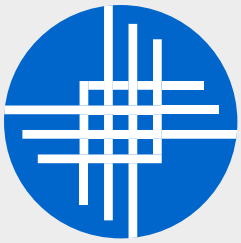
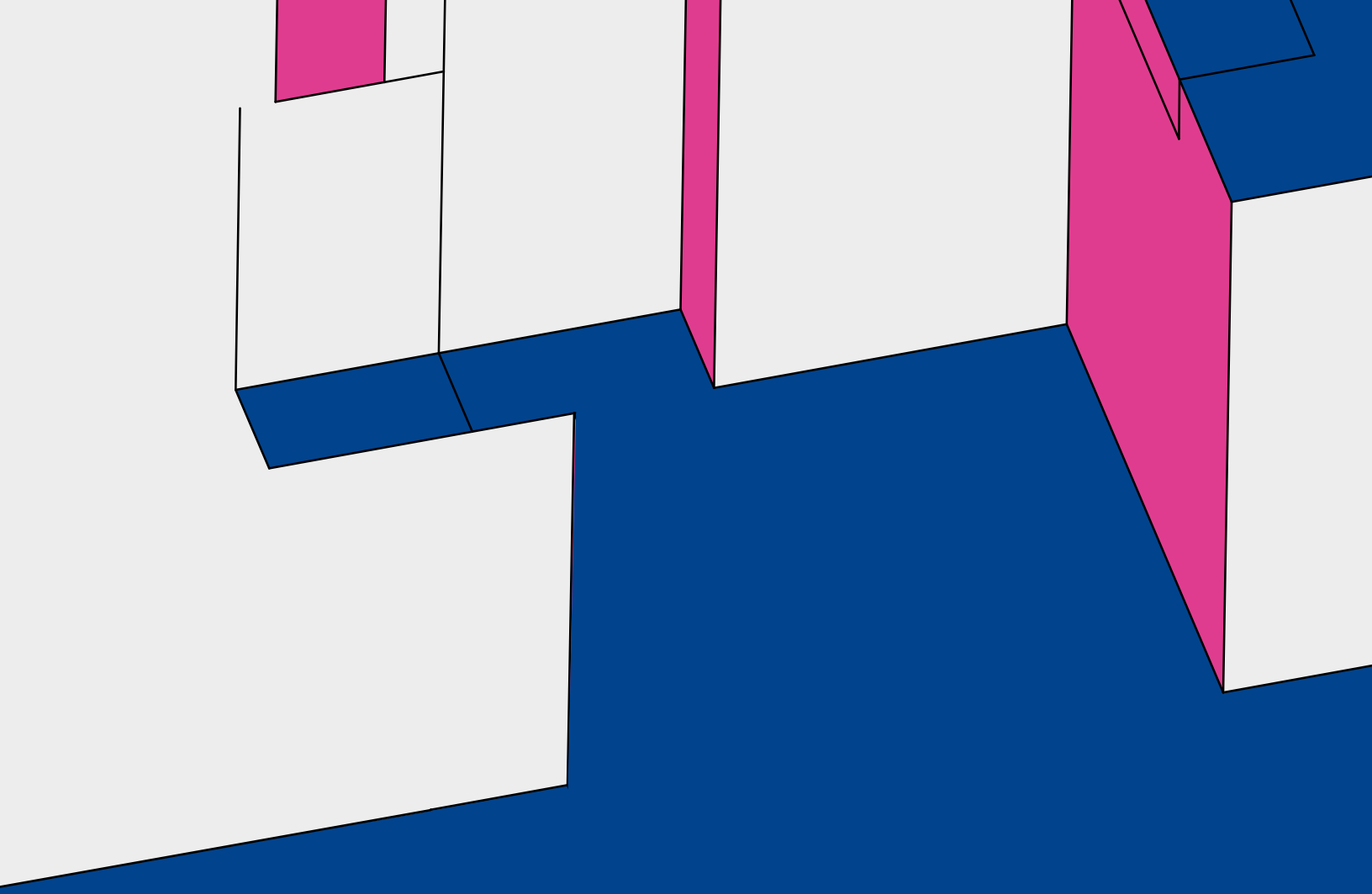


