2016 –2022

Severe Maternal Morbidity

IN PHILADELPHIA

Department of Public Health
CITY OF PHILADELPHIA

DATA & SURVEILLANCE
BIRTH JUSTICE PHILLY

INTRODUCTION

Severe maternal morbidity (SMM) refers to serious, sometimes life threatening, complications related to labor and delivery that can have both short- and long-term impacts on the health of the birthing person and their baby. In the United States, around 50,000 people experience an SMM each year, and this number is increasing over time.[1] Furthermore, data show that some groups of people experience a disproportionate burden of SMM. For example, non-Hispanic Black birthing people in the US are more than twice as likely to experience an SMM compared to their non-Hispanic White counterparts, and birthing people age 40 and older have much higher rates of SMM compared to those in their 20s and 30s.[1]

Monitoring and understanding local trends in maternal health outcomes is critical to detecting emerging or worsening issues, identifying opportunities for improvement, and evaluating the effectiveness of current policy and practice. Investigating the incidence of SMM events in Philadelphia offers valuable insight into the unexpected delivery outcomes encountered by birthing people and their healthcare providers and helps us understand how we might work to prevent these adverse events.

This report presents trends in delivery hospitalizations involving SMM in Philadelphia from 2016-2022.

This is an update to the previous report, "Severe Maternal Morbidity in Philadelphia, 2011-2014". This analysis uses the Center for Disease Control and Prevention (CDC) definition of SMM, which identifies cases of SMM based on the presence of one or more diagnosis or procedure codes from the International Classification of Diseases, version 10 (ICD-10). These codes refer to conditions such as kidney failure, eclampsia, infection and others (please see Resources for complete list). Blood transfusion alone was not considered an indicator of SMM in this analysis. In order to identify the most severe cases, only those with a longer-than-average length of stay in the hospital were included.

Delivery hospitalization and SMM data were obtained from the Pennsylvania Health Care Cost Containment Council (PHC4) inpatient discharge records.

We acknowledge that not all pregnant people identify as women, and that transgender and nonbinary birthing people may face unique barriers in accessing quality health care; therefore, this report uses gender inclusive language to describe people who are or have been pregnant.

Limitations: PHC4 provides only administrative data used for billing purposes. These ICD-10 codes do not provide context about the circumstances surrounding SMM events and may not reflect the most clinically significant causes of SMM. Furthermore, there may be inter-institutional differences in how billing codes are applied. Finally, these data are cross-sectional and therefore only reflect correlation between variables; they cannot determine causal relationships.

HIGHLIGHTS

1,247

Between 2016 and 2022, there were 1,247 cases of SMM identified among Philadelphia birthing people, which is an average of 178 cases per year.

<20 | >35

Birthing people under age 20 or over age 35 had higher rates of SMM compared to those in their 20s and early 30s.

$$$

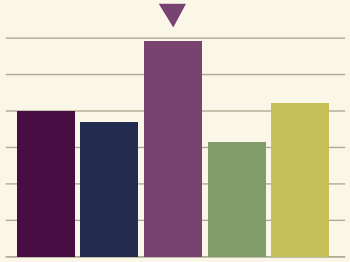
Delivery hospitalizations that involved an SMM were 2-3 times more expensive compared to hospitalizations for uncomplicated deliveries.

70 ⋯→ 121

The rate of SMM increased dramatically over this time period, from 70 cases per 10,000 deliveries in 2016 to 121 cases per 10,000 delivery hospitalizations in 2022.

RACIAL INEQUITY

Non-Hispanic Black birthing people had a higher rate of SMM compared to other racial and ethnic groups.

