as chronic diseases such as diabetes, hypertension, obesity, and stress.</p>
Maternal, Infant, and Early Childhood Home Visiting (MIECHV)	<p><b>Purpose:</b> Provides funding to states, territories, and tribal entities to provide voluntary, evidence-based home visiting services for pregnant women and parents with young children up to kindergarten entry in at-risk communities. According to HRSA officials, home visits help to reduce maternal mortality and SMM by providing postpartum care and screening for depression and intimate partner violence.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> Two of the three states we spoke to serve rural counties with their MIECHV funding and all three serve underserved households in non-rural counties. North Carolina’s MIECHV program is focused on depression screening for pregnant women within 3 months of delivery or enrollment and at-home postpartum care within 8 weeks of delivery.</p>

**Appendix IV: Programs That Aim to Reduce Maternal Mortality and Severe Maternal Morbidity in Selected States**

HHS Programs	Purpose
Rural Maternity and Obstetrics Management Strategies (RMOMS)	<p><b>Purpose:</b> Provides funding to entities to develop models to improve access to and continuity of maternal and obstetrics care in rural communities. The RMOMS goals are to develop a sustainable network approach to coordinate maternal and obstetrics care within a rural region; increase the delivery and access of preconception, pregnancy, labor and delivery, and postpartum services; develop sustainable financing models for the provision of maternal and obstetrics care; and improve maternal and neonatal outcomes.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> An awardee we spoke to in New Mexico told us that it planned to use RMOMS funding to create two prenatal clinics in rural areas that did not previously have local access to prenatal services; expand telehealth services and establish a partnership between the network of clinical and social support services and high-risk pregnancy providers to enable pregnant mothers to connect with obstetricians; and support existing social services agencies and substance abuse treatment services in the region.</p>
State Maternal Health Innovation (MHI)	<p><b>Purpose:</b> Provides funding to states to strengthen partnerships and collaboration by establishing a state-focused Maternal Health Task Force, improving state-level data surveillance on maternal mortality and SMM, and promoting and executing innovation in maternal health service delivery.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> An awardee we spoke to in North Carolina said that it is using State MHI funding to establish its state Maternal Health Taskforce to function as a clearinghouse of information to help the state health department develop a strategic plan, and oversee the implementation of recommendations from the state's MMRC to prevent maternal mortality throughout the state, including in rural and underserved areas.</p>
Supporting MHI	<p><b>Purpose:</b> Provides funding to a single entity to support efforts to reduce and prevent maternal mortality and SMM by providing capacity-building assistance to State MHI and RMOMS awardees to implement innovative and evidence-informed strategies, and by establishing a resource center to provide national guidance in improving maternal health.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> The awardee we spoke to in North Carolina said that in its role as a resource center for maternal health efforts, it provides capacity-building assistance to support system level changes to improve health equity.</p>
Title V Maternal and Child Health (MCH) Services Block Grant <sup>c</sup>	<p><b>Purpose:</b> Provides funding to states and jurisdictions to help support or complement other federal initiatives that aim to reduce maternal mortality and SMM. These efforts include MMRCs, implementation of AIM patient safety bundles, and PQCs.</p> <p><b>State example of how program has been used in rural and underserved areas:</b> Michigan uses the Title V MCH Services Block Grant funding to support Regional PQCs, which support the Mother Infant Health &amp; Equity Improvement Plan, which aims to achieve zero preventable maternal and infant deaths and address health disparities. Through the Mother Infant Health &amp; Equity Improvement Plan, all health care professionals and State of Michigan employees are required to receive implicit bias training, and a Black Leadership Advisory Council was established.</p>

Source: GAO analysis of information from the Centers for Disease Control and Prevention, the Health Resources and Services Administration, and interviews with awardees from selected states. | GAO-21-283

Note: Gray shading = programs that specifically target rural and underserved areas through the funding announcements

<sup>a</sup>LOCATe does not provide funding to states, but states can use it as a tool to support programs to reduce maternal mortality and SMM.

