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Complications of Childbirth: Racial & Ethnic Disparities in Severe Maternal Morbidity in New York State

Prepared by | Sophie Wheelock, Mark Zezza,
and Jessica Athens





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Executive Summary

The United States has a higher maternal mortality rate compared to other peer developed nations.^{1,2} In 2017, the rate in the U.S. was double that of countries such as Germany and Canada.³ Unfortunately, maternal death is considered the “tip of the iceberg” of an even larger body of adverse maternal events impacting women in the U.S.^{4,5}

Prior research has found that for every maternal death, there are up to 100 occurrences of severe maternal morbidity (SMM).⁶ SMM refers to outcomes during labor and delivery (for example, complications such as respiratory distress or shock) that result in adverse short-term or long-term consequences to a woman’s health.⁷ These outcomes may be life-threatening and require the need for lifesaving procedures, such as a blood transfusion or ventilation.^{8,9} Preventing SMM spares women serious injury and potentially life-long health consequences. Severe maternal morbidity is a major risk factor for maternal death; therefore, preventing SMM is also a key strategy to reducing maternal mortality rates.¹⁰

New York State has historically had higher SMM rates than the national average. The most recent years of nationwide data show that New York State ranked in the top quartile of state

- ¹ World Health Organization. “Trends in Maternal Mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division.” 2019.
<https://www.who.int/reproductivehealth/publications/maternal-mortality-2000-2017/en/>
- ² Gunja, Munira Z., Roosa Tikkanen, Shanoor Seervai, and Sara R. Collins. “What Is the Status of Women’s Health and Health Care in the U.S. Compared to Ten Other Countries?” The Commonwealth Fund. December 2018.
https://www.commonwealthfund.org/sites/default/files/2018-12/Gunja_status_womens_health_sb.pdf
- ³ Gunja, et al. “What Is the Status of Women’s Health and Health Care in the U.S. Compared to Ten Other Countries?”
- ⁴ It is important to note that not all people facing these issues identify as women.
- ⁵ Callaghan, William M., Andreea A. Creanga, and Elena V. Kuklina. “Severe Maternal Morbidity among Delivery and Postpartum Hospitalizations in the United States.” *Obstetrics & Gynecology* 120, no. 5 (2012): 1029-1036.
- ⁶ Callaghan et al., “Severe Maternal Morbidity among Delivery and Postpartum Hospitalizations in the United States.”
- ⁷ Centers for Disease Control and Prevention, “Severe Maternal Morbidity in the United States.” Accessed April 2020.
<https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html>
- ⁸ Kilpatrick, Sarah K., Jeffrey L. Ecker, and American College of Obstetricians and Gynecologists. “Severe Maternal Morbidity: Screening and Review.” *American Journal of Obstetrics and Gynecology* 215, no. 3 (2016): B17-B22.
- ⁹ Rivara, Frederick P., and Stephan D. Fihn. “Severe Maternal Morbidity and Mortality: JAMA Network Open Call for Papers.” *JAMA Network Open* 3, no. 1 (2020): e200045-e200045.
- ¹⁰ Ray, Joel G., Alison L. Park, Susie Dzakpasu, Natalie Dayan, Paromita Deb-Rinker, Wei Luo, and K. S. Joseph. “Prevalence of Severe Maternal Morbidity and Factors Associated with Maternal Mortality in Ontario, Canada.” *JAMA Network Open* 1, no. 7 (2018): e184571-e184571.



Executive Summary (continued)

SMM rates.^{11,12} These rates, however, do not adjust for states' patient demographics and hospital characteristics. Still, severe maternal morbidity remains a critical issue for New York, particularly for achieving health equity.

Disparities in severe maternal morbidity by race and ethnicity have been well documented in prior research, nationally and for New York State.^{13,14,15} Several studies focused on births in New York City, where minority racial and ethnic groups make up more than half of the population, also show these disparities.^{16,17,18} Importantly, many of these studies controlled for differences in health status using data on comorbidities for each pregnant woman—implying that, regardless of how healthy they were before giving birth, minority women were more likely than their white counterparts to have serious complications. Some studies also controlled for other factors, including sociodemographic characteristics, educational attainment, access to prenatal care, and neighborhood characteristics as a proxy for socioeconomic status. Even after adjusting for these factors, significant disparities in SMM rates across racial and ethnic groups remained.

¹¹ U.S. Department of Health and Human Services. "Federally Available Data." HRSA Maternal & Child Health. July 2, 2020. <https://mchb.tvisdata.hrsa.gov/uploadedfiles/TvisWebReports/Documents/FADResourceDocument.pdf>

¹² U.S. Department of Health and Human Services. "National Outcome Measures." HRSA Maternal & Child Health. Accessed April 2020. <https://mchb.tvisdata.hrsa.gov/PrioritiesAndMeasures/NationalOutcomeMeasures>

¹³ Liese, Kylea L., Mulubrhan Mogos, Sarah Abboud, Karen Decocker, Abigail R. Koch, and Stacie E. Geller. "Racial and Ethnic Disparities in Severe Maternal Morbidity in the United States." *Journal of Racial and Ethnic Health Disparities* 6, no. 4 (2019): 790-798.

¹⁴ Leonard, Stephanie A., Elliott K. Main, Karen A. Scott, Jochen Profit, and Suzan L. Carmichael. "Racial and Ethnic Disparities in Severe Maternal Morbidity Prevalence and Trends." *Annals of Epidemiology* 33 (2019): 30-36.

¹⁵ Lazariu, Victoria, Trang Nguyen, Louise-Anne McNutt, Jillian Jeffrey, and Marilyn Kacica. "Severe Maternal Morbidity: A Population-Based Study of an Expanded Measure and Associated Factors." *PloS One* 12, no. 8 (2017).

¹⁶ Howell, Elizabeth A., Natalia N. Egorova, Amy Balbierz, Jennifer Zeitlin, and Paul L. Hebert. "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity." *American Journal of Obstetrics and Gynecology* 215, no. 2 (2016): 143-152.

¹⁷ Howell, Elizabeth A., Natalia N. Egorova, Teresa Janevic, Michael Brodman, Amy Balbierz, Jennifer Zeitlin, and Paul L. Hebert. "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities." *Obstetrics & Gynecology* 135, no. 2 (2020): 285-293.

¹⁸ Howland, Renata E., Meghan Angley, Sang Hee Won, Wendy Wilcox, Hannah Searing, Sze Yan Liu, and Emily White Johansson. "Determinants of Severe Maternal Morbidity and its Racial/Ethnic Disparities in New York City, 2008–2012." *Maternal and Child Health Journal* 23, no. 3 (2019): 346-355.



Executive Summary (continued)

Key Takeaways

- These analyses describe trends in unadjusted rates of severe maternal morbidity (SMM) in New York State from 2011 through 2018.
- The findings suggest that the rate of SMM in New York State remains high, affecting thousands of women per year.
- Racial and ethnic disparities in SMM are large in New York State and have not narrowed. These gaps are not limited to one geographic area; they exist throughout New York State.
- In recent years, the State government and other stakeholders have taken laudable steps to address the problems of SMM. Continued action is needed.

CURRENT RESEARCH

Given the uneven quality of maternity care, it is critical to have greater transparency in regard to maternal health outcomes.^{19,20,21,22} More information about health care quality will empower health care consumers, especially pregnant women who can make choices on where to deliver. The New York State Health Foundation has recently funded multiple projects to enable New Yorkers to make informed and higher-value decisions about maternity care. This includes the development of an online tool that allows expectant mothers to compare local providers in the New York City area based on quality measures and other factors that affect maternity and newborn care.²³ In addition, the Foundation is supporting an effort by one of the largest unions in the State to develop a high-value maternity care network for its expectant parents, who are predominantly lower-wage union workers and women of color.^{24,25}

¹⁹ Howell et al., "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity."

²⁰ Berg, Cynthia J., Margaret A. Harper, Samuel M. Atkinson, Elizabeth A. Bell, Haywood L. Brown, Marvin L. Hage, Avick G. Mitra, Kenneth J. Moise, and William M. Callaghan. "Preventability of Pregnancy-Related Deaths: Results of a State-Wide Review." *Obstetrics & Gynecology* 106, no. 6 (2005): 1228-1234.

²¹ Ozimek, John A., Rhonda M. Eddins, Naomi Greene, Daniela Karagyozyan, Sujane Pak, Melissa Wong, Mark Zakowski, and Sarah J. Kilpatrick. "Opportunities for Improvement in Care among Women with Severe Maternal Morbidity." *American Journal of Obstetrics and Gynecology* 215, no. 4 (2016): 509-e1.

²² Geller, Stacie E., Deborah Rosenberg, Suzanne M. Cox, Monique L. Brown, Louise Simonson, Catherine A. Driscoll, and Sarah J. Kilpatrick. "The Continuum of Maternal Morbidity and Mortality: Factors Associated with Severity." *American Journal of Obstetrics and Gynecology* 191, no. 3 (2004): 939-944.

²³ ExpectNY. "Information That Empowers." Accessed June 2020. <https://expectny.com/>

²⁴ New York State Health Foundation. "Building Service 32BJ Health Fund." Accessed June 2020. <https://nyshealthfoundation.org/grantee/building-service-32bj-health-fund/>

²⁵ West, Melanie Grayce. "New York City Union Uses Its Size to Leverage Improved Maternity Care." *Wall Street Journal*, August 19, 2019. <https://www.wsj.com/articles/new-york-city-union-uses-its-size-to-leverage-improved-maternity-care-11566256083>



Executive Summary (continued)

Prior research has documented the high rates of severe maternal morbidity and racial and ethnic disparities across New York State through 2017 and New York City through 2014.^{26,27,28} This report provides a broader and updated perspective on the status of SMM in New York State. SMM is identified using a definition developed by the Centers for Disease Control and Prevention (CDC).²⁹ Data on SMM trends are updated through 2018 using information from inpatient hospital admissions associated with deliveries. (More details on the data and the definition used to identify SMM are in the **Methods** section.) While the data in this report are unadjusted for potentially confounding factors such as pre-existing health conditions and socioeconomic status, they can provide an indication of the persistence of SMM and associated racial and ethnic disparities throughout the State. SMM rates and disparities by race and ethnicity are also examined for different subgroups of women depending on their type of insurance coverage, region of residency, type of SMM event experienced, and type of delivery (cesarean versus vaginal). In addition, a summary is provided of key efforts recently implemented by the State government, hospital systems, and relevant professional organizations to address adverse maternal health outcomes during delivery.

KEY FINDINGS

- In 2018, the overall rate of severe maternal morbidity among women in New York State was approximately 271 out of every 10,000 deliveries (or 2.7%). Out of the 214,525 inpatient hospital admissions associated with deliveries that were analyzed, 5,817 were associated with an SMM event.
- The majority of SMM events were related to blood transfusions (see **Figure ES-1**). Blood transfusions are a proxy for identifying hemorrhage, a form of SMM, but can be

²⁶ U.S. Department of Health and Human Services. "Federally Available Data."

²⁷ Kacica, Marilyn. "Maternal Mortality and Morbidity in New York State" [PowerPoint presentation]. Taskforce on Maternal Mortality and Disparate Racial Outcomes, June 27, 2018, New York, NY. https://www.health.ny.gov/community/adults/women/task_force_maternal_mortality/docs/meeting1/2018-06-26_kacica_mmr_taskforce.pdf

²⁸ New York City Department of Health and Mental Hygiene. "Severe Maternal Morbidity Surveillance." Accessed April 2020. <https://www1.nyc.gov/site/doh/data/data-sets/severe-maternal-morbidity-surveillance.page>

²⁹ Centers for Disease Control and Prevention. "How Does CDC Identify Severe Maternal Morbidity?" December 2019. Accessed April 2020. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/smm/severe-morbidity-ICD.htm>

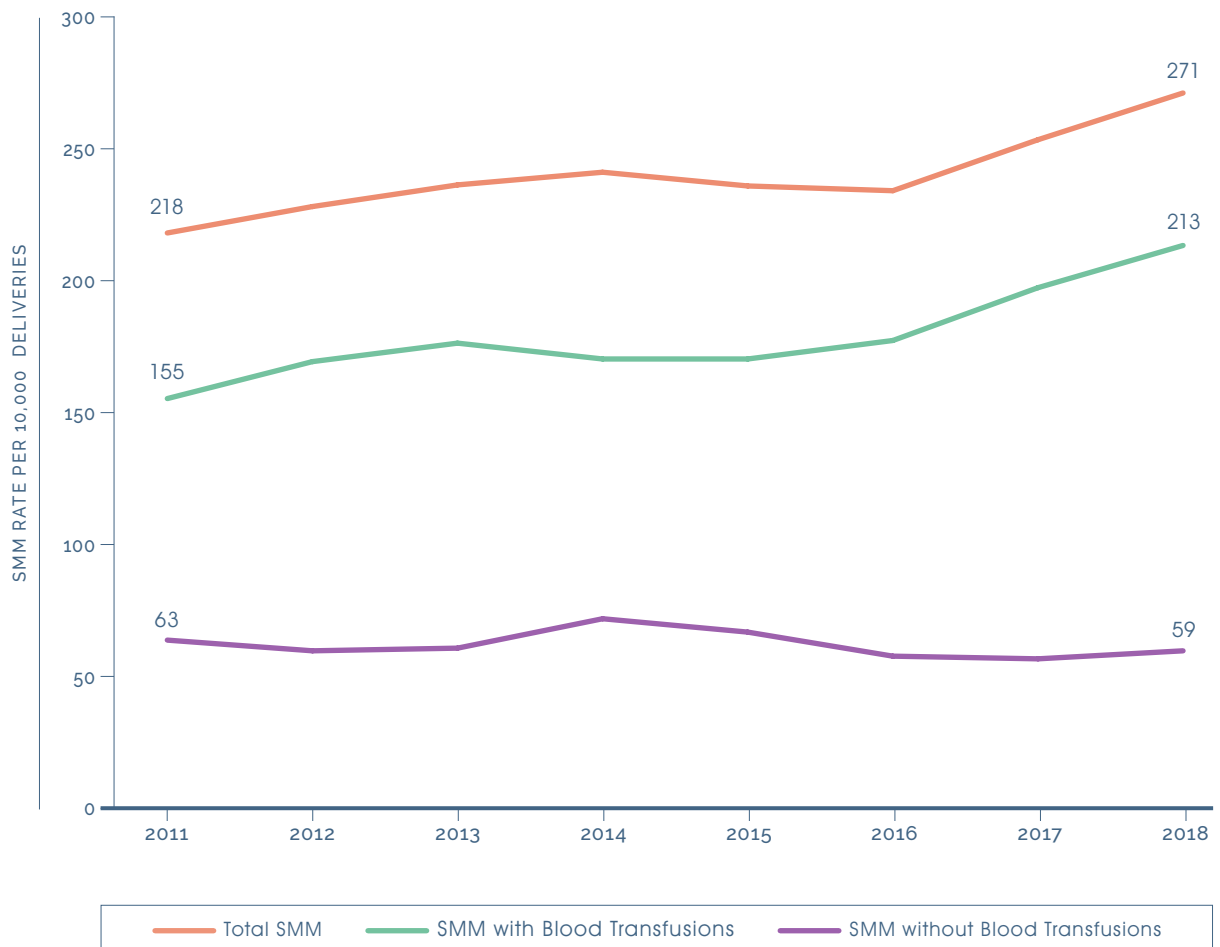


Executive Summary (continued)

an imperfect indicator of SMM. The recent increase in blood transfusion may reflect increased quality improvement efforts in New York to mitigate maternal hemorrhage.