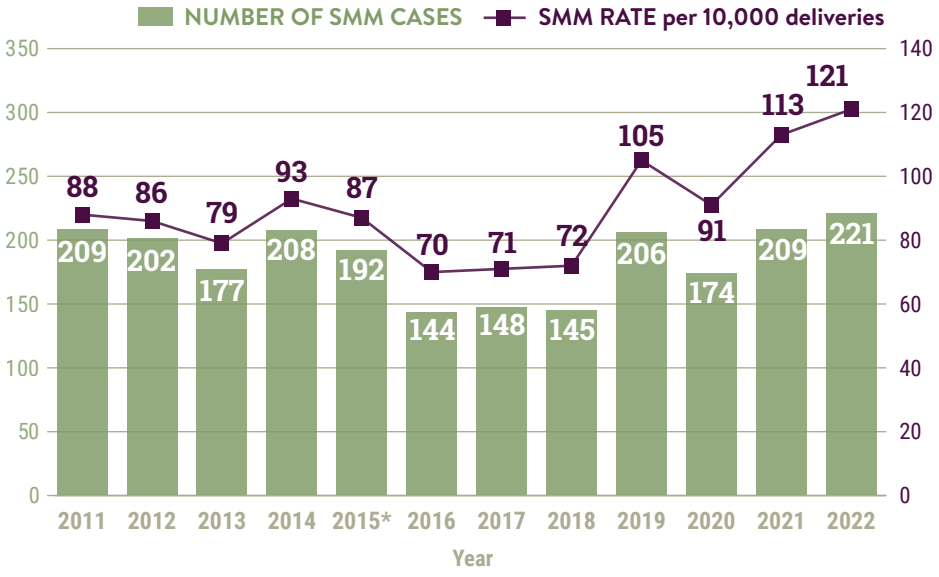


After decreasing and then stabilizing from 2014 to 2018, the rate of SMM in Philadelphia has been trending upward and reached a rate of 121 SMM cases per 10,000 delivery hospitalizations (221 total cases) in 2022.

This trend is consistent with national data in the United States, which also show increasing SMM rates over the last decade.[2] The reasons for rising SMM rates are not fully understood. However, factors such as increased prevalence of preexisting conditions like hypertension, diabetes, and obesity, as well as higher average maternal age, likely play a role.[3] Additionally, it is possible that these increased SMM rates are partially due to better medical record systems that more accurately capture SMM data. Further analysis is needed to understand this trend at the local level.

Between 2016 and 2019, SMM rates in Philadelphia were, on average, higher than national rates by about 36 cases per 10,000 deliveries.[3]

Figure 1. SMM Rate in Philadelphia, 2011–2022



**Estimates for 2015 may be unreliable due to the transition from ICD-9 to ICD-10 coding.*

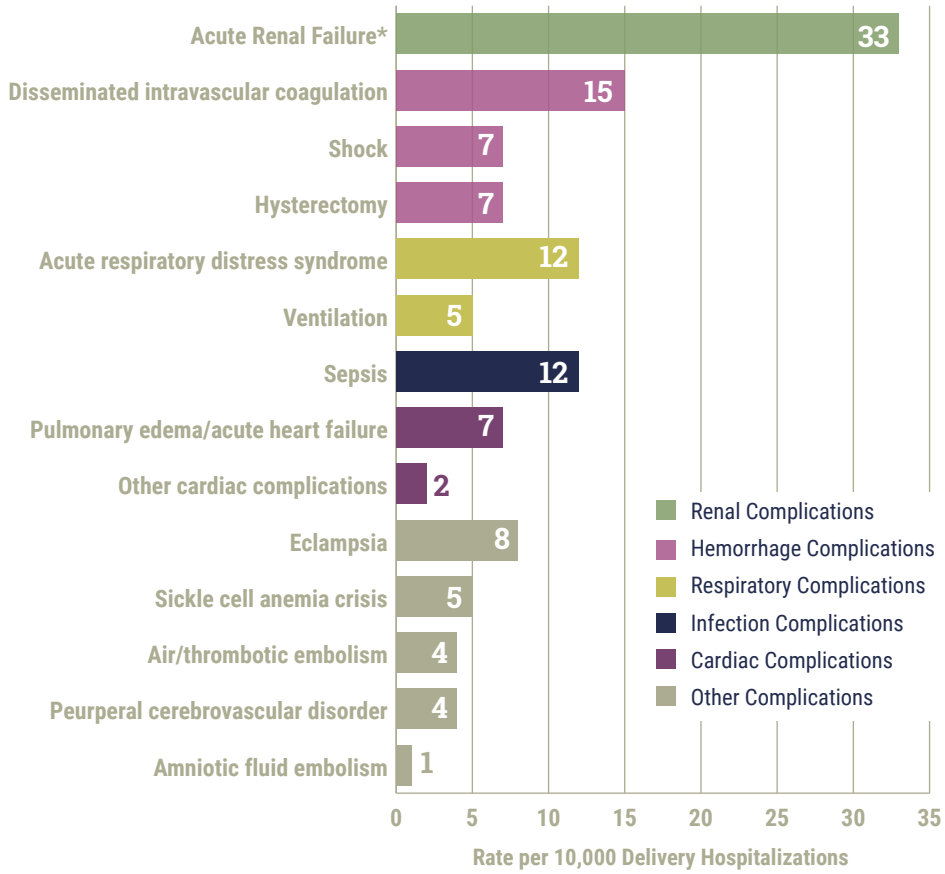
Between 2016 and 2022, acute renal failure was the leading indicator of SMM among Philadelphians, with 33 cases per 10,000 delivery hospitalizations.