<sup>b</sup>Obstetric hemorrhages, includes placental abruption (when the placenta partially or completely separates from the inner wall of the uterus before delivery), ruptured ectopic pregnancy (when a fertilized egg implants outside of the uterus, such as in a fallopian tube, and ruptures as it grows), and hemorrhage due to retained placenta (generally when the placenta is not expelled within 30 minutes

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**Appendix IV: Programs That Aim to Reduce  
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of delivery of the infant). Hypertensive disorders of pregnancy include conditions such as preeclampsia (high blood pressure during pregnancy or postpartum and other organ damage). Thrombotic, pulmonary, or other embolisms include deep vein thrombosis (when a blood clot forms in a deep vein, usually in the lower leg, thigh, or pelvis).

<sup>c</sup>See Title V of the Social Security Act (codified as amended at 42 U.S.C. §§ 701-710).

## Appendix V: Severe Maternal Morbidity Rates in Selected States and Related Maternal Health Programs

As part of our analysis, we spoke to state health department officials and other awardees of the Department of Health and Human Services' (HHS) maternal health programs in three different states—Michigan, New Mexico, and North Carolina—to obtain information about how these programs can be used in rural and underserved areas.<sup>1</sup> See app. IV for descriptions of several HHS maternal health programs that aim to reduce maternal mortality and severe maternal morbidity (SMM). We also conducted an analysis of the states' SMM rates from 2016-2018, and reported them by regional groupings based on the location of the delivery hospital. Figures 16-18 display maps of each of the three states with SMM rates by region, as well as by classification of rurality and

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<sup>1</sup>We selected states to provide variation on the percentage of residents living in rural counties in 2010, the average index of medical underservice score among medically underserved counties, and the state's participation in federal efforts to reduce maternal mortality and SMM.

designation of medical underservice.<sup>2</sup> See app. II for more information regarding our analysis of SMM data.

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## Michigan

A Healthy Start Initiative awardee we spoke to in Michigan said that the program funding supports its home visiting program, which primarily serves American Indian/Alaska Native women in the northern and Upper Peninsula regions (regions 1, 2, and 3). According to our analysis, the Upper Peninsula exhibits the highest SMM rate in the state. Further, according to our analysis, every county within the northern and Upper Peninsula regions are rural and the majority are designated as medically underserved areas (MUA). Although our analysis shows that several counties in these three regions are not designated as MUAs, awardees in Michigan told us that these regions face extreme shortages of clinical specialists that have the expertise required to manage high-risk pregnancies and provide resources to women facing complications during their postpartum period. To fill this gap, home visitors receive training to provide culturally appropriate services, which include counseling women on their diets and completing mental health screenings.

Similarly, the Detroit metropolitan region (region 10) has the second highest SMM rate in the state. According to a Healthy Start awardee we spoke to that serves Detroit, the social determinants of health, such as housing and job security, disproportionately affect women in this region,

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<sup>2</sup>We defined rural and metropolitan based on the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties. The National Center for Health Statistics defines micropolitan and noncore counties as rural and defines large central metro, large fringe metro, medium metro, and small metropolitan areas as metropolitan. Large central metropolitan areas include counties that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan. MUAs are geographic areas designated by the Health Resources & Services Administration (HRSA) as having a shortage of primary care health services based on the area's average index of medical underservice, which accounts for an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate.