- While the number of blood transfusions has increased, the overall rate of SMM unrelated to blood transfusions has largely remained steady from 2011 through 2018.

FIGURE ES-1: New York State Severe Maternal Morbidity Rates, 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

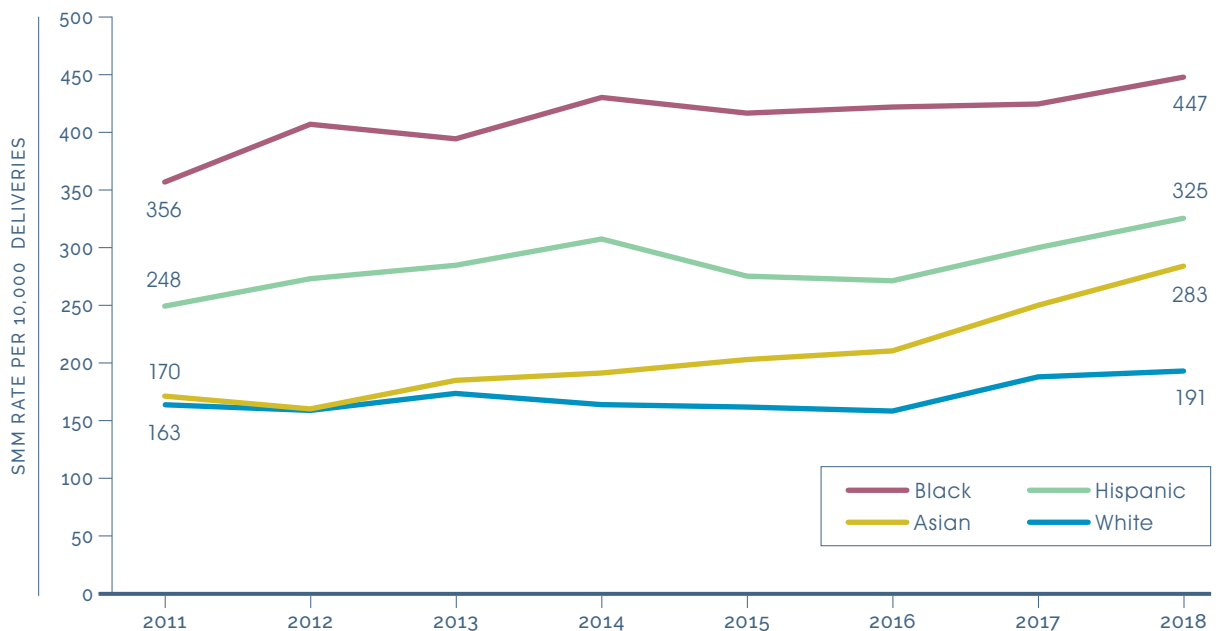
Notes: See **Methods** for details on the data and SMM rate calculation. In this figure, the "SMM with Blood Transfusions" line includes deliveries where a blood transfusion was the only indicator of SMM, and deliveries where a blood transfusion was an indicator along with another, non-blood transfusion indicator of SMM.



Executive Summary (continued)

- Disparities in SMM by race and ethnicity persisted in New York from 2011 through 2018 (see **Figure ES-2**). In 2018, the SMM rate for white women was 191 per 10,000 deliveries. The SMM rate for Black women was 447 per 10,000 deliveries, amounting to 2.3x ($447/191 = 2.3$) the rate for white women.³⁰ The rate for Hispanic women was approximately 1.7x the rate for white women; the rate for Asian women was approximately 1.5x the rate for white women (325 and 283 per 10,000, respectively, compared to 191 per 10,000). For Black and Hispanic women, these are similar disparities as in 2011 (2.2x for Black women and 1.5x for Hispanic women).

FIGURE ES-2: New York State Severe Maternal Morbidity Rates by Race and Ethnicity, 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See **Methods** for details on the data and SMM rate calculation, including the number of deliveries in total and with an SMM event for each year, and how race and ethnicity are categorized.

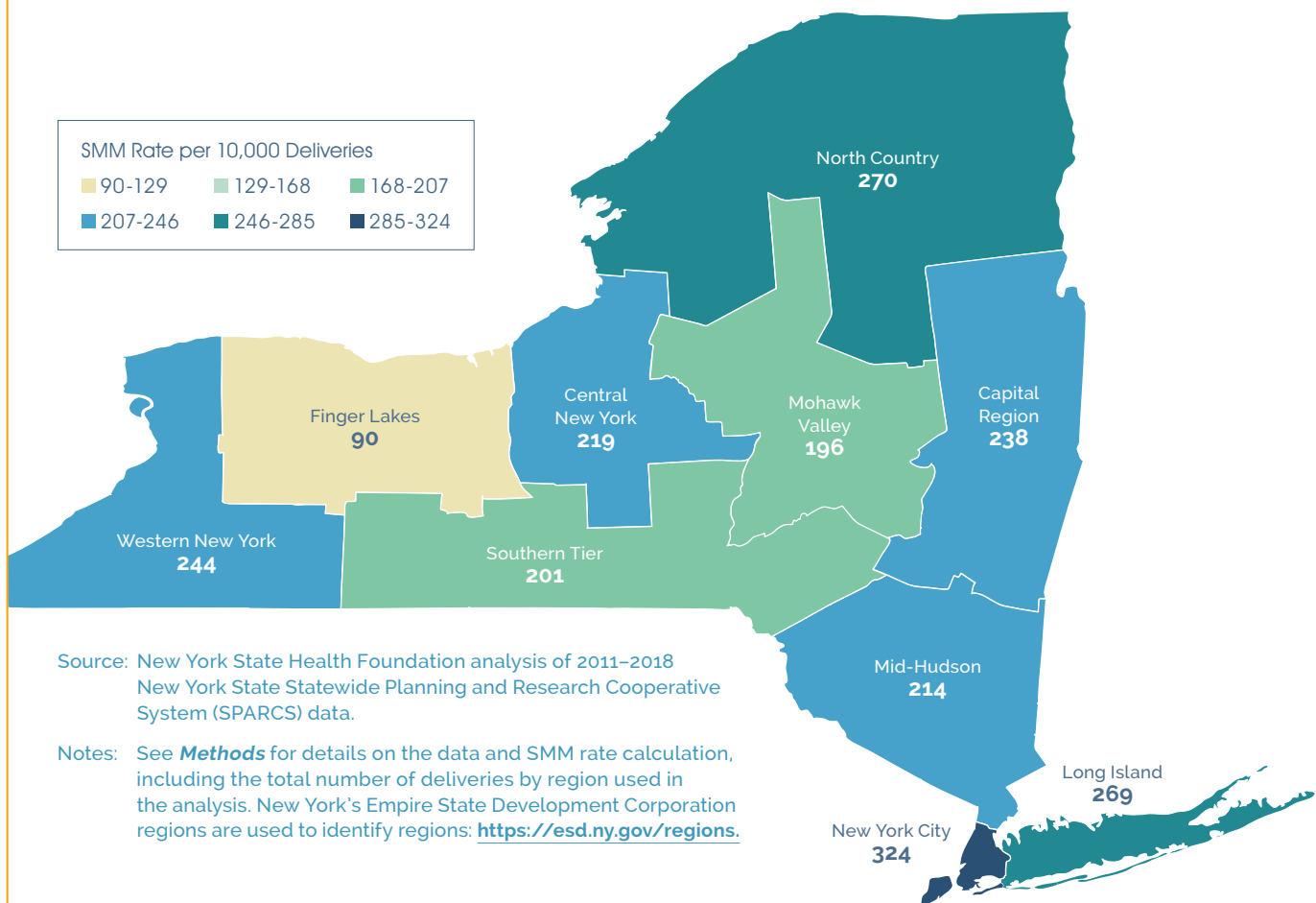
³⁰ In this report, we categorize non-Hispanic Black women as Black, non-Hispanic Asian women as Asian, and non-Hispanic white women as white.



Executive Summary (continued)

- Racial and ethnic disparities were present across both Medicaid and private insurance plans.
- Substantial variation in SMM rates existed across regions throughout the State. In 2018, SMM rates were more than three-and-a-half times larger in the region with the highest rate—New York City (324 per 10,000 deliveries)—compared with the region with the lowest rate—the Finger Lakes (90 per 10,000). Racial and ethnic disparities also existed in each region.
- Substantial racial and ethnic disparities were also present across both vaginal and cesar-ean deliveries.

FIGURE ES-3: Severe Maternal Morbidity Rates by Region of New York State: 2018





Executive Summary (continued)

- Black and Asian women were the only racial and ethnic groups studied that had higher rates in 2018 compared to 2011 for SMM events not related to blood transfusions. The rate of SMM not related to blood transfusions was similar for Hispanic women and was lower for white women in 2018 compared to 2011.

POLICY IMPLICATIONS

As of 2018, severe maternal morbidity still appears to impact thousands of New York women each year. Moreover, racial and ethnic disparities have not improved from 2011 through 2018 and are pervasive across regions and insurance coverage types.

Many causes of SMM have been identified, including at the individual, societal, and health system levels. In particular, there is evidence that a substantial proportion of adverse outcomes could be mitigated by improved quality of care at hospitals.^{31,32} However, some forms of maternal morbidity are unavoidable because they are due to the underlying health of a woman or her pregnancy.³³ There is also a growing body of evidence for disparities linked to structural racism and implicit racial bias that have been ingrained into the societal and health care system culture for decades.^{34,35,36} Given the complex mix of factors causing SMM, reducing its prevalence and closing the racial and ethnic disparities will require a multipronged and sustained effort.

Several important provisions have been implemented to reduce SMM and address racial and ethnic disparities in recent years. Many of these have been recommended by the New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes (the MMDRO Taskforce), including the expansion of data collection and monitoring, as well as the development of a multidisciplinary committee that reviews cases of adverse maternal events to investigate

³¹ Geller et al., "The Continuum of Maternal Morbidity."

³² Ozimek et al., "Opportunities for Improvement in Care among Women with Severe Maternal Morbidity."

³³ Kilpatrick, et al., "Severe Maternal Morbidity: Screening and Review."

³⁴ Howell, Elizabeth A. "Reducing Disparities in Severe Maternal Morbidity and Mortality." *Clinical Obstetrics and Gynecology* 61, no. 2 (2018): 387.

³⁵ Liese, et al., "Racial and Ethnic Disparities in Severe Maternal Morbidity in the United States."

³⁶ Leonard, et al. "Racial and Ethnic Disparities in Severe Maternal Morbidity Prevalence and Trends."



Executive Summary (continued)

root causes and make actionable recommendations to address them.³⁷ Similar initiatives have helped to substantially improve maternal health outcomes in California.³⁸ Furthermore, hospital systems and professional organizations have implemented a host of interventions in recent years to develop improved clinical care practices. These stakeholders have also been working together on efforts to address implicit racial bias and promote access to nonclinical health workers in order to improve maternal health care.

Many of the initiatives reviewed in this paper have been implemented since 2018. While the data in this report do not reflect the full impact of these efforts, the results point to the need for their continued implementation, including the recommendations issued by the MMDRO Taskforce that have not yet been implemented. Additional policies can also be considered to improve insurance coverage for women of reproductive age. In particular, creating a State-funded Essential Plan for undocumented New Yorkers would improve the health of immigrant New Yorkers of reproductive age. In addition, extending Medicaid coverage for pregnant women from 60 days after pregnancy to one year postpartum could help prevent injury and deaths in the postpartum period.

It is possible to reduce SMM rates. Quality improvement, data collection and monitoring, implicit bias training, and nonclinical health workers can be effective components to improving maternal health. New York State has taken substantial action in these areas, but there is room for more work to be done to protect and promote the health of pregnant New Yorkers delivering in the State.

³⁷ New York State Office of the Governor. "Governor Cuomo Receives Report By New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes." March 12, 2019. <https://www.governor.ny.gov/news/governor-cuomo-receives-report-new-york-state-taskforce-maternal-mortality-and-disparate-racial>

³⁸ Main, Elliott K., Cathie Markow, and Jeff Gould. "Addressing Maternal Mortality and Morbidity in California through Public-Private Partnerships." *Health Affairs* 37, no. 9 (2018): 1484-1493.



Background:

The State of Severe Maternal Morbidity in New York

The United States has a higher maternal mortality rate compared to other peer developed nations.^{39,40} In 2017, the rate in the U.S. was double that of countries such as Germany and Canada.⁴¹ This alarmingly high maternal mortality rate in the U.S. has received increased attention in recent years, generating calls to improve maternal health. Unfortunately, the crisis facing maternal health in the U.S. is larger than maternal mortality alone.

Maternal mortality is considered the "tip of the iceberg" of a larger body of adverse maternal events.⁴² Prior research has found that for every maternal death, there are up to 100 occurrences of severe maternal morbidity (SMM).⁴³ SMM is an outcome of labor and delivery (for example, complications such as respiratory distress or shock) that results in short-term or long-term consequences to a woman's health.⁴⁴ These outcomes may be life-threatening and require the need for lifesaving procedures, such as a blood transfusion or ventilation.^{45,46} Preventing SMM spares women serious injury and potentially life-long health consequences. Severe maternal morbidity is a major risk factor for maternal death; therefore, preventing SMM is also a key strategy to reducing maternal mortality rates.⁴⁷

New York State has historically had higher SMM rates than the national average. The most recent years of nationwide data show that New York State ranked in the top quartile of state SMM rates.^{48,49} These rates, however, do not adjust for New York's patient demographics and hospital characteristics. Still, severe maternal morbidity remains a critical issue for

³⁹ World Health Organization. "Trends in Maternal Mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division."