Kidney problems during delivery are usually the result of a different, underlying root cause. As an SMM indicator, acute renal failure is often related to hypertensive disorders, such as preeclampsia, or delivery complications such as hemorrhage or placental abruption.[4] In this cohort, patients diagnosed with acute renal failure were also frequently diagnosed with severe preeclampsia, anemia (a result of hemorrhage), and obesity complicating delivery.

Complications related to hemorrhage, including disseminated intravascular coagulation (DIC), shock, and hysterectomy, were the second leading indicator of SMM. Respiratory complications, including adult respiratory distress syndrome and ventilation, were the third leading indicator.

Blood product transfusion, which was removed as an indicator of SMM for this analysis, was present among Philadelphia birthing people at a rate of 45 cases per 10,000 delivery hospitalizations (not shown in Figure 2). The need for a blood transfusion can be a useful piece of information when looking at delivery complications; however, blood transfusion alone is not considered a reliable indicator of SMM because it is non-specific and may occur without any other, more severe morbidities.[3]

Figure 2. Leading Indicators of SMM in Philadelphia, 2016–2022



Note: Indicator categories are based on the US Dept. of Health and Human Services (HRSA) guidance for calculating SMM rates.[4]

*Acute renal failure generally occurs secondary to a different underlying morbidity, such as preeclampsia or hemorrhage.

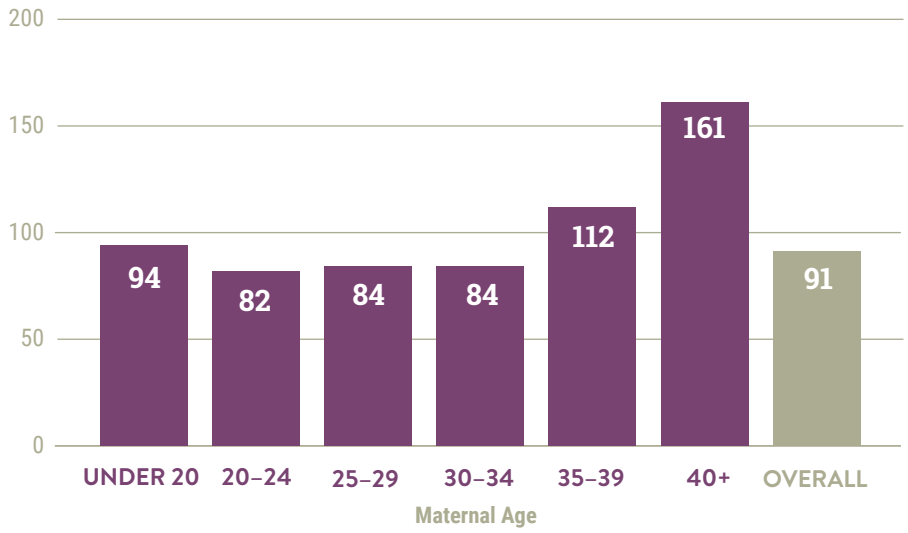
Birthing people age 40 years and older had the highest rate of SMM compared to other age groups (161 cases per 10,000 deliveries.)

Birthing people in their early 20s had the lowest SMM rate (82 cases per 10,000 deliveries), and those in their late 20s and early 30s also had a relatively low SMM rate (84 cases per 10,000 deliveries).

This is consistent with national trends, which show that birthing people over age 40, or under age 20, are more likely to experience an SMM compared to those in their 20s and early 30s.[1]

The proportion of birthing people over age 35 in Philadelphia has been steadily increasing over the last several years (from 13% in 2012 to 22% in 2022), therefore addressing SMM prevention and response in this age group is crucial.