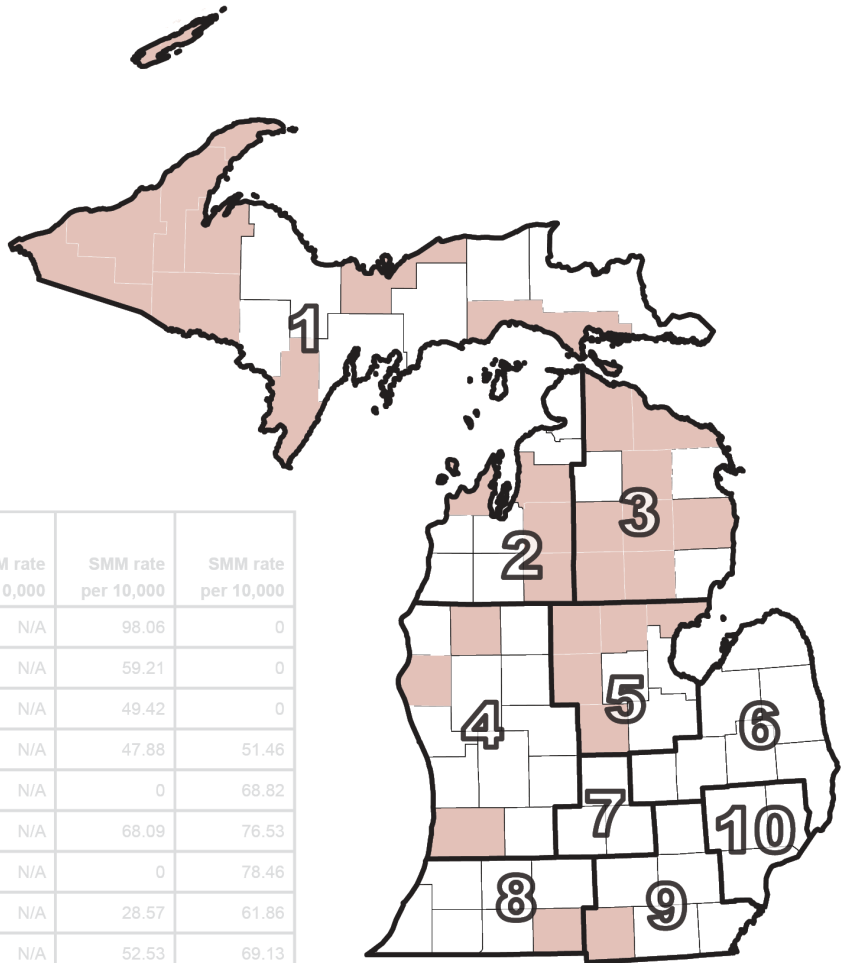
**Appendix V: Severe Maternal Morbidity Rates in Selected States and Related Maternal Health Programs**

therefore creating barriers that limit access to medical providers despite geographic proximity. See figure 16.

**Figure 16: Michigan Severe Maternal Morbidity (SMM) Regional Rates by Rural and Medically Underserved Areas (MUA), 2016-2018**

**Interactivity instructions:** Roll over on each tab to see xxxxxx. See xxxxxx for the non-interactive, printer-friendly version.

- OVERALL
- RURAL, MUA
- URBAN, MUA
- RURAL, NON-MUA
- URBAN, NON-MUA



RURAL, MUA		SMM rate per 10,000	SMM rate per 10,000	SMM rate per 10,000	SMM rate per 10,000	SMM rate per 10,000
<b>PERINATAL REGIONS</b>	1	104.06	113.90	N/A	98.06	0
	2	59.98	62.79	N/A	59.21	0
	3	48.70	48.16	N/A	49.42	0
	4	50.11	39.63	N/A	47.88	51.46
	5	67.54	64.49	N/A	0	68.82
	6	74.71	0	N/A	68.09	76.53
	7	78.46	0	N/A	0	78.46
	8	58.62	52.22	N/A	28.57	61.86
	9	66.38	49.09	N/A	52.53	69.13
	10	82.75	0	N/A	0	82.75

Source: GAO analysis of Agency for Healthcare Research and Quality's state inpatient databases. | GAO-21-xxx

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## Appendix V: Severe Maternal Morbidity Rates in Selected States and Related Maternal Health Programs

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Note: Rates of SMM are per 10,000 delivery hospitalizations. We defined rural and metropolitan based on the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties. The National Center for Health Statistics defines micropolitan and noncore counties as rural and defines large central metro, large fringe metro, medium metro, and small metropolitan areas as metropolitan. Large central metropolitan areas include counties that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan. MUAs are geographic areas designated by the Health Resources & Services Administration as having a shortage of primary care health services based on the area's average index of medical underservice, which accounts for an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate.

