Maryland
DEPARTMENT OF HEALTH

Maryland Maternal Mortality Review

2022 Annual Report
Health – General Article §13-1212

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The MMR Committee acknowledges the people who passed away during or after their pregnancy. Each death represents a person's life that ended too early.

Summary

Maryland's Maternal Mortality Rate (MMR) in the most recent five-year average data (2016-2020) is 10 percent below the national rate. However, both the United States (U.S.) and Maryland MMR rates continue to increase. Both rates are higher than the Healthy People 2030 goal of 15.7 deaths per 100,000 live births, and significant racial disparities in maternal deaths persist.

In 2020, there were a total of 58 pregnancy-associated deaths, which is an increase of 27 deaths compared to 2019. Among these deaths, 17 (29 percent) were determined to be pregnancy-related, and 41 deaths (71 percent) were determined to be non-pregnancy-related. The leading cause of all pregnancy-associated deaths, as well as pregnancy-related and non-pregnancy-related deaths, was behavioral health conditions, including substance use disorder.[1] This is different from 2019 when the leading causes of pregnancy-related deaths were hemorrhage, non-cardiovascular conditions, and pregnancy-induced hypertension. Among non-pregnancy-related deaths, substance use and overdose were the leading causes of death for eight consecutive years.

The pregnancy-related mortality rate has remained similar to previous years and has shown a six percent increase since 2011. The pregnancy-associated mortality rate has varied considerably over the ten-year period between 2011 and 2020, with the 2020 rate being the highest observed during this time. The increasing number of overdose deaths in the last several years has likely contributed to the upward trend in the pregnancy-associated mortality rate. A majority of 2020 deaths (70 percent of pregnancy-related deaths and 78 percent of non-pregnancy-related deaths) were considered preventable.

Recommendations from the MMR Committee and the MMR Stakeholder Group[2] are included as appendices to this report. The recommendations address care coordination, the need for social determinants screening across multiple providers, interpregnancy care and pregnancy planning resources, and standard investigation procedures concerning pregnancy-associated deaths. The MMR Committee will continue to disseminate the findings of this review process and promote collaboration among all providers caring for pregnant and postpartum individuals to reduce pregnancy-associated deaths in Maryland.

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[1] Based on PMSS codes for mental health 100.1-100.5 and 100.9

[2] The Maternal Mortality Review Stakeholder Group (MMRSG) is established in Md. Ann. Code Health – General Art. §13-1208. The statute requires MMRSG to meet at least twice a year to review the findings and recommendations in the annual Maternal Mortality Review Report.

Background

The Maryland Maternal Mortality Review Program (the Program) was established in statute in 2000. Md. Ann. Code Health-General Art., §13-1203 - 1207, establishes the Program in the Maryland Department of Health (MDH) and describes its scope. The purpose of the Program is to:

(1) Identify maternal death cases;
(2) Review medical records and other relevant data;
(3) Determine preventability of death;
(4) Develop recommendations for the prevention of maternal deaths; and
(5) Disseminate findings and recommendations to policymakers, physicians and other health care providers, health care facilities, and the general public.

The Maternal Mortality Review Committee (the MMR Committee), which was established by the Program, is comprised of volunteer health care and public health professionals who conduct maternal mortality case reviews. MDH contracts with MedChi, the Maryland State Medical Society, to provide administrative support in the maternal mortality review process by obtaining medical records, abstracting cases, and hosting meetings of MDH's MMR Committee. The MMR Committee provides an in-depth review of maternal deaths to determine pregnancy-relatedness and preventability. Based upon the MMR Committee's reviews of mortality cases, the MMR Committee then develops recommendations for the prevention of maternal deaths and disseminates their findings and recommendations. Additional recommendations are provided by the Maternal Mortality Review Stakeholder Group (see Appendix B).

In 2021, the Program was awarded funding from the Centers for Disease Control and Prevention (CDC) Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) program. This funding supports agencies and organizations to coordinate comprehensive, multidisciplinary maternal mortality reviews.

Key Definitions

- A **maternal death** is defined by the World Health Organization's (WHO's) International Classification of Diseases Ninth and Tenth Revisions (ICD-9 and ICD-10) as, "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental causes." The ICD-10 codes used to identify maternal deaths are A34, O00-O95, and O98-O99.[3]
- The **maternal mortality ratio or rate (MMR)** is the number of maternal deaths per 100,000 live births in the same time period.
- A **pregnancy-associated death** is defined by the CDC as "the death of a woman while pregnant or within one year or 365 days of pregnancy conclusion, irrespective of the duration and site of the pregnancy, regardless of the cause of death."[4]

[3] https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4622
[4] https://reviewtoaction.org/learn/definitions

- The **pregnancy-associated mortality rate** is the number of pregnancy-associated deaths per 100,000 live births in the same time period.
- A **pregnancy-related death** is defined by the CDC as "the death of a woman while pregnant or within one year of conclusion of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by her pregnancy or its management, but not from accidental or incidental causes."[1]
- The **pregnancy-related mortality rate** is the number of pregnancy-related deaths per 100,000 live births in the same time-period.
- A **pregnancy-associated, but not related death** is defined by the CDC as "the death of a woman during pregnancy or within one year of the end of pregnancy from a cause that is NOT related to pregnancy."[1]
- A **pregnancy-associated, but unable to determine pregnancy-relatedness death** is defined as "A death where the team was unable to determine if it was pregnancy-related or pregnancy-associated."

The three terms "maternal death," "pregnancy-associated death," and "pregnancy-related death," create a challenge when comparing data for different jurisdictional entities from different sources and reports. The WHO monitors maternal deaths worldwide as a key indicator of population health, and of social and economic development. Maternal deaths are identified solely from information on the death certificate or similar registration of the occurrence and cause of death. Maternal deaths are limited in both the time period and causes considered.

In higher-income countries with improved medical care, many deaths related to pregnancy occur beyond 42 days after the end of pregnancy. In 1986, the CDC and the American College of Obstetricians and Gynecologists (ACOG) collaborated to recommend the use of expanded definitions to identify deaths more accurately among individuals where pregnancy was a contributing factor. This collaboration led to the definitions for pregnancy-associated and pregnancy-related deaths. Enhanced surveillance methods are necessary to determine pregnancy-associated and pregnancy-related deaths and are discussed below.

