A MULTI-YEAR LOOK AT MATERNAL MORTALITY:

2017-2021 Pregnancy Associated Mortality Review
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MISSOURI DEPARTMENT OF HEALTH & SENIOR SERVICES

Pregnancy-Associated Mortality Review

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For more information, please visit our website:
https://health.mo.gov/data/pamr/index.php.

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Dedication

The Missouri Department of Health and Senior Services (DHSS) and the PAMR Board share our deepest sympathies to the children, partners, spouses, parents and all those who love and miss the 349 women who died while pregnant or within one year of pregnancy from 2017-2021. DHSS also acknowledges the limitations of this report. This report is critical to identifying the causes and concerns leading to maternal mortality in Missouri. However, DHSS must protect the identities of individuals included in this report. This limits the ability of the program to seperate the data in a way that allows for in-depth exploration and analysis of potential disparities or differences. Throughout this report, we do not provide detailed case counts for any category that had less than five deaths. It is our goal to honor those who have died by telling their story while also protecting their privacy, meeting legal regulations, and following standard statistical practices. We dedicate this report to their memory, with the hope that we may bring meaning to what can often seem a senseless death. We will continue our efforts to understand the causes and contributing factors of maternal mortality in Missouri to prevent others from experiencing such a loss.

DHSS would like to express our sincerest gratitude to the Pregnancy Associated Mortality Review (PAMR) Board for their commitment to reviewing every pregnancy-associated death and prioritizing maternal health. DHSS extends gratitude to our partners and those working to implement recommendations to prevent maternal mortality in Missouri.

Finally, this report marks the fourth report on maternal mortality in Missouri. In this report, DHSS is proud to share new insights into the causes and context of maternal mortality in Missouri. With five years of data, in this report DHSS looks closer at Missouri's state of maternal health. We mark this shift with the new cover image which features a butterfly. This was a deeply meaningful transition for the team. Butterflies represent transformation and change. Featuring this butterfly on the cover signifies the goal to transform outcomes for moms in Missouri. Additionally, the butterfly is made up of different fragments coming together across the page. This imagery is meant to represent the idea that different communities, professions, and partners all have a role to play in improving maternal health in Missouri. Finally, by showcasing this positive image, we hope to spark a spirit of hope for the future.

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Glossary

Alliance for Innovation on Maternal Health (AIM): Quality improvement practice/ initiative to support best practices for maternal health.

Amniotic fluid embolism (AFE): Amniotic fluids enter the mother's bloodstream during or after labor, causing an allergic-like reaction.

Behavioral Risk Factor Surveillance System (BRFSS): A telephone survey that collects information on health conditions, behaviors, preventative practices, and access to health care. This information helps to inform the health in our state.

Cardiovascular disorders associated with pregnancy:

- Cardiomyopathy: A condition that causes the heart to have a harder time pumping blood to the rest of the body, which can lead to symptoms of heart failure.
- Chronic hypertension: High blood pressure present before pregnancy or diagnosed before 20 weeks of pregnancy.
- Hypertensive disorders of pregnancy: Chronic hypertension, gestational hypertension, preeclampsia, eclampsia and HELLP Syndrome (**H**emolysis **E**levated **L**iver enzymes and **L**ow **P**latelet count). See definitions below.
- Eclampsia: A complication developed from preeclampsia that can cause seizures. This is a medical emergency.
- Gestational hypertension: High blood pressure that develops after 20 weeks of gestation with no other symptoms (i.e., two separate readings of blood pressure being 140/90 four hours apart, after a blood pressure reading that was within the normal range prior to).
- Preeclampsia: A complication of pregnancy that can occur after 20 weeks of pregnancy when a woman whose blood pressure had been normal suddenly develops high blood pressure and protein in the urine or other problems.
- Preeclampsia superimposed on chronic hypertension: New-onset proteinuria (protein in the urine) in a woman with high blood pressure but no proteinuria before twenty weeks gestation.

Community violence intervention (CVI): Ways to reduce homicides in communities at risk. For more information visit this website https://www.ojp.gov/topics/community-violence-intervention.

Community-based organization (CBO): Local organization, usually a non-profit but not always, that provides services to address community needs.

Congenital anomaly: Structural (how the body is built) or functional (how the body works) birth differences that occur during fetal development.

Centers for Disease Control and Prevention (CDC): Federal agency that helps conduct and support health promotion, prevention and preparedness.

County size: County size is used to show the residency not the location of death. For example, if a mom died of heart issues out of state, her case is included in the Missouri county where she lived.

- Micropolitan counties/areas: Areas that contain an urban cluster of at least 10,0000 but fewer than 50,000 people.
- Metropolitan counties/areas: Areas that contain an urban core of 50,000 people or more.
- Rural: Counties that are not metro or micro.

Diabetes: A condition that occurs when the body cannot produce enough insulin or use the insulin in the body to remove sugar from the blood.

- Gestational diabetes: A type of diabetes that develops during pregnancy. It often goes away after delivery.
- Type 1 diabetes: A type of diabetes caused by an autoimmune disease that destroys insulin-producing (islet) cells in the pancreas. With this type, there is not enough insulin in the body to remove sugar from the blood.
- Type 2 diabetes: A type of diabetes that occurs when the body has insulin, but does not use it properly.

Disaggregated: Separated or broken down. In this report, it is used to describe when data is provided in more detail.

Embolism (thrombotic): A critical health condition caused by a blood clot moving through the blood and getting stuck in an organ, leading to no blood flow to that area.

Funders to improve maternal health:

- Philanthropic funder: A person/organization seeking to promote the welfare of others by donating money for good causes.
- State funding: Funding or grants available through state funds that can assist with projects to improve maternal mortality.
- Federal funding: Funding or grants available through federal funds to assist with projects to improve maternal mortality..
- Other funds: Funds that are aside from philanthropic, state and federal.

Gastrointestinal (GI) disorder: Conditions that affect the GI tract, a series of hollow organs that run from the mouth to the anus.

Health Insurance Portability and Accountability Act (HIPAA): An act to protect individuals, among other things, from being identified by medical records or individually identifiable information.

Hypertension: A condition when the pressure inside of blood vessels is too high. High blood pressure is like too much water flowing through a garden hose. The high-pressure stream ultimately damages the hose and plants it sprays.

Hemorrhage: Heavy bleeding.

Homicide: Killing of one person by another person.

Infection

- Sepsis/septic shock: This is caused by chemicals that are released in the bloodstream to fight an infection that trigger inflammation throughout the body.
- COVID-19: A disease caused by a virus named SARS-CoV-2. It can be very contagious and spreads quickly. In this report, when COVID-19 is listed as a cause of death, this means they were diagnosed with the infection and it led to their death.

Intimate Partner Violence (IPV) also known as DV (Domestic Violence): A pattern of behavior in any relationship that is used to gain or maintain power and control over an intimate partner. Abuse may be physical, sexual, emotional, economic or psychological actions or threats of actions that influence another person.

Mental health:

- Anxiety disorder: Condition where a person can have frequent intense, and excessive worry and fear about everyday situations.
- Depressive disorder: Condition that causes a decrease in mood, or loss of interest in activities for longer periods of time.
- Perinatal mood and anxiety disorder (PMAD): Term used to describe mental health conditions experienced during pregnancy or after having a new baby, adopting or experiencing pregnancy/infant loss.
- Psychotic disorder: Mental health condition characterized by a disconnection from reality.

Maternal mortality: The death of a woman during pregnancy, childbirth and postpartum period up to 365 days from the end of pregnancy.

Maternal morbidity: Any health condition attributed to and/or aggravated by pregnancy and childbirth that negatively impacts women's health short-term or long-term.

Naloxone: A medication to rapidly reverse an opioid overdose.

National Center for Health Statistics (NCHS): A part of the CDC that gathers, looks at and shares U.S. health information that is up-to-date, important and accurate.

Obesity: A body mass index (BMI) of 30 or higher. BMI is not valid during pregnancy. BMI values are calculated based on pre-pregnancy weight.

Opioids: A class of drugs used to reduce moderate to severe pain (i.e. heroin, morphine and oxycodone).

Opioid use disorder (OUD): A mental health condition in which a problematic pattern of opioid use creates impairment to one's mental and physical health and causes distress and/or impairs daily life.

Overdose: A critical health state that occurs when a person takes too much of a substance, a blend of substances or medicine.

Peripartum: Time frame shortly before, during and immediately after delivering a baby.

Perinatal Quality Collaborative (PQC): Group of clinical team members and public health leaders across a state working to bring awareness and quality care to mothers, families and their babies.

Pulmonary conditions: Conditions including asthma, COPD, and other lung infections like COVID-19 that affect the ability of one's lungs to work properly..

Pregnancy-associated death: When a Missouri resident dies while pregnant, during delivery or within one year postpartum, regardless of the cause. Pregnancy-associated deaths can be further placed into one of three categories:

- Pregnancy-related death: The death of a woman that occurs during or within one year of pregnancy, from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiological effects of pregnancy.
- Pregnancy-associated, but not related death (PANR): The death of a woman during or within one year of pregnancy, from a cause that is not related to pregnancy (i.e., a pregnant woman dies in an earthquake).

- Pregnancy-associated but unable to determine relatedness: Instances when the PAMR board was unable to determine if a death was pregnancy-related or PANR. This category was counted as a PANR death in previous reports due to the small population size. For the sake of brevity, this is referred to as *Unable to Determine* in the charts and figures in the report.

Pregnancy-Associated Mortality Review (PAMR) Board: A group of individuals from across the state who review every pregnancy-associated death and provide recommendations to prevent future deaths.

Pregnancy-related mortality ratio (PRMR): A ratio is another way to show a fraction. It tells how many of one condition compared to the larger group. The PRMR is a fraction used to show the number of pregnancy-related deaths compared to all live births per 100,000 live births.

$$PRMR = \left(\frac{pregnancy\ related\ deaths}{live\ births}\right) \times 100{,}000$$

Screening, Brief Intervention, Referral and Treatment (SBIRT): A tool used to identify individuals at risk for a condition (usually the use of substances like tobacco or alcohol) and then provide access to specialty care.

Social determinants/drivers of health (SDOH): Non-medical factors that affect health outcomes and quality of life. These factors are known as social determinants of health (SDOH) or are sometimes called social drivers of health. Health isn't just about going to the doctor. They include things like not having enough money, living in unsafe or unstable housing, or being in a neighborhood that has more crime. People in areas with poor SDOH often have worse health. Improving these conditions helps everyone be healthier and reduce health differences between groups. Visit https://www.cdc.gov/about/priorities/why-is-addressing-sdoh-important.html

Severe maternal morbidity (SMM): A group of 15 unplanned negative outcomes during childbirth designated by the CDC, which can cause short-term or long-term problems to a woman's health.

Statistical significance: Term used to describe a test used to look at the relationship between two variables. It is performed to determine whether the difference between the two variables is the result of chance or if it is meaningful and did not happen because of chance. For this report, all tests were performed to the 95% confidence level. This means that there is 95% confidence that the relationship between the two variables was meaningful. This does not mean that one thing caused another. Without more advanced tests, it cannot be known if there is a true cause-and-effect relationship.

Substance use disorder (SUD): Recurrent use of substances such as alcohol, marijuana, methamphetamine, narcotics, etc. that causes impairment to one's mental and physical health and causes distress and/or impairs daily life.

Surveillance: One of the steps in public health that seeks to see if there is a public health problem, and if so, what the problem is. In this report, surveillance is the step used to see what problems exist in maternal health. When timing is mentioned for surveillance, it states what time frame we look at to identify the problem.

Unreliable ratio: A ratio is another way to show a fraction. It tells how often a condition occurs within a larger group. Ratios based on numbers smaller than 25 are unreliable. This is because they are easily influenced by small changes in how often a condition occurs. To improve the dependability of report findings, analysts combine numbers from different variables. In this report, analysts often combined five years of data to obtain the most reliable ratios possible. Figures where the calculated ratio are unreliable are indicated using hashed bars on the graphs.

Executive Summary

The 2024 multi-year report describes maternal mortality and demographic characteristics of women in Missouri from 2017-2021. DHSS identified deaths of Missouri residents that occurred when a woman was pregnant or within one year of pregnancy and presented information regarding the pregnancy and death to the Pregnancy Associated Mortality Review (PAMR) Board. The board performed a comprehensive review of these deaths and made recommendations to prevent future deaths. The findings and recommendations are summarized in this report.

Key Findings

An average of 70 Missouri women died while pregnant or within one year of pregnancy each year over 5 years (2017-2021), with the highest number recorded in 2020 (85 deaths).

From 2017-2021 (349 deaths total):[i]

- The pregnancy-related mortality ratio (PRMR) was 32.2 deaths per 100,000 live births.
- The PRMR for Black women was 2.5 times the ratio of white women. This is a decline from the previous three reports.
- Seventy-seven percent of pregnancy-related deaths were determined to be preventable.
- Cardiovascular diseases were the leading underlying cause of pregnancy-related deaths, followed by mental health conditions.
- All pregnancy-related deaths due to mental health conditions, including substance use disorder (SUD), were determined to be preventable.
- Almost half (44%) of all pregnancy-related suicides over five years (2017 to 2021) occurred in 2020.
- COVID-19 was the cause of death for 2 in 3 (75%) pregnancy-related deaths due to infection in 2021.
- Women living in micropolitan counties had the highest ratio of pregnancy-related deaths (38 per 100,000 live births). Prior reports found women living in metropolitan counties had the highest ratio.

- Women residing in rural counties had the highest ratio of pregnancy-associated, not related (PANR) deaths at 67 deaths per 100,000 live births.
- The ratio of PANR deaths for women who were covered by MO HealthNet was more than 7 times greater than the ratio for those with private insurance.

Key Recommendations

Below and within the body of this report are the PAMR Board's recommendations made during 2017-2021 case reviews on what could prevent maternal mortality. The key recommendations are those the board most frequently identified. To help highlight who can take action, the recommendations have been separated by decision-makers. Those recommendations that have been completed or are in the process of being completed are indicated with an asterisk(*).

The Missouri legislature should:

- Provide funding for a statewide Perinatal Quality Collaborative (PQC) by 2023.*
- Establish and fund a statewide Perinatal Psychiatry Access Program to aid health care providers in providing evidence-based mental health care, including SUD treatment to Missouri women.*
- Extend Medicaid coverage to one year postpartum for all conditions (including medical, mental health and SUD), even if the woman did not start treatment before delivery, to aid women whose condition is exacerbated in the postpartum period.*
- Fund Medicaid expansion by 2023.*
- Increase the seat belt violation fine from $10 to $60 by 2026.
- Pass a state primary enforcement seat belt law that covers all occupants, regardless of where they sit in the vehicle by 2026.

All health care providers should:

- Perform a full assessment for depression and anxiety utilizing a standardized, validated tool at least at initial visit, later in pregnancy and at postpartum visits, adding additional screenings as indicated.*
- Perform universal screening for SUD utilizing a standardized, validated tool on every patient at least once prenatally and at least once during the comprehensive postpartum visit, adding additional screenings as indicated.*

- Refer pregnant women to mental health professionals, social workers, community health workers and SUD treatment programs as appropriate.
- Obtain further education regarding screening, referral and treatment of:*
    - Mental health conditions including SUD during and after pregnancy.
    - Cardiovascular disorders associated with pregnancy (i.e., peripartum cardiomyopathy, hypertensive disorders of pregnancy, etc.).
- Obtain further education on the cardiorespiratory physiologic changes in pregnancy and the implications for clinical management in the setting of acute infectious etiologies. This includes utilizing specific pharmacologic and non-pharmacologic management strategies and establishing protocols with partnering physicians, such as providers in the emergency room for timely evaluation, referral and follow up.
- Counsel patients about the American College of Obstetricians and Gynecologists (ACOG) recommendation that pregnant women, or those planning to become pregnant, should be vaccinated against COVID-19. Providers should discuss with their patients about complications of infections during and after pregnancy.

Health care facilities should:

- Utilize social workers, community health workers and doulas during pregnancy and postpartum, to increase continuity of care for referrals, care coordination, communication and addressing social determinants of health.
- Standardize practices and procedures across the health care system by utilizing quality improvement tools such as the Alliance for Innovation on Maternal Health (AIM) patient safety bundles.*
- Establish protocols in alignment with ACOG guidelines for pregnant women who come in for treatment with COVID-19.