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### New Mexico

According to our analysis and interviews with state officials, New Mexico is mostly rural and medically underserved. A Healthy Start awardee in New Mexico told us that it provides home visiting services and supervises community health workers in the Southwest region of New Mexico on the United States-Mexico border. Community health workers are trusted, frontline, but usually non-licensed, staff who work directly with Healthy Start participants. The awardee we spoke to said that community health workers in the Southwest region primarily focus on connecting pregnant women to prenatal care and behavioral health services. According to our analysis, six out of eight counties in the Southwest region are rural and designated MUAs and this region has the second highest SMM rate for rural and medically underserved counties.

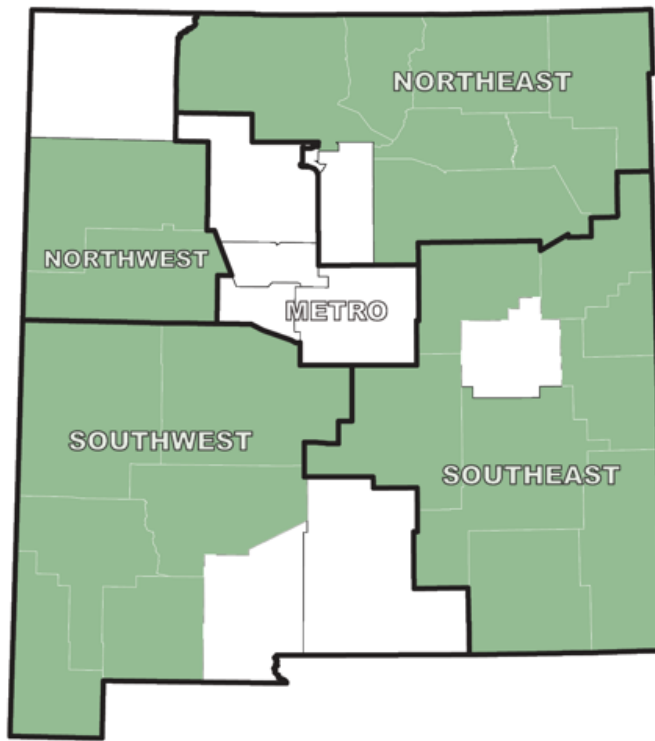
The Rural Maternity and Obstetrics Management Strategies Program awardee we spoke to in New Mexico told us that it applied for the program to improve access to maternal health care in northeastern New Mexico, a mountainous and populated area that is geographically spread out, making access to care a significant challenge for the region. Taos County is located in the Northeast region of New Mexico, and according to our analysis, is both rural and a designated MUA. See figure 17.

Appendix V: Severe Maternal Morbidity Rates in Selected States and Related Maternal Health Programs

Figure 17: New Mexico Severe Maternal Morbidity (SMM) Regional Rates by Rural and Medically Underserved Areas (MUA), 2016-2018

**Interactivity instructions:**  Roll over on each tab to see xxxxxx.  See xxxxxx for the non-interactive, printer-friendly version.