MILKEN INSTITUTE

AUGUST 2023

MATERNAL MORTALITY AMONG VULNERABLE US COMMUNITIES

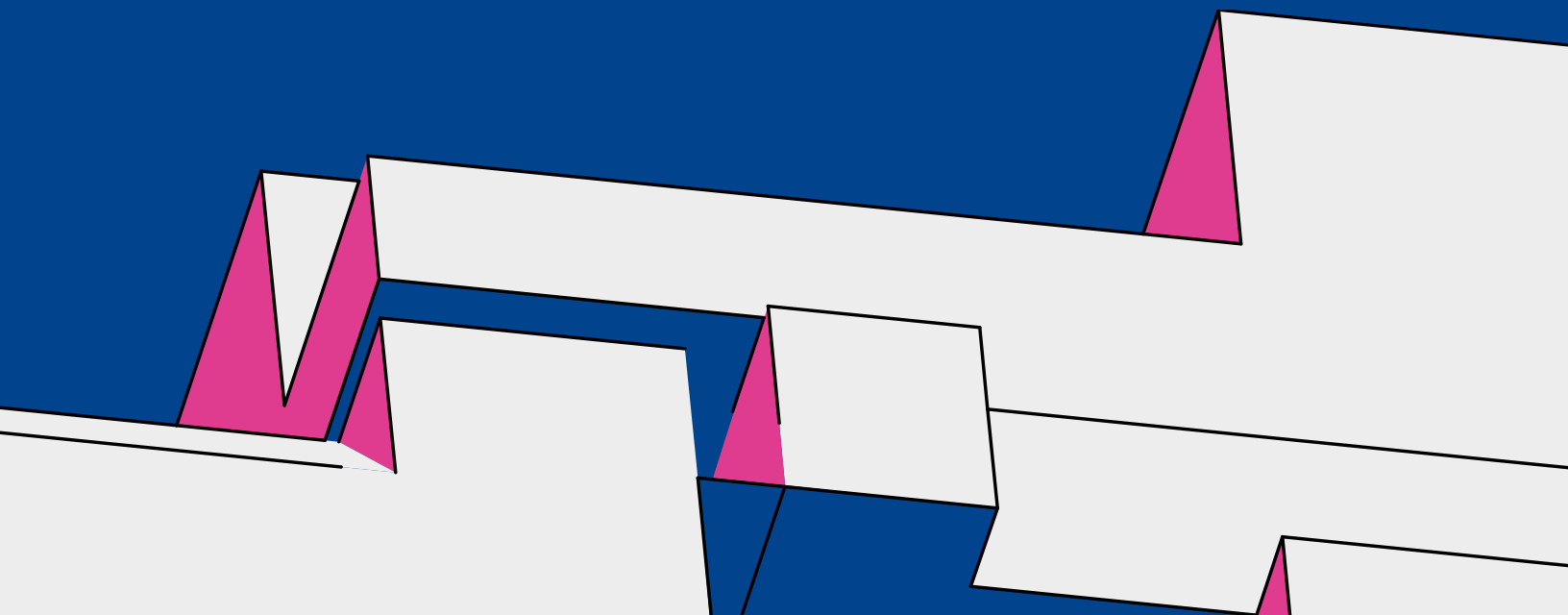
Katherine Sacks, PhD, Lawson Mansell, and Brooke Shearon



ABOUT THE MILKEN INSTITUTE

The Milken Institute is a nonprofit, nonpartisan think tank focused on accelerating measurable progress on the path to a meaningful life. With a focus on financial, physical, mental, and environmental health, we bring together the best ideas and innovative resourcing to develop blueprints for tackling some of our most critical global issues through the lens of what's pressing now and what's coming next.

CONTENTS



INTRODUCTION

The maternal mortality ratio (the number of maternal deaths per 100,000 births) in the United States is one of the highest among countries in the Organisation for Economic Co-operation and Development (OECD) and has steadily increased even as the maternal mortality ratio globally has been falling (Eliason, 2020). To illustrate, in 1987, the US had a mortality rate of 7.2 deaths per 100,000 live births. That ratio has risen dramatically to 20.1 in 2019, 23.8 in 2020, and 32.9 in 2021 (Hoyert, 2023). This is quite different from the rates for high-income peer countries: In 2018, Canada had a ratio of 8.6 and New Zealand a ratio of 1.7, which were much smaller than the US's 2018 ratio of 17.4 (Declercq and Zephryin, 2020; Tikkanen et al., 2020).[1]

Until recently, it has been difficult to make reliable comparisons for maternal death across locations and over time for the entire US (Hawkins et al., 2020). This was due to limitations in the ability to tell if a deceased person was pregnant at the time of her passing. The National Center for Health Statistics (NCHS) in 2003 revised the standard death certificate to include a checkbox indicating pregnancy in the past year. This change was not adopted universally until late 2018, meaning that data have been improving gradually and that some (but not all) of the observed upward trend in maternal mortality in the US was due to better detection and not worse health outcomes (Eliason, 2020; Hoyert & Miniño, 2020). However, even after 2018, when the new forms were fully implemented, the rate of maternal death in the United States continued to rise.

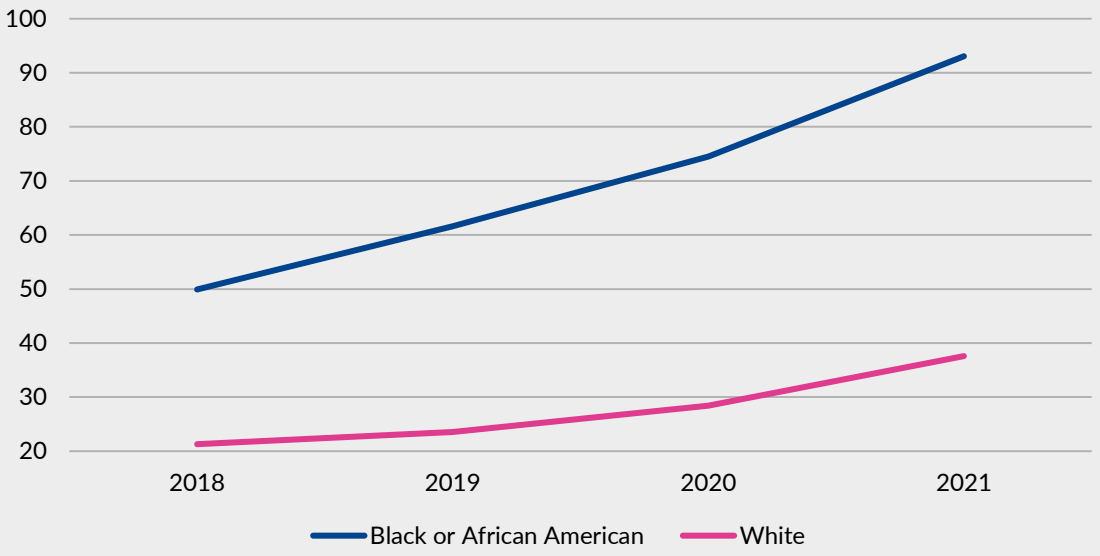
The maternal mortality rate is in part determined by the overall health of a population, access to and quality of health care, and the quality of the human rights environment (among other factors), making it an information-rich summary measure of health and social development (Wilmoth et al., 2012). Maternal mortality has multiple potential contributing factors, and a recent review of pregnancy-related deaths in 36 states found that 84 percent were preventable (Schmidt, 2021; Trost et al., 2022). So, when there is a disparity in maternal mortality, a corresponding disparity likely exists in one (or several) of maternal mortality's contributing factors, representing potential targets for policies aimed at reducing these deaths.