All health care staff should:

- Undergo training on trauma-informed care and implicit bias at least annually.*

Community-based organizations (CBOs) should:

- Collaborate with health care facilities and providers to reduce stigma surrounding maternal mental health and SUD and provide assistance with resources for these conditions.

- Collaborate with health care facilities and providers to educate their community on intimate partner violence (IPV) and provide resources and assistance for those affected by IPV.
- Empower pregnant and postpartum women to utilize doula services, home visiting and/or community health workers to facilitate care coordination and increase health care utilization.
- Provide educational outreach on preconception health and early and consistent prenatal care initiation to optimize prenatal, peripartum and postpartum health.
- Collaborate with providers to educate their community on signs and symptoms of cardiovascular disease in obstetric patients by using tools such as the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) POST- BIRTH Warning Signs or AIM Urgent Maternal Warning Signs.

All medical death certifiers should ensure an autopsy and toxicology tests are completed on a woman who has been pregnant within the last year.*

Government agencies, in partnership with financial institutions and philanthropic funders should invest in urban infrastructure (grocery stores, medical care access, banks and playgrounds) to increase avenues for fostering healthy interpersonal and family relationships with a goal of reducing violence and improving maternal health.

State agencies, health care providers, CBOs and families should increase public awareness of the importance of seat belt safety during the perinatal period.*

State agencies, in partnership with CBOs, should implement community violence intervention (CVI) programs with a focus on reducing homicides among pregnant and postpartum women.

Pregnant women should present for early and consistent prenatal care for appropriate screenings and referrals.

A Word of Caution

This report presents three-year ranges where appropriate to show the beginnings of trends within the data. However, even within these aggregates, the population remains small. A small population size increases the likelihood of skewed results, meaning some effects may be exaggerated, while others may remain hidden. This effect may be increased when data is missing.

As such, a five-year aggregate from 2017-2021 was used as the primary timeframe evaluated to bolster the reported numbers' reliability and stability. This is the first time a continuous five-year aggregate has been available for analysis. However, reporting on data further disaggregated by race/ethnicity and other demographics of interest is not always possible.

Working with small numbers also limits the program's ability to do more complex analyses, such as logistical regression. Additionally, with counts and populations that are small, there are concerns about being able to identify individuals. This prohibits more detailed reporting, which could violate the Health Insurance Portability and Accountability Act (HIPAA). The rules in place prevent reporting of data where the count is less than or equal to five cases. Furthermore, ratios calculated with fewer than 25 cases should be used hesitantly as these may experience wide variation.

Throughout this report, this page is referenced by the use of the Ω symbol.

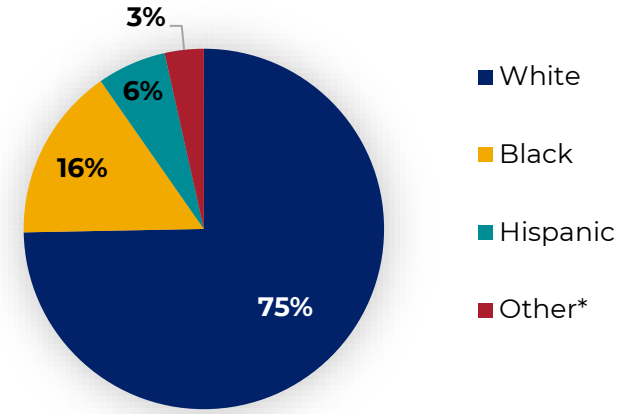
Maternal Health in Missouri

A woman's health influences the well-being of her children, family and community. Preconception health, or health before becoming pregnant, is vitally important and can dramatically impact health outcomes throughout pregnancy and postpartum. Pregnancy provides an opportunity to identify and manage underlying chronic conditions. Health care providers have an increased opportunity during this time to connect patients with available resources and services in their community to address needs related to social determinants of health (SDOH).

Birthing Demographics

Missouri is home to a population of 6,168,187, including 1,996,523 women of reproductive age (defined as 10-60 years old) based on 2021 estimates.[ii]

Figure 1: Percent of MO Live Births by Race/Ethnicity, 2017-2021



Source: DHSS-MOPHIMS-Birth MICA

*Other includes Asian, American Indian, Native Hawaiian, Alaska Native, Pacific Islander and other groups

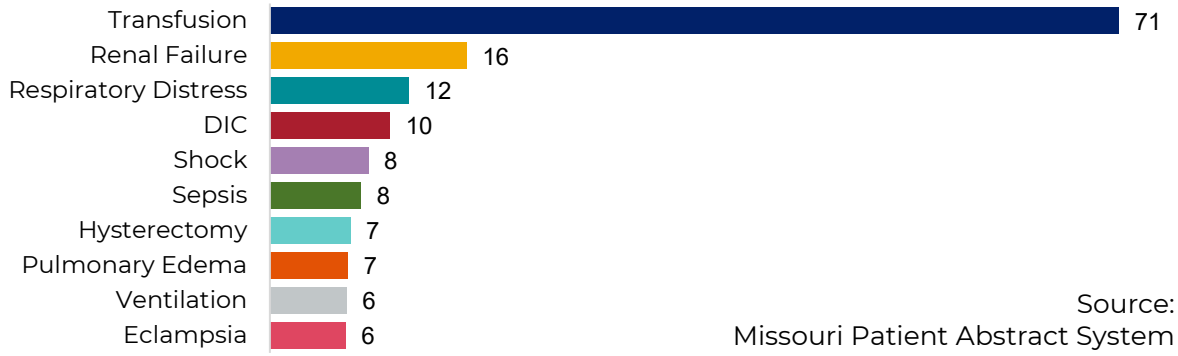
Missouri women had an average of 71,554 live births per year.[iii] Non-Hispanic white women represented 75% of these births, while Non-Hispanic Black women represented 16% and Hispanic women of any race represented 6%. Women who did not fall into any of the above categories, including Asian, American Indian, Native Hawaiian, Alaska Native, Pacific Islander and other groups, represented 3% (Fig. 1).

Severe Maternal Morbidity

Severe maternal morbidity (SMM) is an unintended outcome during labor and delivery that results in significant short-term and long-term complications. From 2017-2021, there were 4,093 instances of SMM in Missouri, with an overall rate of 115 per 10,000 live births.[iv] These acute conditions may include, but are not limited to, blood transfusions, renal failure and hysterectomy.[v] Those most at risk for SMM were women over age 34, carrying multiples,[vi] who had certain coexisting medical conditions,[vii] or who had a prior cesarean delivery.[viii]

Figure 4 provides the rates for leading indicators of SMM retrieved from Missouri's Patient Abstract System which collects hospital discharge data. The most common indicator for SMM is a transfusion. From 2017 to 2021, transfusions occurred at a rate of 71 per 10,000 live births. Renal failure was the second most common indicator of SMM, with a rate of 16 per 10,000 live births.

Figure 4: Leading Indicators of SMM, 2017-2021, Rate per 10,000



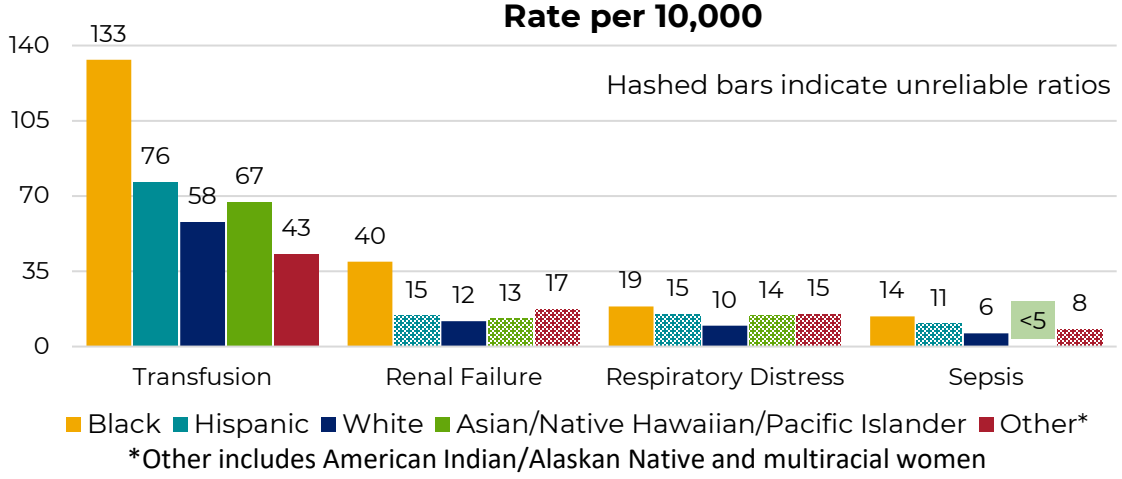
Source: Missouri Patient Abstract System

In addition to the overall rates varying by race, the rates of individual indicators also varied. For this analysis, American Indian/Alaskan Native did not separately meet the reporting threshold requirements and so were combined with those who indicated multiracial or "other" race.[Ω] Those for whom race was "unknown" or "refused" were excluded from this analysis.

- The rate of transfusions per 10,000 live births was:
  - 133 for Black women.
  - 76 for Hispanic women.
  - 67 for Asian/Native Hawaiian/Pacific Islander women.
  - 58 for white women.

    - 43 for other women.
- The rate of renal failure per 10,000 live births was:
    - 40 for Black women.
    - 17 for other women.
    - 15 for Hispanic women.
    - 13 for Asian/Native Hawaiian/Pacific Islander women.
    - 12 for white women.
- The rate of respiratory distress per 10,000 live births was:
    - 19 for Black women.
    - 15 for both Hispanic and other women.
    - 14 for Asian/Native Hawaiian/Pacific Islander women.
    - 10 for white women.
- The rate of sepsis per 10,000 live births was:
    - 14 for Black women.
    - 11 for Hispanic women.
    - 8 for other women.
    - 6 for white women (Fig. 5).

Figure 5: Leading SMM Indicators by Race, 2017-2021, Rate per 10,000

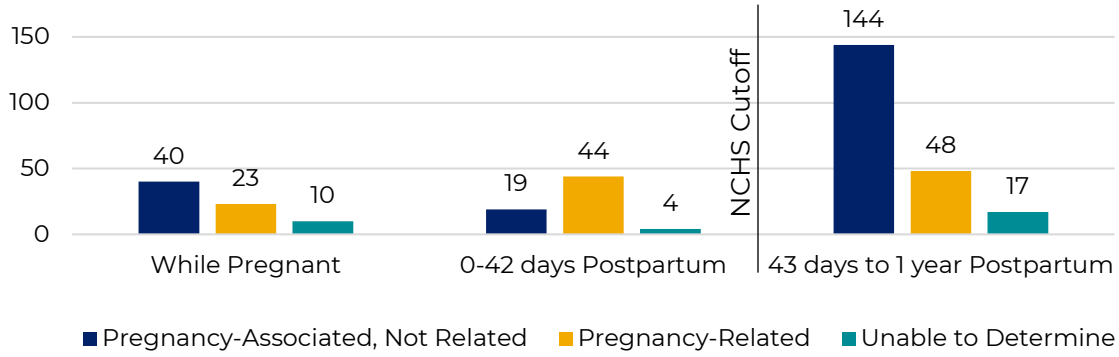


Maternal Mortality

Surveillance Timing

There are different surveillance systems, which use different identification methods for maternal mortality. The CDC National Center for Health Statistics (NCHS) identifies deaths that occur during pregnancy or within 42 days postpartum as possible cases of maternal death, but exclude deaths due to accidental or incidental causes, such as injuries and mental health conditions. Additionally, the PAMR program utilizes the term pregnancy-associated for case identification and continues beyond 42 days postpartum to one year. If Missouri PAMR used the NCHS standard, 48 pregnancy-related deaths in Missouri would not have been identified (Fig. 6).

Figure 6: Timing of Death, 2017-2021



PAMR Board Determinations

During 2020, the number of pregnancy-associated deaths increased in Missouri and nationwide, as represented in figure 7. This increase continued into 2021. The PAMR Board collectively reviewed all pregnancy-associated cases to determine pregnancy-relatedness and the cause and contributing factors of death, and provide recommendations for improved outcomes. For a more detailed look at the PAMR process, see Appendix A and Appendix B.

Figure 7 shows the board's determinations regarding relatedness by year, and figure 8 shows the differences in ratios annually from 2017 to 2021.

Figure 7: Number of Pregnancy Associated Deaths, Missouri 2017-2021

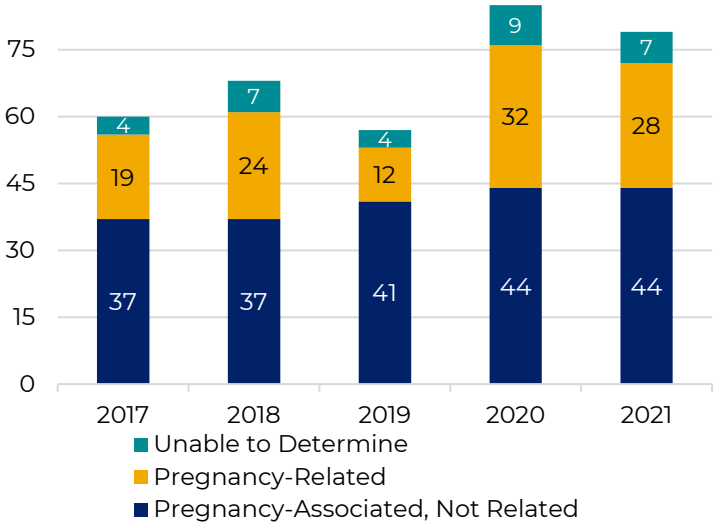
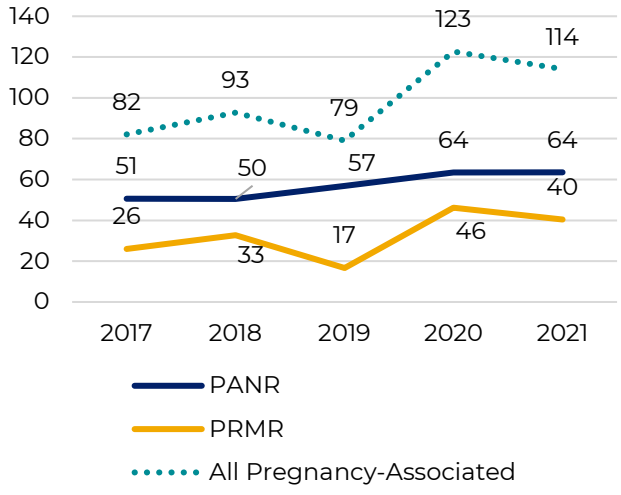


Figure 8: Annual Ratios per 100,000 Live Births



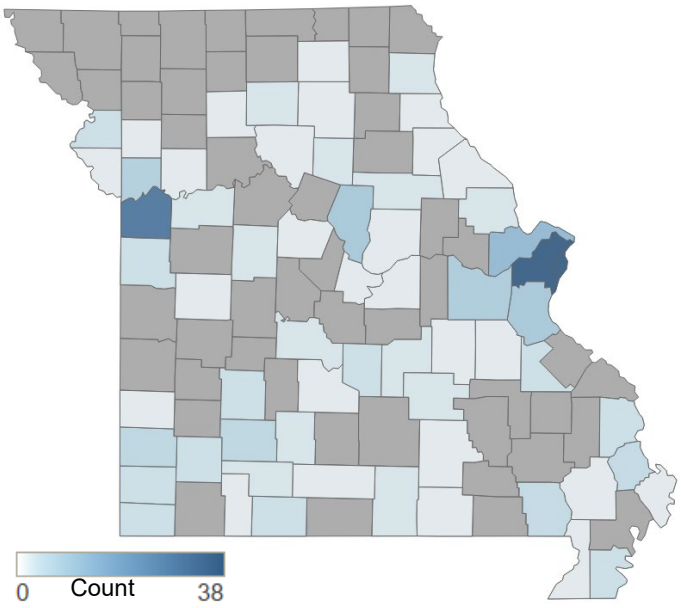
- PANR cases and ratios have steadily increased, with less variability than the pregnancy-related ratios.
- The pregnancy-related ratios have been increasing, with the greatest increase in 2020.
- Looking at each ratio by year demonstrates how widely the numbers may fluctuate with a single year of data.

From 2017-2021, 33% of cases were pregnancy-related, translating to a PRMR of 32 deaths per 100,000 live births. Meanwhile, the majority of cases (58%) were PANR. A further 9% of cases were pregnancy-associated, but unable to determine pregnancy-relatedness.