Figure 3. SMM Rate by Maternal Age in Philadelphia, 2016–2022

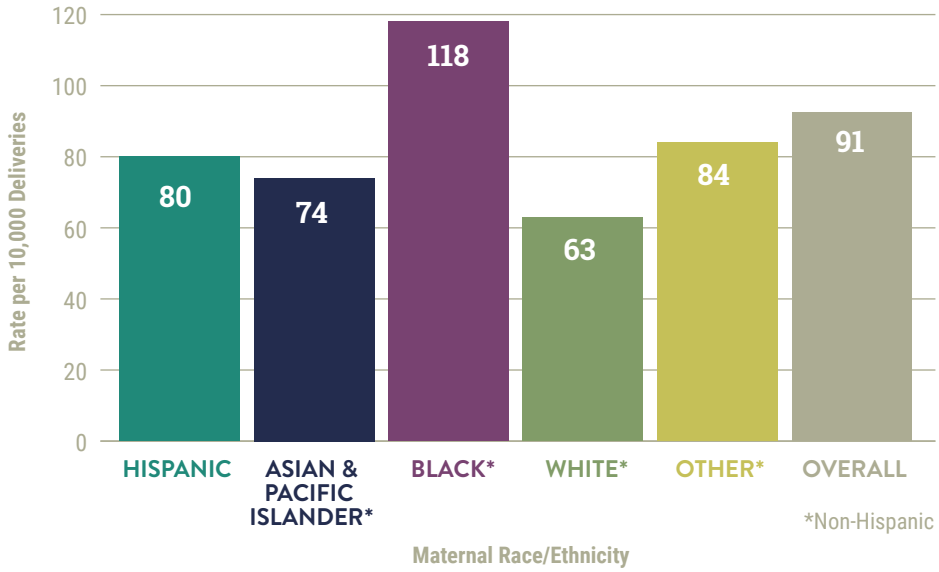


Non-Hispanic Black birthing people, who accounted for 42% of all deliveries during this time period, had the highest rate of SMM (118 cases per 10,000 deliveries) compared to other race and ethnicity groups.

Non-Hispanic White birthing people, who accounted for 30% of deliveries, had the lowest SMM rate (63 cases per 10,000 delivery hospitalizations).

This is consistent with national trends, which indicate that non-Hispanic Black birthing people experience disproportionately high rates of SMM.[1]

Figure 4. SMM Rate by Maternal Race/Ethnicity in Philadelphia, 2016–2022

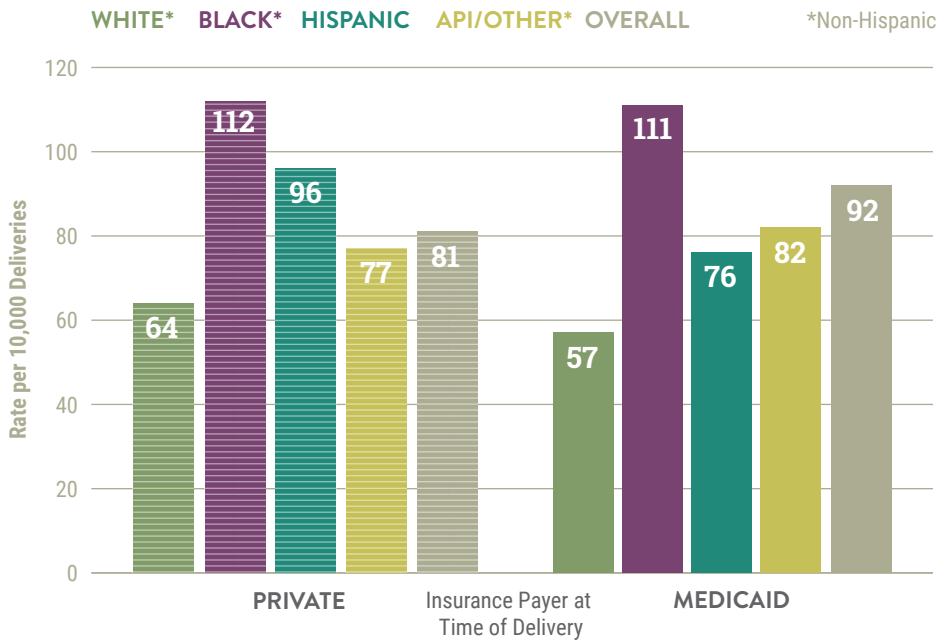


Racial disparities in SMM rates were present among both Medicaid and private health insurance enrollees.