---

1. While the World Health Organization defines rate differently from ratio, the Centers for Disease Control and Prevention uses the term "maternal mortality rate" to refer to the measure used here—the deaths per 100,000 live births. In this report, "rate" and "ratio" are used interchangeably.

There are substantial disparities in maternal mortality based on race, ethnicity, socioeconomic status, age, and nativity within the United States (see Figure 1). Non-Hispanic Black pregnant people and pregnant people in poverty die at rates three to four times higher than White or Hispanic pregnant people or those at higher socioeconomic levels. Rates are, on average, six times higher for pregnant people over 40 compared to those under 25 (Hawkins et al., 2020).

Figure 1. Maternal Mortality Ratio in the United States, by Race (2018–2021)



Source: Milken Institute, CDC (2021)

While race and ethnicity are well-documented contributors to disparate maternal mortality rates, the disparity based on maternal age is understudied (Eliason, 2020). Despite existing data showing that mortality rates increase with maternal age, little research exists on how age interacts with other determinants of maternal death. If disparities widen or narrow for deaths at advanced maternal age, then this provides clues for policy or treatment solutions for targeting these gaps and decreasing maternal mortality more generally. To the extent that there are meaningful differences in the underlying environment (be it social, financial, or in access to health-care resources) that match up with the demographic patterns in mortality that will be explored in the analysis to follow, possible avenues for improvement can be identified. Specifically, the policy question to be examined is, "For places that contain extremely vulnerable Black and White populations, how do their maternal mortality rates differ by race and age, and how (if at all) do these two factors interact?"

EXTREMELY VULNERABLE AMERICA

The population of interest for this report is "Extremely Vulnerable America," as defined by the Milken Institute's Community Explorer report, which uses machine learning to synthesize information from the US Census Bureau's American Community Survey (Lopez et al., 2022). The Community Explorer utilizes 751 variables across 3,142 counties to identify 17 distinct community profiles that combine demographic, economic, and other behavioral determinants. These 17 profiles fall within the following five general groups, in order of population size: Urban America (74 percent), Industry-Driven America (17 percent), Graying America (5.1 percent), Extremely Vulnerable America (3.5 percent), and Non-Contiguous America (0.42 percent).

The Extremely Vulnerable America group contains 378 US counties representing 3.5 percent of the US population and includes the county profiles with the lowest income levels: Hispanic Southern Border (1.4 percent), Black South (1.3 percent), White Appalachia (0.7 percent), and American Indian Reservations (0.1 percent). This report will focus only on states with counties among the Black South and White Appalachia profiles. While "Extremely Vulnerable America" also contains counties in the Hispanic Southern Border and American Indian Reservations profiles, they are not included in this analysis due to a paucity of data.

The Black South profile contains Southern counties with the highest proportion of Black/African American residents and has the lowest median household income of all profiles. White Appalachia contains White communities in Appalachia with the third-highest level of unemployment rates and second-lowest household income of all profiles. We limit the analysis to states where the percentage of the state population residing in White Appalachian and Black South counties is greater than 2 percent: Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. Data are aggregated by state, despite Extremely Vulnerable America being classified by counties, due to the lack of public county-level data for maternal mortality. This leaves us with a sample of states with the greatest concentration of Black South and White Appalachia profiles. Furthermore, these states form a contiguous area representative of what is often thought of as the South in broader cultural parlance.

MORTALITY AND NATALITY DATA

The source of mortality data is the publicly available 2018–2021 Underlying Cause of Death, Single Race data files from NCHS, accessed through the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) database. We calculate maternal mortality as all deaths assigned ICD-10 codes A34 (for Obstetrical tetanus) and O00 to O99 (for Chapter XV Pregnancy, childbirth, and the puerperium). This captures maternal deaths as a result of obstetrical

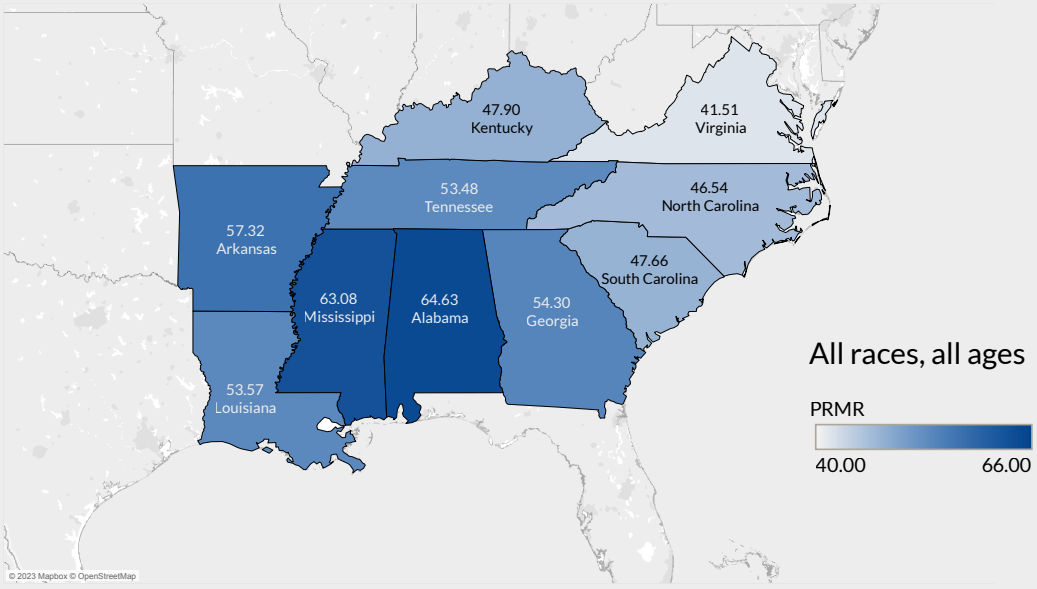
tetanus, maternal deaths up to 42 days after delivery, and later maternal deaths (those occurring more than 42 days after delivery).[2]