OVERALL **RURAL, MUA** URBAN, MUA RURAL, NON-MUA URBAN, NON-MUA



RURAL, MUA		SMM rate per 10,000	SMM rate per 10,000	SMM rate per 10,000	SMM rate per 10,000	SMM rate per 10,000
PERINATAL REGIONS	Metro	84.48	0	73.76	0	88.09
	Northeast	86.58	113.57	0	46.84	67.44
	Northwest	97.28	151.65	65.39	0	0
	Southeast	60.54	59.89	0	277.78	0
	Southwest	67.63	72.14	0	74.24	64.32

Source: GAO analysis of Agency for Healthcare Research and Quality's state inpatient databases. | GAO-21-xxx

Note: Rates of SMM are per 10,000 delivery hospitalizations. We defined rural and metropolitan based on the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for



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**Appendix V: Severe Maternal Morbidity Rates  
in Selected States and Related Maternal Health  
Programs**

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Counties. The National Center for Health Statistics defines micropolitan and noncore counties as rural and defines large central metro, large fringe metro, medium metro, and small metropolitan areas as metropolitan. Large central metropolitan areas include counties that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan. MUAs are geographic areas designated by the Health Resources & Services Administration as having a shortage of primary care health services based on the area's average index of medical underservice, which accounts for an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate.

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## North Carolina

A Healthy Start Initiative awardee in North Carolina said that its program serves Robeson County within region 5, the largest county in square miles in the state where the majority of the population are non-Hispanic American Indian/Alaska Native and non-Hispanic Black. According to our analysis, Robeson County is both rural and a designated MUA. North Carolina's Healthy Start Initiative helps address geographic and other access-related barriers to care by providing transportation services for pregnant women to doctors' appointments or other health related services. See figure 18.

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**Appendix V: Severe Maternal Morbidity Rates  
in Selected States and Related Maternal Health  
Programs**

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**Figure 18: North Carolina Severe Maternal Morbidity (SMM) Regional Rates by Rural and Medically Underserved Areas (MUA), 2016-2018**

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**Appendix V: Severe Maternal Morbidity Rates  
in Selected States and Related Maternal Health  
Programs**

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Note: Rates of SMM are per 10,000 delivery hospitalizations. We defined rural and metropolitan based on the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties. The National Center for Health Statistics defines micropolitan and noncore counties as rural and defines large central metro, large fringe metro, medium metro, and small metropolitan areas as metropolitan. Large central metropolitan areas include counties that 1) contain the entire population of the largest principal city of the metropolitan statistical area, or 2) have their entire population contained in the largest principal city of the metropolitan statistical area, or 3) contain at least 250,000 inhabitants of any principal city of the metropolitan statistical area. Large fringe metropolitan areas include counties in metropolitan statistical areas of 1 million or more that did not qualify as large central metropolitan. Medium metropolitan areas include counties in metropolitan statistical areas with populations of 250,000 to 999,999. Small metropolitan areas include counties in metropolitan statistical areas with populations of less than 250,000. Micropolitan areas include non-metropolitan counties surrounding a smaller urban cluster of 2,500 to 49,999 inhabitants. Noncore areas include non-metropolitan counties that do not qualify as micropolitan. MUAs are geographic areas designated by the Health Resources & Services Administration as having a shortage of primary care health services based on the area's average index of medical underservice, which accounts for an area's provider to population ratio, percentage of population below the federal poverty level, percentage of population over age 65, and infant mortality rate.

## Appendix VI: Key Factors Identified in Maternal Mortality Review Committee Publications

This appendix provides additional information related to our identification of the key factors that can affect maternal mortality in rural and underserved areas within three areas—health system factors, socioeconomic factors, and patient factors. After identifying key factors that can affect maternal mortality in rural and underserved areas in our literature review and in our interviews with officials from selected states and selected stakeholders, we analyzed maternal mortality review committee publications to determine if they identified similar key factors. Maternal mortality review committees are multi-disciplinary committees that convene at the state or local level to comprehensively review deaths during or within a year of pregnancy. The committees have access to clinical and non-clinical information, such as vital records, medical records, and social service records, to understand the circumstances surrounding each death, and to develop recommendations for action to prevent similar deaths in the future.

Out of the recent publications from maternal mortality review committees, we identified 14 publications from between 2016 and 2020 that addressed rural and/or underserved areas in either their analyses of maternal deaths. We then reviewed the 14 publications in further depth to inform our analysis of the key factors affecting maternal mortality in rural and underserved areas. We found that these publications identified key factors such as limited access to care, facility services, and comorbid conditions. See table 4.