Deaths by Residence

As shown in figure 9, pregnancy-associated deaths most frequently occurred among residents of metropolitan counties. The map shows the total number of deaths rather than the ratio. This is because stable ratios cannot be calculated for most counties due to the small numbers involved, particularly in rural counties.

Figure 9: Count of All Pregnancy-Associated Deaths by Residence, 2017-2021



Missouri has seven Behavioral Risk Factor Surveillance System (BRFSS) regions (Fig. 10). Due to having a small sample size,Ω it was not possible to calculate a stable ratio for most counties with a pregnancy-related death. Grouping the counties into these regions allows for data disaggregation below the state level. The region with the highest ratio of pregnancy-related deaths was the Northeastern Region (41.55 deaths per 100,000 live births), while the area with the lowest rate was the Central Region (21.79 deaths per 100,000 live births). The St. Louis Region is the only region with a stable ratio (Table 1).Ω

Figure 10: BRFSS Region Map

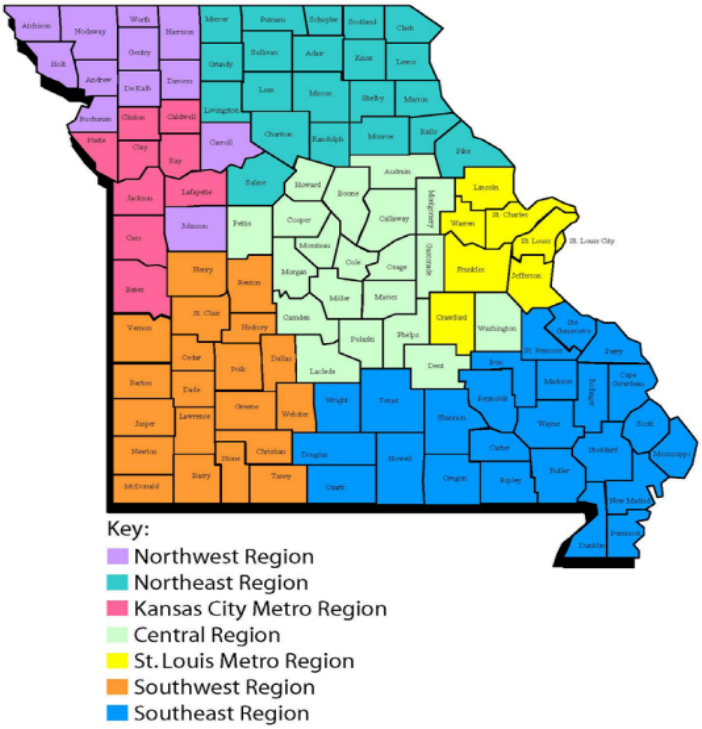


Table 1: Pregnancy-Related Deaths by BRFSS Region

BRFSS Region	Count	Rate per 100,000 Live Births
Northwest	x	*
Northeast	6	41.55
Kansas City Metro	24	31.16
Central	9	21.79
St. Louis Metro	47	38.60
Southwest	19	33.97
Southeast	8	24.42

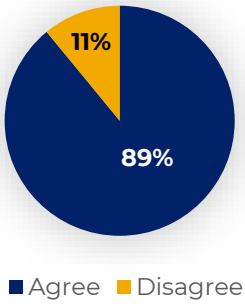
"X" indicates confidentiality (count ≤5).
*** Rate is unreliable; numerator ≤5.**

Data Evaluation

The PAMR Board could only make decisions based on the quality of information it received. PAMR staff made every attempt to obtain records from health care providers, facilities, coroners and medical examiners. However, toxicology screenings and autopsies were not always performed, and additional information from the health care system was not always available. For instance, a woman could have sought medical treatment from a provider in another location or details such as the provider's name or clinic were not documented (e.g., "the patient was seen by a neurologist for headaches").

> Medical death certifiers should ensure an autopsy and toxicology are completed on a woman who has been pregnant within the last year.

Figure 11: Committee Agreement with Underlying Cause of Death Listed on Death Certificate, 2017-2021



The PAMR Board agreed with the underlying cause of death listed on the death certificate for the majority of pregnancy-associated cases (89%, Fig. 11). They disagreed with the cause of death only when the evidence was sufficient to justify disputing the information on the death certificate. In these 39 cases, the PAMR Board disagreed with the cause of death; only 33% of these cases had an autopsy.

Of these 39 cases:

- **69%** were determined by the board to be **pregnancy-related.**
- **62%** were determined to have a **medical** (including mental health and SUD) underlying cause of death.
- **54%** died between **43 days and one year postpartum.**
- **More than one in three** (38%) were determined to have died of **cardiovascular disease.**

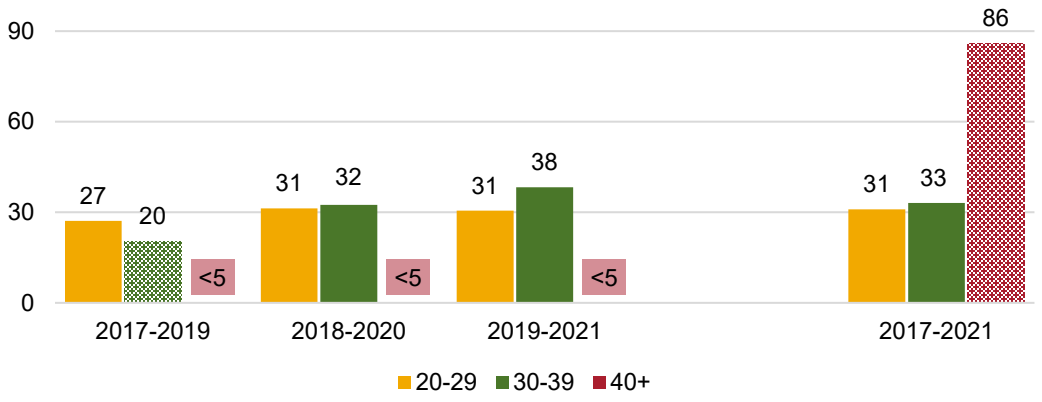
Pregnancy-Related Demographic Disparities

Maternal mortality may impact different groups in different ways and at various frequencies. Comparing ratios helps determine the degree of disparity in health outcomes between different populations. Understanding these differences aids the PAMR board in making more targeted recommendations and aids community partners in focusing prevention efforts. While the demographics provided offer some insights into population differences, these deaths do not occur within a vacuum, and fully exploring the mechanisms that drive disparate outcomes is beyond the scope of this annual report.

- The ratio of pregnancy-related deaths for those who had a high school diploma or GED was **3.3 times higher** than for those who had obtained education beyond a high school diploma or GED.
- The ratio of pregnancy-related deaths was **2.8 times higher** for those who were covered by MO HealthNet compared with those who had private insurance.
- The ratio of pregnancy-related deaths for Black women was **2.5 times higher** than the ratio of deaths for white women.

From figure 12, the PRMR is consistently highest in women 40 years old or older (independent of co-morbidities) at 86 pregnancy-related deaths per 100,000 live births. The aggregate ratios calculated are unreliable for ages < 20.[Ω] Despite this, the disparity between age groups was statistically significant.

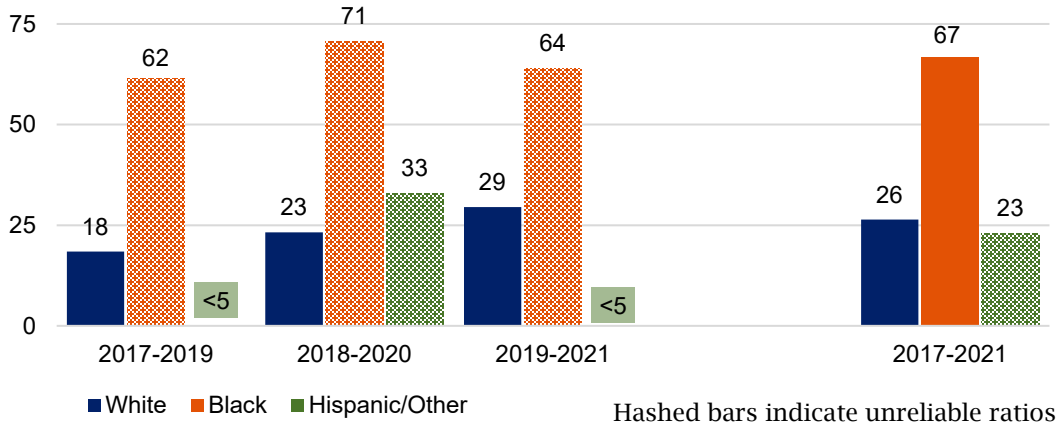
Figure 12: Pregnancy-Related Mortality Ratio per 100,000 Live Births by Age



- Women aged **40+** had a pregnancy-related death ratio **2.8 times higher** than women between 20 and 29-years-old. Most live births in Missouri (53%) were to women 20-29-years-old.

Pregnancy-related mortality is highest among Black women, with a ratio of 66.7 deaths per 100,000 live births (Fig. 13) as compared to 28 in their non-Black counterparts. This disparity persists across all timeframes. Due to the small population size, Hispanic and all other races (including Asian, Native Hawaiian, Pacific Islander, American Indian, Alaska Native and multiracial) were combined to meet reporting requirements. The ratio calculated for Black women is reliable at the five-year aggregate level. Table 2 demonstrates the breakdown for all race/ethnic groups evaluated. The disparity in racial outcomes was statistically significant.

Figure 13: Pregnancy-Related Mortality Ratio per 100,000 Live Births by Race/Ethnicity



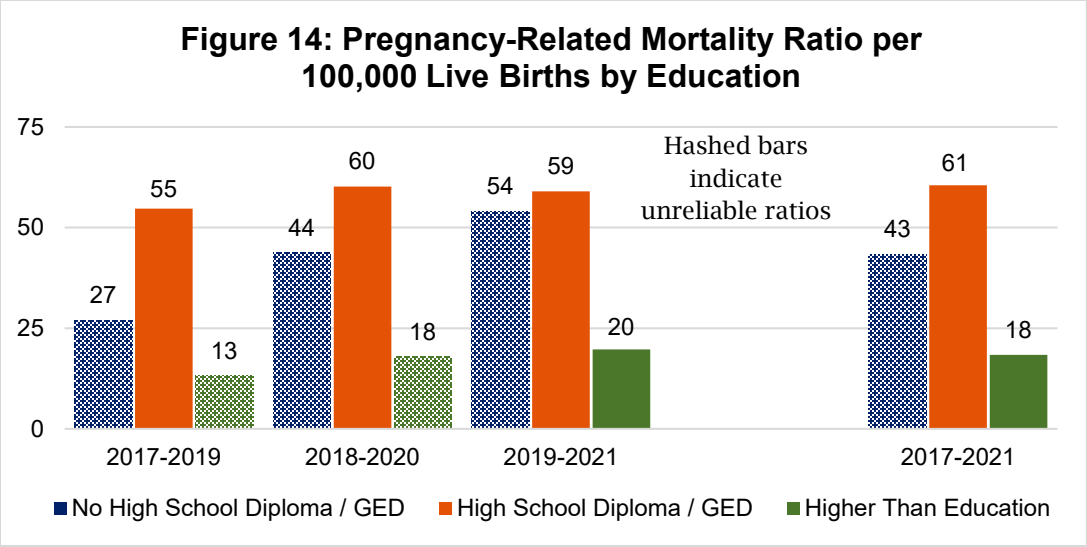
- **Black women** experienced pregnancy-related death at a ratio **2.5 times higher** than their non-Black counterparts. White women had the majority (75%) of live births in Missouri.

Table 2: Pregnancy-Related Mortality Ratio by Race/Ethnicity per 100,000 Live Births, 2017-2021

Race/Ethnicity	Count	Births	Rate
White	70	265,445	26.37
Black	37	55,462	66.71
Hispanic	x	22,004	*
Asian/Native Hawaiian and Other Pacific Islander	x	10,365	*
American Indian and Alaska Native	x	1,458	*
Other/Multiracial	x	1,361	*

The "x" symbol indicates the confidentiality rule has been triggered (count ≤ 5).
* Ratio is unreliable; numerator less than 5.
^Other includes those that identify as all races other than those listed above and/or multiracial.

The PRMR was highest for those with a high school diploma/GED, with 60.6 pregnancy-related deaths per 100,000 live births (Fig. 14). The majority (63%) of live births were to women with more than a high school diploma/GED. The differences between education levels were statistically significant.



- Women with a **higher education level** had a ratio of pregnancy-related death **3.3 times lower** than those who had a high school diploma/GED.

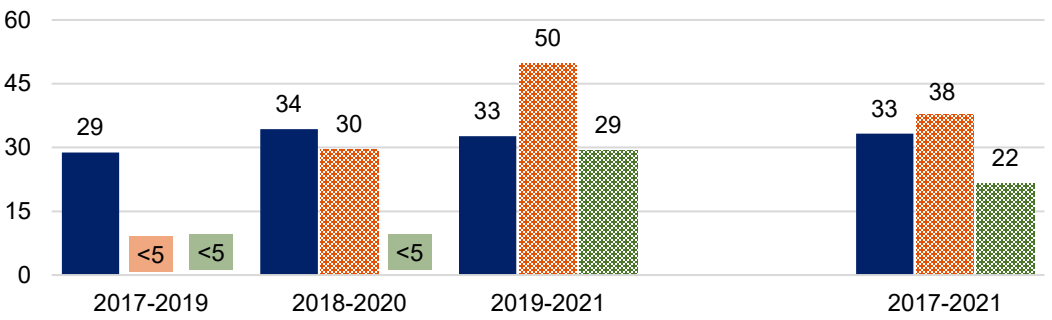
Table 3: Race/Ethnicity by Education Level for Pregnancy-Related Deaths, 2017-2021

Race/Ethnicity	Less than High School/GED	High School Diploma/GED	More than High School/GED
White	8	35	26
Black	9	16	12
Hispanic/Other^	X	X	X

The "x" symbol indicates the confidentiality rule has been triggered (count ≤ 5).
^Other includes Asian, Native Hawaiian, Pacific Islander, American Indian and Alaska Native.

Women who lived in **micropolitan** counties had the highest PRMR from 2017-2021 at **38** pregnancy-related deaths per 100,000 live births (Fig. 15). Most (76%) births occurred to women residing in metropolitan counties. Despite a lower population size for rural women, the disparities based on residential status were statistically significant.

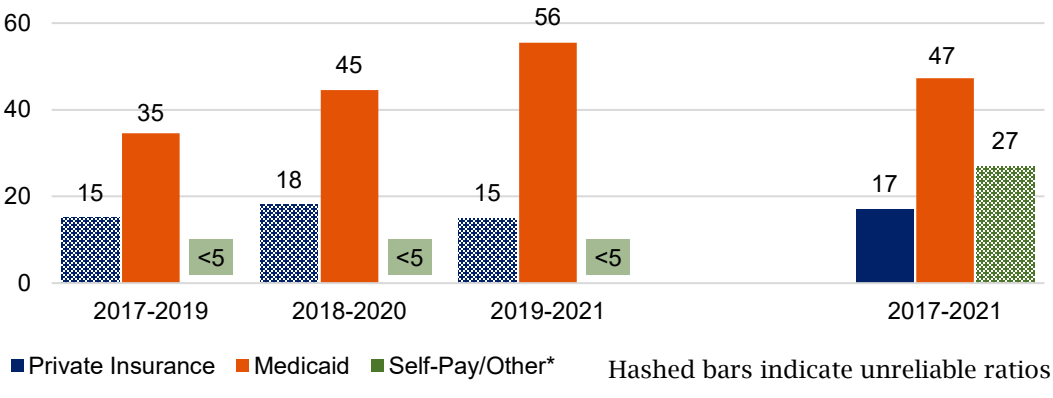
Figure 15: Pregnancy-Related Mortality Ratio per 100,000 Live Births by Residential Status



- Women residing in **metropolitan** counties had a pregnancy-related mortality ratio **1.5 times higher** than those residing in rural counties.

The highest PRMR was among women who were covered by MO HealthNet at 47 deaths per 100,000 live births (Fig. 16). Those with an unknown insurance status were excluded. "Other" may include but is not limited to programs such as Tri-Care, Indian Health Services, and Christian Medical Health Sharing groups. Due to the small population of pregnancy-related deaths with self-pay or other insurance, these groups are combined to meet the reporting threshold. Ω The difference between groups for pregnancy-related deaths was found to be statistically significant.