This finding indicates that differences in health care access related to insurance coverage do not account for the observed racial disparities. Between 2016 and 2022, 73% of non-Hispanic Black birthing people in Philadelphia were enrolled in Medicaid at the time of delivery and 24% were enrolled in private health insurance, whereas 33% of non-Hispanic White birthing people were enrolled in Medicaid and 64% were enrolled in private health insurance.

While the overall rate of SMM for people enrolled in Medicaid was higher than the overall rate for people enrolled in private health insurance (92 vs. 81 per 10,000 delivery hospitalizations), this was not the case within individual racial and ethnic groups, due to the differences in proportions of Medicaid and Private health insurance enrollees within these groups. Hispanic, non-Hispanic White, and non-Hispanic Black people enrolled in private health insurance experienced higher rates of SMM compared to their Medicaid-enrolled counterparts (although this was a very small difference among non-Hispanic Black people).

Figure 5. SMM Rate by Insurance Payer and Race/Ethicity in Philadelphia, 2016–2022



Note: In this figure, Asian and Pacific Islander (API) birthing people were included in the "Other" race/ethnicity category due to small numbers.

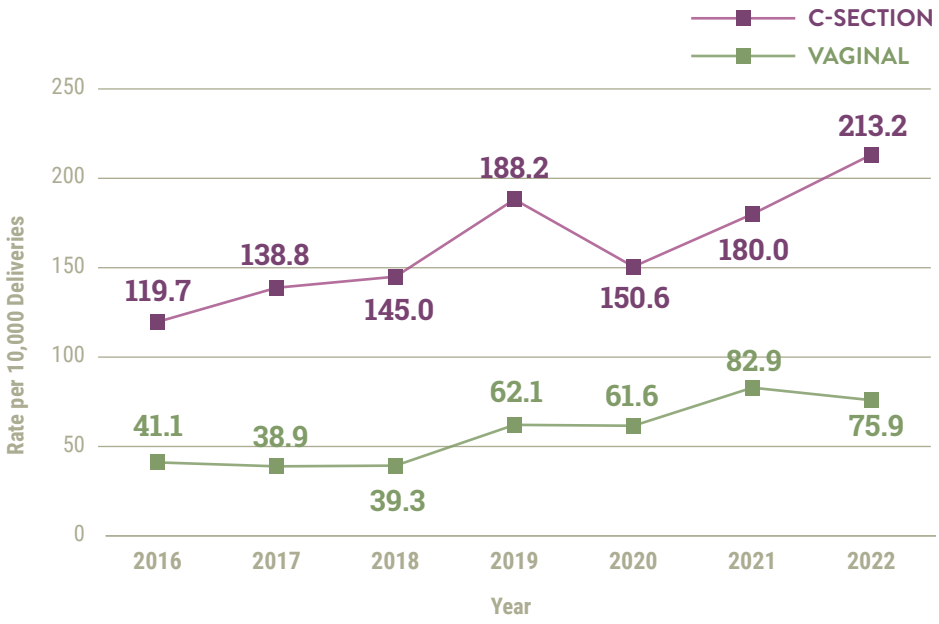
Between 2016 and 2022, the SMM rate for C-section deliveries in Philadelphia was consistently higher than the SMM rate for vaginal deliveries.

The SMM rate for both methods of delivery increased from 2016 to 2022, from 41.1 to 75.9 per 10,000 vaginal deliveries, and from 119.7 to 213.2 per 10,000 C-sections.

Approximately 30% of all delivery hospitalizations during this time period were C-sections, and this proportion remained stable over the observed time period.

Based on the data used in this analysis, it is not possible to determine whether the decision to deliver by C-section was made before or after the SMM event. In some cases, the SMM may have been related to the C-section procedure, and in others, the C-section may have been performed in response to the SMM event.