The outcome of interest is the maternal mortality ratio, the number of maternal deaths per 100,000 live births. This allows us to make comparisons across geographies with different-sized populations. Data from 2018–2021 were pooled to get the largest possible sample of updated death certificates. The CDC WONDER database also provided the count of live births (the denominator of the maternal mortality ratio) via the NCHS natality files. For both mortality and natality files, the main analysis sample contains individuals in a given state who are Black or White (of any ethnicity) and fall between the ages of 15 and 44. Ages were measured in 10-year increments, with bins covering 15–24, 25–34, and 35–44 years of age.

BIG-PICTURE PATTERNS IN MATERNAL MORTALITY

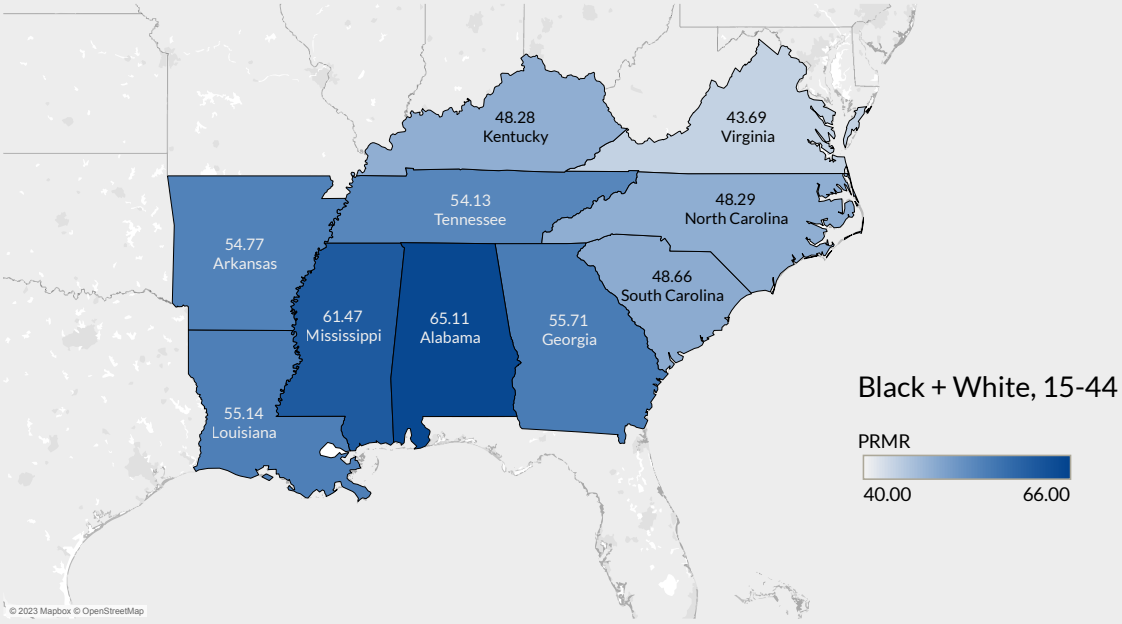
The total population maternal mortality ratios in the analysis states were highest in the deep South, with the highest rates in Mississippi and Alabama (see Figure 2a). These states have a higher concentration of Black residents, who suffer a disproportionate share of the burden of maternal death. None of the states had overall maternal mortality ratios lower than the national rate (34.09 deaths per 100,000 live births). A similar pattern can be observed in these states among our population of interest (see Figure 2b).

Figure 2a. Maternal Mortality Ratios for All Races, All Ages (2018–2021, pooled)



2. Many analyses of maternal death exclude later maternal deaths and so omit ICD-10 codes O96–97 (as these refer to deaths occurring after 42 days or from sequelae of obstetric causes); we have retained them in this analysis to more fully account for deaths that could occur due to social and environmental determinants (Eliason, 2020).

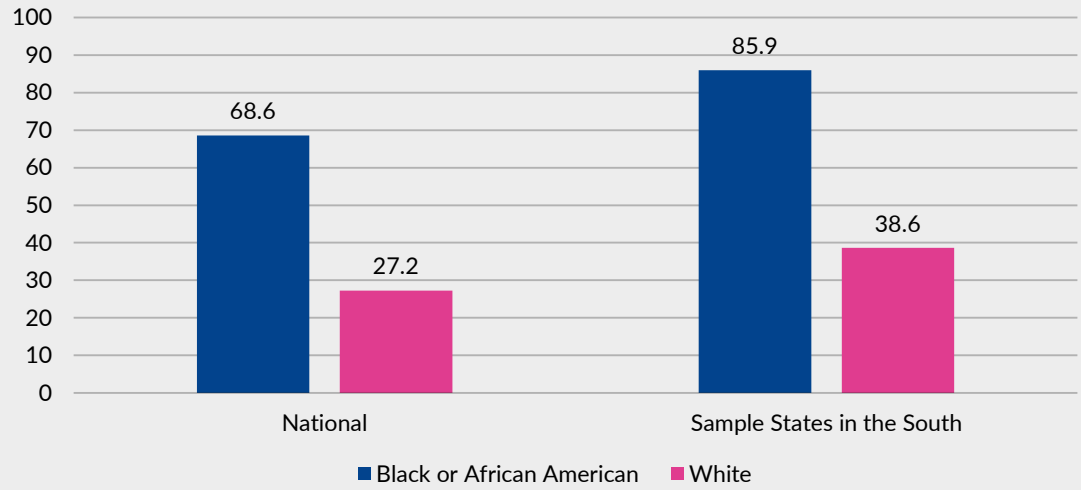
Figure 2b. Maternal Mortality Ratios for Black and White Mothers, Aged 15–44 (2018–2021, pooled)



Source: Milken Institute analysis, CDC (2021)

Not only do the sample states have overall maternal mortality ratios higher than the national average, but their maternal mortality ratios for specific demographic groups are also higher (see Figure 3). The sample states have Black and White maternal mortality ratios of 85.93 and 38.61, whereas the nation has Black and White maternal mortality ratios of 68.59 and 27.23. This puts the sample at demographic-specific maternal mortality ratios that are 25.28 and 5.21 percent larger (respectively) than national ratios.