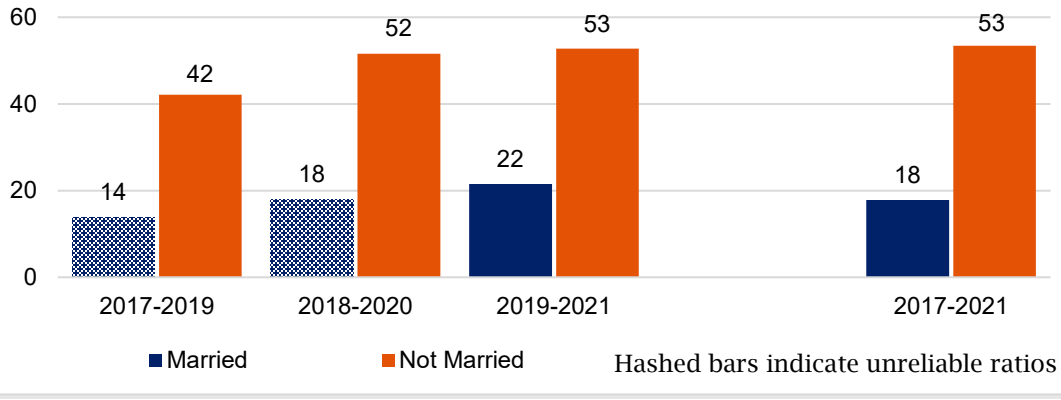
Figure 16: Pregnancy-Related Mortality Ratio per 100,000 Live Births by Payment Type



- Women who were covered by MO HealthNet had a PRMR **2.8 times higher** than those with private insurance. The majority of live births in Missouri (55%) had private insurance.

As shown in figure 17, the aggregate PRMR of not-married women is more than 2.9 times the ratio for married women, who made up 60% of live births in Missouri from 2017-2021. This difference was found to be statistically significant. For this report, marital status was based on marital status at the time of death. Women who were separated but still legally married at the time of death were included as not married to match the population data. Not married also includes those who are divorced, widowed, separated and were never married. Those with unknown marital status were excluded. It is important to note that in Missouri, divorce is not often finalized while women are still pregnant. So, the married category may include individuals still married, not separated, but wishing to no longer be married.

Figure 17: Pregnancy-Related Mortality Ratio per 100,000 Live Births by Marital Status



- The PRMR was **highest** among women who were not married, with a ratio of **53.5** deaths per 100,000 live births.

Causes, Contexts, and Recommendations for Pregnancy-Related Deaths

Causes of Pregnancy-Related Death

The leading cause of pregnancy-related deaths from 2017-2021 were due to cardiovascular disease including hypertensive disorders of pregnancy. This was closely followed by mental health conditions (including substance use disorder), followed by infection then injury (homicides).

Figure 18 highlights the most common disaggregated leading causes of pregnancy-related death. Cardiomyopathy was the most common cause of deaths due to cardiovascular disease. Depressive/anxiety disorders were the most common cause of death due to mental health conditions. COVID-19 was the most common cause of death due to infection.

Figure 18: Leading Cause of Death Disaggregated by Most Frequent Cause, 2017-2021

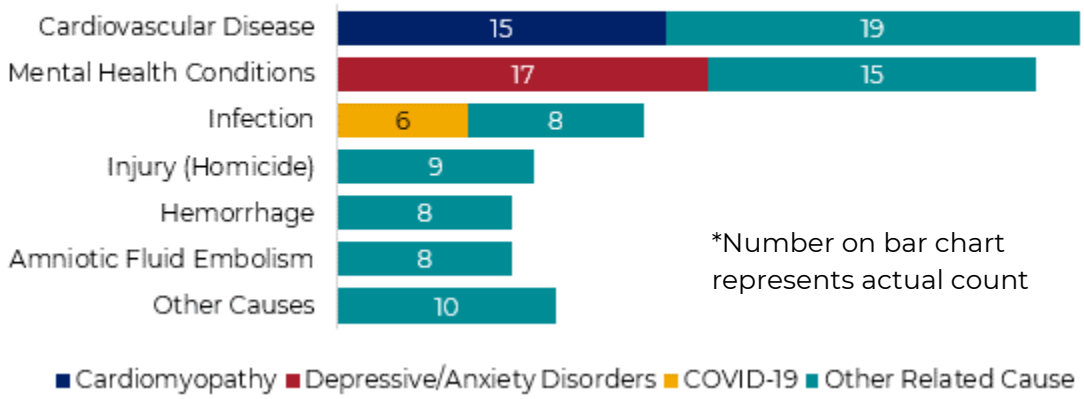


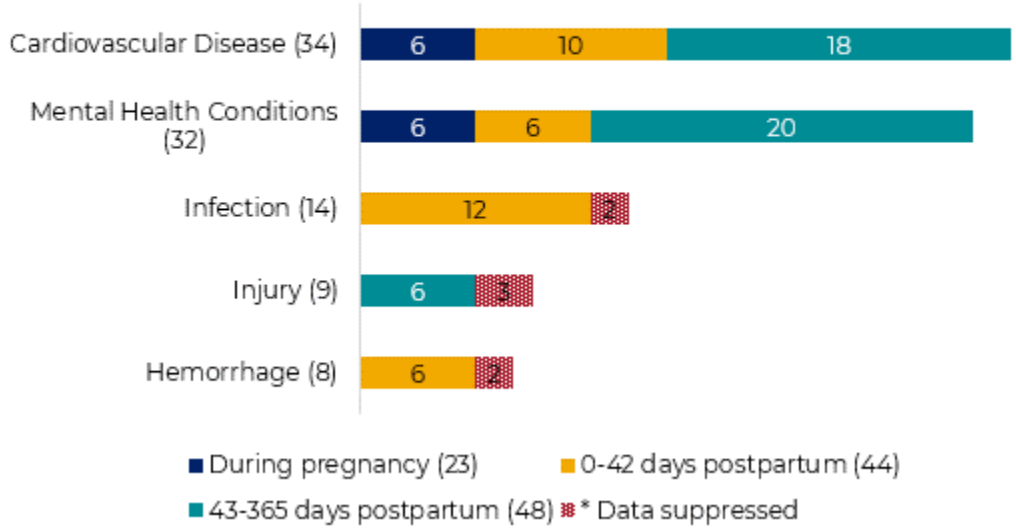
Table 4 providers a more detailed breakdown. Other causes of death which include embolism, cerebrovascular accident, conditions unique to pregnancy, gastrointestinal disorder and pulmonary conditions, were combined to meet reporting criteria.

Table 4: Disaggregating Pregnancy-related Causes of Death		
Cause of Death	Count	Percentage
Cardiovascular Disease	34	30%
Cardiomyopathy	15	13%
Hypertensive Disorders of Pregnancy	8	7%
Other Cardiovascular Disease	11	10%
Mental Health Conditions	32	28%

Depressive and Anxiety Disorder	17	15%
Substance Use Disorder	15	13%
Infection	14	12%
COVID-19	6	5%
Other Infection (sepsis, pneumonia, chorioamnionitis, postpartum genital tract infections)	8	7%
Other Causes (Embolism, Cerebrovascular Accident, Conditions Unique to Pregnancy, Gastrointestinal Disorder, Pulmonary Condition.)	10	9%
Injury (Homicide)	9	8%
Amniotic Fluid Embolism	8	7%
Hemorrhage	8	7%

Figure 19 shows the timing of pregnancy-related deaths by underlying causes of death.[ix] The most common cause overall was cardiovascular disease (34). However, between 0 and 42 days postpartum, the most common cause of pregnancy-related death was infection (12). Between 43 and 365 days postpartum, the most common cause of pregnancy-related death was mental health conditions including SUD.

Figure 19: Timing of Leading Underlying Causes of Pregnancy-Related Deaths, 2017-2021



DHSS is not able to report the full disaggregation of the causes of death by timing due to small numbers. A more detailed analysis by race/ethnicity and insurance type is provided in tables 5 and 6.[Ω]

Table 5: Cause of Death Disaggregated by Race/Ethnicity				
Cause	White	Black	Hispanic	Other^
Cardiovascular Disease	19	14	X	X
Mental Health Condition	23	6	X	X
Infection	8	X	X	X
Injury (Homicide)	X	6	X	X
Amniotic Fluid Embolism	7	X	X	X
Other Causes (Hemorrhage, Embolism, Cerebrovascular Accident, Conditions Unique to Pregnancy, Gastrointestinal Disorder, Pulmonary Condition.)	10	6	X	X
"X" = data suppressed for confidentiality (count ≤5). ^Other includes Asian, Native Hawaiian, Pacific Islander, American Indian, Alaska Native and multiracial.				

Table 6: Cause of Death Disaggregated by Insurance Type			
Cause	Private	Medicaid	Self-Pay/Other
Cardiovascular Disease	9	19	X
Mental Health Condition	10	19	X
Infection	6	6	X
Injury (Homicide)	X	X	X
Amniotic Fluid Embolism	X	X	X
Other Causes (Hemorrhage, Embolism, Cerebrovascular Accident, Conditions Unique to Pregnancy, Gastrointestinal Disorder, Pulmonary Condition.)	X	12	X
"X" = data suppressed for confidentiality (count ≤5).			

After identifying causes, the PAMR Board provides recommendations for action based on the leading causes of pregnancy-related deaths and contributing factors. The board utilizes the committee decisions form (Appendix B) to develop recommendations. Contributing factors can occur at one of five levels: patient/family, provider, facility, community and system (Appendix C). The board seeks to identify a range of recommendations to address multiple levels, types of prevention, and expected impacts. To better understand the discussion going forward, it is important to know that contributing factors that occur at one level may have solutions that can be implemented at another level.

Cardiovascular Disease

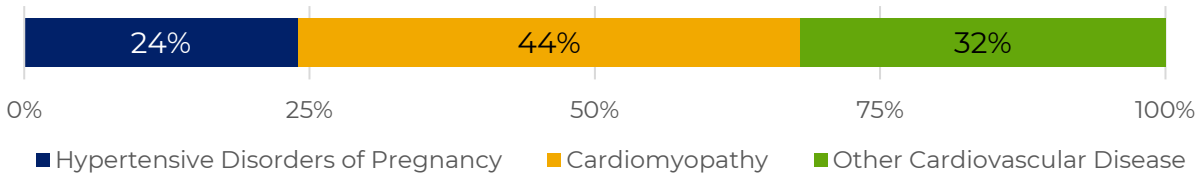
Cardiovascular disease was the **leading** cause of pregnancy-related death from 2017-2021 and refers to disorders of the cardiovascular system such as cardiomyopathies, hypertensive disorders, and other cardiovascular conditions such as myocardial infarction or arrhythmias.

- **Almost half** (44%) were from **cardiomyopathy.** This was more than any other single cardiovascular condition (Fig. 20).
- **85%** of these cases resided in **metropolitan counties.**
- **58%** of these cases were covered by **MO HealthNet.**
- **55%** of these cases began prenatal care in the **first trimester.**

Frequent social and emotional stressors that appeared, as well as potential touchpoints for intervention:

  - **44%** of these cases noted **unemployment.**
  - **38%** of these cases noted a history of **substance use.**

Figure 20: Breakdown of Pregnancy-Related Deaths due to Cardiovascular Disease, 2017-2021



Recommendations for Cardiovascular Disease

Provider Recommendations:

All perinatal patients with elevated blood pressure should check their blood pressure daily throughout pregnancy and report results to their physician.
All providers should refer patients with a cardiac condition to a cardiologist and ensure a warm handoff.
Providers (especially emergency room physicians) must obtain further education on cardiovascular conditions in obstetric patients to include physiologic changes during and after pregnancy, evaluation and management up to one year after completion of the pregnancy.
All providers should assess their perinatal patient's health literacy and incorporate appropriate teaching methods and supportive care for acute and chronic conditions to promote continued health improvement with consideration of the patient's personal goals.
All providers should utilize a standardized cardiac risk assessment tool (such as California Maternal Quality Care Collaborative) for every obstetric patient based on risk factors and presenting symptoms.

Facility Recommendations:

Hospitals should standardize practices and procedures across the health care system through https://mopqc.org/missouri-pqc-initiatives such as Alliance for Innovation on Maternal Health (AIM) patient safety bundles for Severe Hypertension in Pregnancy and Cardiac Conditions in Obstetric Care (CCOC).

Community Recommendations:

Community-based organizations, in partnership with providers, should educate their community on signs and symptoms of cardiovascular disease in obstetric patients by using tools such as the AWHONN Post Birth Warning Signs.

System Recommendations:

The Missouri legislature should extend and fund Medicaid to one year postpartum for all conditions to aid women whose condition is exacerbated in the postpartum period.

	Insurance companies should expand covered services and equipment to manage and monitor cardiovascular conditions (i.e., home health and home blood pressure monitors).
	State and local government bodies should partner with CBOs to implement obesity prevention strategies such as advocating for workplace policies that increase physical activity, increasing access to playgrounds and bike paths, zoning that limits fast food establishments, facilitating the situating of supermarkets in underserved neighborhoods, increase access to farmers markets and community gardens, testing for lead exposure.

Mental Health Conditions

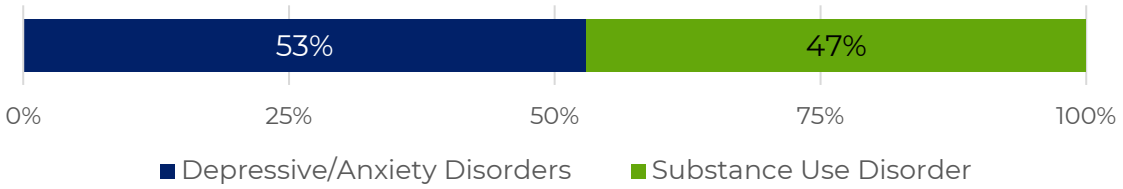
Overall, mental health conditions, including depressive, anxiety and substance use disorders, were the **second most common** underlying cause of death for pregnancy-related cases from 2017-2021.

- **More than half** (53%) of these cases were due to **depressive/anxiety disorders** (Fig. 21).
- **72%** of these cases were **Non-Hispanic white women**.
- **75%** of these cases resided in **metropolitan counties.**
- **59%** of these cases were covered by **MO HealthNet.**
- **62%** of these cases began prenatal care in the **first trimester.**
- **91%** of poisoning/overdose deaths involved **polysubstance use.**
    - Toxicology screens identified **opioids** (72%) including fentanyl, morphine, oxycodone and others as the most common drug class, followed by **stimulants** (36%), specifically amphetamines and methamphetamines and then **benzodiazepines** (28%). Because more than one substance could be in each screening, the percentages add up to more than 100%.

Frequent social and emotional stressors that appeared, as well as potential touchpoints for intervention:

- **63%** of these cases noted a history of **substance use.**
- **41%** noted **unemployment.**
- **38%** had involvement with **child protective services.**

Figure 21: Breakdown of Pregnancy-Related Deaths due to Mental Health Conditions, 2017-2021



Recommendations for Mental Health Conditions

The PAMR Board placed particular emphasis on early intervention and coordinating care with social workers and community health workers through warm referrals or a transfer of care between members of the health care team. Ideally, this would occur within the same clinic setting. However, noting the limitations of that strategy, another option is to ensure women have a scheduled appointment with the referral agency before leaving the appointment. The PAMR Board included all providers in this recommendation because providers other than obstetricians, like pediatricians and emergency department physicians, encounter pregnant and postpartum women.

Provider Recommendations:

All providers should utilize validated screening tools to perform a full assessment for depression, anxiety and SUD and make warm referrals to mental health professionals, community health workers and SUD treatment programs.
All providers should obtain further education on the treatment of mental health conditions, including SUD during and after pregnancy.
All providers should provide pregnant and postpartum women with education regarding the signs, symptoms, and risks of postpartum depression and resources/numbers to obtain help.
All health care workers (physicians, nurses, doulas, etc.) should complete trainings on trauma-informed care at least annually. Additionally, health care workers should gain clinical experience working with individuals disproportionately affected. Some examples may include patient-family advisors, community listening sessions, shadowing colleagues at facilities different than yours, etc.

Community Recommendations:

Community-based organizations should expand resources and education to their community on maternal mental health and SUD to reduce stigma.