Figure 6. SMM Rate by Delivery Type in Philadelphia, 2016–2022

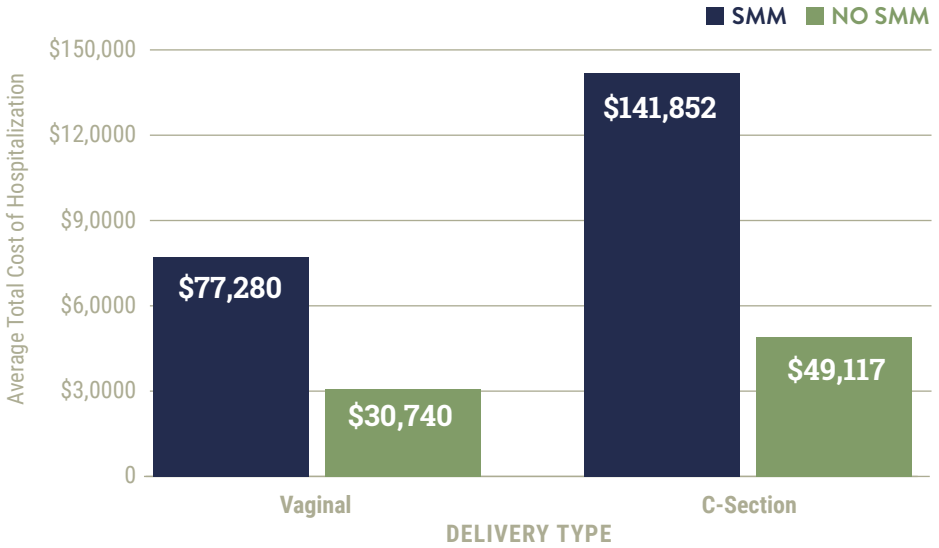


Delivery hospitalizations were much more expensive for patients who had an SMM compared to those who did not (2.5 times more expensive for vaginal deliveries and 2.9 times more expensive for C-section deliveries).

Birthing people who experience an SMM during their delivery are likely to spend more time in the hospital and to require more care while there, leading to significantly higher charges.

For birthing people who have health insurance, the insurance payer covers most (if not all) of this cost. Both Medicaid and private insurance covered, on average, over 99% of the total cost of delivery hospitalization.

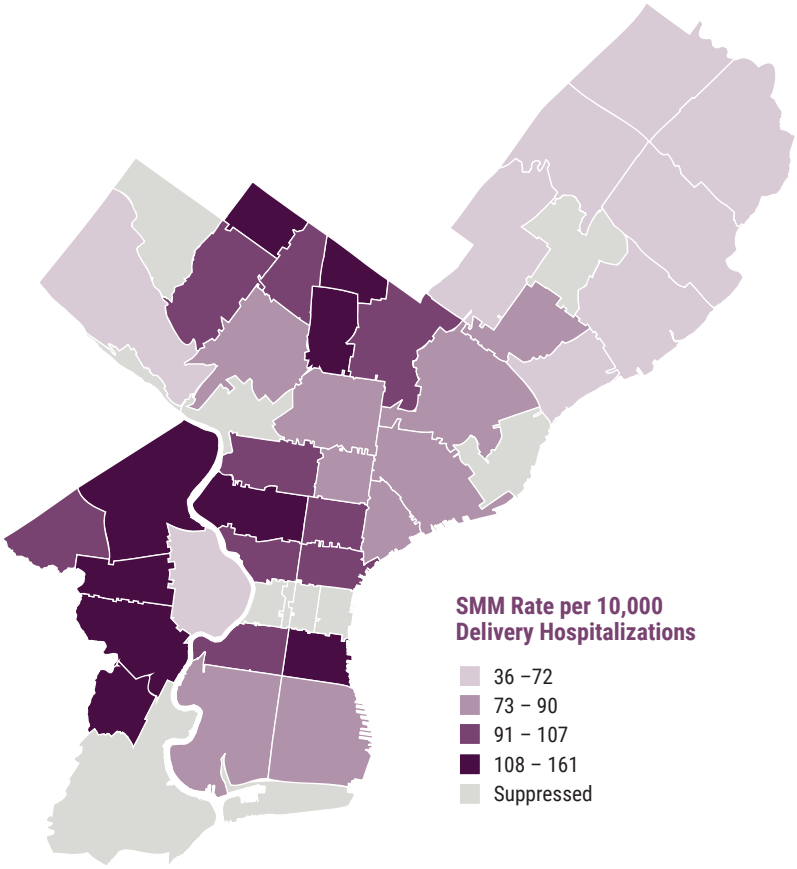
Figure 7. Average Cost of Delivery Hospitalization by SMM Event and Delivery Type in Philadelphia, 2016–2022



SMM rates varied widely by zip code. Areas in Northeast Philadelphia tended to have the lowest SMM rates, while areas in West and Upper North Philadelphia tended to have the highest SMM rates.