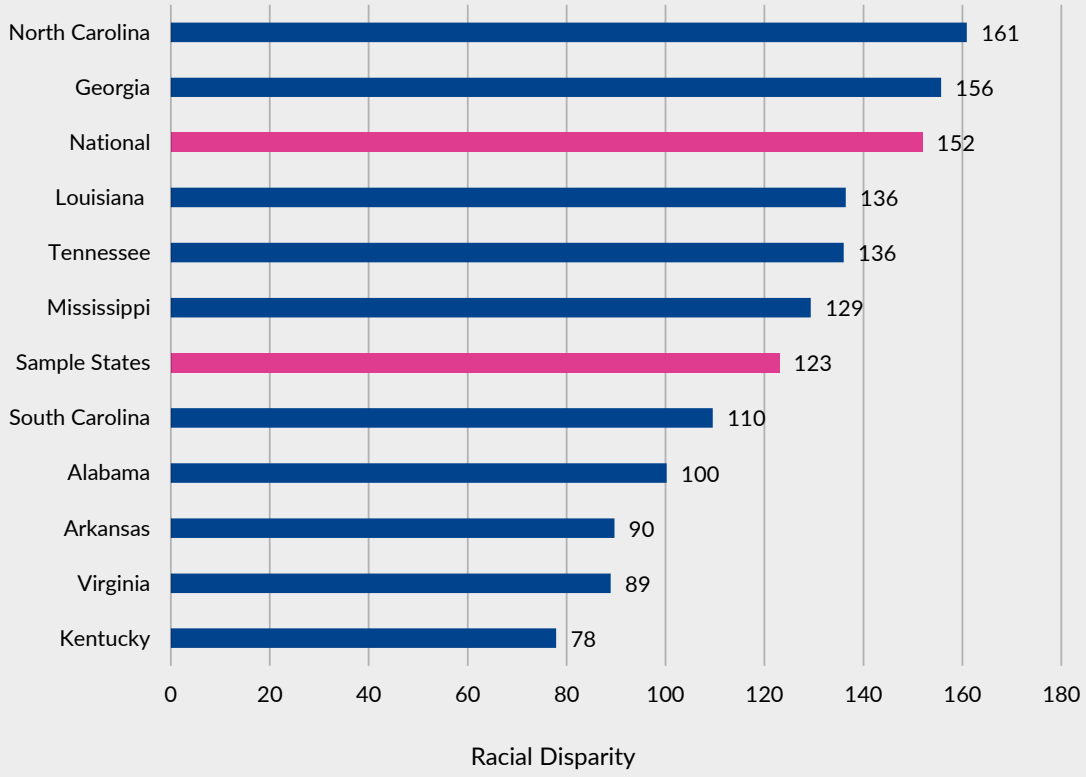
Figure 3. Maternal Mortality Ratios by Race (Black and White Mothers, Aged 15–44)



Source: Milken Institute analysis, CDC (2021)

Though both the Black and White maternal mortality ratios are higher in the sample states than in the nation as a whole, the percent difference between the two (i.e., mortality disparity based on race) is actually smaller in the sample states than in the entire country. However, this was not true for each sample state individually: North Carolina and Georgia had a larger Black and White mortality disparity than the nation (see Figure 4).

Figure 4. Black–White Maternal Mortality Disparities, by State

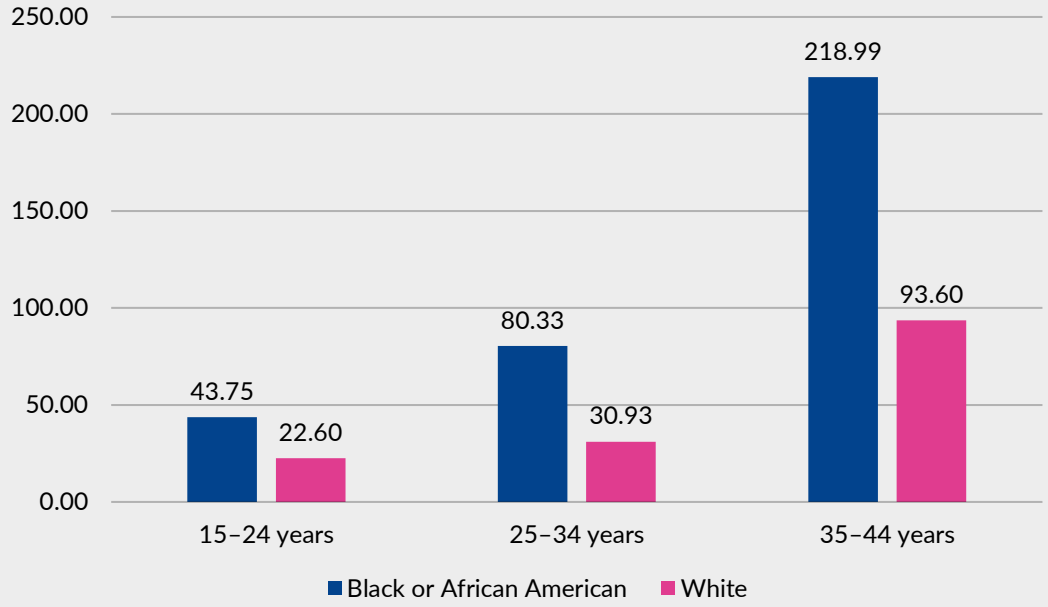


Source: Milken Institute analysis, CDC (2021)