Rising Rates of Maternal Deaths

Nationally, the number of maternal deaths, as defined above, has significantly decreased since the 1930s when the MMR was 670 maternal deaths per 100,000 live births. The lowest MMR in the U.S. was recorded in 1987, with 6.6 maternal deaths per 100,000 live births. However, since then, the MMR has risen, reaching 32.9 maternal deaths per 100,000 live births in 2021, which is the most recent year for which national data are available.[5] It is important to note that prior to the issuance of the 2020 report, annual reports used different definitions of maternal deaths and MMR, which included all ICD-10 codes O00-O99. The MMR Committee uses a five-year average of Maryland's MMR to compare with the national rate. Averaging the Maryland rate is necessary because maternal deaths are relatively infrequent events in Maryland that may vary considerably year to year.[6]

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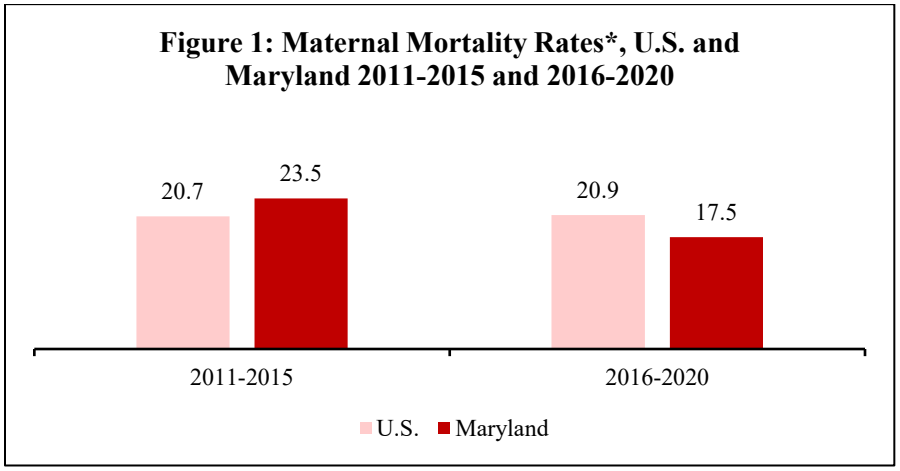
[5] https://www.cdc.gov/nchs/data/hestat/maternal-mortality/2021/maternal-mortality-rates-2021.htm
[6] As of the 2020 census, Maryland's population is 6,177,224. Source: https://msa.maryland.gov/msa/mdmanual/01glance/html/pop.html

In previous years, the Maryland MMR was consistently higher than the national rate. For the period from 2011 to 2015, the Maryland MMR was 13 percent higher than the national rate. However, for the period from 2016 to 2020, the Maryland MMR was 18 percent less than the national rate. Between the two five-year periods shown (Figure 1), the U.S. MMR increased by one percent, and the Maryland rate decreased by 26 percent. Both the U.S. and Maryland rates remain above the Healthy People 2030 Objective MICH-4 target of 15.7 maternal deaths per 100,000 live births.[7]

The reason for the increase in MMR since the 1980s is unclear. Many studies have shown an increase in chronic health conditions among pregnant individuals in the United States, including obesity, hypertension, diabetes, and heart disease.[8,9,10] These conditions likely put pregnant individuals at higher risk of adverse outcomes.



* Rate of maternal deaths per 100,000 live births. Data Source: CDC WONDER as of 05/2024.

Racial Disparity

In the U.S. between 2016 and 2020, Black non-Hispanic (NH) individuals had an MMR 2.6 times greater than White NH individuals, a disparity that has persisted since the 1940s. In Maryland, there is also a large disparity between the rates among Black NH and White NH individuals.[11] Figure 2 below shows the MMR by race in Maryland for six overlapping five-year periods over the past decade. The 2016-2020 Black NH MMR was 2.3 times higher than the White NH MMR. Appendix C shows the five-year rolling MMR by race in Maryland dating back to the 2003-2007 time period.

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[7] https://health.gov/healthypeople/objectives-and-data/browse-objectives/pregnancy-and-childbirth/reduce-maternal-deaths-mich-04

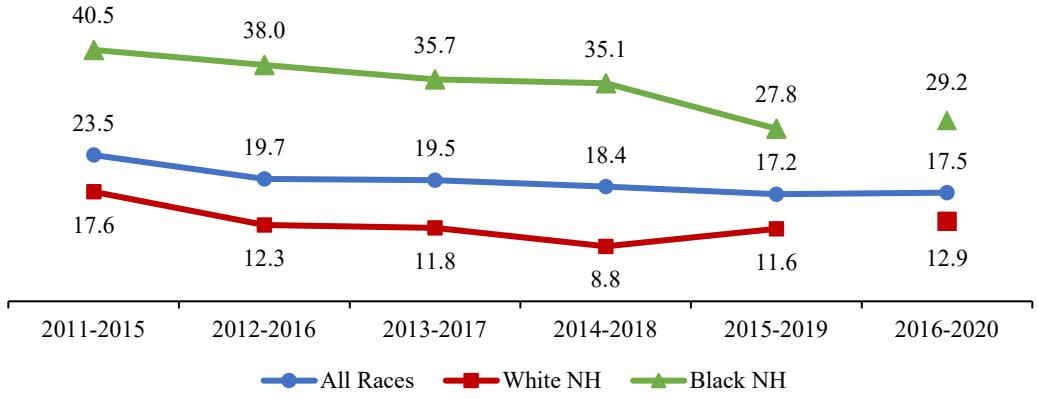
[8] Horon IL. Underreporting of Maternal Deaths on Death Certificates and the Magnitude of the Problem of Maternal Mortality. Am J Public Health. 2005; 95:478-82. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1449205/.

[9] Horon IL, Cheng D. Effectiveness of Pregnancy Check Boxes on Death Certificates in Identifying Pregnancy-Associated Mortality. Pub Health Reports. 2011; 126:195-200. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3056032/.

[10] Berg C, Danel I, Atrash H, Zane S, Bartlett L (Editors). Strategies to Reduce Pregnancy-related Deaths: from Identification and Review to Action. Atlanta: Centers for Disease Control and Prevention; 2001 https://stacks.cdc.gov/view/cdc/6537.

[11] This report utilizes race and ethnicity categories as defined by the Maryland Vital Statistics Administration. See Page xiii, https://health.maryland.gov/vsa/Documents/Reports%20and%20Data/Annual%20Reports/2020Annual.pdf

Figure 2: Five-Year Rolling Maternal Mortality Rate* by Race, Maryland



* Rate of maternal deaths per 100,000 live births. Data Source: CDC WONDER as of 05/2024
Ranges 2011-2015 through 2015-2019: MMR for White NH and Black NH individuals are calculated using bridged race data
Range 2016-2020: MMR for White NH and Black NH individuals are calculated using single race data where available, and bridged race data where single race data not available. As a result of the rate calculations, the 2016-2020 rates for White NH and Black NH individuals are not directly comparable to previous periods (indicated by a break in the line graph).
Additional information on the differences between bridged-race and single-race data may be found on the CDC, NCHS website: https://www.cdc.gov/nchs/hus/sources-definitions/race.htm

Methodology

Case Identification

Cases for review are limited to individuals who were residents of Maryland at the time of their death. Maryland residents who died in other states are not included in the case reviews. Maternal deaths are determined by cause of death and pregnancy information on the death certificate alone. The Maryland death certificate was revised in January 2001 to include questions about pregnancy status, pregnancy outcome, and date of delivery for the 12 months preceding death. This pregnancy checkbox has significantly increased identification of maternal deaths beyond those recognized by cause of death alone.[12, 13]

Pregnancy-associated deaths are identified in one of three ways in Maryland. Individual death certificates are the first method of identifying pregnancy-associated deaths using checkbox questions, or because the cause of death is clearly related to pregnancy (e.g., ruptured ectopic pregnancy, postpartum hemorrhage). The second method of determining pregnancy-associated deaths comes from linking death certificates for individuals aged 10-50 years with birth certificates and fetal death certificates from the 365 days preceding death to identify additional