System Recommendations:

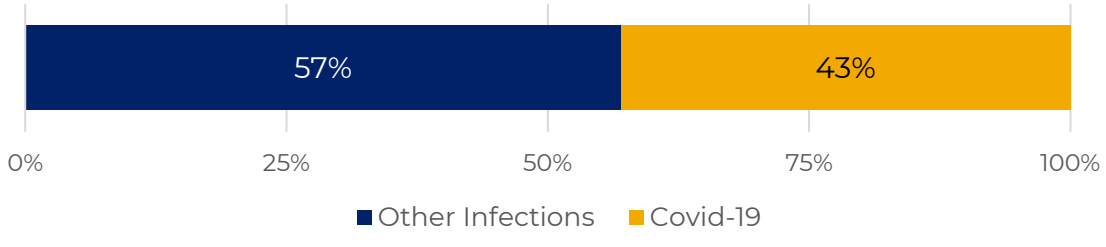
The State of Missouri should establish a state-wide perinatal consult center (telehealth) for providers regarding SUD and mental health conditions.

Infection

Infection was the **third most common** underlying cause of pregnancy-related death from 2017-2021 and includes COVID-19, sepsis, pneumonia, chorioamnionitis and postpartum genital tract infections. Pregnancy-related deaths where infection was the underlying cause spiked in 2021 due to COVID-19. The dominant variant circulating during the time of these deaths was Delta.

- The **greatest** proportion (43%) of deaths from infection was due to **COVID-19** (Fig. 22). Other infections include sepsis, pneumonia, chorioamnionitis, and postpartum genital tract infections, none of which individually met the reporting threshold.Ω
    - The **majority** of women who died from COVID-19 among the cases reviewed were **unvaccinated.**
- In the **majority** of these cases, obesity **contributed** to their death.
- **86%** of these cases occurred between **0 and 42 days postpartum.**
- **71%** of these cases resided in **metropolitan counties.**
- **86%** of these cases were **preventable.**

Figure 22: Breakdown of Pregnancy-Related Deaths due to Infection, 2017-2021



Recommendations for Infection

Provider Recommendations:

Providers should counsel patients about the American College of Obstetricians and Gynecologists (ACOG) recommendation that pregnant women, or those planning to become pregnant, should be vaccinated against COVID-19. Providers should discuss the complications of infections during and after pregnancy with their patients.

Providers should receive further education on the cardiorespiratory physiologic changes in pregnancy and the implications for clinical management in the setting of acute infectious etiologies. This includes prescribing antivirals and other medications as indicated, having a protocol in the emergency room to follow and setting up close follow up for patient monitoring.

Facility Recommendations:

Hospitals should standardize practices and procedures across the health care system through utilization of evidence-based practices such as the AIM bundle for Sepsis in Obstetric Care.

Emergency departments should establish protocols in alignment with ACOG guidelines for pregnant women who come in for treatment with COVID-19.

Injury (Homicide)

All pregnancy-related injury deaths were the result of homicide and were the fourth leading cause of death. This represents 8% of all pregnancy-related deaths.

- The **most common** means of fatal injury in these cases was a **firearm** (67%).
- **67%** of these cases occurred between **43 days and one year postpartum.**
- **All** of these cases occurred in **metropolitan counties.**
- In **each** case, the perpetrator was a **current or former partner,** and **most** had a documented **history of IPV (intimate partner violence).**

Recommendations for Injury

Provider Recommendations:

Health care providers should screen all women for IPV and perform a risk assessment of firearms in the home if indicated.

Community Recommendations:

Community-based organizations should collaborate with health care facilities and providers to educate their community on DV and IPV and provide resources and assistance for women affected.

System Recommendations:

State agencies, in partnership with community partners, should implement community violence intervention (CVI) programs with a focus on reducing homicides to pregnant and postpartum women.

Other Recommendations:

In the absence of social support, OB providers should connect perinatal patients with doula services.

Improving safety for pregnant and postpartum women will require a multi-level and multi-disciplinary approach. **Medical providers can intervene early using innovative strategies, such as offering a way to indicate IPV on a urine sample cup for safely communicating beyond standard screenings.** The theme that emerged most frequently from the board's recommendations for pregnancy-related deaths due to injury was educational outreach, specifically regarding resources that are available to victims, abusers and families dealing with IPV.

Communities can also create awareness of the problem. However, it is imperative to understand the difference between awareness and prevention. Awareness activities, such as one-time events or education sessions, will not change the beliefs, attitudes or behaviors required to prevent violence. Yet, without a basic understanding of the nature and dynamics of IPV, a community may not have the context to do actual prevention work alone.

Institutional and community awareness of the issue is needed, as it is the first step to understanding the concept of prevention. Thus, awareness is necessary but not sufficient to achieve societal change. Awareness must mobilize the community to take action and engage in prevention efforts to bring societal change. Comprehensive primary prevention programming can foster that change.[x]

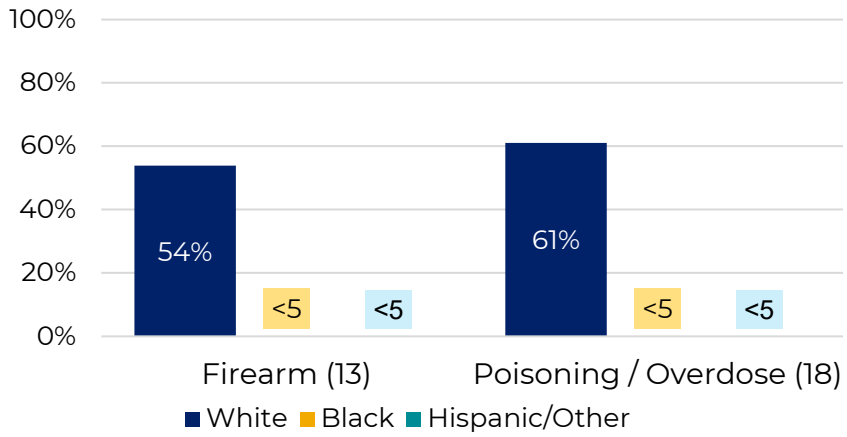
Means of Pregnancy-Related Death

All accidental deaths, homicides and suicides are further evaluated to determine the cause of the injury that led to their death. This is referred to as the means of fatal injury. Means of fatal injury includes categories such as poisoning/overdose, firearm, motor vehicle, explosives, strangulation, etc. See Appendix A.

For pregnancy-related deaths overall, the most common means (method) of fatal injury was overdose/poisoning (16%), closely followed by firearms (11%) (Fig. 23). Of note, the majority of pregnancy-related injury deaths occurred after six weeks postpartum.

- **Firearms** were the **leading** means of fatal injury for pregnancy-related homicides (67%) and suicides (44%).
- **77%** of firearm deaths among cases reviewed occurred in **metropolitan counties.**
- **Firearms** were the means of fatal injury for **one in ten** (11%) pregnancy-related deaths.

Figure 23: PAMR-Determined Pregnancy-Related Means of Fatal Injury by Race/Ethnicity, 2017-2021



Manner of Pregnancy-Related Death

Manner of death, or how the death occurred, is determined by the PAMR Board and may include homicide, suicide or accidental death such as motor vehicle accidents (see appendix A).

Homicides

All data regarding homicides is included in the causes of death-injury section of the report.

Suicides

Suicides represented 14% of pregnancy-related cases. Cases the PAMR Board determined were "probably" suicide were classified as suicide for this report. Deaths the board answered "unable to determine" regarding suicidality were treated as not suicides.

All providers should perform a **risk assessment for firearms** in the home and provide education on safe firearm storage.

- Of these cases, the **most common** (**44%**) means of fatal injury was a **firearm.**
- **63%** of these cases occurred between **43 days to one year postpartum.**
- **94%** of these cases were to **white** women.
- **69%** of these cases resided in **metropolitan counties.**
- **77%** of these cases initiated prenatal care in the **first trimester.**

Secondary Underlying Cause of Death

There are instances where the PAMR Board identifies a secondary underlying cause of death for pregnancy-related deaths. Forty-two of the 115 pregnancy-related cases had a secondary underlying cause of death. Mental health conditions including SUD were the most common secondary cause of death (26%), closely followed by cardiovascular disease (24%) and infection (24%).

COVID-19 was the cause of death for 2 out of 3 pregnancy-related deaths due to infection in 2021.

Differences in 2021

In 2021, pregnancy-related deaths saw a spike in deaths due to infection (9) and amniotic fluid embolism (AFE)(6). This made up 64% of all pregnancy-related deaths due to infection and 75% of all pregnancy-related deaths due to AFE from 2017 to 2021. COVID-19 was the cause of death for 2 out of 3 pregnancy-related deaths due to infection in 2021.

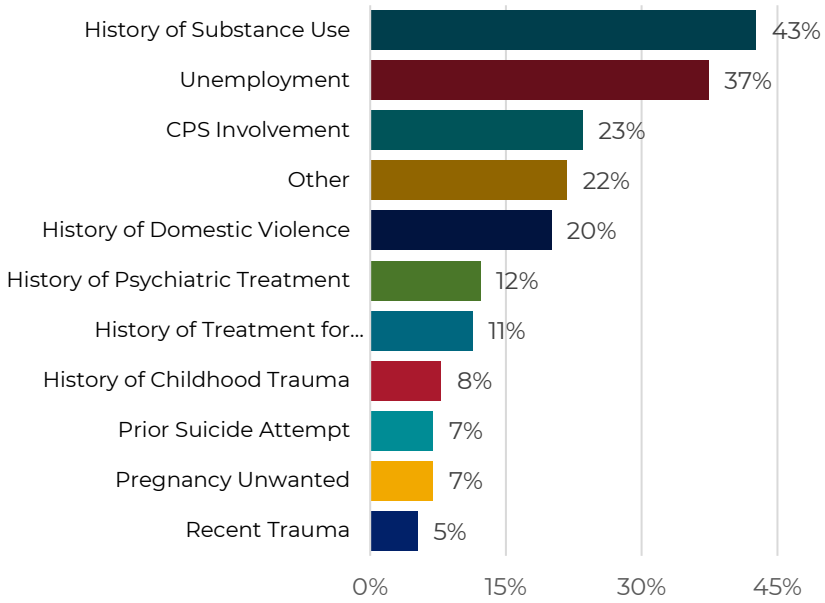
Social and Emotional Stressors

The PAMR Board looks at factors in one's course of life, such as social and emotional stressors, that add context to a pregnancy-related death. Beyond the demographic analyses reported above, women whose deaths were pregnancy-related had documentation in the records obtained of undergoing social and emotional distress (Fig. 24).

- **More than four in ten** (43%) had a history of substance use (alcohol, opioids, marijuana, etc.), but only about **one in ten** (11%) had a history of **treatment** for substance use.
- **37%** had experienced **unemployment.**
- **23%** had involvement with **Child Protective Services (CPS).**
- **20%** had a documented history of **IPV.**

The PAMR Board acknowledges that some of these indicators are likely underreported for various reasons and/or not available in medical records. The board seeks to better understand all social influencers of health for future maternal mortality prevention efforts.

Figure 24: Pregnancy-Related Social and Emotional Stressors, 2017-2021



Circumstances Surrounding Death

The PAMR Board evaluates four additional circumstances contributing to a pregnancy-related death. These are mental health conditions other than SUD, SUD, obesity and discrimination. Additionally, the board looks at other circumstances such as prenatal care utilization and smoking to better understand the complete picture of health.

Mental Health Conditions Other than SUD

In 2017-2021, mental health conditions other than SUD contributed to nearly one in three (32%) pregnancy-related deaths. This is slightly higher than the rate of one in five pregnant women who may be affected by depression, anxiety and other mental health conditions.[xi]

Although SUD is a mental health condition, it is important to capture data when mental health conditions other than SUD, such as postpartum depression or anxiety, contribute to a death.

- **54%** of these cases had been treated for **depression** before their most recent pregnancy.
  - During pregnancy, only **38%** of these cases were treated for depression.
  - After pregnancy, this number remained at **38%.**
- **35%** of these cases had been treated for an **anxiety disorder** before this pregnancy.
  - During pregnancy, **only 32%** of these cases were treated for anxiety.
  - After pregnancy, this number **decreased** again to **22%** of cases being treated for anxiety.
- **76%** of these cases were women residing in **metropolitan counties.**
- **56%** of these cases initiated prenatal care in the **first trimester.**
- **59%** of these cases were covered by **MO HealthNet.**

Substance Use Disorder

Substance use contributed to **31%** of pregnancy-related deaths. Substances used include opiates, alcohol and other substances. Although documentation of substance use was often present in the medical record without a formal diagnosis of a substance use disorder, there was sufficient evidence for the PAMR Board to confidently say a substance use disorder was present.

Only 1 in 3 had a history of substance use treatment.

- **81%** of these cases resided in **metropolitan counties.**
- **75%** of these cases were covered by **MO HealthNet.**

Frequent social and emotional stressors that appeared, as well as potential touchpoints for intervention:

- **Only 31%** had a history of substance use **treatment.**
- **53%** experienced **unemployment.**
- **56%** had involvement with **Child Protective Services.**

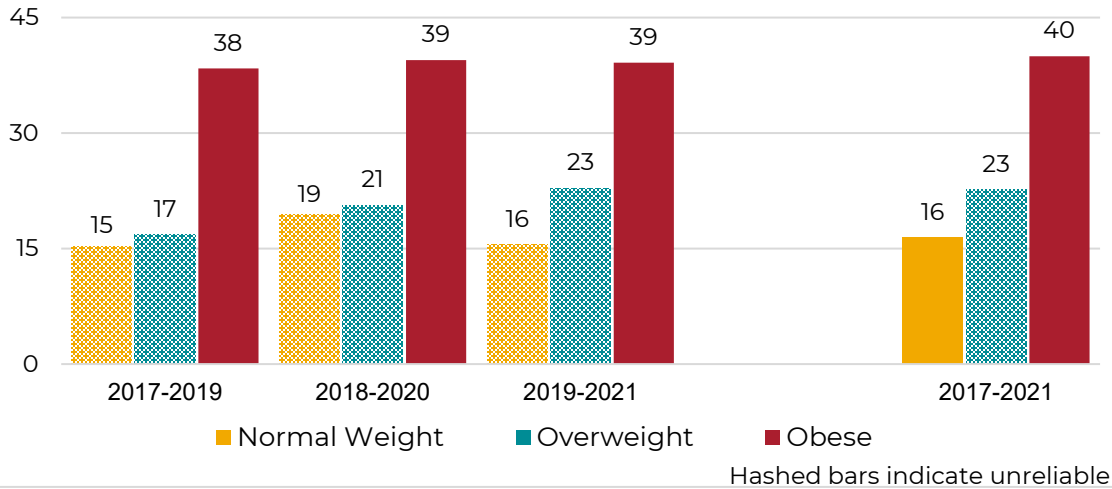
Obesity

The board similarly evaluates obesity, defined as a pre-pregnancy BMI of 30 or above. Obesity continues to be a public health concern across the country and is a high-risk factor for both maternal mortality and SMM.[xii] The finding that obesity was not a contributing factor does not mean the person who died was not obese. In addition to increased complications during pregnancy, the ratio of pregnancy-related deaths for women with obesity is significantly higher than for any other weight group (Fig. 25).

- The PRMR was **higher** among women who were **obese and overweight.**
- The ratio for obese women was **2.5 times** that of women of healthy weight.[xiii]
- The underweight category failed to meet the reporting criteria of greater than 5 cases at all points.

Obesity played a direct role in **1 in 6** (17%) pregnancy-related deaths.

Figure 25: Pregnancy-Related Mortality Ratio per 100,000 Live Births by BMI, 2017-2021



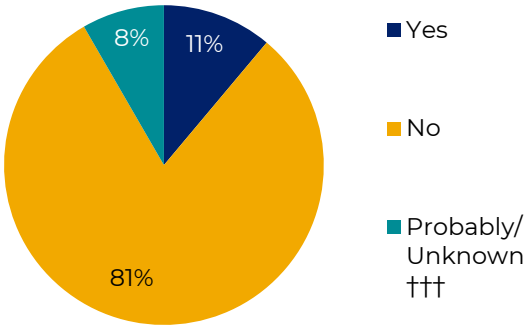
- **Obesity contributed** to **one in six** (17%) pregnancy-related deaths.
  - **79%** of these cases lived in **metropolitan counties.**

- **56%** of these cases were covered by **MO HealthNet.**
- **61%** of these cases initiated prenatal care in the **first trimester.**
- **37%** of these cases experienced **unemployment.**

Discrimination

The board considered discrimination due to age, ability, race, class, social economics, stigmatizing language and other variables. This is the first year the board had three years of aggregate data (2019-2021) to make determinations regarding discrimination.