THE BLACK AND WHITE GAP AND MATERNAL AGE

Maternal mortality ratios increase for both groups as maternal age increases but grow at different rates for different groups. The Black maternal mortality ratio almost doubles (an increase of 83.61 percent) moving from 15–24 year-old mothers to 25–34 year-old mothers, and then increases by another 172.69 percent moving from 25–34 year-old mothers to 35–44 year-old mothers. The White ratios follow a different pattern, first increasing by 36.86 percent, moving from 15–24 year-old mothers to 25–34 year-old mothers, and then by 202.62 percent moving from 25–34 year-old mothers to 35–44 year-old mothers (see Figure 5).

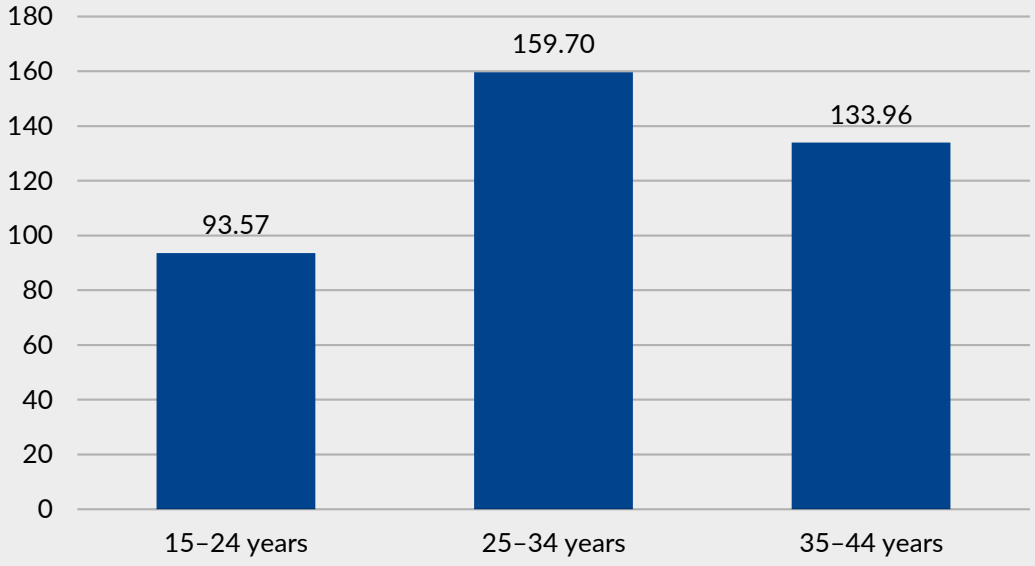
Figure 5. Maternal Mortality Ratios, by Age and Race, in Sample States



Source: Milken Institute analysis, CDC (2021)

This generates a lopsided upside-down "U" pattern in the disparity by age group, where racial disparities in the maternal mortality ratio are lower but still present for the youngest mothers, increase for the middle maternal ages, then slightly decrease for the oldest mothers (see Figure 6). The disparity remains quite large for the oldest mothers in our sample: The disparity is still 43.17 percent larger for 35–44 year-olds than for 15–24 year-olds (see Figure 6).

Figure 6. Black–White Maternal Mortality Disparities by Age, in Sample States

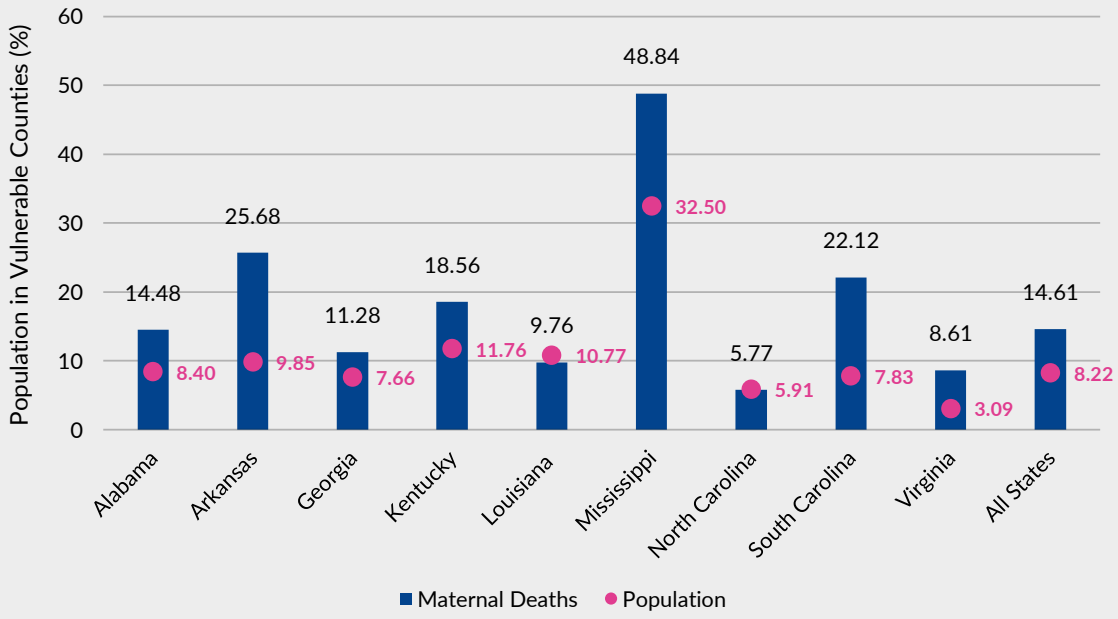


Source: Milken Institute analysis, CDC (2021)

WHERE WAS MORTALITY CONCENTRATED?