Many of the areas with higher SMM rates correlate to parts of Philadelphia with higher rates of poverty and chronic health conditions (although, this is not true for all zip codes with high SMM rates). Improving neighborhood-level factors that impact community health and wellness should be a priority for improving maternal health outcomes in Philadelphia.

Figure 8. Severe Maternal Morbidity in Philadelphia, 2016–2022



Note: Zip codes with fewer than 1,000 live births or fewer than 10 SMM cases between 2016 and 2022 were suppressed.

What can be done?

The Department of Public Health is:

Launching a new active surveillance system to investigate cases of severe maternal morbidity at Philadelphia birthing hospitals. The system, which began collecting data in 2024, pulls information directly from patients' medical records, which offer more clinical context compared to the administrative data sources used in this report. These data will expand our understanding of the circumstances surrounding SMM events among Philadelphians and offer key insight into opportunities for prevention.

Healthcare providers can:

- OB providers:
  - Screen pregnant people for chronic conditions that are risk factors for severe maternal morbidity and connect them to subspecialty care.
  - Provide education to all birthing people on prenatal and postpartum health to identify and address potential warning signs of complications.
  - Provide additional prenatal counseling and education for pregnant individuals of advanced maternal age about the potential risks of severe maternal morbidity.
  - In collaboration with health systems, implement best practices including safety bundles established by the Alliance for Innovation on Maternal Health (see Resources).
  - Ensure that individuals at high risk for preeclampsia are prescribed low-dose aspirin (baby aspirin) as a preventive measure, following guidelines from professional organizations such as ACOG.[6]
- Non-OB providers:
  - Adopt a patient-centered approach to consistently assess pregnancy intentions and goals, especially for those with high-risk medical comorbidities and provide tailored counseling and appropriate referrals to better address family planning needs and optimize medical comorbidities prior to conception.
  - Ensure that when providing care to pregnant or postpartum individuals, they are aware of and consider pregnancy-related conditions.
  - Include pregnancy status in routine medical histories and assessments.
  - Communicate and coordinate care with OB providers to manage chronic conditions effectively.

Health insurance providers can:

- Reduce administrative barriers for patients enrolling in health insurance.
- Remove administrative barriers to diagnostic tools for identifying pregnancy related cardiovascular complications such as echocardiograms.
- Universally cover blood pressure cuffs for all pregnant individuals.
- Reimburse for innovative strategies to identify and manage pregnancy related comorbidities such as remote fetal monitoring, blood pressure monitoring, and diabetes management.
- Reimburse for travel to prenatal care appointments.
- Reimburse for pregnancy support services such as universal home visiting and doula services.

Healthcare systems, healthcare providers, insurance companies, and community-based organizations can:

- Collaborate to establish care pathways for individuals who experience a SMM event. This includes:
  - Developing and offering support groups or counseling services for individuals recovering from SMM.
  - Ensuring access to mental health professionals trained in trauma-informed care.

People who are planning to become pregnant can:

- Have annual visits with a primary care doctor to identify and manage chronic conditions.
- Discuss health concerns with their primary care provider to ensure they are as healthy as possible prior to becoming pregnant, and between pregnancies.
- Discuss family planning and preconception care with their primary care or OB/GYN provider to prepare for a future pregnancy.
- Reduce or quit smoking.
- Discuss substance use with their provider and engage in services and treatment for substance use disorders if appropriate.

People who are pregnant or postpartum can:

- Begin prenatal care as early as possible.
- When obtaining any non-obstetric medical care, always inform the provider if they are pregnant or have been pregnant in the last year.
- Seek medical attention immediately if they experience symptoms such as dizziness, chest pain, rapid pulse, difficulty breathing, or swelling of the legs, hands, or face.
- Tell their healthcare provider about any new symptoms, regardless of whether they seem related to pregnancy.
- Access mental health support if needed, especially after a SMM event.