⁴⁰ Gunja et al., "What Is the Status of Women's Health and Health Care in the U.S. Compared to Ten Other Countries?"

⁴¹ Ibid.

⁴² Callaghan et al., "Severe Maternal Morbidity among Delivery and Postpartum Hospitalizations in the United States."

⁴³ Ibid.

⁴⁴ Centers for Disease Control and Prevention, "Severe Maternal Morbidity in the United States."

⁴⁵ Kilpatrick et al., "Severe Maternal Morbidity: Screening and Review."

⁴⁶ Rivara and Fihn. "Severe Maternal Morbidity and Mortality: JAMA Network Open Call for Papers."

⁴⁷ Ray, et al. "Prevalence of Severe Maternal Morbidity and Factors Associated with Maternal Mortality in Ontario, Canada."

⁴⁸ [#] U.S. Department of Health and Human Services. "Federally Available Data."

⁴⁹ [#] U.S. Department of Health and Human Services. "National Outcome Measures."



Background:

The State of Severe Maternal Morbidity in New York (continued)

New York, particularly for achieving health equity. Prior research has found that maternal outcomes are persistently worse for Black and Hispanic women relative to white women, even after controlling for health status, sociodemographic factors, and neighborhood income.^{50,51,52} To address these aims, the State government, hospital systems, and professional organizations have implemented a host of interventions in recent years to develop improved clinical care practices, expand data collection and monitoring, address implicit racial bias, and promote the role of nonclinical health workers.

Prior research has documented the high rates of severe maternal morbidity and disparities across New York State through 2017 and New York City through 2014.^{53,54,55} This report evaluates SMM trends through 2018, using data on inpatient hospital admissions related to deliveries. (More details on the data and the definition of SMM are in the **Methods** section.) SMM rates and disparities are also examined according to the pregnant women's insurance coverage, region of residency, type of SMM event experienced, and the type of delivery (cesarean versus vaginal). In addition, this report provides a summary of key efforts recently implemented by the State government, hospital systems, and relevant professional organizations to address adverse maternal health outcomes during delivery.

⁵⁰ Howell et al., "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity."

⁵¹ Liese et al., "Racial and Ethnic Disparities in Severe Maternal Morbidity in the United States."

⁵² Leonard et al., "Racial and Ethnic Disparities in Severe Maternal Morbidity Prevalence and Trends."

⁵³ U.S. Department of Health and Human Services. "Federally Available Data."

⁵⁴ Kacica. "Maternal Mortality and Morbidity in New York State."

⁵⁵ New York City Department of Health and Mental Hygiene. "Severe Maternal Morbidity Surveillance." Accessed April 2020. <https://www1.nyc.gov/site/doh/data/data-sets/severe-maternal-morbidity-surveillance.page>

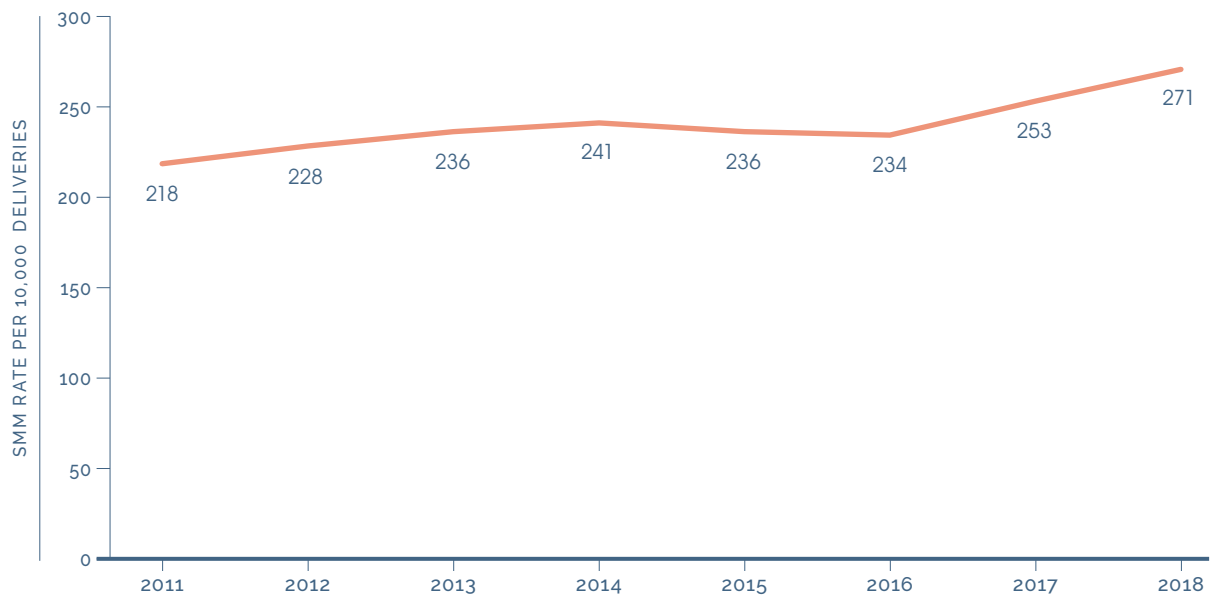


Key Findings

SEVERE MATERNAL MORBIDITY RATES IN NEW YORK STATE REMAIN HIGH

In 2018, approximately 2.7% of pregnant women (271 per 10,000) had deliveries associated with a severe maternal morbidity event in New York State (**Figure 1**). The rate of SMM is identified in this analysis based on a definition by the Centers for Disease Control and Prevention (CDC) that uses International Classification of Diseases (ICD) procedure and diagnosis codes. There is not a complete consensus among organizations and researchers on which conditions and procedures should be used to identify SMM; however, prior research has shown that measures using the CDC approach are reasonable for measuring SMM at the population level.^{56,57} (See the **Limitations** section for more details on alternative measures, as well as

FIGURE 1: New York State Severe Maternal Morbidity Rates, 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See **Methods** for details on the data and SMM rate calculation, including the number of deliveries in total and with an SMM event for each year.

⁵⁶ Main, Elliott K., Anisha Abreo, Jennifer McNulty, William Gilbert, Colleen McNally, Debra Poeltler, Katarina Lanner-Cusin et al. "Measuring Severe Maternal Morbidity: Validation of Potential Measures." *American Journal of Obstetrics and Gynecology* 214, no. 5 (2016): 643-e1.

⁵⁷ Kilpatrick et al., "Severe Maternal Morbidity: Screening and Review."



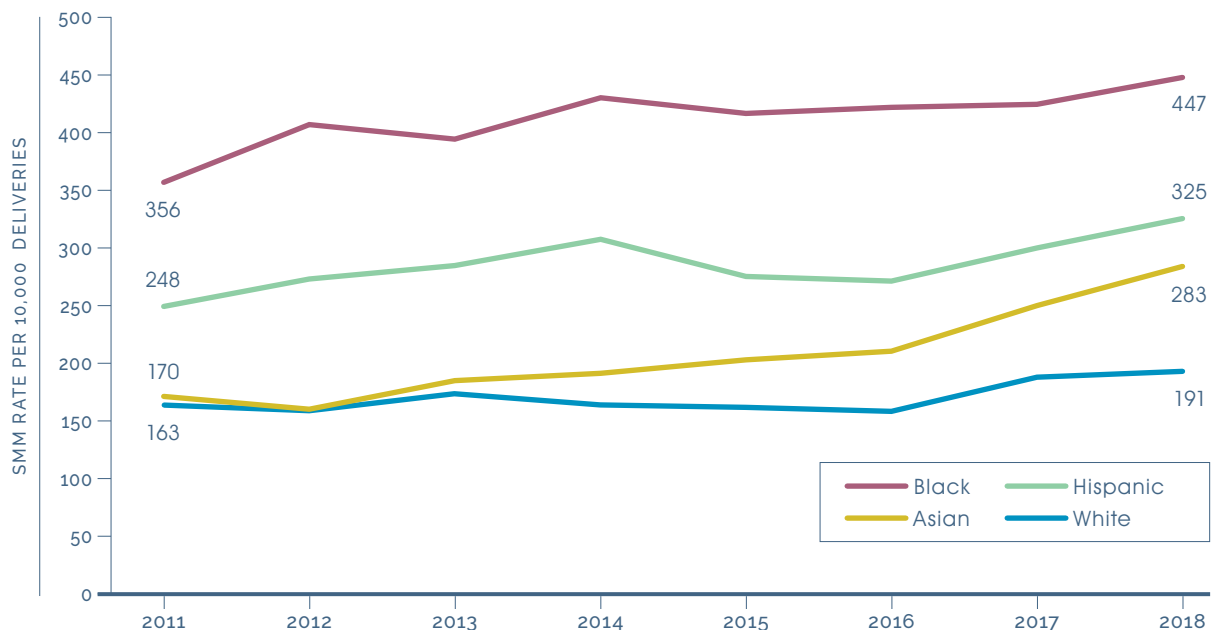
Key Findings (continued)

page 21 for more information about how blood transfusions in particular can be an imperfect measure to identify SMM.) In this study, deliveries are identified by hospital admissions for vaginal or cesarean deliveries and are limited to live births delivered in hospitals located in New York State. Deliveries associated with multiple SMM events are considered a single SMM event. The **Methods** section provides more details on the data used for the analysis, including how deliveries and SMM events were identified.

WOMEN OF COLOR ARE DISPROPORTIONATELY AFFECTED BY SEVERE MATERNAL MORBIDITY

From 2011 to 2018, disparities in severe maternal morbidity rates by race and ethnicity either persisted or grew (**Figure 2**).⁵⁸ In 2011, Black women experienced an SMM rate that was 2.2x higher than the rate for white women; Hispanic women had an SMM rate that was 1.5x

FIGURE 2: New York State Severe Maternal Morbidity Rates by Race and Ethnicity, 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See **Methods** for details on the data and SMM rate calculation, including the number of deliveries in total and with an SMM event for each year, and how race and ethnicity are categorized.

⁵⁸ In this report, we categorize non-Hispanic Black women as Black, non-Hispanic Asian women as Asian, and non-Hispanic white women as white. Other races are excluded from the analyses by race and ethnicity due to small sample sizes or an indeterminate race and ethnicity designation.



Key Findings (continued)

higher than the rate for white women. These gaps did not change substantially over time. In 2018, Black and Hispanic women had 2.3x and 1.7x higher rates of SMM than white women, respectively. The SMM rate for Asian women in 2011 was similar to the SMM rate for white women, but grew to a rate 1.5x higher than the rate for white women in 2018. In general, white women experienced the lowest rate of SMM relative to all other races and ethnicities studied.

Disparities in SMM by race and ethnicity have been well documented in prior research, nationally and for New York State.^{59,60,61} In addition, several studies focused on births in New York City, where minority racial and ethnic groups make up more than half of the population, also show these disparities.^{62,63} Importantly, these studies controlled for differences in health status using data on comorbidities for each pregnant woman—implying that, regardless of how healthy they were before giving birth, minority women were more likely than their white counterparts to have serious complications. Some also controlled for other factors, including sociodemographic characteristics, educational attainment, access to prenatal care, and neighborhood characteristics as a proxy for socioeconomic status. Even after adjusting for these factors, significant disparities in SMM rates across racial and ethnic groups remained. Although the data in this report are unadjusted rates, which do not control for these potentially confounding variables, the patterns found in our SMM rates by race and ethnicity are consistent with prior studies and suggest that substantial racial and ethnic disparities persist in New York.

RACIAL AND ETHNIC DISPARITIES EXIST WITHIN BOTH MEDICAID AND PRIVATELY INSURED POPULATIONS

Figure 3 displays severe maternal morbidity rates by race and ethnicity for women with Medicaid and those with private health insurance. Within each insurance type, women of color had higher rates of SMM. In 2018, Black, Hispanic, and Asian women with Medicaid had SMM rates approximately 2.3x, 1.7x, and 1.5x higher, respectively, than white women with Medicaid. The disparities were similar for women with private insurance. In 2018, Black, Hispanic, and Asian women with private insurance had SMM rates approximately 2.3x, 1.6x, and 1.5x higher, respectively, than white women with private insurance.

⁵⁹ Liese et al., "Racial and Ethnic Disparities in Severe Maternal Morbidity in the United States."

⁶⁰ Leonard et al., "Racial and Ethnic Disparities in Severe Maternal Morbidity Prevalence and Trends."

⁶¹ Lazariu et al., "Severe Maternal Morbidity: A Population-Based Study of an Expanded Measure and Associated Factors."

⁶² Howell et al., "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity."

⁶³ Howell et al., "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities."



Key Findings (continued)

Pregnant women insured through Medicaid share a similar socioeconomic status, because New York State's program eligibility requires an income of less than 223% of the Federal Poverty Level.⁶⁴ The persistence of racial disparities within this relatively socioeconomically homogenous group suggests that factors beyond socioeconomic status are contributing to racial and ethnic disparities in SMM.

FIGURE 3: Severe Maternal Morbidity Rates by Insurance Type in New York: 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See *Methods* for details on the data and SMM rate calculation. Deliveries covered by other types of insurance or which were associated with unknown/missing insurance information in the data were not included in the Figure.

⁶⁴ New York State Department of Health. "Medicaid (Annual and Monthly) Income Levels for Pregnant Women and Children." Accessed April 2020. https://www.health.ny.gov/community/pregnancy/health_care/prenatal/income.htm



Key Findings (continued)

Overall, women with Medicaid generally had higher rates of SMM than women with private health insurance (e.g., in 2018, the Medicaid SMM rate was 307 per 10,000 deliveries, versus 232 per 10,000 for the privately insured population). This disparity is consistent with findings from prior research on deliveries in New York City.⁶⁵ This finding is especially concerning given that women insured through Medicaid represent a population more likely to experience barriers to care. It is also a widespread problem, as Medicaid covers approximately half of all deliveries in the State (between 46% and 53% of all deliveries used in this analysis in any given year from 2011 through 2018).⁶⁶

However, a recent study of deliveries in New York City found that, after adjusting for clinical and other risk factors, maternal health outcomes were no worse for women with Medicaid relative to those with private health insurance within the same hospital. Yet, racial disparities remained as Black and Latina women had higher rates of SMM than white women within the same hospital.⁶⁷ These findings suggest that type of insurance does not explain the higher risk of SMM among women of color.