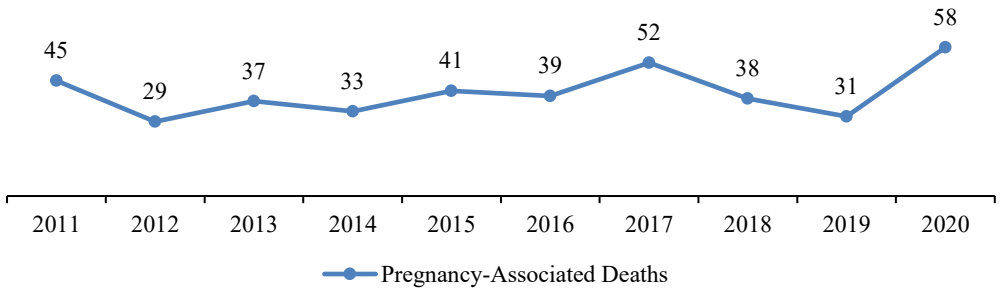
[12] Horon IL. Underreporting of Maternal Deaths on Death Certificates and the Magnitude of the Problem of Maternal Mortality. Am J Public Health. 2005; 95:478-82. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1449205/.
[13] Horon IL, Cheng D. Effectiveness of Pregnancy Check Boxes on Death Certificates in Identifying Pregnancy-Associated Mortality. Pub Health Reports. 2011; 126:195-200. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3056032/.

cases that were not found through examination of death certificates alone. The third method is the review of cases reported to the Office of the Chief Medical Examiner (OCME) that are identified to show evidence of pregnancy in deceased individuals.

The MMR Committee designates and further investigates all deaths occurring during pregnancy or within 365 days of pregnancy conclusion. Therefore, pregnancy-associated deaths include maternal deaths (those occurring during pregnancy up to 42 days after the end of pregnancy) and deaths occurring between 43 to 365 days after the pregnancy ends.

Using the three methods above, 58 pregnancy-associated deaths were identified in 2020. This report provides a thorough examination of these cases. Figure 3 shows the numbers of pregnancy-associated deaths in Maryland from 2011 to 2020. An average of 40 pregnancy-associated deaths occurred per year during this period.

Figure 3: Number of Pregnancy-Associated Deaths, Maryland, 2011-2020



Data Source: Maryland MMR Program as of 12/2022.

Case Review

Pregnancy-associated deaths undergo several stages of review. Once cases are identified, medical records are obtained from the hospitals of death and delivery, when applicable. Physician and nurse-midwife abstractors review death certificates, hospital records, OCME records, and other available materials for all cases, and prepare case summaries that are submitted to the MMR Committee for review.[14] The 2020 case review was the first year that the Program utilized the Maternal Mortality Review Information Application (MMRIA) system, designed by the CDC "to facilitate MMRC functions through a common data language."[15] The MMR Committee reviewed all 2020 pregnancy-associated deaths from all causes (medical, injury, substance use, homicide, and suicide) for cause of death, pregnancy-relatedness, and preventability.

[14] The MMRC attempt to gather and review comprehensive records for each case. These include but are not limited to social media records, EMS notes, prescription drug monitoring database information, and police reports. Availability of these records varies by case.

[15] For additional information about MMRIA, see https://www.cdc.gov/reproductivehealth/maternal-mortality/erase-mm/index.html#maternal-mortality-review. The Program has established a DUA with the CDC governing the use of data entered into MMRIA.

Pregnancy-relatedness and potential preventability of the deaths are determined through MMR Committee discussion. The MMR Committee includes obstetric, maternal fetal medicine, nurse-midwifery, nursing, and social work specialists, as listed in Appendix A. Public health professionals including representatives from MDH's Maternal and Child Health Bureau participate in the MMR Committee. The MMR Committee discussions incorporate the CDC framework for case review, which considers medical and non-medical factors contributing to pregnancy-associated deaths and examines quality and content of care.[16] Cases discussed by the MMR Committee are de-identified and all members sign confidentiality agreements prior to starting the review.

2020 Case Findings

The MMR Committee identified a total of 58 pregnancy-associated deaths in 2020, resulting in a pregnancy-associated mortality rate of 84.6 deaths per 100,000 live births. For further analysis, the MMR Committee divided these deaths into pregnancy-related and non-pregnancy-related deaths, which represent two non-overlapping groups. Of the 58 pregnancy-associated deaths, 17 were determined to be pregnancy-related, for a pregnancy-related mortality rate of 24.8 deaths per 100,000 live births. The remaining deaths were split into 33 pregnancy-associated, not related deaths and eight pregnancy-associated, unable to determine relatedness deaths. For the remainder of the report, these two groups will be combined into non-pregnancy-related deaths, with a total of 41 deaths and a mortality rate of 59.8 per 100,000 live births.

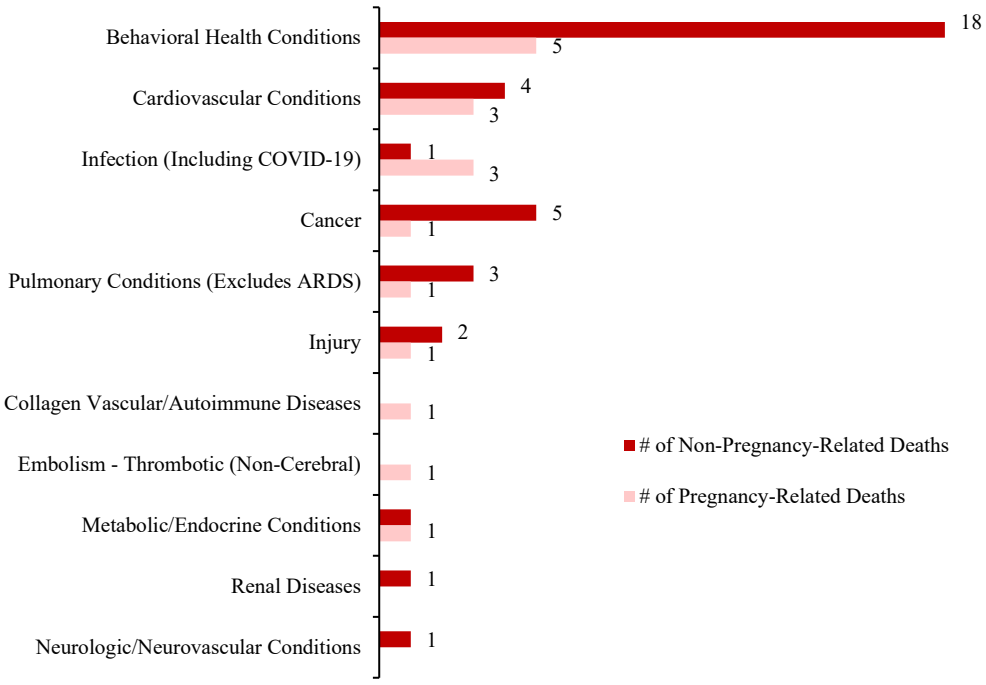
Cases by Cause of Death Category

Figure 4 shows pregnancy-related and non-pregnancy-related deaths by category of cause of death.[17] The leading cause of pregnancy-associated death was behavioral health conditions, accounting for 23 deaths: five pregnancy-related and 18 non-pregnancy-related deaths. These accounted for 29 percent of all pregnancy-related and 43 percent of non-pregnancy-related deaths, respectively, in 2020. Twenty-two of the behavioral health conditions were classified as substance use disorder and one was classified as depression.