Community members can:

- Check-in with pregnant and postpartum people about their wellbeing.
- Encourage pregnant or postpartum people who are concerned about their health or experiencing new symptoms to talk to their healthcare provider.
- Support and advocate for mental health services and chronic disease management resources in the community.

RESOURCES

National Resources for Severe Maternal Morbidity:

- Centers for Disease Control and Prevention (CDC) Severe Maternal Morbidity

  https://www.cdc.gov/maternal-infant-health/php/severe-maternal-morbidity/index.html

- CDC Definition of SMM Indicators and Corresponding ICD-10 Codes

  https://www.cdc.gov/maternal-infant-health/php/severe-maternal-morbidity/icd.html

- CDC Hear Her Campaign

  https://www.cdc.gov/hearher/index.html

- Alliance for Innovation on Maternal Health (AIM) Patient Safety Bundles

  https://saferbirth.org/patient-safety-bundles/

Philadelphia Resources for Birthing People, Providers, and Families:

- Birth Justice Philly

  https://www.birthjusticephilly.com/

- Philly Loves Families

  https://www.phillylovesfamilies.com/

REFERENCES

1. The Commonwealth Fund. Severe Maternal Morbidity in the United States: A Primer. https://www.commonwealthfund.org/publications/issue-briefs/2021/oct/severe-maternal-morbidity-united-states-primer
2. Fink DA, Kilday D, Cao Z, Larson K, Smith A, Lipkin C, Perigard R, Marshall R, Deirmenjian T, Finke A, Tatum D, & Rosenthal N. (2023) Trends in Maternal Mortality and Severe Maternal Morbidity During Delivery-Related Hospitalizations in the United States, 2008 to 2021. JAMA network open, 6(6). https://doi.org/10.1001/jamanetworkopen.2023.17641
3. Hirai AH, Owens PL, Reid LD, Vladutiu CJ, & Main EK. (2022). Trends in Severe Maternal Morbidity in the US Across the Transition to ICD-10-CM/PCS From 2012-2019. JAMA network open, 5(7). https://doi.org/10.1001/jamanetworkopen.2022.22966
4. Shah S, & Verma P. (2023). Pregnancy-Related Acute Kidney Injury: Do We Know What to Do?. Nephron, 147(1), 35–38. https://doi.org/10.1159/000525492
5. Maternal and Child Health Bureau. Federally Available Data (FAD) Resource Document. July 10, 2024; Rockville, MD: Health Resources and Services Administration. Available at: https://mchb.tvisdata.hrsa.gov/Home/Resources
6. Low-dose aspirin use during pregnancy. ACOG Committee Opinion No. 743. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;132:e44–52. Retrieved from https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2018/07/low-dose-aspirin-use-during-pregnancy

TECHNICAL NOTES

The estimates in this report are based on data from the Pennsylvania Health Care Cost Containment Council (PHC4). Inpatient data from 2016-2022 were used to identify delivery hospitalizations and severe maternal morbidity cases. The sample was limited to patients assigned 'Female' between the ages of 10 and 65 years who had a diagnosis-related group (DRG) number corresponding to Pregnancy, Childbirth, and the Puerperium. The unit of analysis was inpatient hospitalization (not the individual). Pregnancies not resulting in a live birth, including ectopic and molar pregnancies, spontaneous or elective abortions, and stillbirths were excluded.

Delivery hospitalizations were identified using a subset of ICD-10 codes corresponding to 1) encounters for labor and delivery, 2) complications of labor and delivery, 3) outcomes of delivery, and 4) obstetric procedures related to delivery. Severe maternal morbidity cases were identified using ICD-10 diagnosis and procedure codes corresponding to the 20 indicators of severe maternal morbidity as defined by the CDC (see full list under Resources). Blood transfusion alone was not considered an indicator of severe maternal morbidity in this analysis, due to its low specificity as a measure of morbidity. A severity recalculation was applied to restrict cases to those considered most severe. Cases were only classified as severe maternal morbidity if:

- The birthing person's length of stay in the hospital was equal to or greater than the 90th percentile by delivery route.
- The birthing person was transferred to or from a different facility before or after delivery.
- The birthing person died during the delivery hospitalization.
- At least one of the four procedure indicators was present.

Suggested Citation:

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