**Table 4: Key Factors That Can Affect Maternal Mortality in Rural and Underserved Areas**

	<b>Factor</b>	<b>Examples from maternal mortality review committee publications that examined factors in rural and underserved areas</b>
<b>Health System Factors</b>	Limited Access to Care	Of the 14 publications reviewed, 12 identified at least one factor related to access to care, including limited prenatal care, care coordination, or referrals for specialty care.
	Facility Services	Of the 14 publications reviewed, nine identified at least one factor related to facility services, including inadequate services, lack of policies or procedures, and inadequate or unavailable equipment.

**Appendix VI: Key Factors Identified in Maternal Mortality Review Committee Publications**

<b>Factor</b>	<b>Examples from maternal mortality review committee publications that examined factors in rural and underserved areas</b>	
Provider Shortages	The publications reviewed did not specifically address provider shortages. Nine of the publications we reviewed identified factors related to provider training or knowledge, including inadequate staff knowledge or training or delay in recognizing and treating complications.	
<b>Socioeconomic Factors</b>	Insurance Status	The publications we reviewed did not consider insurance status as a factor in specific maternal deaths, but many of the publications reported maternal deaths by insurance status. Of the 14 publications reviewed, eight looked at maternal deaths by insurance status and found higher rates among Medicaid beneficiaries compared to the privately insured population.
	Income Level	The publications we reviewed did not consider income level as a factor because income is often missing or not included in death records. However, several publications used qualification for Medicaid to approximate income level and noted higher proportions of maternal deaths among Medicaid beneficiaries. Others noted financial barriers to accessing health care.
<b>Patient Factors</b>	Comorbid Conditions	Of the 14 publications reviewed, nine identified at least one factor related to comorbid or chronic medical conditions, including diabetes, cardiovascular disease, and asthma. Additionally, 12 publications identified at least one factor related to mental health conditions, including depression, anxiety, and severe mental illness.
	Age	The publications we reviewed did not consider age as a factor in specific maternal deaths, but many of the publications reported maternal deaths by age. Of the 14 publications reviewed, 11 analyzed deaths by age and the majority of those found that older age groups had a higher risk of pregnancy-related death.

Source: GAO analysis of maternal mortality review committee publications. | GAO 21-283

The following publications from maternal mortality review committees from 2016 through 2020 addressed rural and/or underserved areas in their analyses of maternal deaths.