RATES OF SEVERE MATERNAL MORBIDITY VARY SIGNIFICANTLY BY REGION; RACIAL AND ETHNIC DISPARITIES EXIST IN ALL REGIONS

Figure 4 displays severe maternal morbidity rates by region in New York State for 2018. There is substantial geographic variation in SMM rates. In 2018, SMM rates were more than three-and-a-half times larger in the region with the highest rate—New York City (324 per 10,000 deliveries)—compared with the region with the lowest rate—the Finger Lakes (90 per 10,000).

There is no clear pattern between a region's urban or rural designation and SMM rates. However, it is concerning that the regions with the most deliveries per year—New York City and Long Island—have relatively higher rates of SMM (see **Table 10** in the **Methods** section for the total number of deliveries included in the analysis by region). Nearly two-thirds of all deliveries in the State occurred in these two regions in 2018.

⁶⁵ Howell et al., "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities."

⁶⁶ Together, private insurance and Medicaid covered more than 90% of all deliveries in each year of the analysis. Due to small sample sizes, other insurance types are excluded from the analysis by type of insurance.

⁶⁷ Howell et al., "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities."



Key Findings (continued)

FIGURE 4: Severe Maternal Morbidity Rates by Region of New York State: 2018

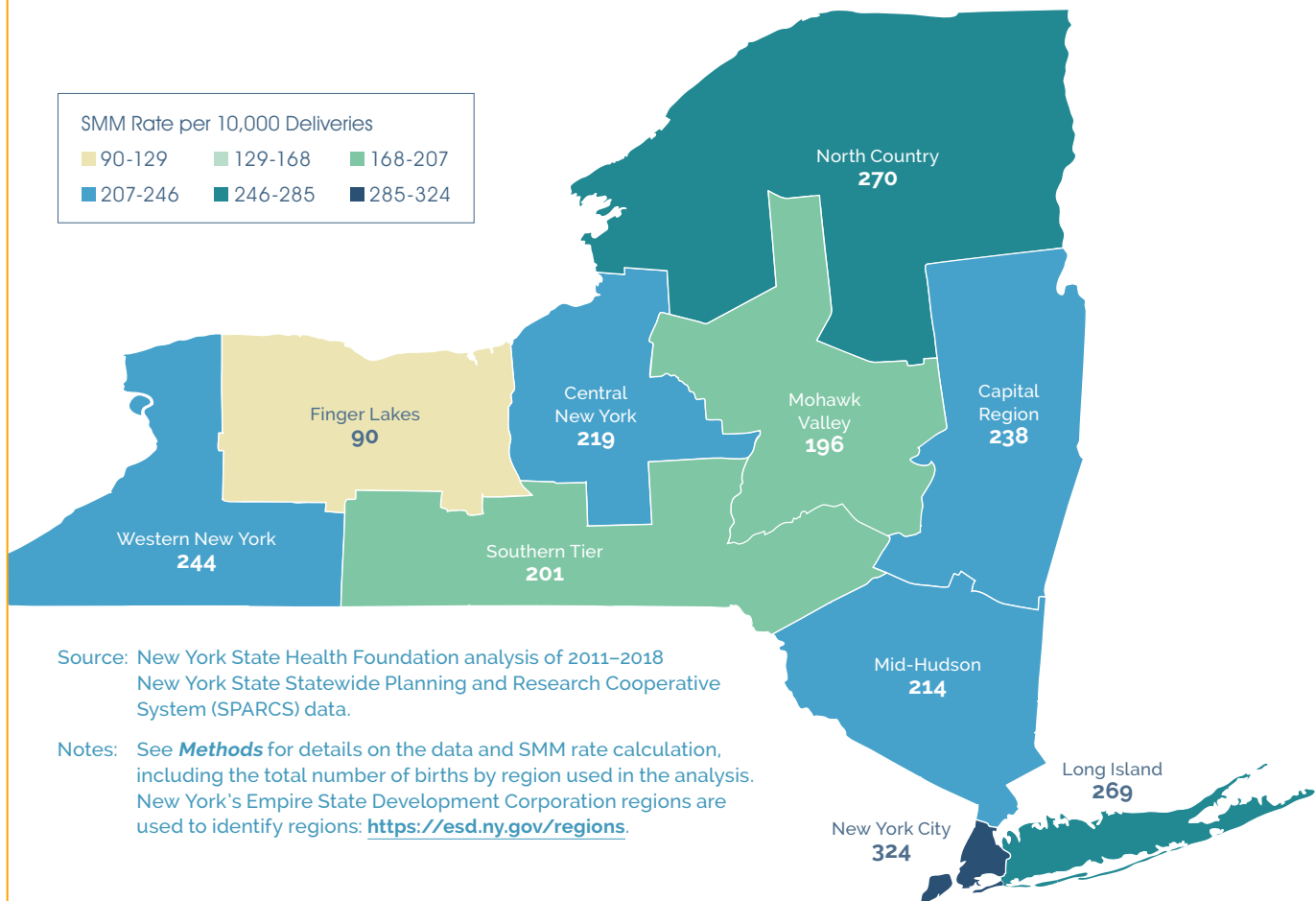


Figure 5 displays severe maternal morbidity rates by race and ethnicity for each region of the State in 2018. Racial or ethnic disparities in SMM rates existed in all regions; Black women typically had the highest rates of SMM. Long Island had the highest rate in any region of SMM among Black women, with a rate of 519 per 10,000 deliveries (approximately 5.2% of deliveries). The same year, New York City had the highest rate in any region of SMM among Hispanic women, with a rate of 362 per 10,000 deliveries (approximately 3.6% of deliveries). The Mohawk Valley had the highest SMM rate in 2018 for Asian women, with more than 5% of deliveries associated with an SMM event.⁶⁸ The North Country had the highest

⁶⁸ Note that the relatively high rate for Asian women in the Mohawk Valley may at least partially be the result of a small sample size in the analysis for this cohort (163 deliveries). Still, the SMM rate for Asian women in the Mohawk Valley was generally higher than all other races and ethnicities analyzed in the region from 2011 through 2018.

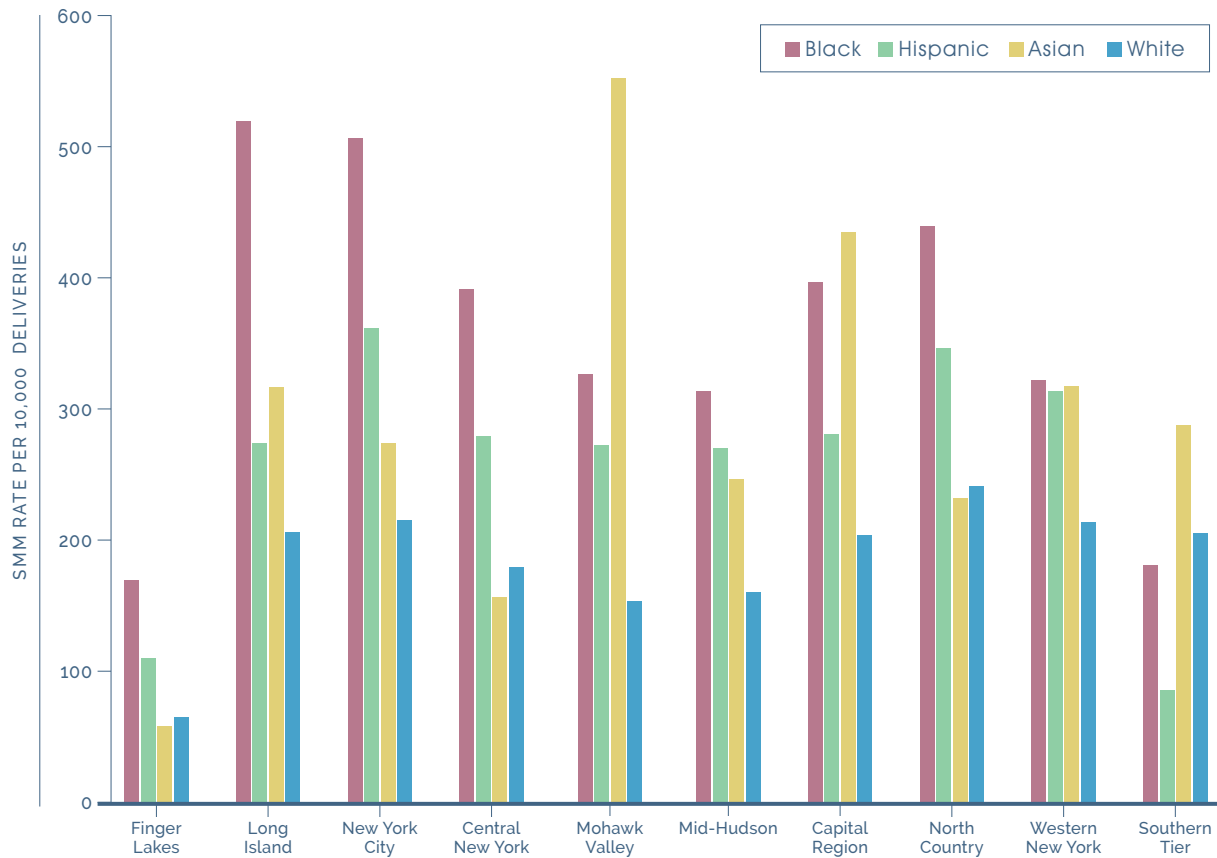


Key Findings (continued)

rate in any region of SMM among white women, with a rate of 242 per 10,000 deliveries (approximately 2.4% of deliveries).

In 2018, the SMM rate for Black women was at least twice (2.0x) as high as for white women in half of the State's regions. The SMM rate for Hispanic women was at least 50% (1.5x) higher than for white women in half of the State's regions, and the rate for Asian women was at least 40% (1.4x) higher than for white women in half of the State's regions.

FIGURE 5: Racial and Ethnic Disparities in Severe Maternal Morbidity Rates by Region of New York State, 2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See **Methods** for details on the data and SMM rate calculation, including the total number of deliveries by region and race and ethnicity used in the analysis. Regions are ordered in the figure from the region with the largest disparity between Black and white SMM rates (Finger Lakes) and smallest disparity between Black and white SMM rates (Southern Tier). New York's Empire State Development Corporation regions are used to identify regions: <https://esd.ny.gov/regions>.



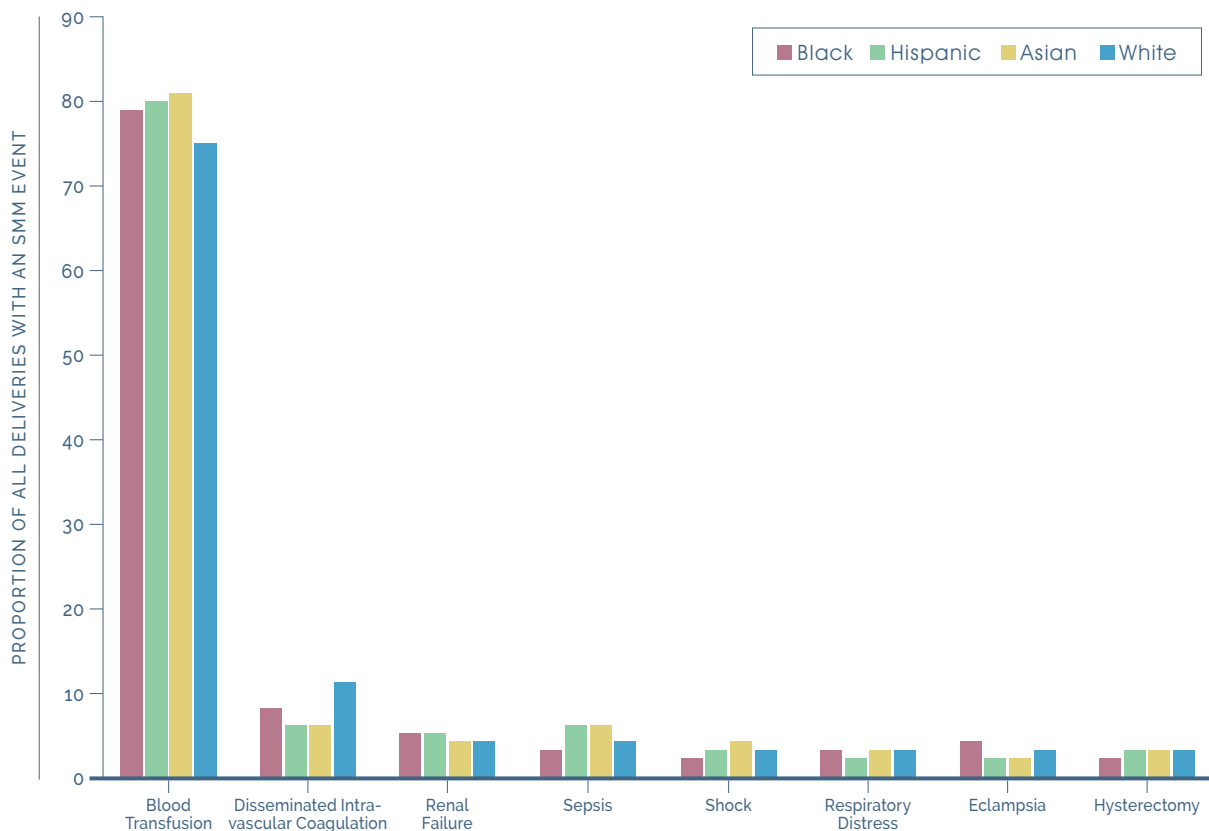
Key Findings (continued)

DISTRIBUTION OF SEVERE MATERNAL MORBIDITY INDICATORS IS SIMILAR ACROSS RACIAL AND ETHNIC GROUPS, BUT DISPARITIES STILL EXIST

There are 21 categories of diagnoses and procedures that identify severe maternal morbidity as defined by the CDC; these are referred to as SMM indicators.⁶⁹ **Figure 6** displays the distribution of SMM for the most common SMM indicators by race and ethnicity in 2018. The text box on page 21 defines the SMM indicators included in **Figure 6**.