While one might expect an outsized share of maternal deaths to occur in the vulnerable counties identified by the Community Explorer, this was not the case in every state (see Figure 7). Most states did see a higher proportion of total maternal deaths occurring in vulnerable counties than the proportion of the population living in those counties. When looking at all 10 states, 8.22 percent of people resided in one of these vulnerable counties, but 14.61 percent of maternal deaths occurred among mothers living in such counties. The exceptions were Louisiana and North Carolina, where the proportion of residents in vulnerable counties was slightly higher than the proportion of maternal deaths in these counties.

Figure 7. Proportion of a State's Population Residing in and Maternal Deaths Occurring in "Vulnerable" Counties



Source: Milken Institute, CDC (2021)

LIMITATIONS AND CONCLUSIONS

This analysis provides a descriptive overview of maternal mortality based on data available to the general public. Most data were pooled at the state level (the number of deaths within vulnerable counties in a state was available, but such data were not available for births). Age was constrained to arbitrary 10-year bins, which limits the ability to see detailed nuances along this demographic. While mortality is clearly highest in the oldest age category, it is not possible to see where that mortality is concentrated within the 10-year span, such as after age 40, for example. Were we to

examine deaths in five-year or single-year age groups, data suppression would have limited availability even further. This analysis only considers deaths where a pregnancy-related condition was the *underlying* cause of death, meaning that many deaths where pregnancy might have been a contributing factor are missing from the data. Causes such as homicide, suicide, and drug overdose are major contributors to pregnancy-associated mortality but may not be coded as the underlying cause of death in the data (Campbell et al., 2021; Howard et al., 2021). Future analysis might utilize the multiple cause of death data to increase detection of such deaths.

The evidence provided above serves as a starting point for public health and policy discussions on health disparities without assessing causal pathways by which these disparities have arisen. To the extent that contributing factors to maternal mortality follow patterns with regard to age and race similar to those explored in the report above, we have identified areas that have the potential to be fruitful for future investigation and deployment of resources by policymakers, funders, health-care organizations, and other interested parties.

For example, while the Black–White maternal mortality disparity in the US is large, the fact that it is smaller in states that contain the most vulnerable Black populations is noteworthy. These 10 states alone contain more than one-third of the nation's Black population (34.31 percent; US Census Bureau, 2021). The South more broadly contains over *half* of the US's Black population (Moslimani et al., 2023). Given that the Black–White disparity is large nationwide, a first thought would be that a similarly large disparity would be observed where vulnerable Black populations are most heavily located. This report casts doubt on that assertion: These places perform better in terms of the disparity than the national average. Understanding the underlying reasons for this could help policymakers craft interventions with the best chance for success.

Future analyses should continue to explore the disparities (racial, age-specific, or other) in health outcomes in additional communities as identified by the Community Explorer profiles. Doing so can help policymakers in identifying concerns affecting specific groups of populations in counties across the US. As the issue of disparities in access to health care and health measures becomes increasingly salient to the general public, it is critical to illuminate what is actually happening through the use of vital statistics data and an exploration of its underlying patterns across US communities.

BIBLIOGRAPHY

Buescher, Paul A. and Manjoo Mittal. "Racial Disparities in Birth Outcomes Increase with Maternal Age: Recent Data from North Carolina." *North Carolina Medical Journal* 67, no. 1 (January 2006): 16–20. https://doi.org/10.18043/ncm.67.1.16.

Campbell, Jacquelyn, Sabrina Matoff-Stepp, Martha L. Velez, Helen Hunter Cox, and Kathryn Laughon. "Pregnancy-Associated Deaths from Homicide, Suicide, and Drug Overdose: Review of Research and the Intersection with Intimate Partner Violence." *Journal of Women's Health* 30, no. 2 (February 1, 2021): 236–44. https://doi.org/10.1089/jwh.2020.8875.

Centers for Disease Control and Prevention, National Center for Health Statistics. "National Vital Statistics System, Mortality 2018-2021." Accessed May 30, 2023. CDC WONDER Online Database. http://wonder.cdc.gov/ucd-icd10-expanded.html.

Centers for Disease Control and Prevention, National Center for Health Statistics. "National Vital Statistics System, Natality." Accessed May 30, 2023. CDC WONDER Online Database. http://wonder.cdc.gov/natality-expanded-current.html.

Dagher, Rada K. and Deborah E. Linares. "A Critical Review on the Complex Interplay between Social Determinants of Health and Maternal and Infant Mortality." *Children* 9, no. 3 (March 2022): 394. https://doi.org/10.3390/children9030394.

Declercq, Eugene and Laurie C. Zephyrin. *Maternal Mortality in the United States: A Primer*. The Commonwealth Fund. December 16, 2020. https://doi.org/10.26099/TA1Q-MW24.

Eliason, Erica L. "Adoption of Medicaid Expansion Is Associated with Lower Maternal Mortality." *Women's Health Issues* 30, no. 3 (May 2020): 147–52. https://doi.org/10.1016/j.whi.2020.01.005.

Geronimus, Arline T. "The Weathering Hypothesis and the Health of African-American Women and Infants: Evidence and Speculations." *Ethnicity & Disease* 2, no. 3 (1992): 207–21.

Geronimus, Arline T. "Black/White Differences in the Relationship of Maternal Age to Birthweight: A Population-Based Test of the Weathering Hypothesis." *Social Science & Medicine* 42, no. 4 (February 1996): 589–97. https://doi.org/10.1016/0277-9536(95)00159-X.