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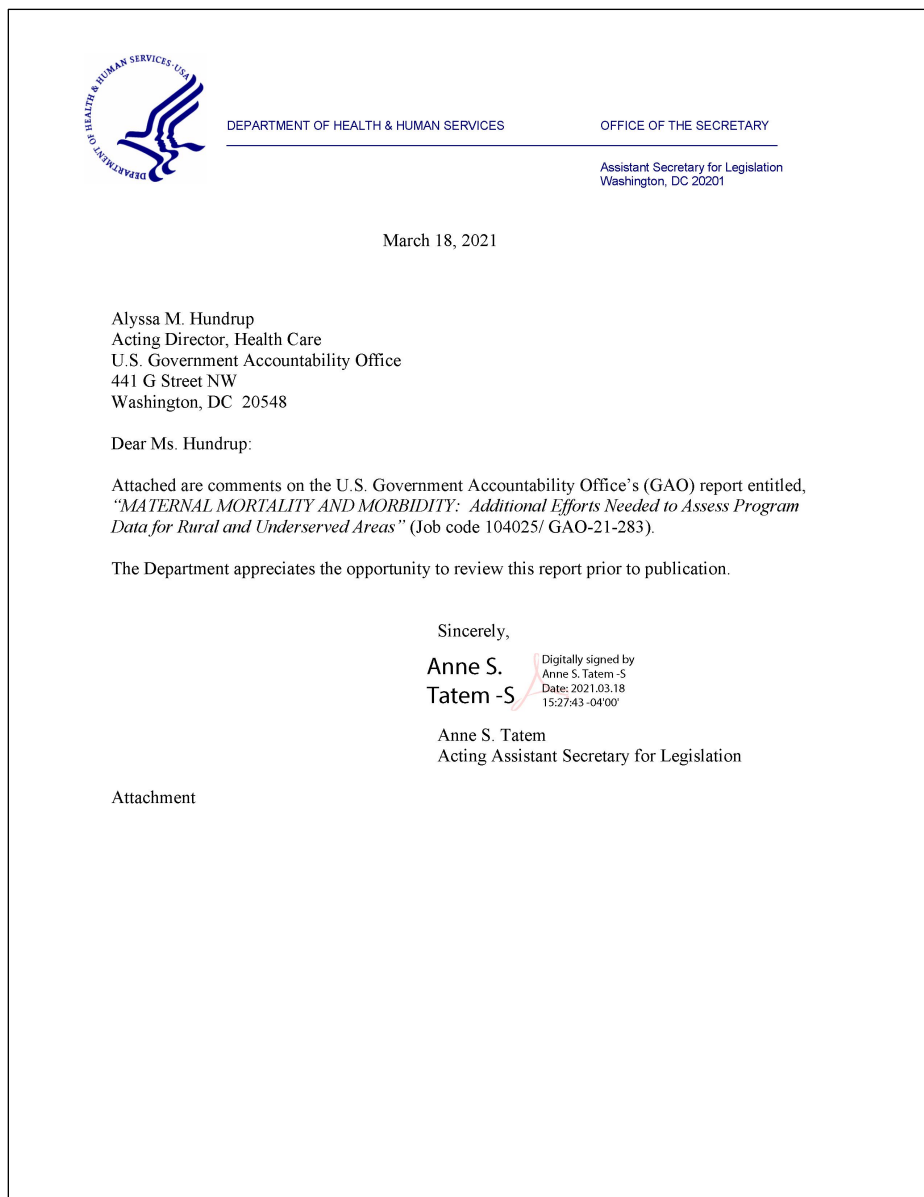
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# Appendix VII: Comments from the Department of Health and Human Services



**Appendix VII: Comments from the Department  
of Health and Human Services**

**GENERAL COMMENTS FROM THE DEPARTMENT OF HEALTH & HUMAN  
SERVICES ON THE GOVERNMENT ACCOUNTABILITY OFFICE'S DRAFT  
REPORT ENTITLED — MATERNAL MORTALITY AND MORBIDITY:  
ADDITIONAL EFFORTS NEEDED TO ASSESS PROGRAM DATA FOR RURAL AND  
UNDERSERVED AREAS (GAO-21-283)**

The U.S. Department of Health & Human Services (HHS) appreciates the opportunity from the Government Accountability Office (GAO) to review and comment on this draft report.

**Recommendation 1**

The Director of CDC should take steps to systematically disaggregate and analyze maternal health program data by rural and underserved areas, and make adjustments to program efforts, as needed. **(Recommendation 1)**

**HHS Response**

CDC concurs with GAO's recommendation.  
CDC will be implementing new activities with the FY 2021 appropriation for Maternal Mortality Review Committees (MMRCs) to improve the data that is available, including implementing a Community Vital Signs Dashboard for MMRCs.

**Recommendation 2**

The Administrator of HRSA should take steps to systematically disaggregate and analyze maternal health program data by rural and underserved areas and make adjustments to program efforts, as needed. **(Recommendation 2)**

**HHS Response**

HRSA concurs with GAO's recommendation.  
There are program differences in the availability and granularity of data. HRSA will review its maternal health programs to identify ways to disaggregate and analyze associated data by rural and underserved areas. HRSA is committed to improving health outcomes of mothers and will take necessary steps to identify health disparities, monitor our efforts to address them, and make adjustments to program data collection and analysis, as appropriate.