[16] Berg C, Danel I, Atrash H, Zane S, Bartlett L (Editors). Strategies to Reduce Pregnancy-related Deaths: from Identification and Review to Action. Atlanta: Centers for Disease Control and Prevention; 2001 https://stacks.cdc.gov/view/cdc/6537.

[17] MMRIA classifies three causes of death: 1) what is listed on the death certificate; 2) the immediate cause of death, and 3) the underlying cause of death, which "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." Throughout this report, "cause of death" refers to the underlying cause of death.

Figure 4: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Category of Cause of Death, Maryland, 2020 (Total deaths=58)



Data Source: Maryland MMR Program as of 12/2022.
ARDS: Acute respiratory distress syndrome

Among the 17 pregnancy-related deaths in 2020, the leading causes of death were behavioral health conditions with five deaths, followed by cardiovascular medical conditions and infection, which each accounted for three deaths. Cancer, collagen/autoimmune diseases, thrombotic pulmonary embolism, injury, metabolic/endocrine conditions, and pulmonary conditions each accounted for one pregnancy-related death. The leading cause of death for non-pregnancy-related deaths was also behavioral health conditions. Other leading causes of non-pregnancy-related deaths were cardiovascular conditions, cancer, pulmonary conditions, and injury.[18]

COVID-19 and Pregnancy-Associated Deaths

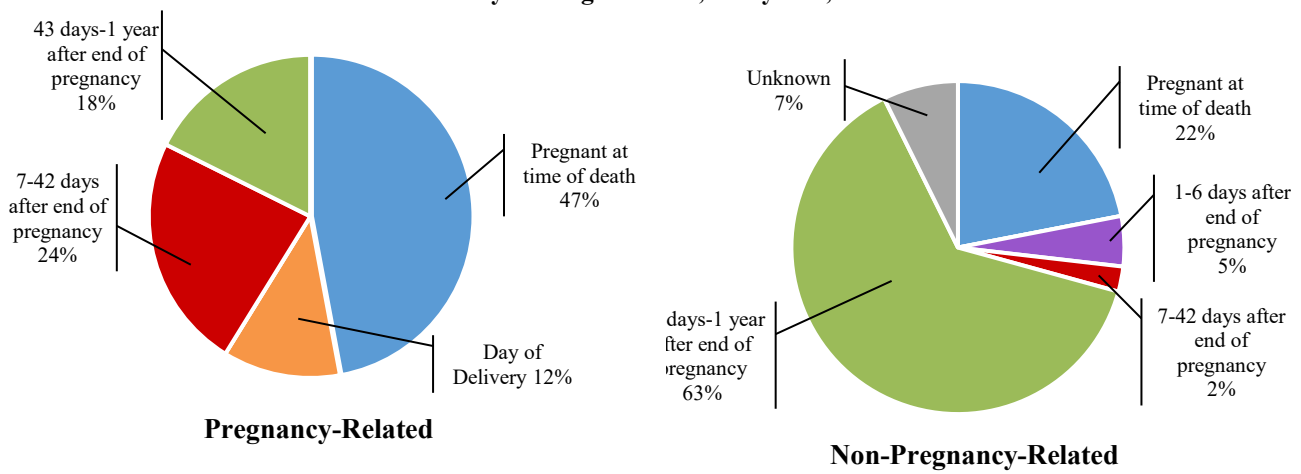
The 2020 cases occurred in the first year that COVID-19 would be considered a cause of death for Marylanders. COVID-19 was classified under "infection" in this report. There were three deaths where the underlying cause was COVID-19 in 2020. Two were determined to be pregnancy-related deaths, and one was determined to be non-pregnancy-related.

[18] In this report in the majority of situations, "injury" includes both intentional (e.g. suicide, homicide) and unintentional (e.g. motor vehicle collisions) causes. In previous reports intentional and unintentional injuries were separate categories, but were grouped together this year due to low overall numbers.

Cases by Timing of Death in Relation to Pregnancy

Among the 17 pregnancy-related deaths in 2020, eight (47 percent) occurred during pregnancy, two (12 percent) occurred on the day of delivery, four (24 percent) occurred within 42 days postpartum and three (18 percent) occurred between 43 and 365 days postpartum. Of the 41 non-pregnancy-related deaths, nine (22 percent) occurred during pregnancy, two (five percent) occurred between one and six days postpartum, one (two percent) occurred between seven and 42 days postpartum, and 26 (63 percent) occurred between 43 to 365 days postpartum. For three non-pregnancy-related deaths, the timing of death was unknown (Figure 5).

Figure 5: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Timing of Death, Maryland, 2020

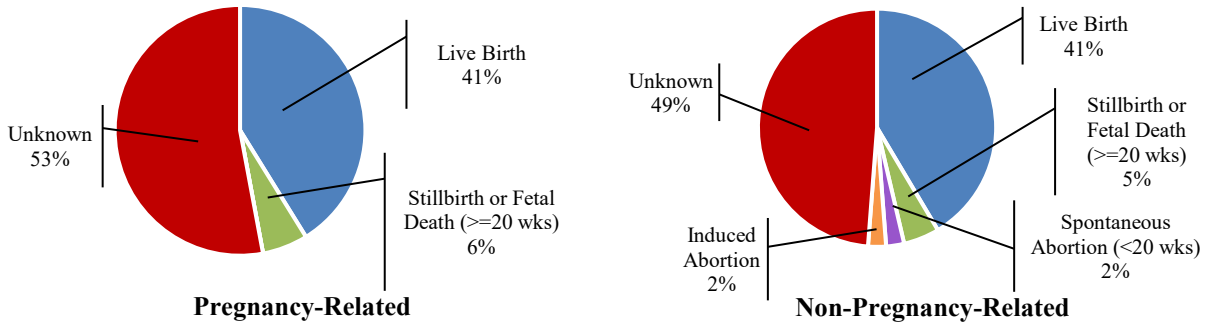


Data Source: Maryland MMR Program as of 12/2022.
Note: Percentages may not total 100 due to rounding.

Cases by Outcome of Pregnancy

Among the 17 pregnancy-related deaths in 2020, seven (41 percent) had a live birth and one (six percent) involved a stillbirth or fetal death. For nine (53 percent) pregnancy-related death cases, the pregnancy outcome was unknown. Among the 41 non-pregnancy-related deaths, 17 (41 percent) had a live birth, two (five percent) involved a stillbirth or fetal death, one (two percent) involved a spontaneous abortion, and one (two percent) involved an induced abortion. For 20 non-pregnancy-related death cases (49 percent), the pregnancy outcome was unknown (Figure 6).