Geronimus, Arline T., John Bound, and Landon Hughes. "Trend toward Older Maternal Age Contributed to Growing Racial Inequity in Very-Low-Birthweight Infants in the US." *Health Affairs* 42, no. 5 (May 2023): 674–82. https://doi.org/10.1377/hlthaff.2022.01066.

Hawkins, Summer Sherburne, Marco Ghiani, Sam Harper, Christopher F. Baum, and Jay S. Kaufman. "Impact of State-Level Changes on Maternal Mortality: A Population-Based, Quasi-Experimental Study." *American Journal of Preventive Medicine* 58, no. 2 (February 2020): 165–74. https://doi.org/10.1016/j.amepre.2019.09.012.

Howard, Jeffrey T., Corey S. Sparks, Alexis R. Santos-Lozada, Samson A. Olowolaju, Jud C. Janak, and Krista J. Howard. "Trends in Mortality among Pregnant and Recently Pregnant Women in the US, 2015–2019." *JAMA* 326, no. 16 (October 26, 2021): 1631–33. https://doi.org/10.1001/jama.2021.13971.

Hoyert, Donna L. and Arialdi M. Miniño. "Maternal Mortality in the United States: Changes in Coding, Publication, and Data Release, 2018." *National Vital Statistics Reports* 69, no. 2. (January 30, 2020). https://stacks.cdc.gov/view/cdc/84769.

Hoyert, Donna. "Maternal Mortality Rates in the United States, 2021." National Center for Health Statistics (US), March 16, 2023. https://doi.org/10.15620/cdc:124678.

Lopez, Claude, Hyeongyul Roh, and Maggie Switek. *The Community Explorer: Using County-Level Data on US Diversity Effectively to Inform Policy*. Milken Institute. October 17, 2022. https://milkeninstitute.org/report/community-explorer-county-data.

Moslimani, Mohamad, Christine Tamir, Abby Budiman, Luis Noe-Bustamante, and Lauren Mora. "Facts about the US Black Population." *Pew Research Center's Social & Demographic Trends Project* (blog). March 2, 2023. https://www.pewresearch.org/social-trends/fact-sheet/facts-about-the-us-black-population/.

Schmidt, Alexandra and Gloria Bachmann. "An Overview of Finnish Maternal Health Care as a Potential Model for Decreasing Maternal Mortality in the United States." *Women's Health Reports* 2, no. 1 (March 1, 2021): 37–43. https://doi.org/10.1089/whr.2021.0001.

Schummers, Laura, Michele R. Hacker, Paige L. Williams, Jennifer A. Hutcheon, Tyler J. Vanderweele, Thomas F. McElrath, and Sonia Hernandez-Diaz. "Variation in Relationships between Maternal Age at First Birth and Pregnancy Outcomes by Maternal Race: A Population-Based Cohort Study in the United States." *BMJ Open* 9, no. 12 (December 1, 2019): e033697. https://doi.org/10.1136/bmjopen-2019-033697.

Tikkanen, Roosa, Munira Z. Gunja, Molly FitzGerald, and Laurie Zephyrin. "Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries," The Commonwealth Fund, November 18, 2020. https://doi.org/10.26099/411V-9255.

Trost, Susanna, Jennifer Beauregard, Gyan Chandra, Fanny Njie, Jasmine Berry, Alyssa Harvey, and David A Goodman. "Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019." Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services, 2022.
US Census Bureau. "Decennial Census PL 94-171 Redistricting Data." September 16, 2021. https://www.census.gov/programs-surveys/decennial-census/about/rdo/summary-files.html.

US Census Bureau, 2020 Census State Redistricting Data (Public Law 94-171) Summary File, accessed June 16, 2023, https://data.census.gov/table?tid=DECENNIALPL2020.P1.

Wilmoth, John R., Nobuko Mizoguchi, Mikkel Z. Oestergaard, Lale Say, Colin D. Mathers, Sarah Zureick-Brown, Mie Inoue, and Doris Chou. "A New Method for Deriving Global Estimates of Maternal Mortality." *Statistics, Politics, and Policy* 3, no. 2 (July 13, 2012): 2151-7509.1038. https://doi.org/10.1515/2151-7509.1038.

ABOUT THE AUTHORS

Katherine Sacks, PhD, is an associate director in health economics within the Research Department at the Milken Institute. Prior to joining the Milken Institute, Sacks was part of the team creating a State Safety-net Generosity Index, and she has been working to quantify the regulations governing social assistance programs in the United States across all states since the advent of welfare reform in the 1990s. Her research incorporates novel methodological approaches to combine program rules into a measure of safety-net generosity in each state in a given year, which she has used to examine the relative assistance climates of different states. She also researches the social determinants of health, focusing on adverse maternal birth outcomes, and the effects of the social safety net on measures of population health. Sacks holds an MA and PhD in public policy from the University of North Carolina at Chapel Hill, an MSc from the London School of Economics, and a BA from Barnard College.

Lawson Mansell is an associate with the Research Department at the Milken Institute. He supports the department's research portfolio in regional and health economics. Prior to joining the Milken Institute, Mansell worked for the Niskanen Center and Palmetto Promise Institute in South Carolina where he also previously served on the staff of South Carolina's first congressional district. Mansell holds a Master of Public Policy from Pepperdine University School of Public Policy and a Bachelor of Arts in political science from Thomas Edison State University.

Brooke Shearon is a recent Master of Public Policy (MPP) graduate at the University of North Carolina at Chapel Hill, and she holds a BA in economics and public policy from the University of North Carolina at Chapel Hill. This project serves as her capstone requirement for the MPP. Her research interests include health policy, public health risks, the social determinants of health, disparities in health, and health policy evaluation. In June 2023, Shearon joined the American Institutes for Research's Health Division in the Health Learning, Translation and Quality Measurement Program Area as a research associate.


MILKEN
INSTITUTE