**Recommendation 3**

The Secretary of HHS should direct the Healthy People Maternal, Infant, and Child Health Workgroup and the Maternal Health Working Group to develop and implement a coordinated approach to track and monitor maternal health efforts across HHS, including in rural and underserved areas. This approach could include a coordinated effort to track maternal mortality in these areas and share best practices identified when reviewing relevant maternal health programs to help inform HHS's progress towards teaching its action plan goal. **(Recommendation 3)**

**HHS Response**

OASH concurs with GAO's recommendation.  
OASH will review the communication between the two workgroups and identify ways to formalize methods to track and monitor maternal health efforts and share best practices, including in rural and underserved areas.



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## Text of Appendix VII: Comments from the Department of Health and Human Services

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Page 1

March 18, 2021

Alyssa M. Hundrup

Acting Director, Health Care

U.S. Government Accountability Office 441 G Street NW

Washington, DC 20548

Dear Ms. Hundrup:

Attached are comments on the U.S. Government Accountability Office's (GAO) report entitled, "MATERNAL MORTALITY AND MORBIDITY: Additional Efforts Needed to Assess Program Data for Rural and Underserved Areas" (Job code 104025/ GAO-21-283).

The Department appreciates the opportunity to review this report prior to publication.

Sincerely,

Anne S. Tatem

Acting Assistant Secretary for Legislation

Attachment

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Page 2

GENERAL COMMENTS FROM THE DEPARTMENT OF HEALTH & HUMAN  
SERVICES ON THE GOVERNMENT ACCOUNTABILITY OFFICE'S DRAFT  
REPORT ENTITLED — MATERNAL MORTALITY AND MORBIDITY:

**ADDITIONAL EF-FORTS NEEDED TO ASSESS PROGRAM DATA FOR  
RURAL AND UNDERSERVED AREAS (GAO-21-283)**

The U.S. Department of Health & Human Services (HHS) appreciates the opportunity from the Government Accountability Office (GAO) to review and comment on this draft report.

**Recommendation 1**

The Director of CDC should take steps to systematically disaggregate and analyze maternal health program data by rural and underserved areas, and make adjustments to program efforts, as needed. (Recommendation 1)

**HHS Response**

CDC concurs with GAO's recommendation.

CDC will be implementing new activities with the FY 2021 appropriation for Maternal Mortality Re-view Committees (MMRCs) to improve the data that is available, including implementing a Community Vital Signs Dashboard for MMRCs.

**Recommendation 2**

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**HHS Response**

HRSA concurs with GAO's recommendation.

There are program differences in the availability and granularity of data. HRSA will review its maternal health programs to identify ways to disaggregate and analyze associated data by rural and underserved areas. HRSA is committed to improving health outcomes of mothers and will take necessary steps to identify health disparities, monitor our efforts to address them, and make adjustments to program data collection and analysis, as appropriate.

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across HHS, including in rural and un-served areas. This approach could include a coordinated effort to track maternal mortality in these areas and share best practices identified when reviewing relevant maternal health programs to help inform HHS's progress towards teaching its action plan goal. (Recommendation 3)

**HHS Response**

OASH concurs with GAO's recommendation.

OASH will review the communication between the two workgroups and identify ways to formalize methods to track and monitor maternal health efforts and share best practices, including in rural and underserved areas.

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## Appendix VIII: GAO Contact and Staff Acknowledgments

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### GAO Contact:

Alyssa M. Hundrup, (202) 512-7114 or [hundrupa@gao.gov](mailto:hundrupa@gao.gov).

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### Staff Acknowledgments:

In addition to the contact named above, Raymond Sendejas (Assistant Director), Rebecca Rust Williamson (Analyst-in-Charge), Hannah Grow, and Caitlyn Leiter-Mason made key contributions to this report. Also contributing were Sam Amrhein, Leia Dickerson, Eric Peterson, Vikki Porter, Jennifer Rudisill, and Ravi Sharma.

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