Figure 6: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Pregnancy Outcome, Maryland, 2020

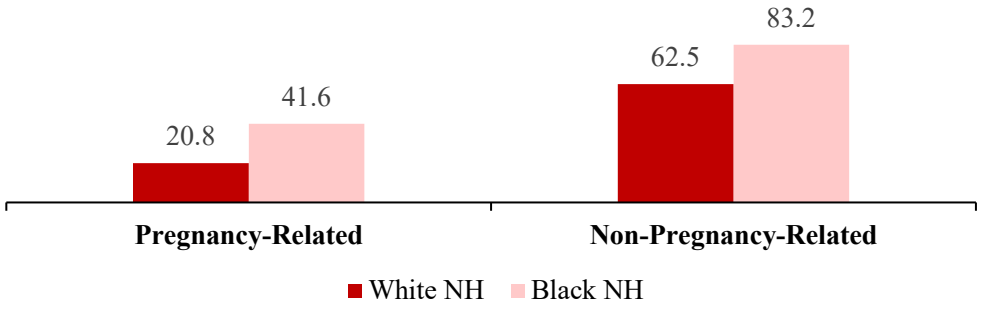


Data Source: Maryland MMR Program as of 12/2022.
Note: Percentages may not total 100 due to rounding.

Cases by Maternal Race and Ethnicity

Of the 17 pregnancy-related deaths occurring in 2020, six cases (35 percent) involved White NH individuals, nine cases (53 percent) involved Black NH individuals, and two cases (12 percent) involved Hispanic individuals. Among the 41 non-pregnancy-related deaths, 18 cases (44 percent) involved White NH individuals, 18 cases (44 percent) involved Black NH individuals, four cases (10 percent) involved Hispanic individuals, and one case (two percent) involved a Other NH (Other race includes Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native) individual. Pregnancy-related and non-pregnancy-related mortality rates among Black NH and White NH individuals in 2020 are shown in Figure 7.

Figure 7: Pregnancy-Related and Non-Pregnancy-Related Mortality Rates by Selected Race/Ethnicities, Maryland, 2020*



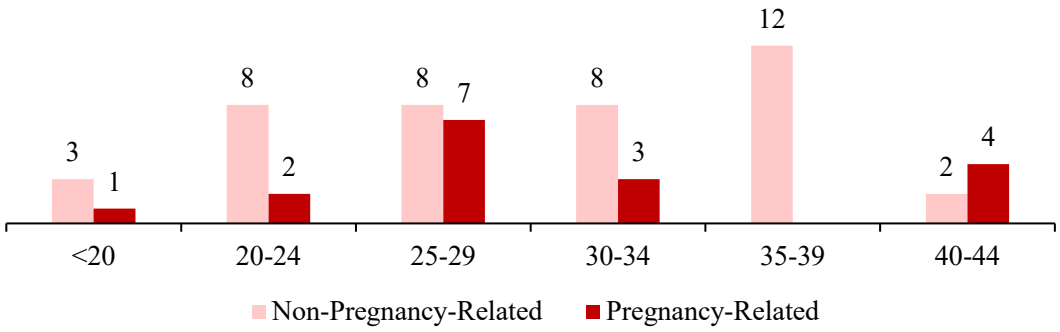
* Rate of pregnancy-related and non-pregnancy-related deaths per 100,000 live births. Data Source: Maryland MMR Program and VSA as of 12/2022.

The rate of non-pregnancy-related deaths among Black NH individuals was 1.3 times higher than that of White NH individuals. The rate of pregnancy-related deaths in Black NH individuals was 2.0 times higher than that of White NH individuals, illustrating the persistent racial disparity in these rates in Maryland.

Cases by Maternal Age

The distribution of pregnancy-related and non-pregnancy-related deaths by maternal age group is shown in Figure 8, with the majority occurring in ages 25-29 for pregnancy-related deaths and 35-39 for non-pregnancy-related deaths. Rates of death by age group are not calculated because the numbers of deaths in most groups are very small (rates involving fewer than five deaths cannot be reported).

Figure 8: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Maternal Age, Maryland, 2020

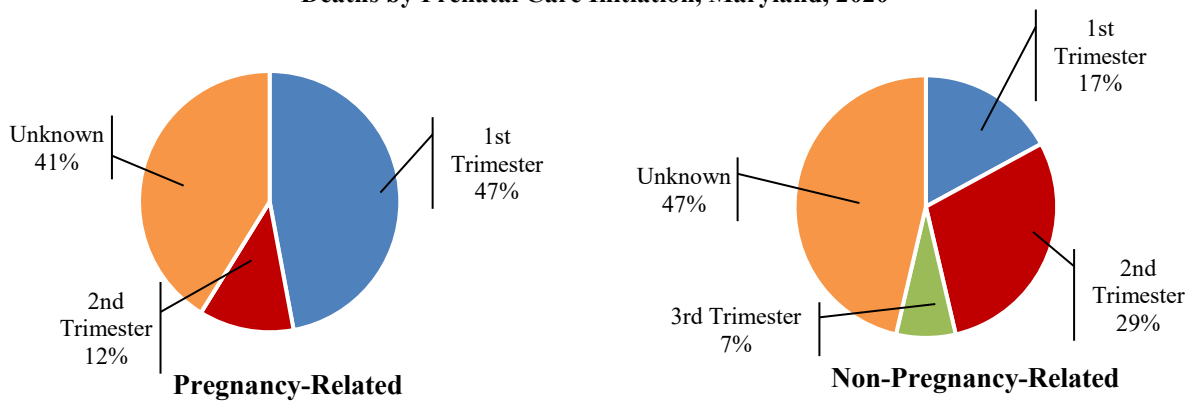


Data Source: Maryland MMR Program as of 12/2022.

Cases by Timing of Prenatal Care Initiation

Pregnancy-related and non-pregnancy-related deaths by the trimester when prenatal care was initiated are shown in Figure 9 below. Of the 17 pregnancy-related deaths, 10 (59 percent) were among pregnant individuals who initiated prenatal care in the first or second trimester of pregnancy. Among the 41 non-pregnancy-related deaths, 19 (46 percent) began prenatal care in the first or second trimester. In seven pregnancy-related and 19 non-pregnancy-related cases, the timing of prenatal care initiation was unknown.