The distribution of types of SMM was similar across race and ethnicity in 2018, with some minor variation. Black, Hispanic, and Asian women were more likely to have a blood transfusion than white women. Black and Hispanic women were more likely to experience

FIGURE 6: Distribution of Common Severe Maternal Morbidity Indicators by Race and Ethnicity, 2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: Proportions are calculated using the total number of hospital admissions for deliveries with any SMM indicator as the denominator. Proportions do not sum to 100% as deliveries may be associated with multiple SMM indicators. Also, not all SMM indicators are displayed. See **Methods** for details on SMM rate calculation.

⁶⁹ Centers for Disease Control and Prevention. "Severe Maternal Morbidity in the United States."



Key Findings (continued)

renal failure than white or Asian women. Black women were also more likely to experience eclampsia, Asian women were more likely to experience shock, and white women were more likely to experience disseminated intravascular coagulation than all other races and ethnicities studied. However, the generally similar distribution of types of SMM across race and ethnicity supports existing research that differences in pregnancy outcomes by race or ethnicity are not the result of biologic differences.⁷⁰

Common Indicators of Severe Maternal Morbidity

Blood transfusion: During a blood transfusion, a patient receives donated blood to recover from excessive bleeding.

Disseminated intravascular coagulation: A condition that causes abnormal blood clotting throughout the body's blood vessels.⁷¹

Renal failure: A condition in which the kidneys stop working.⁷²

Sepsis: An overwhelming immune response to infection.⁷³

Shock: A condition caused by a sudden drop in blood flow throughout the body.

Respiratory distress: A lung condition that causes low blood oxygen.⁷⁴

Eclampsia: High blood pressure during pregnancy that affects brain function, causing seizures or coma.⁷⁵

Hysterectomy: A surgical procedure that removes the uterus and sometimes other reproductive organs.

The majority of severe maternal morbidity events were associated with a blood transfusion, comprising 71% to 78% of total SMM incidents in New York State for any given year from 2011 through 2018. Blood transfusions are both a proxy indicator for hemorrhage (an SMM event) and an appropriate treatment to prevent maternal death. Depending on clinical factors (e.g., units of blood given, or reason for transfusion), they do not always represent an SMM event. Furthermore, the ICD codes used as part of the CDC definition for SMM do not specify the units of blood given to a patient, which would provide a better indication of a severe

⁷⁰ Leimert, Kelycia B., and David M. Olson. "Racial Disparities in Pregnancy Outcomes: Genetics, Epigenetics, and Allostatic Load." *Current Opinion in Physiology* 13 (2020): 155-165.

⁷¹ National Heart, Lung, and Blood Institute. "Disseminated Intravascular Coagulation." Accessed April 2020. <https://www.nhlbi.nih.gov/health-topics/disseminated-intravascular-coagulation>

⁷² National Cancer Institute. "Renal Failure." Accessed April 2020. <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/renal-failure>

⁷³ National Institute of General Medical Sciences. "Sepsis." Accessed April 2020. <https://www.nigms.nih.gov/education/fact-sheets/Pages/sepsis.aspx>

⁷⁴ National Heart, Lung, and Blood Institute. "Acute Respiratory Distress Syndrome." Accessed April 2020. <https://www.nhlbi.nih.gov/health-topics/acute-respiratory-distress-syndrome>

⁷⁵ National Institute of Child Health and Human Development. "About Preeclampsia and Eclampsia." Accessed April 2020. <https://www.nichd.nih.gov/health/topics/preeclampsia/conditioninfo>

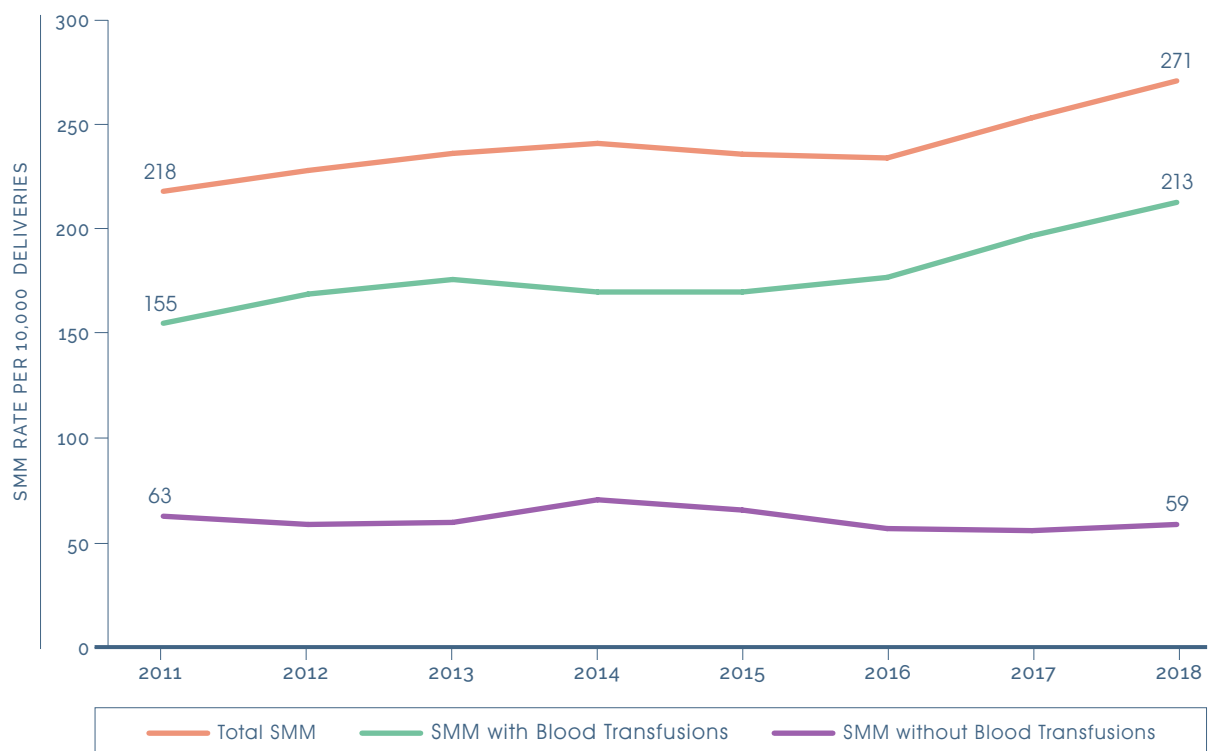


Key Findings (continued)

maternal hemorrhage event. For these reasons, researchers often analyze SMM trends with and without blood transfusions.⁷⁶

Figure 7 displays severe maternal morbidity rates with and without blood transfusions from 2011 through 2018. While there was a substantial increase in SMM associated with blood transfusions during this time period, the SMM rate for all other indicators remained generally flat. The SMM rate without blood transfusions was 63 per 10,000 in 2011 and fluctuated between 56 per 10,000 and 71 per 10,000 during the study time period. This finding implies that the increase in the SMM rate from 2011 to 2018 was mostly driven by an increase in the rate of blood transfusions.

FIGURE 7: Severe Maternal Morbidity Rates with and without Blood Transfusions, 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See **Methods** for details on the data and SMM rate calculation. In this figure, the "SMM with Blood Transfusions" line includes deliveries where a blood transfusion was the only indicator of SMM, and deliveries where a blood transfusion was an indicator along with another, non-blood transfusion indicator of SMM.

⁷⁶ Main et al., "Measuring Severe Maternal Morbidity: Validation of Potential Measures."

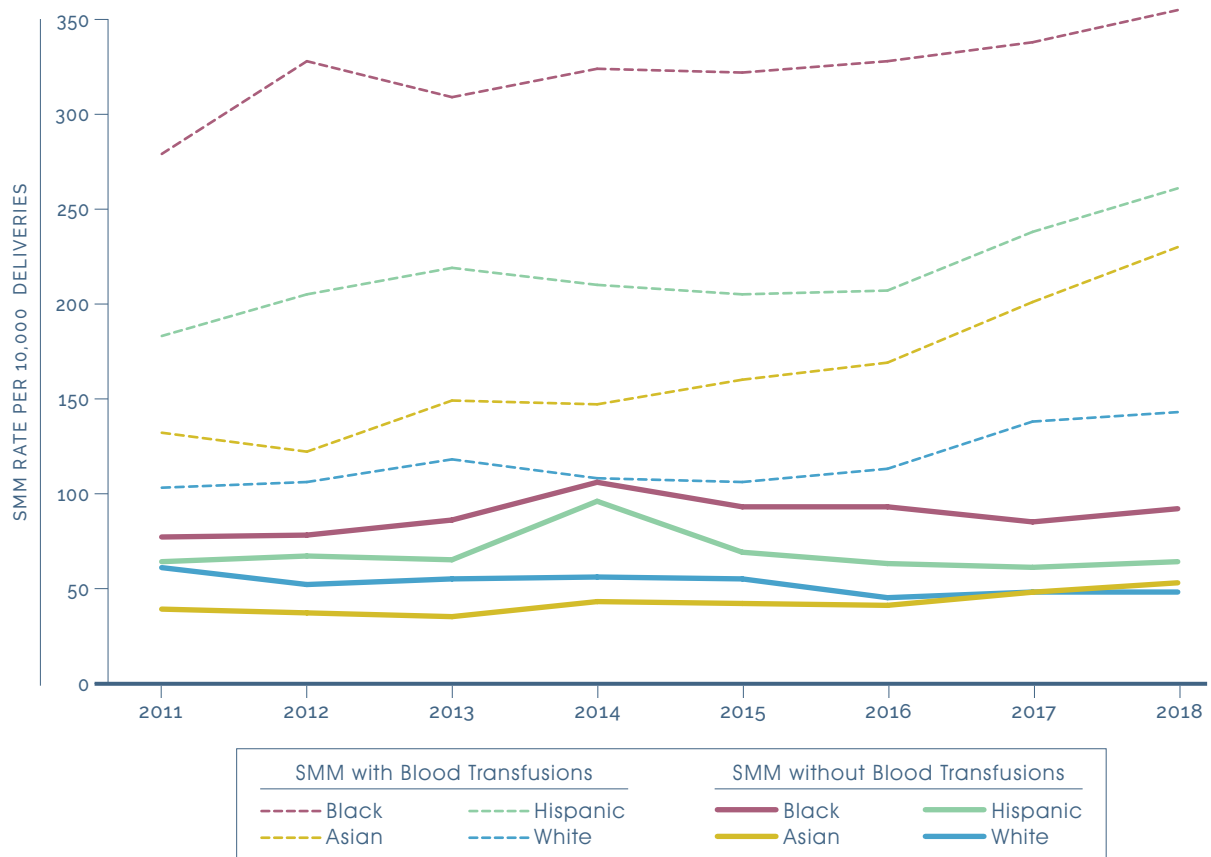


Key Findings (continued)

The trend in blood transfusions may also reflect the implementation of quality improvement efforts to more quickly identify the need to use blood transfusions to protect against potential life-threatening hemorrhages. These efforts are described in more detail in the **Discussion** section. More research is needed to determine the extent to which the increase in blood transfusions may have resulted from these efforts and if the increase in SMM may also have been associated with decreases in mortality.

Figure 8 displays severe maternal morbidity rates with and without blood transfusions by race and ethnicity from 2011 through 2018. Racial and ethnic disparities existed for SMM both with and without blood transfusions. The rate of blood transfusions increased for all races

FIGURE 8: Severe Maternal Morbidity Rates with and without Blood Transfusions by Race and Ethnicity, 2011–2018



Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Notes: See **Methods** for details on the data and SMM rate calculation. In this figure, the "SMM with Blood Transfusions" lines include deliveries where a blood transfusion was the only indicator of SMM, and deliveries where a blood transfusion was an indicator along with another, non-blood transfusion indicator of SMM.



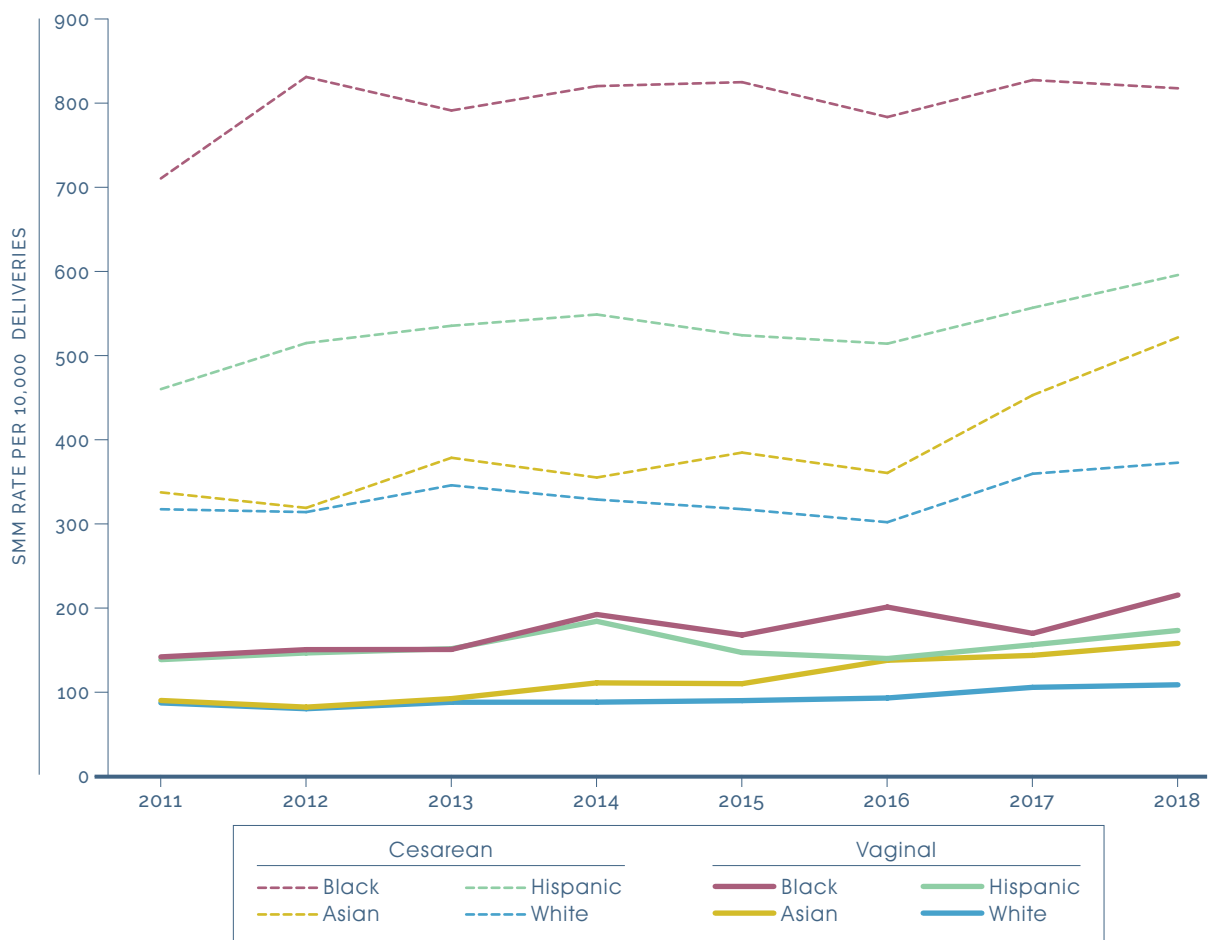
Key Findings (continued)

and ethnicities analyzed over the time period. Although increases in the utilization of blood transfusion can represent a positive trend from recent efforts to mitigate maternal hemorrhage, it is still concerning that racial and ethnic disparities exist. In addition, trends differed by race and ethnicity when looking at SMM rates unrelated to blood transfusions. This rate increased for Black and Asian women, remained generally flat for Hispanic women, and decreased for white women from 2011 to 2018. More research is needed to better understand these differences.