Figure 26: Pregnancy-Related Deaths and Discrimination, 2019-2021



The board determined discrimination contributed to 1 in 9 (11%) pregnancy-related deaths (Fig. 26). The population size limits further analysis of these deaths; however, examples where the board determined discrimination contributed to the death are provided below.[xiv]

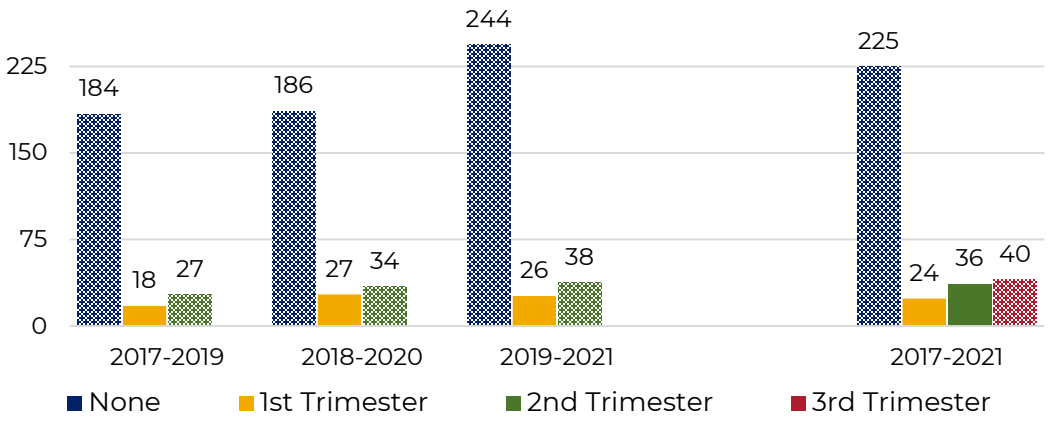
Examples:

1. The patient was noted as having “meth mouth” in medical records resulting in numerous urine drug screens, all of which were negative. There was no history of substance use or other indication to justify these actions.
2. Physician notes indicated assumptions about the patient’s adherence to treatment. “[The patient] likely isn’t taking medication as prescribed.” There was no documentation of discussion regarding barriers to accessing medication. Instead, it was just an assumed non-compliance issue.
3. There were instances where patients with careers in the medical field lacked screening, evaluation and treatment despite repeatedly notifying their providers of concerns. Despite being in the medical field, they received care that was below the standard of care. Despite one’s educational background, all patients should be screened, referred and managed according to standards of care.

4. Documentation from one emergency department (ED) visit indicated a patient presented earlier to another ED and the patient "heard hospital staff making fun of her."
5. Notes from a mental health provider indicated "medication not prescribed due to pregnancy." Medications that are compatible with pregnancy were available for this patient. This is an example of undertreatment and discrimination due to pregnancy.
6. The patient had multiple "no-show" appointments. There was no indication from a physician that a discussion took place with the patient to understand difficulties attending appointments, or if the patient even understood why additional specialist appointments were scheduled.

Prenatal Care

Figure 27: Pregnancy-Related Mortality Ratio per 100,000 Live Births by Prenatal Care Initiation



- The PRMR for women with **no prenatal care** was **9.5 times higher** than for those who initiated prenatal care in the first trimester (Fig. 27). This disparity was found to be statistically significant.
- For 72% of all live births in Missouri from 2017-2021, prenatal care began in the first trimester, compared with only 54% of pregnancy-related deaths.

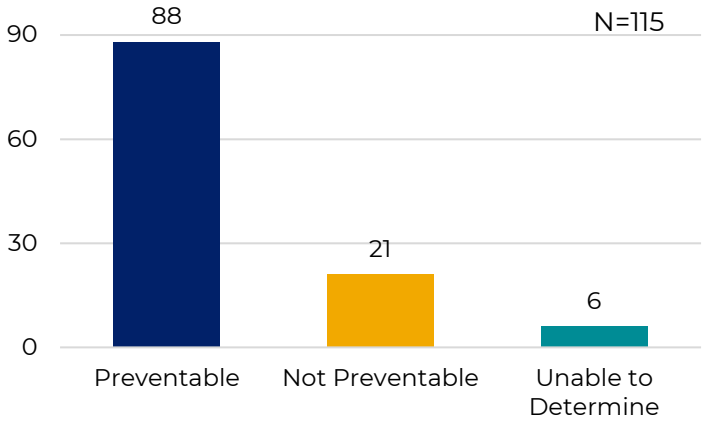
Tobacco Use

While tobacco use may not have been a direct contributor to death, the negative health impacts of smoking on a person are well-documented. As such, the PAMR program began tracking tobacco use in 2018 regardless of whether it contributed to the death. From 2018-2021:

- In **47%** of pregnancy-related deaths, the decedents were noted to have **currently or previously used tobacco.**
- In **54%** of pregnancy-associated deaths, the decedents were noted to have **currently or previously used tobacco.**

Preventability

Figure 28: Preventability of Pregnancy-Related Deaths, 2017-2021

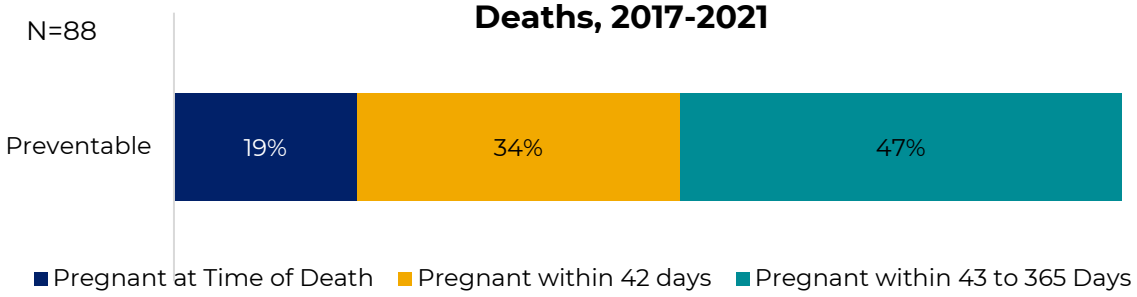


The PAMR Board evaluated if a pregnancy-related death was preventable and then made recommendations to prevent future events. **The board determined that 77% of pregnancy-related deaths were preventable** (Fig. 28). Preventability encompasses a variety of situations that could have altered the outcome, including missed opportunities for screening during prior health care encounters, referral to a higher level of care, specialist consultation, intervention by family or friends and individual knowledge of warning signs. Preventable pregnancy-related deaths varied by cause of death. The PAMR Board determined:

- **All** deaths due to **mental health conditions, including SUD** were **preventable.**
- **Most** deaths due to remaining causes were **preventable.**

Figure 29 shows the timing of preventable pregnancy-related deaths, the greatest proportion (47%) occurred between 43 days and one year postpartum. Although the majority of preventable pregnancy-related deaths occurred postpartum, early identification and timely treatment are an essential component of preventing the progression of diseases. Pregnancy-related deaths where the board determined there was no chance of preventability were most commonly due to cardiovascular disease (8), followed by amniotic fluid embolism (7).

Figure 29: Timing of Preventable Pregnancy-Related Deaths, 2017-2021



Looking at where these deaths occurred, from 2017-2021, more than half (61%) of pregnancy-related deaths occurred within a hospital. Fifty-two (74%) were inpatient and 18 were outpatient/ED. Sixty-five percent of inpatient deaths and 83% of outpatient/ER deaths were considered preventable. A further 28 pregnancy-related deaths occurred at the decedent's home, 86% of which were determined to be preventable. It should be noted that this only indicates where a death occurred, which is not necessarily where the underlying event occurred.

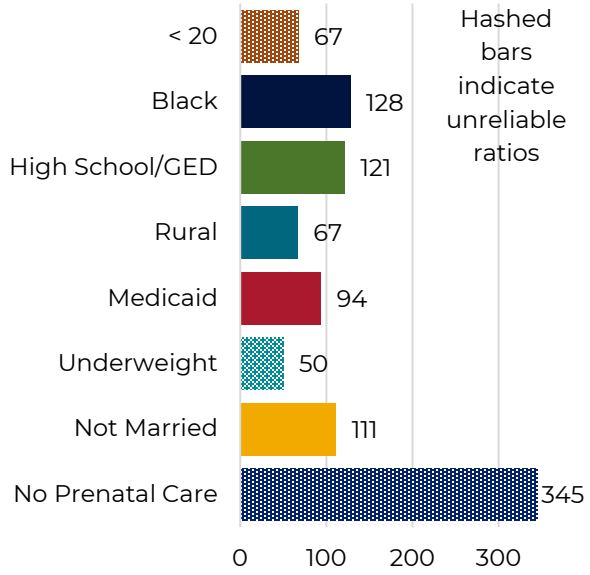
Insights from Pregnancy-Associated, Not Related Deaths

While prevention of pregnancy-related death is the primary focus of the PAMR program, there are also excellent insights to be gained from PANR deaths. These cases are not assessed for preventability, but the PAMR Board does evaluate these deaths for means of fatal injury and contributing factors to make recommendations that may prevent similar deaths in the future. **The leading means of fatal injury was poisoning/overdoses (42%), followed by motor vehicle collisions (MVC) at 38%.**

PANR Disparities

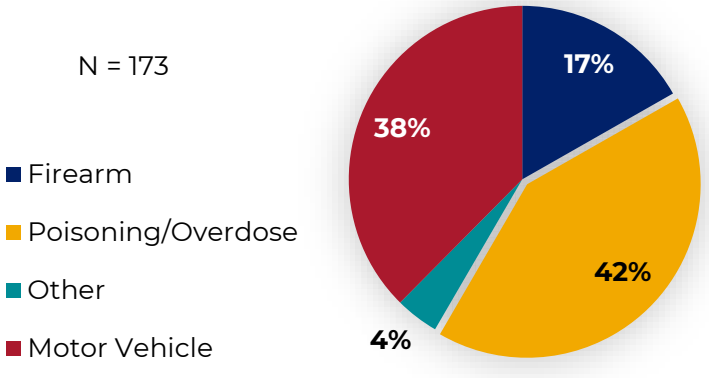
As with pregnancy-related deaths, there are demographic differences in the ratios of PANR deaths. Figure 30 provides a demographic breakdown of those groups with the highest ratio of PANR deaths.

Figure 30: Highest Ratios of PANR Death per 100,000 Live Births, 2017-2021



- Black women had a ratio (128) that was 3 times greater than white women.)
- Those with a high school diploma or GED had a ratio that was more than 6 times the ratio for those with more than a high school diploma or GED.
- The ratio for those who were covered by MO HealthNet was more than 7 times the ratio of those with private insurance.
- The ratio for those who had no prenatal care was nearly 10 times the ratio of those who began prenatal care in the first trimester.

Figure 31: PANR Means of Injury, 2017-2021



The majority of PANR deaths due to injury (69%), including firearms , MVCs and overdoses, occurred between 43 days and one year postpartum. However, 32% of PANR deaths due to MVC occurred during pregnancy. Figure 31 further breaks down the means of injury for PANR deaths. “Other” means of fatal injury includes sharp instrument, strangulation/hanging, falling, drowning and burns.

Poisoning/Overdose

As overdoses were the most common means of accidental injury deaths, further analysis was warranted.

- 64% of these cases were to white women.
- 63% of these cases were between 20 and 29 years old.
- 78% of these cases resided in metropolitan counties.

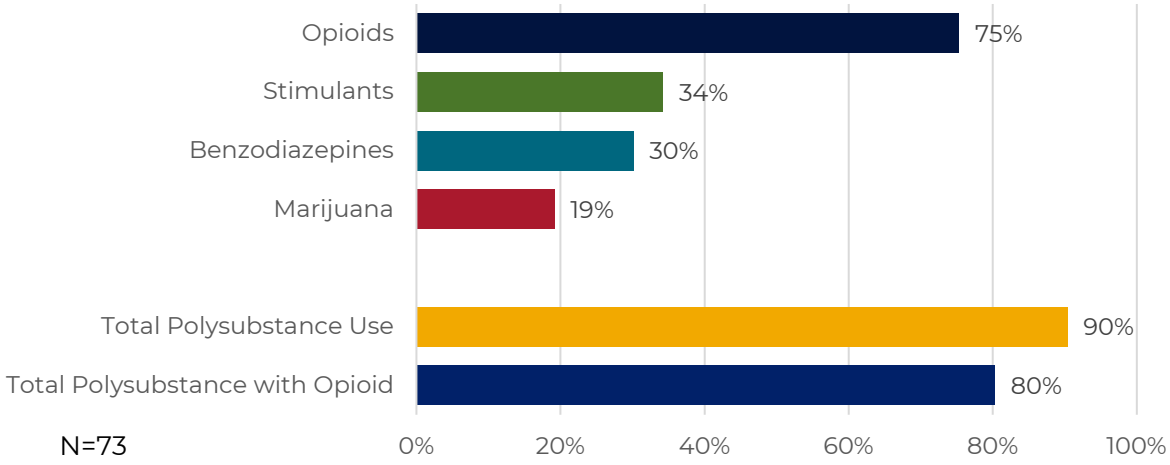
- 63% of these cases were covered by MO HealthNet.

Frequent social and emotional stressors appeared, as well as potential touchpoints for intervention:

- More than **4 in 5 (82%)** of these cases had a history of substance use, but **less than 1 in 3** had a history of substance use **treatment.**
- 25% had a history of psychiatric hospitalization or treatment.
- 11% had a prior suicide attempt.
- 21% had a history of IPV.
- 47% had a history of unemployment.

The records obtained provided information regarding the types of substances in toxicology results. **The most common drug class identified in toxicology screens was opioids (75%)**, which comprised a variety of drugs, including fentanyl, morphine, oxycodone and others. This was followed by **stimulants** (34%), specifically amphetamines and methamphetamines and then **benzodiazepines** (30%). Marijuana appeared in 19% of these cases (Fig. 32). **The majority of poisoning/overdose deaths (90%) involved polysubstance use.** Opioids were detected in 80% of poisoning/overdose deaths involving multiple substances.

Figure 32: Substances found in Pregnancy-Associated, Not Related Overdose/Poisoning Deaths, 2017-2021



Motor Vehicle Crashes

MVCs were the second most frequent means of accidental death. Additional analysis indicated:

- More than **one in two** (54%) of these cases were **not** buckled up (excluding pedestrians hit by vehicles and motorcycles).
- 33% of these cases occurred during pregnancy.
- 52% of these cases were non-Hispanic white.
- 53% of these cases initiated prenatal care during the first trimester.
- 57% of these cases were covered by MO HealthNet.
- 66% of these cases were women aged 20-29 years old.
- 66% of these cases resided in metropolitan counties.
- 2019 had the lowest number of fatalities due to MVCs overall (7).

Firearm

Firearm was the third most frequent means of death. Additional analysis indicated:

- 23% of these cases had a history of IPV.[xv]
- 75% of these cases were between 20 and 29 years old.
- 67% of these cases were Black women.
- 67% were covered by MO HealthNet.
- 92% occurred in metropolitan counties.
- For homicides, the perpetrator's relationship to the decedent was unknown for the greatest proportion (44%) of cases.

Frequent social and emotional stressors that appeared, as well as potential touchpoints for intervention:

  - 33% had a history of unemployment.
  - 43% had a history of substance use.

Recommendations

In addition to the above recommendations regarding pregnancy-related deaths, the PAMR Board recommended the following:

Mental Health Conditions, Including SUD

Provider Recommendations:

- All providers should perform validated depression, anxiety and SUD screenings at multiple intervals throughout pregnancy and the postpartum period, making referrals to mental health providers and for psychosocial support services, as appropriate.
- All providers should ensure pregnant and postpartum patients at increased risk for opioid overdose are provided with naloxone.
- All providers should utilize the Screening, Brief Intervention, Referral and Treatment (SBIRT) process throughout the prenatal and postpartum period up to one year postpartum.
- Providers should educate themselves annually through professional journals, webinars, conferences, etc., on screening, referral and treatment of mental health conditions, SUD, cardiovascular disorders associated with pregnancy (i.e., cardiomyopathy, hypertension, etc.) and trauma-informed care.

Facility Recommendations:

- Hospitals should standardize practices and procedures across the health care system through utilization of quality improvement practices such as the AIM patient safety bundle for Perinatal Mental Health Conditions.
- Health care facilities should utilize social workers and community health workers to increase continuity of care for referrals, follow-up care, communication and social determinants of health.
- The Missouri Behavioral Health Council should require Comprehensive Substance Treatment and Rehabilitation Programs (CSTAR) to accept all forms of insurances for pregnant and postpartum women by 2026.