Figure 9: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Prenatal Care Initiation, Maryland, 2020

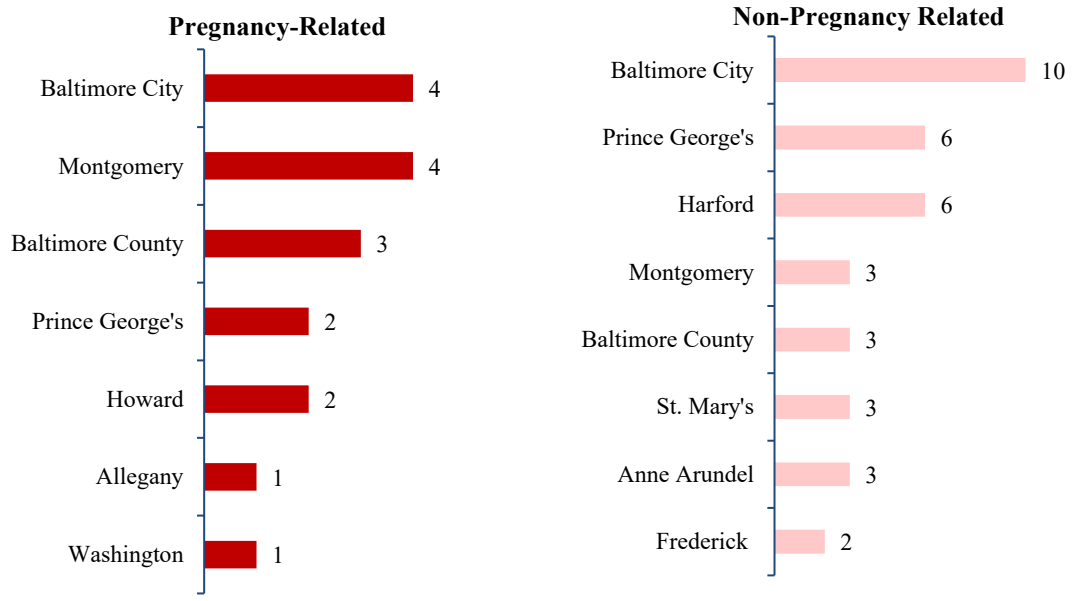


Data Source: Maryland MMR Program as of 12/2022.

Cases by Jurisdiction of Residence and Occurrence

Figure 10 shows pregnancy-related and non-pregnancy-related deaths by jurisdiction of residence.[19] For pregnancy-related deaths, Baltimore City and Montgomery County each had four (24 percent) deaths. Baltimore County had three (18 percent) deaths and Prince George's and Howard counties each had two (12 percent) deaths. There were single (6 percent) deaths among residents of Allegany and Washington counties. Of the 41 non-pregnancy-related deaths, ten (24 percent) were among residents of Baltimore City. Prince George's and Harford counties each had six (15 percent) deaths. There were three (7 percent) deaths among residents of Montgomery, Baltimore, St. Mary's, and Anne Arundel counties. Frederick County had two (5 percent) deaths.

Figure 10: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Jurisdiction of Residence, Maryland, 2020

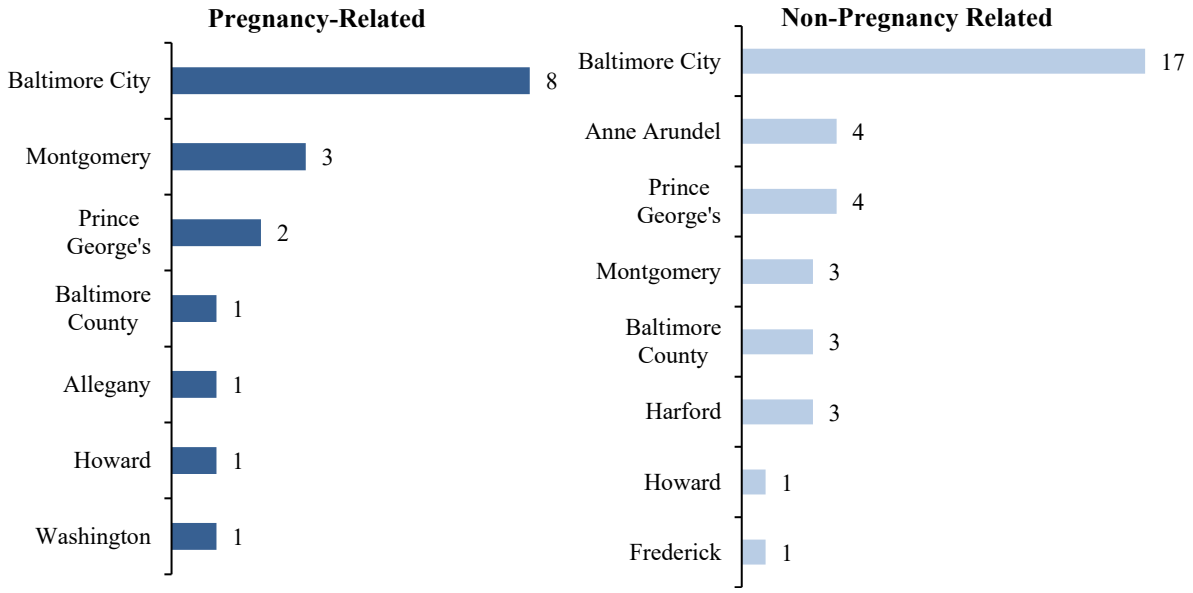


Data Source: Maryland MMR Program as of 12/2022.

Figure 11 shows pregnancy-related and non-pregnancy-related deaths by jurisdiction in which the death occurred. Eight (47 percent) of the 17 pregnancy-related deaths occurred in Baltimore City, three (18 percent) occurred in Montgomery County, and two (12 percent) occurred in Prince George's County. There were single (six percent) deaths that occurred in Allegany, Baltimore, Howard, and Washington counties. Among the 41 non-pregnancy-related deaths, 17 (41 percent) occurred in Baltimore City, four (eight percent) occurred in Prince George's and Anne Arundel counties, and three (seven percent) occurred in Baltimore, Harford, and Montgomery counties. There was one (two percent) death in both Frederick and Howard counties.

[19] Maryland has 24 jurisdictions: Twenty-three are counties, and one (Baltimore City) is a municipality. Source: https://msa.maryland.gov/msa/mdmanual/01glance/html/county.html

Figure 11: Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Jurisdiction of Occurrence, Maryland, 2020



Data Source: Maryland MMR Program as of 12/2022.\

Preventability of Deaths

A death was considered preventable if the death "may have been averted by one or more changes in the health care system related to clinical care, facility infrastructure, public health infrastructure and/or patient factors."[20] Whether the death was clearly preventable or only potentially preventable by some intervention is a decision made by the MMR Committee after reviewing the case. Of the 17 pregnancy-related deaths, twelve (70 percent) were judged to be preventable. Among the 41 non-pregnancy-related deaths, 32 (78 percent) were judged to be preventable. The MMR Committee was unable to determine preventability for two of the non-pregnancy-related deaths.

All 23 of the behavioral health condition deaths were considered preventable including the 22 due to substance use disorder and the one due to depression, as were four cardiovascular condition deaths, two metabolic/endocrine deaths, two injury deaths, two infection deaths, one suicide death, one cancer death, one neurologic/neurovascular condition death, one renal death, one pulmonary condition death, and one collagen vascular/autoimmune disease death. The one death where preventability was undetermined was a pulmonary condition death. One cancer death did not have a determination made.

[20] Berg CJ, Harper MA, Atkinson SM, et al. Preventability of Pregnancy-Related Deaths - Results of a State-Wide Review. Obstet and Gynecol. 2005; 106:1228-1234. https://journals.lww.com/greenjournal/Fulltext/2005/12000/Preventability_of_Pregnancy_Related_Deaths.4.aspx.