RACIAL AND ETHNIC DISPARITIES PERSIST ACROSS VAGINAL AND CESAREAN DELIVERIES

From 2011 through 2018, women of color had higher rates of severe maternal morbidity for both vaginal and cesarean deliveries (**Figure 9**). In 2018, Black, Hispanic, and Asian women who had

FIGURE 9: Severe Maternal Morbidity Rates by Race and Ethnicity and Type of Delivery, 2011–2018



Source: New York State Health Foundation analysis of 2018 New York State SPARCS data.

Notes: See **Methods** for details on the data and SMM rate calculation, including the number of deliveries in total and with an SMM event for each year.



Key Findings (continued)

cesarean deliveries had SMM rates 2.2x, 1.6x, and 1.4x higher, respectively, than white women who had cesarean deliveries. The same year, Black, Hispanic, and Asian women with vaginal deliveries had SMM rates approximately 2.0x, 1.6x, and 1.5x higher, respectively, than white women with vaginal deliveries.

Approximately one-third of deliveries in each year from 2011 to 2018 were cesarean deliveries. Cesarean deliveries can be a risk factor for SMM.⁷⁷ Overall, women who had cesarean deliveries had higher rates of SMM than women with vaginal deliveries (e.g., in 2018, the overall cesarean SMM rate was 3.7x higher than the overall vaginal SMM rate). However, these findings do not take into consideration the temporality of cesarean delivery and SMM. For example, a woman may experience SMM as part of her cesarean delivery, or she may undergo an emergency cesarean because she is experiencing an SMM event. Also complicating the analysis of SMM by delivery type is that the SMM and cesarean delivery may be attributable to fetal or newborn issues. These factors may contribute to the higher rates of SMM among cesarean deliveries in our findings.

⁷⁷ Leonard, Stephanie A., Elliott K. Main, and Suzan L. Carmichael. "The Contribution of Maternal Characteristics and Cesarean Delivery to an Increasing Trend of Severe Maternal Morbidity." *BMC Pregnancy and Childbirth* 19, no. 1 (2019): 16.



Discussion

The data in this report suggest severe maternal morbidity remains a marked risk for all women during delivery in New York State. The findings build on prior research that has identified significant racial and ethnic disparities in SMM across regions of New York State and across publicly and privately insured populations; they also show that these disparities have persisted over time.^{78,79}

Factors Associated with Severe Maternal Morbidity

Some forms of maternal morbidity are unavoidable because they are attributable to the underlying health of a woman or her pregnancy.⁸⁰ Other forms of SMM, or the progression from morbidity to severe morbidity, are preventable.⁸¹ However, identifying how to prevent SMM is complex, as it is influenced by individual, societal, and health system factors. At the individual level, many pre-existing chronic health conditions have been associated with higher rates of poor delivery outcomes, including but not limited to obesity, hypertension, and pre-gestational diabetes.^{82,83,84} Health insurance coverage, educational attainment, and income levels (at the individual and neighborhood levels) have also been shown to be related to maternal outcomes.^{85,86,87}

Case study reviews of adverse maternal outcomes have identified inadequacies in hospital quality as contributory factors to SMM; these include insufficient staff development and the failure to identify high-risk patients at admission, as well as substandard care processes, equipment,

⁷⁸ Howell et al., "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities."

⁷⁹ Lazariu et al., "Severe Maternal Morbidity: A Population-Based Study of an Expanded Measure and Associated Factors."

⁸⁰ Kilpatrick et al., "Severe Maternal Morbidity: Screening and Review."

⁸¹ Geller et al., "The Continuum of Maternal Morbidity and Mortality: Factors Associated with Severity."

⁸² Robinson, Heather E., Colleen M. O'Connell, K. S. Joseph, and N. Lynne McLeod. "Maternal Outcomes in Pregnancies Complicated by Obesity." *Obstetrics & Gynecology* 106, no. 6 (2005): 1357-1364.

⁸³ Bateman, Brian T., Pooja Bansil, Sonia Hernandez-Diaz, Jill M. Mhyre, William M. Callaghan, and Elena V. Kuklina. "Prevalence, Trends, and Outcomes of Chronic Hypertension: A Nationwide Sample of Delivery Admissions." *American Journal of Obstetrics and Gynecology* 206, no. 2 (2012): 134-e1.

⁸⁴ Campbell, Katherine H., David Savitz, Erika F. Werner, Christian M. Pettker, Dena Goffman, Cynthia Chazotte, and Heather S. Lipkind. "Maternal Morbidity and Risk of Death at Delivery Hospitalization." *Obstetrics & Gynecology* 122, no. 3 (2013): 627-633.

⁸⁵ Howell et al., "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity."

⁸⁶ Howell et al., "Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities."

⁸⁷ Fingar, Kathryn R., Megan M Hambrick, Kevin C. Heslin, and Jennifer E. Moore. "Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006–2015." H-CUP Statistical Brief 243. September 2018.



Discussion (continued)

and medication.^{88,89} In one study, a multidisciplinary review team in Chicago found that 45% of “near-miss” morbidities (i.e., the most severe form of morbidity on the continuum of adverse maternal events) were preventable, with provider factors being the most common preventable factors.⁹⁰ A Los Angeles study concluded that there were opportunities for care improvement in nearly half of SMM cases examined.⁹¹

Prior research on SMM trends has also found that significant disparities in SMM by race and ethnicity exist even after controlling for individual, neighborhood, and measurable hospital-level factors (e.g., volume of deliveries and nursery level).^{92,93,94} Experts have suggested that other factors such as structural racism and implicit racial bias in health care, which are more difficult to measure, also contribute to the higher rates of SMM for minority women, particularly Black and Hispanic women.^{95,96,97} Implicit racial biases by health care providers have been associated with less accurate diagnoses, curtailed treatment options, and worse clinical outcomes for minority patients.⁹⁸ Structural racism (also known as societal racism), which can be felt through neighborhood-level segregation, economic disadvantage, and chronic stress, has been shown to increase risk of adverse birth outcomes, as well as the risk of comorbidities that are associated with SMM.⁹⁹

⁸⁸ Berg, et al., “Preventability of Pregnancy-Related Deaths: Results of a State-wide Review.”

⁸⁹ Geller et al., “The Continuum of Maternal Morbidity and Mortality: Factors Associated with Severity.”

⁹⁰ Ibid.

⁹¹ Ozimek, et al. “Opportunities for Improvement in Care among Women with Severe Maternal Morbidity.”

⁹² Liese, et al., “Racial and Ethnic Disparities in Severe Maternal Morbidity in the United States.”

⁹³ Lazariu et al., “Severe Maternal Morbidity: A Population-Based Study of an Expanded Measure and Associated Factors.”

⁹⁴ Howell et al., “Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity.”

⁹⁵ Howell. “Reducing Disparities in Severe Maternal Morbidity and Mortality.”

⁹⁶ Liese et al., “Racial and ethnic disparities in severe maternal morbidity in the United States.”

⁹⁷ Leonard, et al., “Racial and Ethnic Disparities in Severe Maternal Morbidity Prevalence and Trends.”

⁹⁸ FitzGerald, Chloë, and Samia Hurst. “Implicit Bias in Healthcare Professionals: A Systematic Review.” *BMC Medical Ethics* 18.1 (2017): 19.

⁹⁹ Janevic, Teresa, Jennifer Zeitlin, Natalia Egorova, Paul L. Hebert, Amy Balbierz, and Elizabeth A. Howell. “Neighborhood Racial and Economic Polarization, Hospital of Delivery, and Severe Maternal Morbidity: An Examination of whether Racial and Economic Neighborhood Polarization is Associated with Severe Maternal Morbidity Rates and whether the Delivery Hospital Partially Explains the Association.” *Health Affairs* 39, no. 5 (2020): 768-776.



Discussion (continued)

New York State Has Taken Action

In the last decade, New York State, localities, professional associations, hospitals, and other key stakeholders have taken laudable action to prevent adverse outcomes in maternal health. Given the mix of factors contributing to SMM, it is not surprising that action to date has represented a wide array of activities. Many of the most recent efforts have been spurred by recommendations from the 2018 New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes (the MMDRO Taskforce). (See the text box below for more details about the MMDRO Taskforce.)

New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes¹⁰⁰

In April 2018, Governor Andrew Cuomo announced the New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes, as part of a State effort to reduce maternal mortality and racial disparities. The Taskforce was a multidisciplinary group of experts in the field of maternal health, including medical providers, hospital providers, doulas, and community members. After meeting three times between June and December 2018, the Taskforce issued ten policy recommendations to the Governor to reduce maternal mortality and racial disparities.¹⁰¹ Many of these recommendations are now being implemented.

Many of the key interventions implemented in New York State to improve maternal health, as well as the status of select recommendations by the MMDRO Taskforce, are highlighted below. While much of the focus of these interventions has been on maternal mortality, they will likely serve to prevent maternal morbidity, given that maternal mortality is considered the most severe outcome on the maternal morbidity continuum.¹⁰² For this reason, we describe maternal mortality interventions as interventions that can also reduce maternal morbidity.

¹⁰⁰ New York State Office of the Governor. "Governor Cuomo Receives Report By New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes." March 12, 2019. <https://www.governor.ny.gov/news/governor-cuomo-receives-report-new-york-state-taskforce-maternal-mortality-and-disparate-racial>

¹⁰¹ New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes. "Recommendations to the Governor to Reduce Maternal Mortality and Racial Disparities." March 2019. https://www.health.ny.gov/community/adults/women/task_force_maternal_mortality/docs/maternal_mortality_report.pdf

¹⁰² New York City Department of Health and Mental Hygiene. "Severe Maternal Morbidity in New York City, 2008–2012." 2016. <https://www1.nyc.gov/assets/doh/downloads/pdf/data/maternal-morbidity-report-08-12.pdf>



Discussion (continued)

This list is not a comprehensive account of all actions taken in New York State to improve maternal health. For example, it does not include important New York City-specific interventions (see the text box on page 30). However, it provides an overview of key interventions taken statewide that have the potential to reduce the number of women impacted by SMM and to close disparities by race and ethnicity. The interventions are sorted into four broad categories:

- (1) improving quality of care,
- (2) measuring and monitoring the problem,
- (3) combatting implicit bias, and
- (4) expanding the role of nonclinical, community-based health workers.

Action 1: Improving Quality of Care

Interventions increasing the uptake of best practices in birthing hospitals are critical to reduce severe maternal morbidity. A successful initiative to disseminate and standardize best practices in New York is the Safe Motherhood Initiative, a statewide quality improvement effort by the American College of Obstetricians and Gynecologists (ACOG), District II. To address substantial variation in the care provided across New York's 127 delivery hospitals, ACOG District II developed three best-practice care management plans—known as “bundles”—for hospitals to better and more uniformly respond to common types of maternal morbidity (the bundles were related to obstetric hemorrhage, severe hypertension, and venous thromboembolism). Developed in partnership with the hospitals, these bundles consist of algorithms, dosing tables, risk assessment tables, and checklists to improve quality and patient safety.¹⁰³ The initiative has engaged nearly all delivery hospitals statewide; provides ongoing support via webinars, grand rounds, quarterly meetings, and implementation visits; and recently released a fourth bundle on maternal sepsis.¹⁰⁴

¹⁰³ Burgansky, Anna, Donna Montalto, and Norain A. Siddiqui. “The Safe Motherhood Initiative: The Development and Implementation of Standardized Obstetric Care Bundles in New York.” *Seminars in Perinatology* 40, no. 2, (2016): 124-131.

¹⁰⁴ Greater New York Hospital Association. “Maternal Sepsis Bundle Introduced at ACOG SMI Meeting.” November 25, 2019. <https://www.gnyha.org/news/maternal-sepsis-bundle-introduced-at-acog-smi-meeting/>



Discussion (continued)

Interventions to Improve Maternal Health Outcomes in New York City

In 2018, New York City accounted for approximately half (49%) of all deliveries in the State, including more than half of all Black and Hispanic deliveries. It is also a region with relatively high severe maternal morbidity rates and disparities. In recent years, several important interventions have been launched to address SMM in New York City. Some of these interventions are similar to efforts at the State level. For example, in December 2017, New York City launched the Maternal Mortality and Morbidity Review Committee (M3RC), which consists of more than 40 members and meets every 2 to 3 months to conduct a multidisciplinary expert review of every maternal death in New York City from both a clinical and a social determinants of health perspective.