System Recommendations:

- Local housing authorities should implement system-wide policies prioritizing housing for pregnant and postpartum people.
- The legislature should create separate non-punitive reporting pathways for perinatal patients seeking treatment for SUD that result in connecting the patient with social resources designed to increase the probability of sustained recovery.
- The Department of Mental Health should increase the number of perinatal SUD peer support specialists and mental health specialists by 2026.

Motor Vehicle Crashes

System Recommendations:

State agencies, health care providers, community-based organizations and families should increase public awareness of the importance of seat belt safety during the perinatal period.

The Missouri legislature should increase the seat belt violation fine from $10 to $60 by 2026.

The Missouri legislature should pass a state primary enforcement seat belt law that covers all occupants, regardless of where they are sitting in the vehicle, by 2026.

Firearm

System Recommendations:

State agencies, in partnership with community partners, should implement community violence intervention (CVI) programs with a focus on reducing homicides of pregnant and postpartum women.

Government agencies, in partnership with financial institutions and philanthropic funders, should invest in urban infrastructure (grocery stores, medical care access, banks and playgrounds) to increase maternal health outcomes and decrease violence.

The State of Missouri, in partnership with community partners, should invest in Early Childhood Comprehensive Systems (evidence-based home visiting, high quality childcare and Head Start, etc.) to reduce community violence.

Community Recommendations:

Community-based organizations should collaborate with health care facilities and providers to educate their community on domestic violence (DV) and intimate partner violence (IPV) and provide resources and assistance for women affected by IPV.

Other Recommendations:

During case reviews, the PAMR Board discussed recommendations and opportunities for strengthening systems and processes, even though these actions may not have prevented the specific death. These included:

Patients should present to early and consistent prenatal care for appropriate screenings and referrals.

The Missouri Department of Social Services should evaluate and improve the Medicaid Enrollment process and educate providers and consumers on coverage to encourage early entry into prenatal care.

	Health care facilities and providers should maintain standards of care regardless of surrounding circumstances.
	All providers should establish processes to perform follow-up phone calls if a patient does not present to scheduled visits always considering the social drivers of health.
	All medical death certifiers should ensure an autopsy and toxicology are completed on a woman who has been pregnant within the last year.
	Birthing hospitals should ensure that women are scheduled for a postpartum visit or other follow-up appointments prior to discharge, and providers should establish processes to perform follow-up phone calls if a client does not present to a follow-up visit (i.e. postpartum visit).
	Community-based organizations should provide outreach to educate women on preconception health and early and consistent prenatal care to optimize a woman's health.
	The State of Missouri should adopt a centralized medical record system.
	State and local government bodies should partner with CBOs to implement obesity prevention strategies such as advocating for workplace policies that increase physical activity, increasing access to playgrounds and bike paths, zoning that limits fast food establishments, facilitating the situation of supermarkets in underserved neighborhoods, increase access to farmers markets and community gardens, testing for lead exposure.

Implementation and Improvement

The PAMR program has continued to work toward the improvement of data gathering and dissemination through fostering partnerships and tools such as the PAMR data dashboard.

Summary of Major Accomplishments

The following timeline highlights major accomplishments from 2018 through 2023.

Timeline Details

2021

- Improved measurement of the actual ratio of maternal mortality in Missouri through determination of pregnancy-relatedness.
- Continued utilization of provisional vital statistics data to improve timeliness of case reviews (49% increase from baseline).
- Continued collaboration between internal and external partners on maternal mortality prevention efforts.
- Completed twenty dissemination activities on maternal mortality (an increase from 3 the previous year).
- PAMR data fueled Missouri's AIM work.
- Participated in CDC's national call for Maternal Mortality Review Information Application (MMRIA) data for conducting national maternal mortality aggregate data analysis.
- Participated in CDC's State Vitals and MMRIA Integration Pilot.

Timeline Details

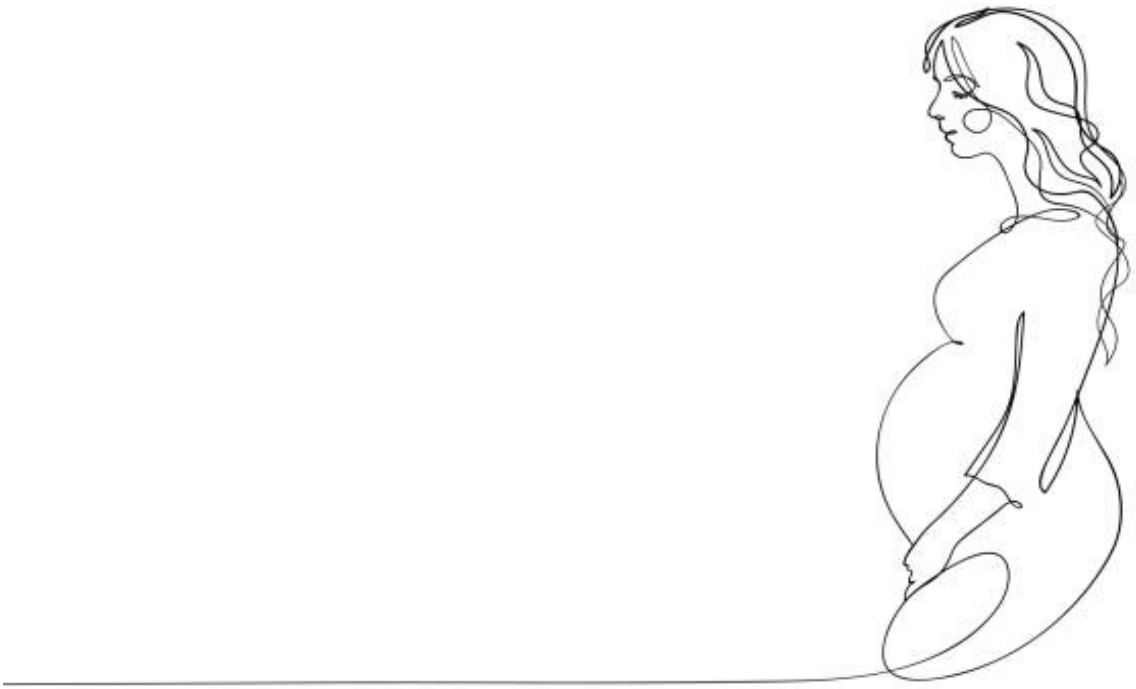
2022

- Published and disseminated second report on maternal mortality in the state. Improved focus on pregnancy-related deaths in annual maternal mortality report using more stable ratios due to aggregating data.
- Expanded PAMR case identification techniques to be more comprehensive and improve timeliness of case identification.
- Completed 44 dissemination activities on maternal mortality, including dissemination of an infographic through social media on Jan. 23 to mark Maternal Health Awareness Day.
- Presented a poster of PAMR data at PQC convention and presented at the annual Association of Maternal and Child Health Programs conference titled "Polysubstance Abuse: A Pervasive Threat to Maternal Health in Missouri."
- Shared aggregate PAMR data as part of CDC's Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017-2019 brief.
- Incorporated Community Vital Signs (CVS) indicator dashboard in PAMR case narratives and meetings. The CVS is a tool providing community and social-level contextual information in maternal mortality cases.
- Participated in Emory University's CVS Technical Assistance to increase actionable PAMR recommendations at the community-level.
- Developed and implemented five new maternal health programs. (See page 40, 2020 Annual Report, for more details.)
- Completed a statewide maternal mortality awareness campaign through radio and social media messaging.

Timeline Details

2023

- Published and disseminated third report on maternal mortality in the state.
- Maintained timely (99%) identification (within 12 months of death) of pregnancy-associated deaths.
- Maintained an active and multidisciplinary, diverse board.
- Created 27 different data products on burden and opportunities for prevention of pregnancy-related deaths.
- Completed 41 dissemination activities to the public, clinicians, and policy makers.
- Completed six engagements with organizations/agencies/community groups that serve or represent populations disproportionately affected by maternal mortality.
- Shared aggregate PAMR data as part of CDC's Pregnancy-Related Deaths: Data From Maternal Mortality Review Committees in 38 U.S. States, 2020 report.



Conclusion

Maternal mortality in the state of Missouri is exceptionally complex. It touches on the societal issues of health disparities, lack of access to care and the ongoing opioid epidemic. Seeking to understand this problem brings to light a variety of other concerns rooted in the systems intended to help. By addressing the issues the PAMR Board identified, the State seeks to decrease maternal mortality while simultaneously improving the health of women, particularly during the reproductive years and after.

With this goal in mind, the PAMR Board developed vital recommendations, which have the potential to reverse the trajectory of maternal mortality in Missouri, upon implementation. Moving forward, the PAMR Board will continue to review cases of maternal mortality and provide recommendations to eliminate preventable maternal mortality in the future.

Appendix A: Methodology

Distinguishing PAMR

The CDC oversees multiple programs that monitor maternal mortality. These programs offer valuable information at the national level regarding causes of death and associated risk factors. However, they are not able to evaluate contextual factors that contributed to individual deaths beyond data on the death certificate or to determine preventability. They also use a more narrow definition of what deaths are related to pregnancy.

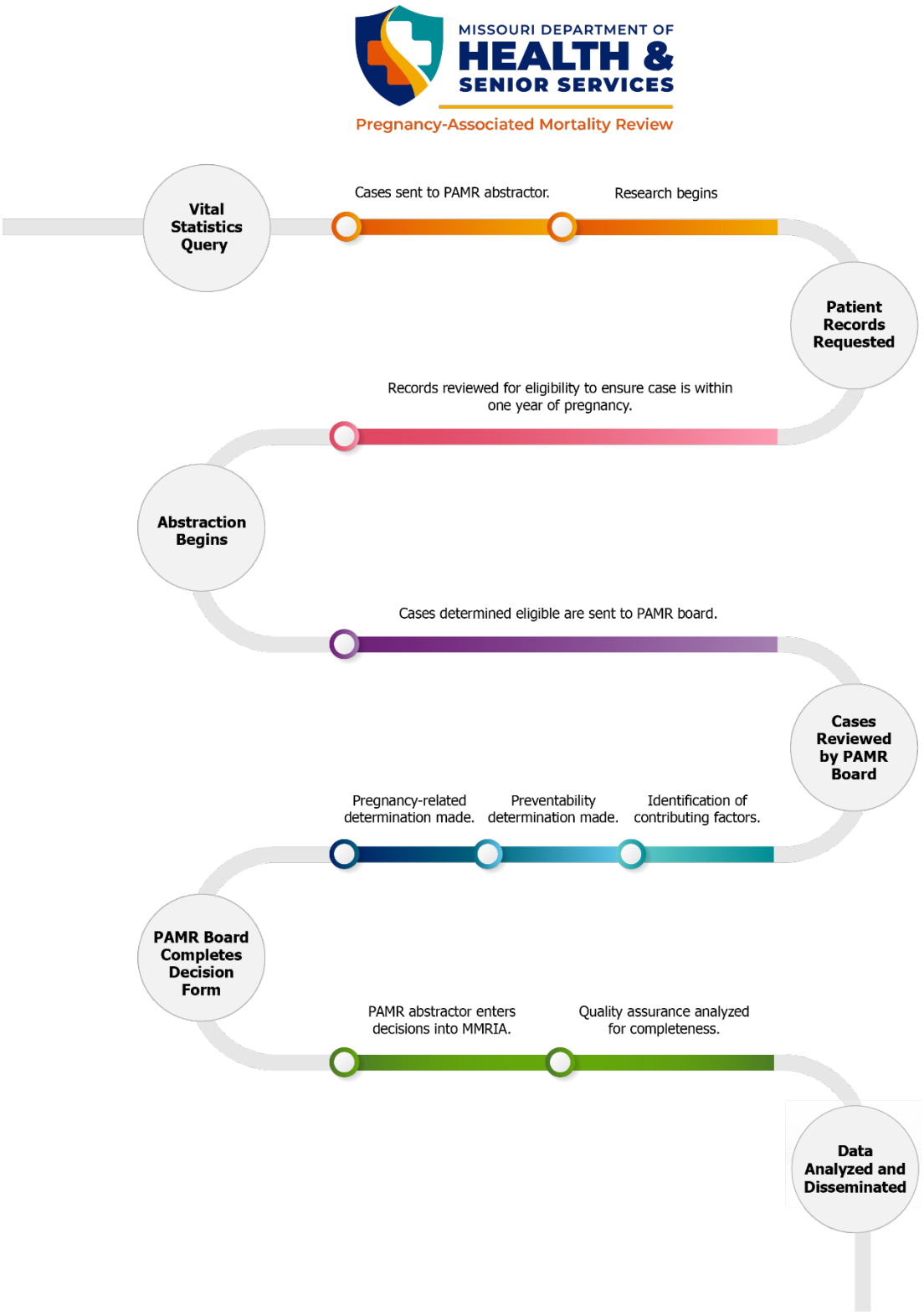
The PAMR program differs from these national programs because it functions as the state's Maternal Mortality Review Committee (MMRC). MMRCs operate using a standardized and comprehensive system to better understand the context and causes surrounding a woman's death. They assess if a death could have been prevented and make recommendations to help similar situations have better outcomes. While focused on the prevention of death, MMRCs also act to improve health and wellness throughout the reproductive life cycle.

PAMR Process

The Office of Epidemiology (OOE) identifies cases of maternal mortality for the PAMR program to investigate using vital records and hospital data through the Patient Abstract System (PAS). After OOE identifies cases, they pull information from the Bureau of Vital Records including the death certificate, birth certificate and fetal death information. The program supplements this data with data from the PAS, notating where and when identified cases interacted with the health care system to allow the program to request medical records.

Once cases have been identified and the data exported, they are forwarded to the PAMR abstractor for further investigation. This includes obtaining medical records, toxicology reports, news articles, social media postings and other data. The abstractor can further determine if a case was a false positive through the information they obtain, for instance, when a woman's medical records indicate they have had a hysterectomy. The data for deaths that were not deemed false positives is then used to create a summary of the events that led up to and ended in death. The summary is then given to the multi-disciplinary PAMR Board, who evaluate the case to determine pregnancy relatedness, as well as the contributing factors and preventability of a death. The PAMR Board also makes recommendations to help improve the outcome of similar situations in the future. See Figure 33 for a visual overview of the PAMR process.

Figure 33: Flow Chart of PAMR Program Process



Appendix B: Committee Decisions Form

MMRIA | MATERNAL MORTALITY REVIEW COMMITTEE DECISIONS FORM v23 | 1

REVIEW DATE

Month/Day/Year

RECORD ID #

PREGNANCY-RELATEDNESS: SELECT ONE

☐ PREGNANCY-RELATED
A death during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy

☐ PREGNANCY-ASSOCIATED, BUT NOT-RELATED
A death during pregnancy or within one year of the end of pregnancy from a cause that is not related to pregnancy

☐ PREGNANCY-ASSOCIATED BUT UNABLE TO DETERMINE PREGNANCY-RELATEDNESS

ESTIMATE THE DEGREE OF RELEVANT INFORMATION (RECORDS) AVAILABLE FOR THIS CASE:
These fields are for internal jurisdiction use to help evaluate opportunities to gain better access to information for reviews.

☐ COMPLETE
All records necessary for adequate review of the case were available

☐ SOMEWHAT COMPLETE
Major gaps (i.e., information that would have been crucial to the review of the case)

☐ MOSTLY COMPLETE
Minor gaps (i.e., information that would have been beneficial but was not essential to the review of the case)

☐ NOT COMPLETE
Minimal records available for review (i.e., death certificate and no additional records)

DOES THE COMMITTEE AGREE WITH THE UNDERLYING[1] CAUSE OF DEATH LISTED ON DEATH CERTIFICATE?
The underlying cause of death determination as documented by a multidisciplinary MMRC may be different from the underlying cause of death used by pathologists in producing official death certification documented in the Vital Statistics system.

☐ YES ☐ NO

COMMITTEE DETERMINATION OF CAUSE(S) OF DEATH

IF PREGNANCY-RELATED, COMMITTEE DETERMINATION OF UNDERLYING[1] CAUSE OF DEATH
Refer to Appendix A for PMSS-MM cause of death list.

If a death is pregnancy-associated, not related then an underlying cause of death entry is not necessary. Use optional box below.