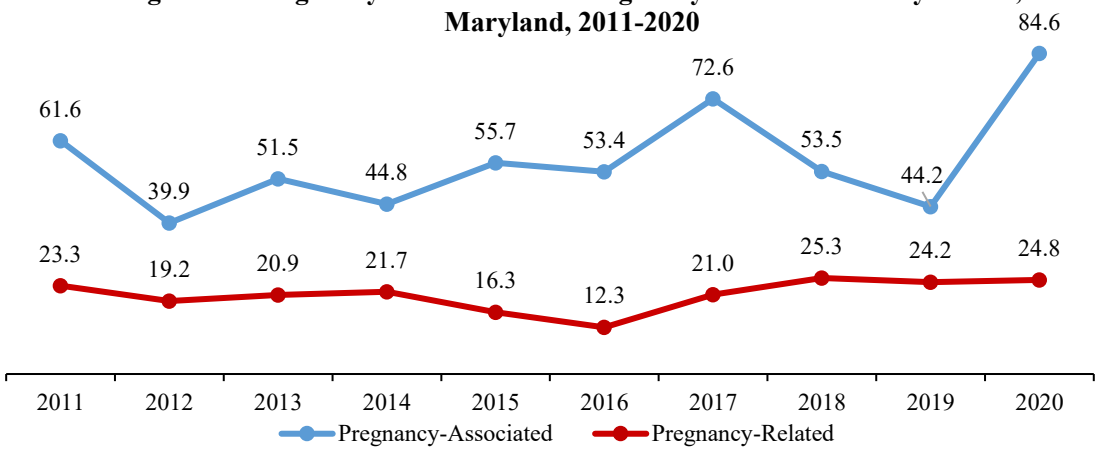
Trends in Pregnancy-Associated and Pregnancy-Related Deaths

As noted in Figure 1, the Maryland MMR has decreased over the past 10 years and is now below the national average. The MMR, however, is limited in both causes of death considered and the timeframe in relation to pregnancy. The MMR includes only deaths from pregnancy-related causes that can be identified by the death certificate alone and that occurred during pregnancy or within 42 days of pregnancy conclusion. The slight increase in the Maryland MMR suggests that more deaths during pregnancy or the early postpartum period are occurring.

The cases reviewed by the MMR Committee are more comprehensive and include all pregnancy-associated deaths, which include deaths from any cause that occur during pregnancy or up to 365 days after the conclusion of pregnancy. Pregnancy-associated deaths are reviewed for pregnancy-relatedness, creating a subgroup of pregnancy-related deaths. Of note, one pregnancy-associated death which occurred in 2012 did not undergo full review by the MMR Committee. Therefore, the MMR Committee did not designate a cause of death or assess the pregnancy-relatedness of this case. This case is excluded from any cause-specific or relatedness-specific trends presented in this section.

The trends in pregnancy-associated and pregnancy-related mortality rates from 2011 to 2020 are shown in Figure 12. The pregnancy-associated mortality rate shows considerable variability over the ten-year period, and the 2020 rate is the highest observed over this time. The increasing number of overdose deaths in the last several years has likely contributed to the upward trend in the pregnancy-associated mortality rate. The pregnancy-related mortality rate remains similar to previous years and shows an increase of six percent since 2011. An analysis of racial disparities in pregnancy-related deaths begins on page 23.

Figure 12: Pregnancy-Associated and Pregnancy-Related Mortality Rates*, Maryland, 2011-2020



*Number of pregnancy-associated and pregnancy-related deaths per 100,000 live births.
Data Source: VSA and Maryland MMR Program as of 12/2022.
The Pregnancy-Related Mortality Rate in Figure 12 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness. This death is included in the Pregnancy-Associated Mortality Rate.

Causes of pregnancy-related deaths are largely medical conditions directly related to pregnancy (such as postpartum hemorrhage, amniotic fluid embolus, or pre-eclampsia) or those exacerbated

by pregnancy (such as pre-existing cardiovascular disease). There are some cases of homicide and suicide that are also determined to be pregnancy-related. The number of cases in Maryland from any individual cause is so small that determining trends for specific causes of pregnancy-related death is not possible.

Substance Use Disorder and Overdose Deaths

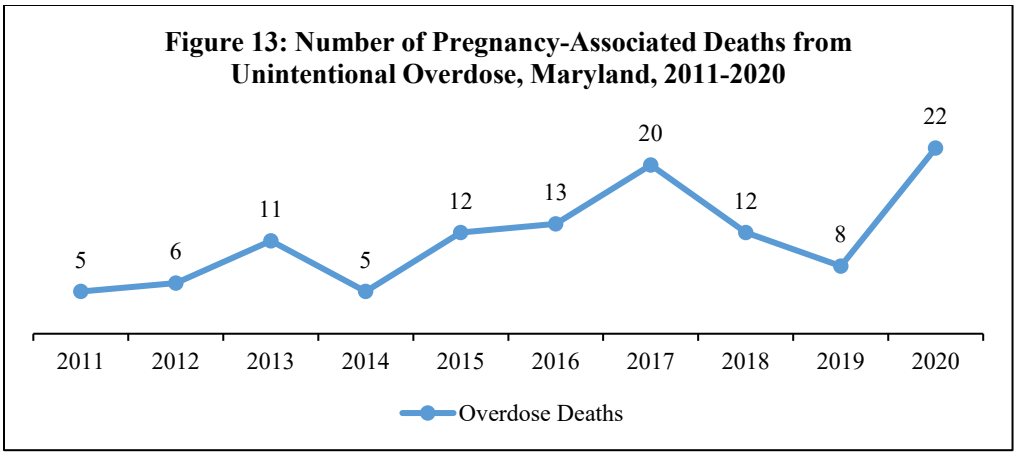
In 2020, for the eighth consecutive year, unintentional drug overdose or substance use disorder was the leading cause of pregnancy-associated death in Maryland. Twenty-two of the 58 total deaths (38 percent) resulted from substance use disorder. All but four of the overdose deaths were considered to be non-pregnancy-related. The 18 non-pregnancy-related overdose deaths accounted for 44 percent of the 41 non-pregnancy-related deaths. Fifteen of these deaths (58 percent) involved opioids. Of the deaths involving opioids, all 15 of them involved the potent opioid fentanyl or one of its analogs. Cocaine was involved in three overdose deaths.

The average age at death was 30 years (range 17-38 years). Thirteen overdose deaths (59 percent) were identified as White NH individuals, seven (32 percent) were identified as Black NH individuals, and two (9 percent) were identified as an Other NH race. Five of the individuals (23 percent) delivered live born infants and the average timing of death was 49 days (1.5 months) postpartum. Ten (48 percent) of the overdose victims were pregnant at the time of death and seven deaths (33 percent) occurred within 43 days to one year after the conclusion of pregnancy. Nineteen (86 percent) of the overdose victims had a known history of substance use and 11 (50 percent) had received substance use disorder treatment.