Since 2013, the New York City Department of Health and Mental Hygiene (DOHMH) and the Fund for Public Health in New York City (FPHNYC) have received two grants from Merck for Mothers to implement SMM projects. The first grant resulted in the implementation of the first citywide SMM surveillance system.¹⁰⁵ The second resulted in the launch of the "Reducing Inequities and Disparities in Preventable Severe Maternal Morbidity in New York City Project" (the SMM Project). Between 2017 and 2020, the SMM Project worked directly with clinical and community partners to improve the quality of maternity care at hospitals; learn about mothers' needs and experiences with SMM and the ramifications of SMM on their lives to inform action and further research; and inform and support mobilization of communities around maternal health.

In 2018, building on the work of these and other DOHMH community engagement projects, the City announced a five-year plan aiming to reduce the overall SMM rate while eliminating racial and ethnic disparities.¹⁰⁶ Nearly \$13 million in funding was made available for the plan. Key components of the plan include:

- Creating a city-wide Maternal Hospital Quality Improvement Network (MHQIN) tasked with developing hospital-specific recommendations to reduce racial and ethnic disparities in preventable SMM. Strategic areas of the MHQIN include:
 - Integrating SMM reviews in routine hospital quality improvement processes and using SMM data to inform practices and policy change, including simulation training
 - Changing hospital culture to embody a person-centered approach to maternity care and birth equity
 - Engaging, educating, and supporting communities facing the most significant health, social, and economic challenges and addressing the chronic diseases and social conditions that increase risk of SMM
 - Developing public awareness campaigns in partnership with community-based organizations and residents
- Enhancing maternity care at the City's public hospital system

¹⁰⁵ New York City Department of Health and Mental Hygiene. "Severe Maternal Morbidity in New York City, 2008–2012."

¹⁰⁶ New York City Office of the Mayor. "De Blasio Administration Launches Comprehensive Plan to Reduce Maternal Deaths and Life-Threatening Complications from Childbirth Among Women of Color." July 20, 2018. <https://www1.nyc.gov/office-of-the-mayor/news/365-18/de-blasio-administration-launches-comprehensive-plan-reduce-maternal-deaths-life-threatening>



Discussion (continued)

Another quality improvement initiative is New York State's Perinatal Quality Collaborative. This 10-year-old collaborative between the New York State Department of Health and providers, hospitals, and professional organizations aims to increase the uptake of clinical best practices in maternity care and collect data on implementation and outcomes. Currently, the collaborative is partnering with ACOG District II to improve the identification and treatment of obstetric hemorrhage at nearly 90 hospitals across the State.¹⁰⁷ This effort is critical given that blood transfusions, which can be indicative of hemorrhage, were a driving indicator of the growth in SMM rates from 2011 through 2018. The Perinatal Quality Collaborative has also engaged birthing hospitals across the State in quality improvement projects to reduce pre-eclampsia, eclampsia, severe hypertension, and early scheduled deliveries without a medical indication.¹⁰⁸ The ACOG District II Safe Motherhood Initiative partnered with the Perinatal Quality Collaborative at the peak of the COVID-19 pandemic in New York State, creating opportunities for providers to convene remotely and share emerging issues and best practices.

The Safe Motherhood Initiative, in partnership with the Perinatal Quality Collaborative, has helped to focus attention on SMM as a clinical priority, motivate a collaborative effort across providers throughout the State, and increase the implementation of uniform best practices. Despite these achievements in quality improvement, more work remains to be done. The State appears not yet to have implemented a recommendation by the MMDRO Taskforce to develop best practices curricula for medical providers, medical schools, and nursing schools.¹⁰⁹ Quality improvement initiatives beginning in medical education will serve to improve maternal health care into the future.

Action 2: Measuring and Monitoring the Problem

A key strategy to reduce severe maternal morbidity is accurately measuring its incidence. Surveillance of SMM is necessary to observe clinical patterns, identify disparities and deficiencies, and measure progress. In 2019, the MMDRO Taskforce recommended that the State create a data warehouse measuring hospital performance on perinatal quality measures.¹¹⁰

¹⁰⁷ New York State Perinatal Quality Collaborative. "New York State Obstetric Hemorrhage Project." Accessed April 2020. https://www.albany.edu/cphce/nyspqcpblic/nys_obhemorrhage_project_onepager.pdf

¹⁰⁸ New York State Perinatal Quality Collaborative. "NYSPQC." Accessed April 2020. https://www.albany.edu/cphce/mch_nyspqc.shtml

¹⁰⁹ New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes. "Recommendations to the Governor to Reduce Maternal Mortality and Racial Disparities."

¹¹⁰ New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes. "Recommendations to the Governor to Reduce Maternal Mortality and Racial Disparities."



Discussion (continued)

This recommendation was modeled off of a component of the California Maternal Quality Care Collaborative, a widely respected public-private partnership launched in 2006 to improve maternal health in the state. Real-time data collection helped California's hospitals significantly reduce their rate of maternal mortality by enabling hospitals to track their performance and peer hospitals' performance without delay (see text box below). The FY 2020 New York State Budget dedicated \$8 million over two fiscal years for initiatives to improve maternal health, including the creation of a perinatal data warehouse.¹¹¹ In addition to linking relevant data sources (including vital statistics, autopsy reports, medical records, and hospital discharge records), such a data warehouse can add significant value by developing comparative maternal/infant performance measures for hospitals and other providers, as well as for certain patient subpopulations (e.g., based on factors such as comorbidities, location, and demographic characteristics). California's system also succeeded in automating data transmission from hospitals to the data center, which would be particularly useful to low-resource hospitals in New York. Although development of the data warehouse is underway, the COVID-19 pandemic has delayed its implementation.

California's Maternal Data Center¹¹²

From 2006 to 2013, while the national rate of maternal mortality increased, California succeeded in lowering its maternal mortality rate by 55%.¹¹³ California achieved this dramatic reduction in part through the creation of an extensive data collection program. The Maternal Data Center is an online, low-burden tool hospitals use to track maternity care performance in real time. Participating hospitals can view patient cases and provider-level performance, as well as compare their performance to state benchmarks. As of 2018, the total number of hospitals participating in the Maternal Data Center represented 95% of annual births.¹¹⁴

Another crucial element of California's Maternal Quality Care Collaborative was the institution of a multidisciplinary committee that reviews data on adverse maternal events to investigate root causes and make actionable recommendations to address them.¹¹⁵ Based on another

¹¹¹ State of New York Office of the Budget. "Governor Andrew Cuomo Announces Highlights of the FY 2020 State Budget." April 1, 2019. <https://www.budget.ny.gov/pubs/press/2019/pr-enactfy20.html>

¹¹² Main, et al., "Addressing Maternal Mortality and Morbidity in California through Public-Private Partnerships."

¹¹³ Ibid.

¹¹⁴ Ibid.

¹¹⁵ California Department of Health. "California Pregnancy-Associated Mortality Review." Accessed April 2020. <https://www.cdph.ca.gov/Programs/CFH/DMCAH/Pages/PAMR.aspx>



Discussion (continued)

MMDRO Taskforce recommendation, New York codified a similar review committee, known as the Maternal Mortality Review Board (MMRB), into law in 2019.¹¹⁶ The MMRB is tasked with reviewing each incident of maternal mortality and, by its discretion, morbidity. The MMRB is a multidisciplinary group capable of exploring clinical causes of adverse maternal outcomes, as well as causes within the health care system (e.g., access barriers, implicit bias, and hospital policies) and those outside of the health care system (e.g., social determinants of health and structural racism). New York's MMRB met for the first time in August 2019 and will convene regularly for case review.

The combination of the MMRB and an enhanced data warehouse should improve the ability of the State to monitor and assess adverse outcomes closer to real time, as well as to recommend interventions that address the multi-faceted causes of adverse maternal outcomes. Considering the thousands of cases of SMM and maternal mortality that occur annually in New York, it is not feasible for every case to be studied during a single period of review. Equipping the MMRB and the data warehouse to conduct ongoing, in-depth reviews and data collection of SMM will allow the State to better assess maternal outcomes as they occur.

Action 3: Combatting Implicit Bias

As discussed above, emerging research points to implicit bias as a contributor to racial and ethnic disparities in SMM.¹¹⁷ The MMDRO Taskforce recommended the State develop an implicit racial bias curriculum for hospitals, as well as an incentive structure for hospitals to adopt the program.¹¹⁸ The New York Perinatal Quality Collaborative is currently developing such a training program, after receiving funding from the FY 2020 State Budget.¹¹⁹

The MMDRO Taskforce also recommended that the State work to increase the diversity of health care providers in medical education and the field. Diversity among medical professionals has been shown to improve the patient-provider relationship, increase patient satisfaction, and increase access to care for minority patients.¹²⁰ Underrepresented

¹¹⁶ A.3276/S.1819, 2019 Reg. Sess. (NY 2019)

¹¹⁷ Howell, Elizabeth A. "Reducing Disparities in Severe Maternal Morbidity and Mortality."

¹¹⁸ New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes. "Recommendations to the Governor to Reduce Maternal Mortality and Racial Disparities."

¹¹⁹ State of New York Office of the Budget. "Governor Andrew Cuomo Announces Highlights of the FY 2020 State Budget."

¹²⁰ Mitchell, Dennis A., and Shana L. Lassiter. "Addressing Health Care Disparities and Increasing Workforce Diversity: The Next Step for the Dental, Medical, and Public Health Professions." *American Journal of Public Health* 96, no. 12 (2006): 2093-2097.



Discussion (continued)

minority providers are also more likely to work in areas of need.¹²¹ The MMDRO Taskforce recommended that the State create an educational loan forgiveness program for underrepresented health care providers and a State University of New York midwifery scholarship program to encourage diversity among maternity care providers.¹²² These initiatives have not been implemented to date.

Action 4: Expanding the Role of Doulas and Community Health Workers

Nonclinical, community-based health care workers such as birth doulas and community health workers have been shown to play an important role in preventing SMM. Birth doulas have been associated with improved birth outcomes and reduced likelihood of birth complications.¹²³ Community health workers provide outreach, health education, and social support to women during pregnancy or the preconception period.

Women of color may particularly benefit from doula and community health worker services. Research documents that women of color often experience disrespect during their pregnancy care, feel uninvolved in the clinical decision-making process, or do not feel that they have a voice in the delivery room.¹²⁴ In addition to contributing to low-quality care, these events can increase risk of SMM. Doulas and community health workers can help advocate for respectful care at the time of birth and by educating women about their rights during pregnancy.

The State has taken action in this domain. In the FY 2020 State Budget, based on MMDRO Taskforce recommendations, the State funded the Department of Health's Maternal Infant Community Health Collaborative (MICHC) to increase access to community health workers.^{125,126} Statewide, 23 MICHC projects are collaborating with community partners

¹²¹ Mitchell and Lassiter. "Addressing Health Care Disparities and Increasing Workforce Diversity: The Next Step for the Dental, Medical, and Public Health Professions."

¹²² New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes. "Recommendations to the Governor to Reduce Maternal Mortality and Racial Disparities."

¹²³ Gruber, Kenneth J., Susan H. Cupito, and Christina F. Dobson. "Impact of Doulas on Healthy Birth Outcomes." *The Journal of Perinatal Education* 22, no. 1 (2013): 49-58.

¹²⁴ McLemore, Monica R., Molly R. Altman, Norlissa Cooper, Shanell Williams, Larry Rand, and Linda Franck. "Health Care Experiences of Pregnant, Birthing and Postnatal Women of Color at Risk for Preterm Birth." *Social Science & Medicine* 201 (2018): 127-135.

¹²⁵ State of New York Office of the Budget. "Governor Andrew Cuomo Announces Highlights of the FY 2020 State Budget."

¹²⁶ New York State Taskforce on Maternal Mortality and Disparate Racial Outcomes. "Recommendations to the Governor to Reduce Maternal Mortality and Racial Disparities."



Discussion (continued)

and health workers to engage high-need women in health care and social services.¹²⁷ Community health workers have played an important role during the COVID-19 pandemic in New York, working with pregnant women remotely to navigate the rapidly changing environment of maternity care and hospital delivery.^{128,129,130,131}

The State also launched a pilot program in 2019 to allow Medicaid reimbursement for doula services.¹³² However, the State has struggled to recruit doulas because of low reimbursement rates.¹³³ The pilot program is currently operating in Erie County and will launch in Kings County if a sufficient number of doulas enroll in the pilot.

More Work Remains

Across these four domains of action, New York State has taken considerable steps to improve maternal health. Many of these interventions have been implemented too recently to evaluate whether they have had an impact on overall rates of SMM in the State. Several recommended interventions have yet to be fully implemented, while some have yet to start. Recognizing that some of the causes of SMM, such as implicit racial bias, have been ingrained into the societal and health care system culture for decades, it is likely that a comprehensive, sustained, and aggressive effort will be required to permanently reduce SMM. However, the experience in other states, such as California, suggests that substantial progress can be made in the near-term.

¹²⁷ New York State Department of Health. "Maternal and Infant Community Health Collaboratives Initiative." Accessed April 2020. https://www.health.ny.gov/community/adults/women/maternal_and_infant_comm_health_collaboratives.htm

¹²⁸ Mothers and Babies Perinatal Network. "The Latest Information and Resources Regarding COVID-19." Accessed June 2020. <https://mothersandbabies.org/covid-19-information/>

¹²⁹ Livingston County Department of Health. "Community Health Worker Program." Accessed June 2020. <https://www.livingstoncounty.us/829/MICHC>

¹³⁰ Public Health Solutions. "Comadres." Accessed June 2020. <https://www.healthsolutions.org/community-work/family-health/home-visiting-programs/comadres/>

¹³¹ Maternal Infant Services Network. "COVID-19 Updates." Accessed June 2020. <https://misn-ny.org/>

¹³² New York State Department of Health. "New York State Doula Pilot Program." Accessed April 2020. https://www.health.ny.gov/health_care/medicaid/redesign/doulapilot/index.htm

¹³³ Eisenberg, Amanda and Shannon Young. "State Doula Program Fails to Get Off the Ground." POLITICO New York Health Care. November 26, 2019. <https://www.politico.com/states/new-york/newsletters/politico-new-york-health-care/2019/11/26/state-doula-program-fails-to-get-off-the-ground-330658>



Discussion (continued)

To achieve this progress, the State should act on those recommendations issued by the MMDRO Taskforce that have not yet been implemented, and continue the action that it has initiated. In particular, it will be critical to operationalize the new maternal health data warehouse, which will help maximize the value of the MMRB and allow hospitals to identify and adjust more quickly to deficiencies in care.