TYPE	OPTIONAL: CAUSE (DESCRIPTIVE)
UNDERLYING[1,2]	
CONTRIBUTING[2,3]	
IMMEDIATE[3]	
OTHER SIGNIFICANT[3]	

COMMITTEE DETERMINATIONS ON CIRCUMSTANCES SURROUNDING DEATH[4]–

DID **OBESITY** CONTRIBUTE TO THE DEATH?	☐ YES	☐ PROBABLY	☐ NO	☐ UNKNOWN
DID **DISCRIMINATION**[5] CONTRIBUTE TO THE DEATH?	☐ YES	☐ PROBABLY	☐ NO	☐ UNKNOWN
DID **MENTAL HEALTH CONDITIONS** OTHER THAN SUBSTANCE USE DISORDER CONTRIBUTE TO THE DEATH?	☐ YES	☐ PROBABLY	☐ NO	☐ UNKNOWN
DID **SUBSTANCE USE DISORDER** CONTRIBUTE TO THE DEATH?	☐ YES	☐ PROBABLY	☐ NO	☐ UNKNOWN

MANNER OF DEATH

WAS THIS DEATH A SUICIDE?	☐ YES	☐ PROBABLY	☐ NO	☐ UNKNOWN
WAS THIS DEATH A HOMICIDE?	☐ YES	☐ PROBABLY	☐ NO	☐ UNKNOWN

IF ACCIDENTAL DEATH, HOMICIDE, OR SUICIDE, LIST THE **MEANS OF FATAL INJURY**	☐ FIREARM ☐ SHARP INSTRUMENT ☐ BLUNT INSTRUMENT ☐ POISONING/OVERDOSE ☐ HANGING/ STRANGULATION/ SUFFOCATION	☐ FALL ☐ PUNCHING/ KICKING/BEATING ☐ EXPLOSIVE ☐ DROWNING ☐ FIRE OR BURNS ☐ MOTOR VEHICLE	☐ INTENTIONAL NEGLECT ☐ OTHER, SPECIFY: ☐ UNKNOWN ☐ NOT APPLICABLE
IF HOMICIDE, WHAT WAS THE **RELATIONSHIP OF THE PERPETRATOR TO THE DECEDENT?**	☐ NO RELATIONSHIP ☐ PARTNER ☐ EX-PARTNER ☐ OTHER RELATIVE	☐ OTHER ☐ ACQUAINTANCE ☐ OTHER, SPECIFY:	☐ UNKNOWN ☐ NOT APPLICABLE

[1] Underlying cause refers to the disease or injury that initiated the chain of events leading to death or the circumstances of the accident or violence which produced the fatal injury.
[2] OPTIONAL field, CDC does not use this data.
[3] Add descriptions of contributors in the pathway between the immediate and underlying cause of death, as provided by the committee. Note that this is different from the contributing factors worksheet on page 2.
[4] If "Yes" or "Probably" is selected for preventable deaths, then an aligned contributing factor class and description would be expected in the grid on page 2.
[5] Encompasses Discrimination, Interpersonal Racism, and Structural Racism as described in Appendix B.

COMMITTEE DETERMINATION OF PREVENTABILITY

A death is considered preventable if the committee determines that there was at least some chance of the death being averted by one or more reasonable changes to patient, family, provider, facility, system and/or community factors.

WAS THIS DEATH PREVENTABLE?	☐ YES	☐ NO
CHANCE TO ALTER OUTCOME[6]	☐ GOOD CHANCE ☐ NO CHANCE	☐ SOME CHANCE ☐ UNABLE TO DETERMINE

CONTRIBUTING FACTORS AND RECOMMENDATIONS FOR ACTION (Entries may continue to grid on page 3)

CONTRIBUTING FACTORS WORKSHEET

What were the factors that contributed to this death? Multiple contributing factors may be present at each level: Choose one contributing factor per row until all contributing factors have been identified and described.

RECOMMENDATIONS OF THE COMMITTEE

If there was at least some chance that the death could have been averted, what were the specific and feasible actions that, if implemented or altered, might have changed the course of events? Develop one recommendation per row until all contributing factors have been addressed.

DESCRIPTION OF ISSUE (enter a description for EACH contributing factor listed)	CONTRIBUTING FACTOR (enter one per row; repeat as needed if a contributor has more than one recommendation)	LEVEL	COMMITTEE RECOMMENDATION [Who?] should [do what?] [when?] Map recommendations to contributing factors; repeat as needed if a recommendation has more than one contributor.	LEVEL	PREVENTION TYPE (choose below)	EXPECTED IMPACT (choose below)

CONTRIBUTING FACTOR KEY (DESCRIPTIONS IN APPENDIX B)

- Access/financial
- Adherence
- Assessment
- Chronic disease
- Clinical skill/quality of care
- Communication
- Continuity of care/care coordination
- Cultural/religious
- Delay
- Discrimination
- Environmental
- Equipment/technology
- Interpersonal racism
- Knowledge
- Law Enforcement
- Legal
- Mental health conditions
- Outreach
- Policies/procedures
- Referral
- Social support/ isolation
- Structural racism
- Substance use disorder - alcohol, illicit/prescription drugs
- Tobacco use
- Trauma
- Unstable housing
- Violence
- Other

DEFINITION OF LEVELS

- PATIENT/FAMILY: An individual before, during or after a pregnancy, and their family, internal or external to the household, with influence on the individual
- PROVIDER: An individual with training and expertise who provides care, treatment, and/or advice
- FACILITY: A physical location where direct care is provided - ranges from small clinics and urgent care centers to hospitals with trauma centers
- SYSTEM: Interacting entities that support services before, during, or after a pregnancy - ranges from healthcare systems and payors to public services and programs
- COMMUNITY: A grouping based on a shared sense of place or identity - ranges from physical neighborhoods to a community based on common interests and shared circumstances

PREVENTION TYPE

- PRIMARY: Prevents the contributing factor before it ever occurs
- SECONDARY: Reduces the impact of the contributing factor once it has occurred (i.e., treatment)
- TERTIARY: Reduces the impact or progression of what has become an ongoing contributing factor (i.e., management of complications)

EXPECTED IMPACT

- SMALL: Education/counseling (community- and/or provider-based health promotion and education activities)
- MEDIUM: Clinical intervention and coordination of care across continuum of well-woman visits (protocols, prescriptions)
- LARGE: Long-lasting protective intervention (improve readiness, recognition and response to obstetric emergencies/LARC)
- EXTRA LARGE: Change in context (promote environments that support healthy living/ensure available and accessible services)
- GIANT: Address social drivers of health (poverty, inequality, etc.)

Appendix C: Contributing Factor Classes and Recommendation Levels

Mental health conditions were the most commonly identified contributing factor at the patient/family level (Table 5) followed by SUD, adherence, and knowledge.

Table 7: Pregnancy-Related Deaths: Patient/Family-Level Factor			
Class	Count	Class	Count
Mental Health Conditions	28	Unstable Housing	6
SUD	27	Other	4
Adherence	21	Trauma	4
Knowledge	17	Access/Financial	3
Social Support/Isolation	11	Communication	1
Chronic Disease	11	Cultural/Religious	1
Delay	10	Environmental	1
Violence	7	Tobacco Use	1

Assessment was the most commonly identified contributing factor at the provider level (Table 6) followed by quality of care, discrimination, knowledge, and referral.

Table 8: Pregnancy-Related Deaths: Provider-Level Factor			
Class	Count	Class	Count
Assessment	42	Mental Health Conditions	5
Quality of Care	16	SUD	5
Discrimination	14	Other	4
Knowledge	13	Violence	3
Referral	12	Communication	3
Care Coordination	9	Access/Financial	2
Chronic Disease	7	Policies/Procedures	2
Delay	6	Trauma	1

Access/financial was the most commonly identified factor at the system level (Table 7) followed by care coordination and mental health conditions.

Table 9: Pregnancy-Related Deaths: System-Level Factor			
Class	Count	Class	Count
Access/Financial	14	SUD	2
Care Coordination	7	Chronic Disease	2

Mental Health Conditions	5	Unstable Housing	2
Assessment	4	Quality of Care	1
Violence	4	Referral	1
Other	4	Social Support/Isolation	1
Policies/Procedures	4	Communication	1
Knowledge	3	Law Enforcement	1

Policies/procedures were the most commonly identified factor at the facility level, followed by care coordination (Table 8).

Table 10: Pregnancy-Related Deaths: Facility-Level Factor			
Class	Count	Class	Count
Policies/Procedures	8	Unstable Housing	1
Care Coordination	6	Quality of Care	1
SUD	2	Delay	1
Communication	2	Violence	1
Assessment	1	Discrimination	1
Mental Health Conditions	1	Chronic Disease	1
Knowledge	1		

The most commonly identified factor at the community level was knowledge (Table 9). This was followed by factors that fell into the "other" category.

Table 11: Pregnancy-Related Deaths: Community-Level Factor			
Class	Count	Class	Count
Knowledge	4	Mental Health Conditions	1
Other	3	Social Support/Isolation	1
Access/Financial	2	Unstable Housing	1
Violence	2	Cultural/Religious	1
Outreach	2		

Contributing factors often occurred at one level, but the recommendation to address the contributing factor was identified at another level. For example, a SUD was identified at the patient/family level, but the recommendation was that the provider should address the SUD through screening, brief intervention and referral to treatment (Table 10).

Table 12: Pregnancy-Related Deaths: Contributing Factor Level and Recommendation Level						
Contributing Factor Level	Recommendation Level					TOTAL
	Patient/Family	Provider	Facility	System	Community	
Patient/Family	2	43	8	47	38	138
Provider	3	92	26	19	0	140
Facility	0	3	19	4	0	26
System	0	12	3	38	2	55
Community	0	1	0	3	13	17
TOTAL	**5**	**151**	**56**	**111**	**53**	**376**

Assessment was the most commonly identified recommendation at the provider level (Table 11) followed by knowledge, SUD, mental health conditions, and chronic disease.

Table 13: Pregnancy-Related Deaths: Provider-Level Recommendation			
Class	Count	Class	Count
Assessment	31	Care Coordination	7
Knowledge	14	Other	5
SUD	14	Trauma	5
Mental Health Conditions	13	Delay	4
Chronic Disease	13	Violence	4
Discrimination	9	Social Support/Isolation	3
Referral	9	Access/Financial	2
Adherence	8	Policies/Procedures	2
Quality of Care	8	Communication	2

Mental health conditions were the most commonly identified recommendation at the system level (Table 12) followed by SUD, access/financial and knowledge.

Table 14: Pregnancy-Related Deaths: System-Level Recommendation			
Class	Count	Class	Count
Mental Health Conditions	19	Policies/Procedures	4
SUD	16	Social Support/Isolation	4
Access/Financial	16	Chronic Disease	3
Knowledge	10	Violence	3
Care Coordination	8	Discrimination	3

Unstable Housing	7	Referral	1
Assessment	5	Environmental	1
Other	5	Law Enforcement	1
Adherence	4	Tobacco Use	1
Quality of Care	4		

Assessment was the most commonly identified recommendation at the facility level (Table 13) followed by policies/procedures, care coordination and delay.

Table 15: Pregnancy-Related Deaths: Facility-Level Recommendation			
Class	Count	Class	Count
Assessment	9	Referral	2
Policies/Procedures	8	Violence	2
Care Coordination	7	Mental Health Conditions	1
Delay	6	Knowledge	1
Quality of Care	5	SUD	1
Discrimination	4	Chronic Disease	1
Adherence	3	Other	1
Communication	3	Cultural/Religious	1
Access/Financial	2		

Knowledge was the most commonly identified recommendation at the community level (Table 14) followed by violence and mental health conditions.

Table 16: Pregnancy-Related Deaths: Community-Level Recommendation			
Class	Count	Class	Count
Knowledge	11	Unstable Housing	3
Violence	8	SUD	3
Mental Health Conditions	6	Outreach	2
Delay	5	Cultural/Religious	1
Chronic Disease	4	Adherence	1
Social Support/Isolation	4	Access/Financial	1
Other	4		

The most commonly identified recommendation at the patient/family level addressed issues with *delay* (Table 15).

Table 17: Pregnancy-Related Deaths: Patient/Family-Level Recommendation

Class	Count	Class	Count
Delay	2	Mental Health Conditions	1
Assessment	1	Communication	1

For PANR deaths, contributing factors the board identified at the patient level most often had system level recommendations (Table 16). While there was some distribution at the other levels, the identified factors most commonly had recommendations at the same level. Overall, the most common contributing factors for PANR deaths was *SUD* (Table 17) followed by adherence and violence.

Table 18: PANR Deaths: Contributing Factor Level and Recommendation Level						
Contributing Factor Level	Recommendation Level					TOTAL
	Patient/Family	Provider	Facility	System	Community	
Patient/Family	11	40	9	78	26	164
Provider	0	61	9	17	1	88
Facility	0	1	11	4	1	17
System	0	2	0	33	2	37
Community	0	0	0	11	22	33
TOTAL	**11**	**104**	**29**	**143**	**52**	**339**

Table 19: PANR Deaths: Contributing Factor Classes			
Class	Count	Class	Count
Substance Use Disorder	78	Policies/Procedures	9
Adherence	58	Referral	9
Violence	45	Delay	8
Knowledge	33	Outreach	5
Mental Health Conditions	31	Social Support/Isolation	5
Assessment	30	Trauma	5
Care Coordination	22	Environmental	4
Legal	19	Cultural/Religious	3
Access/Financial	18	Law Enforcement	3
Quality of Care	12	Tobacco Use	3
Discrimination	12	Communication	2
Unstable Housing	12	Equipment/Technology	1
Chronic Disease	10	Structural Racism	1
Other	9		

References

[i] All statistics include Missouri residents who died while pregnant or within one year of pregnancy unless otherwise specified.

[ii] DHSS – MOPHIMS – Population MICA: 2021. Retrieved from https://healthapps.dhss.mo.gov/MoPhims/MICAHome.

[iii] DHSS – MOPHIMS – Birth MICA: 2017-2021. Retrieved from https://healthapps.dhss.mo.gov/MoPhims/MICAHome.

[iv] This data is based on Missouri residents only. A list of indicators utilized is available at https://www.cdc.gov/maternal-infant-health/php/severe-maternal-morbidity/icd.html.

[v] Kilpatrick SK, Ecker JL. (2016). Severe maternal morbidity: screening and review. *American Journal of Obstetrics and Gynecology*. 215(3). doi:10.1016/j.ajog.2016.07.050.

[vi] Nik Hazlina NH, Norhayati MN, Shaiful Bahari I and Mohamed Kamil HR (2022) The Prevalence and Risk Factors for Severe Maternal Morbidities: A Systematic Review and Meta-Analysis. *Front. Med.* 9:861028. doi: 10.3389/fmed.2022.861028.

[vii] Campbell KH, Savitz D, Werner EF, Pettker CM, Goffman D, Chazotte C, Lipkind HS. Maternal morbidity and risk of death at delivery hospitalization. Obstet Gynecol. 2013 Sep;122(3):627-33. doi: 10.1097/AOG.0b013e3182a06f4e. PMID: 23921870.

[viii] Korb D, Goffinet F, Seco A, Chevret S, Deneux-Tharaux C; EPIMOMS Study Group. Risk of severe maternal morbidity associated with cesarean delivery and the role of maternal age: a population-based propensity score analysis. CMAJ. 2019 Apr 1;191(13):E352-E360. doi: 10.1503/cmaj.181067. PMID: 30936165; PMCID: PMC6443524.

[ix] Cause of death stratified by insurance type was also examined, but again, there were no statistically significant results.Ω

[x] For more information and evidence on how communities, families and individuals can make their communities safer, visit https://www.cdc.gov/violence-prevention/?CDC_AAref_Val=https://www.cdc.gov/violenceprevention/intimatepartnerviolence/.

[xi] Gavin, N.I., Gaynes, B.N., et al. (2005). Perinatal depression: A systematic review of prevalence and incidence. *Obstetrics and Gynecology*, 106(5 Pt 1), 1071-1083.

[xii] Lisonkova S, Muraca GM, Potts J, et al. Association between Prepregnancy body mass index and severe maternal morbidity. *JAMA*. 2017;318(18):1777. Doi: 10.1001/jama.2017.16191.

[xiii] Statistical significance was determined at the ($p \leq 0.05$) level using Chi-Square testing.[Ω]

[xiv] Ratios would be unstable due to small sample size.[Ω]

[xv] Information regarding homicides is, at times, limited by ongoing investigations.