Additional policies could also be considered to improve insurance coverage for women of reproductive age in order to increase access to care that can help prevent or better manage chronic conditions that increase risk of SMM. In particular, many undocumented adult immigrants have limited access to health insurance coverage in New York. Creating access to a State-funded Essential Plan for undocumented New Yorkers would improve the health of immigrant New Yorkers of reproductive age, potentially leading to better maternal health outcomes. In addition, extending Medicaid coverage for pregnant women from sixty days after pregnancy to one year postpartum could help prevent injury and deaths in the postpartum period. While not part of this analysis, approximately one-third of pregnancy-related deaths in the U.S. occur between one week and one year postpartum.¹³⁴ Currently, many low-income women who qualified for Medicaid in New York State because of their pregnancy may lose eligibility 60 days after delivery, when Medicaid's income limit decreases. Legislation supported by provider and advocacy organizations has been introduced this year in both the State Assembly and the State Senate to authorize this extended Medicaid eligibility.^{135,136}

¹³⁴ Centers for Disease Control and Prevention. "Pregnancy-Related Deaths." Accessed April 2020. <https://www.cdc.gov/vitalsigns/maternal-deaths/index.html>

¹³⁵ S7147. 2020 Reg. Sess. (NY 2020).

¹³⁶ New York State Assembly Standing Committee on Health. "Protecting Maternal Health: Women's Health Professionals Join Health Committee Chairs to Call for Extended Medicaid Eligibility." February 12, 2020. <https://www2.assembly.state.ny.us/comm/?id=19&sec=story&story=92925>



Conclusion

Severe maternal morbidity is a serious health threat to women delivering in New York State, potentially affecting thousands of women in 2018. Despite growing evidence of and increased attention to racial and ethnic disparities in maternal health, the gaps in SMM rates are not closing. In 2018, Black, Hispanic, and Asian women in New York State had approximately 2.3x, 1.7x, and 1.5x higher rates of SMM, respectively, than white women.

It is possible to reduce SMM rates. Quality improvement, data collection and monitoring, implicit bias training, and nonclinical health workers can be effective components to improving maternal health. New York has taken substantial action in these areas, but there is room for more work to be done. Specifically, the State should continue to implement the MMDRO Taskforce recommendations. Additionally, the State can improve women's health overall by increasing access to affordable health coverage.

The problem of SMM cannot be solved through a single intervention. A sustained and multi-pronged campaign, however, holds promise to significantly improve the health of pregnant women delivering in New York and to close racial and ethnic disparities.



Methods

Our analysis uses 2011 through 2018 claims data on inpatient admissions from the New York State Department of Health Statewide Planning and Research Cooperative System (SPARCS). We had access to limited-data patient records that include race, ethnicity, and residency information of the patient, but do not include specific dates of hospital admissions (i.e., admissions data included only day of week, month, and year).

We identified deliveries using Medicare Severity-Diagnosis Related Group (MS-DRGs), which is a system for categorizing inpatient admissions based on diagnoses associated with the admission.¹³⁷ We used DRG delivery codes for cesarean and vaginal deliveries to identify deliveries (765, 766, 767, 768, 774, 775). We also identified deliveries using International Classification of Diseases, Ninth and Tenth Revision, Clinical Modification (ICD-9-CM and ICD-10-CM) diagnosis codes for outcomes of delivery and procedure codes for delivery-related procedures, consistent with the CDC definition of identifying SMM.¹³⁸

Only live births delivered at a New York hospital were considered for the analysis. Stillbirths were restricted using ICD-9 diagnosis (V271, V274, V277, V279) codes and ICD-10 diagnosis (Z371, Z374, Z377, Z379) codes. Abortions were excluded using ICD-9 diagnosis (630-639) and procedure (6901, 6951, 7491, 750) codes and ICD-10 diagnosis (O00, O01, O02, O03, O04, O07, O08) and procedure (10A00ZZ, 10A03ZZ, 10A04ZZ, 10A07Z6, 10A07ZW, 10A07ZX, 10A07ZZ, 10A08ZZ) codes. If a patient had two hospital admissions coded as a delivery within six months within the same calendar year, we interpreted these as part of the same delivery.

We identified SMM events using procedure and diagnosis codes on the claims data, using a list of 21 SMM indicators developed by the CDC.¹³⁹ The indicators are based on ICD-CM diagnosis and procedure codes. In October 2015, the U.S. transitioned from the 9th to the 10th revision of ICD. Our analysis for years 2011 through 2014 used ICD-9 codes, year 2015 used ICD-9 and ICD-10 codes, and years 2016 through 2018 used ICD-10 codes.

¹³⁷ Centers for Medicare & Medicaid Services. MS-DRG Classifications and Software. Accessed May 2020. <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/MS-DRG-Classifications-and-Software>

¹³⁸ Kuklina, Elena V., Maura K. Whiteman, Susan D. Hillis, Denise J. Jamieson, Susan F. Meikle, Samuel F. Posner, and Polly A. Marchbanks. "An Enhanced Method for Identifying Obstetric Deliveries: Implications for Estimating Maternal Morbidity." *Maternal and Child Health Journal* 12, no. 4 (2008): 469-477.

¹³⁹ Centers for Disease Control and Prevention. "How Does CDC Identify Severe Maternal Morbidity?"



Methods (continued)

The SMM rate per 10,000 deliveries is calculated as the number of deliveries with at least one SMM event divided by the total number of deliveries multiplied by 10,000. For example:

$$2011 \text{ SMM Rate} = \left(\frac{4,746}{217,840} \right) \times 10,000 = 217.9 \text{ per } 10,000 \text{ deliveries}$$

Table 8 shows the overall count of deliveries with at least one SMM event and total deliveries for each year in our analysis.

	2011	2012	2013	2014	2015	2016	2017	2018
SMM Rate per 10,000	217.9	227.9	236.2	241.0	235.8	234.0	253.3	271.2
Deliveries with at least one SMM Event	4,746	4,954	4,984	5,123	5,048	5,230	5,481	5,817
Total Deliveries	217,840	217,363	210,971	212,551	214,067	223,467	216,366	214,525

Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

To analyze SMM rates by ethnicity, we categorized women with an ethnicity coded as “Hispanic” in the SPARCS dataset as Hispanic and women with ethnicity coded as “Non-Hispanic” or “Ethnicity Unknown” in the dataset as Non-Hispanic. To analyze SMM rates by race, we categorized the women we assigned to the Non-Hispanic category as Black, white, or Asian, according to their race code identified in the data. Other races were also identified in the data, but were left out of the analyses by race and ethnicity given small sample sizes. Similarly, women with unidentified race were left out of the analyses specific to racial and ethnic groups. However, women of all races and ethnicities were included in analyses involving overall trends (i.e., analyses not specific to race and ethnicity). **Table 9** shows the total number of deliveries included in the analysis by race and ethnicity.

RACE/ETHNICITY	2011	2012	2013	2014	2015	2016	2017	2018
Non-Hispanic Asian	17,305	18,240	16,944	17,695	18,917	21,954	21,593	21,310
Non-Hispanic Black	33,802	32,838	31,299	31,525	31,491	31,451	30,104	28,986
Hispanic	34,979	39,503	38,716	35,034	35,236	38,562	37,277	38,353
Non-Hispanic White	101,043	97,519	95,083	98,946	99,799	102,866	99,621	99,707
Total	187,129	188,100	182,042	183,200	185,443	194,833	188,595	188,356

Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Note: Deliveries with unknown race and are excluded from the table. Deliveries in the table do not represent all races in the SPARCS data.



Methods (continued)

The regional analysis of SMM rates was based on the address identified as being of the patients. The regional definitions of the New York State Economic Development Corporation were used to group deliveries into regions.¹⁴⁰ **Table 10** shows the total number of deliveries included in the analysis by region. **Table 11** shows the total number of deliveries included in the analysis by region and race/ethnicity. Delivering mothers with missing address information were left out of the regional analyses, but were included in overall rates.

TABLE 10: Total Deliveries by Region, 2011–2018

REGION	2011	2012	2013	2014	2015	2016	2017	2018
Capital Region	9,284	9,487	9,223	8,897	9,057	9,984	9,848	9,460
Central New York	7,140	7,189	6,968	7,400	7,570	8,092	7,834	7,663
Finger Lakes	10,733	10,583	10,652	10,917	10,950	11,834	11,553	11,386
Long Island	27,049	26,694	26,259	26,473	26,999	28,714	31,178	29,649
Mid-Hudson	21,659	21,667	21,603	21,130	21,266	22,559	22,674	21,821
Mohawk Valley	4,768	4,571	4,610	4,442	4,468	4,681	4,716	4,637
New York City	110,005	109,080	103,769	106,098	106,794	108,354	100,625	102,268
North Country	4,435	4,223	4,063	4,125	4,259	4,403	4,351	4,042
Southern Tier	5,520	5,702	5,293	5,513	5,440	6,248	5,566	5,381
Western New York	12,071	11,892	11,618	11,803	12,164	13,612	13,730	13,618
Total	212,664	211,088	204,058	206,798	208,967	218,481	212,075	209,925

Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Note: Deliveries with missing patient county data are excluded from the table.

TABLE 11: Total Deliveries by Region and Race/Ethnicity, 2018

REGION	TOTAL	NON-HISPANIC ASIAN	NON-HISPANIC BLACK	HISPANIC	NON-HISPANIC WHITE
Capital Region	8,489	345	1,059	284	6,801
Central New York	7,208	191	971	321	5,725
Finger Lakes	10,654	336	1,760	900	7,658
Long Island	27,708	2,869	2,331	7,916	14,592
Mid-Hudson	17,149	567	1,944	3,701	10,937
Mohawk Valley	4,472	163	306	256	3,747
New York City	87,486	15,454	17,678	23,459	30,895
North Country	3,844	43	182	144	3,475
Southern Tier	4,525	104	275	115	4,031
Western New York	12,897	566	2,172	890	9,269
Total	184,432	20,638	28,678	37,986	97,130

Source: New York State Health Foundation analysis of 2011–2018 New York State Statewide Planning and Research Cooperative System (SPARCS) data.

Note: Deliveries with missing patient county data and unknown race are excluded from the table. Deliveries in the table do not represent all races in the SPARCS data.

¹⁴⁰ Empire State Development. "Regions." Accessed April 2020. <https://esd.ny.gov/regions>



Limitations

Our analysis is descriptive in nature and cannot provide a conclusive statement of whether SMM is increasing or decreasing, or the extent to which disparities exist. One reason for this is that our analysis did not adjust for important factors that influence SMM rates, such as sociodemographic status, pre-existing conditions, neighborhood income, and hospital quality. However, prior research has controlled for many of these factors and found significant racial disparities remain.^{141,142,143} Our results are consistent with these findings and provide some indication that the disparities previously documented have continued, despite increased awareness and recent interventions.

The transition in October 2015 from the 9th to the 10th revision of ICD may have affected the identification of SMM in our analysis. This may particularly be the case for blood transfusions.¹⁴⁴ Some of the relative increase in SMM during the 2016 through 2018 period may be reflective of changes in how diagnoses and procedures were coded on hospital claims for pregnancy admissions from the 9th to the 10th revision of ICD. However, it is likely that any impacts from the coding change would be concentrated in the first year of the change. The fact that SMM rates increased in most post-transition years, and not only during the initial year of transition, suggests that the coding change may not be solely responsible for the recent increasing trend.

Due to the format of our data, our analysis did not account for multiple births. If a patient delivered two or more infants as part of one pregnancy, we interpreted these as one delivery. Therefore, total deliveries reported in the analysis do not represent total newborns. If a patient had two hospital admissions coded as a delivery within six months in the same calendar year, we interpreted these as part of the same delivery. Given the structure of our data, we did not interpret deliveries within six months of each other as part of the same delivery if the deliveries crossed a calendar year (e.g., a delivery by the same patient in December 2011 and January 2012 would be counted as two deliveries). This may contribute to a small overcount of deliveries.

¹⁴¹ Howell et al., "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity."

¹⁴² Lazariu et al., "Severe Maternal Morbidity: A Population-Based Study of an Expanded Measure and Associated Factors."

¹⁴³ Liese et al., "Racial and Ethnic Disparities in Severe Maternal Morbidity in the United States."

¹⁴⁴ Alliance for Innovation on Maternal Health. "AIM Severe Maternal Morbidity (SMM) Data Alert for Blood Transfusions." April 2016. <https://www.cmqcc.org/sites/default/files/AIM-SMM-Data-Alert-Blood-Transfusions-v4-15-2016%20%284%29.pdf>



Limitations (continued)

Our analysis identifies SMM using the CDC's defined indicators and corresponding ICD diagnosis and procedure codes. While the CDC definition is widely used in the literature, medical chart reviews would be best to determine the presence of SMM. However, other research has shown that SMM measures based on an earlier iteration of the CDC definition that is similar to the one used in this analysis can serve as a reasonable metric for measuring SMM at the population level.¹⁴⁵ Some research on maternal morbidity has also proposed additional indicators to measure SMM, such as including any admission for a delivery that results in an intensive care unit (ICU) hospital stay.¹⁴⁶ A New York State study found that including ICU hospital stays increased the number of hospital admissions for deliveries identified as having an SMM event by 3% relative to the traditional CDC definition.¹⁴⁷ There are also analyses based on prior CDC recommendations for defining SMM that have used more restrictive measures of SMM, such as requiring a minimum length of stay in the hospital before a delivery could be considered as having an SMM event.¹⁴⁸ In addition, some research, as was done in this analysis, reports SMM using the CDC definition with and without codes for blood transfusions.^{149,150} As discussed above, although blood transfusions are a proxy indicator for hemorrhage (an SMM event), they may not always represent an SMM event. Additional detail beyond what is available on claims data and ICD codes would be needed to verify that the blood transfusion was associated with an SMM event.

¹⁴⁵ Main et al., "Measuring Severe Maternal Morbidity: Validation of Potential Measures."

¹⁴⁶ Lazariu et al., "Severe Maternal Morbidity: A Population-Based Study of an Expanded Measure and Associated Factors."

¹⁴⁷ Ibid.

¹⁴⁸ Callaghan et al., "Severe Maternal Morbidity among Delivery and Postpartum Hospitalizations in the United States."

¹⁴⁹ Howell et al., "Site of Delivery Contribution to Black-White Severe Maternal Morbidity Disparity."

¹⁵⁰ Main et al., "Measuring Severe Maternal Morbidity: Validation of Potential Measures."



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