In addition to the individuals with a history of substance use who died from overdose in 2020, there were an additional 12 individuals identified who had a history of substance use but died from other causes. Of those individuals, only five received treatment for substance use disorder. Thus overall, 31 (53 percent) of the individuals who died within a year of pregnancy in 2020 had some documented history of substance use disorder.

Multiyear Review of Overdose Deaths

To better understand factors involved in overdose deaths, a review of all pregnancy-associated deaths in Maryland from 2011 to 2020 was undertaken. Over this ten-year period, substance use and overdose was the leading cause of death, accounting for 114 (28 percent) of 402 pregnancy-associated deaths where a cause of death was determined. Figure 13 shows the number of pregnancy-associated overdose deaths by year, with the highest number of cases occurring in 2020.



Data Source: VSA and Maryland MMR Program as of 12/2022.
Figure 13 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

Of the 114 overdose deaths, 103 (90 percent) involved opioids. Table 1 shows the specific opioids identified by toxicology testing at the time of death in these cases.

Table 1: Pregnancy-Associated Deaths from Unintentional Overdose by Opioid, Maryland, 2010-2020 (N=110)

Opioid	Number of Instances Found
Fentanyl/fentanyl analogs	63
Morphine (heroin)	39
Methadone	23
Oxycodone	16
Tramadol	9
Unspecified opioid	6
Codeine	5
Hydrocodone	2
Oxymorphone	2
Buprenorphine	2
Hydromorphone	1
Meperidine	1

Data Source: Maryland MMR Program as of 12/2022. Note: Values in table do not add up to sample size of 110 since multiple drugs may be detected in the same case. The sample size of 110 for this table includes deaths from 2010.

From 2010 to 2020, the most frequently detected opioid was fentanyl (including fentanyl analogs). Fentanyl was not detected in any overdose death prior to 2014 but has contributed increasingly to these deaths each year since. In ninety-five (83 percent) of the 114 overdose deaths, two or more drugs were detected by postmortem testing. In fifty-six (59 percent) of the multiple drug cases, two to six different opioids were identified. Benzodiazepines were detected in twenty-two (19 percent), and alcohol in nineteen (17 percent) of the 114 overdose death cases.

In Table 2, the 114 overdose deaths are compared with the 288 non-overdose deaths that occurred between 2011 and 2020. Most notably, the racial distribution is strikingly different, with nearly three quarters of overdose deaths occurring among White NH individuals and over half of non-overdose deaths occurring among Black NH individuals. A similar percentage of individuals were pregnant at the time of death in both groups, but deaths following the conclusion of pregnancy occurred on average much later among the overdose group. Pregnancy outcomes were also similar in both groups, with 62 percent of pregnancies among the overdose group and 63 percent among the non-overdose group resulting in a live birth. For timing of prenatal care initiation, 46 percent of the overdose group and 54 percent of the non-overdose group started prenatal care in the first or second trimester.

Among the 114 overdose deaths occurring from 2011 to 2020, the average age at death was 29 years old. Eighty-two (72 percent) of these deaths were among White NH individuals and 24 (21 percent) among Black NH individuals, with four cases (4 percent) among individuals of other races and four cases (four percent) in a Hispanic individual.

Seventy-one (62 percent) of the 114 individuals who died of overdose had delivered live-born infants. Twenty-eight individuals (25 percent) were pregnant at the time of death and six (5 percent) had had an elective termination or spontaneous abortion prior to death. In 16 cases, the pregnancy outcome was unknown. Eleven deaths (10 percent) occurred at or before 42 days postpartum; seventy-four (65 percent) occurred between 43 and 365 days postpartum. Among overdose deaths, the average timing of death was 192 days postpartum.

In 82 of the overdose cases (72 percent), at least one behavioral health diagnosis was documented. Of the individuals who died of overdose, 106 (93 percent) had a known history of substance use and of these, 20 (18 percent) had documentation of some substance use treatment. Please note that the documentation for substance use treatment reflects data from 2018-2020 only.

There were large differences between the two groups related to several behavioral health factors. Individuals who died of overdose were more than three times as likely as individuals who died of other causes to have a known history of substance use (93 percent vs. 26 percent). Individuals who died of overdose were over two and half times as likely to smoke (72 percent vs. 26 percent) and were almost three times as likely to have one or more behavioral health diagnoses (72 percent vs. 25 percent). Also, 112 of 114 overdose deaths (97 percent) were considered preventable or potentially preventable, compared with only 64 percent of the non-overdose deaths.

Table 2: Incident Characteristics of Pregnancy-Associated Deaths, Maryland, 2011-2020 Data presented as mean ± standard deviation, or number (%)		
Characteristic	**Overdose Deaths (n=114)**	**Non-overdose Deaths (n=288)**
Demographics		
Average age at death (years)	29 ± 5	31± 7
White NH	82 (72)	98 (34)
Black NH	24 (21)	146 (51)
Non-Hispanic Other	4 (4)	16 (6)
Hispanic	4 (4)	28 (10)
Timing of death		
Pregnant at death	28 (25)	72 (25)
0-42 days postpartum	11 (10)	92 (32)
43-365 days postpartum	74 (65)	121 (42)
Unknown	1 (1)	3 (1)
Average days postpartum	192 ± 100	106 ±116
Pregnancy outcome		
Live-born infant	71 (62)	176 (61)
Co-occurring maternal-fetal deaths	18 (16)	63 (22)
Fetal death	3 (3)	16 (6)
Elective termination	2 (2)	9 (3)
Spontaneous abortion	4 (4)	5 (2)
Ectopic pregnancy	0 (0)	3 (1)
Other outcome	0 (0)	1 (0.3)
Unknown	16 (14)	15 (5)
Prenatal care initiation		
1st trimester	29 (25)	115 (40)
2nd trimester	24 (21)	37 (13)
3rd trimester	9 (8)	9 (3)
No prenatal care	14 (12)	26 (9)
Termination or death in early pregnancy	6 (5)	14 (5)
Unknown	32 (28)	87 (30)
Behavioral health / social factors		
Known history of substance use	106 (93)	73 (25)
Any history of substance use treatment (among those with known history of substance use; for 2018-2020 only)	20 (18)	7 (2)
Smoking	82 (72)	73 (25)
Behavioral health diagnosis(es)	82 (72)	69 (24)
Intimate partner violence	19 (17)	32 (11)
Preventability		
Death preventable / potentially preventable	112 (98)	183 (64)

Data Source: Maryland MMR Program as of 12/2022.
Note: History of substance use treatment includes only 2018-2020 data.
Total of overdose and non-overdose deaths in Table 2 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness

Behavioral Health Diagnoses

Among the 58 pregnancy-associated deaths in 2020, 25 individuals (43 percent) had pre-existing behavioral health disorders, and 15 (26 percent) had a diagnosis of depression. In 16 of the 22 overdose cases (73 percent), there were one or more pre-existing behavioral health diagnoses, with four (18 percent) experiencing only depression, three (14 percent) experiencing only anxiety, and two (9 percent) with co-occurring depression and substance use disorder. Two (9 percent) of the cases had a diagnosis of bipolar disorder.

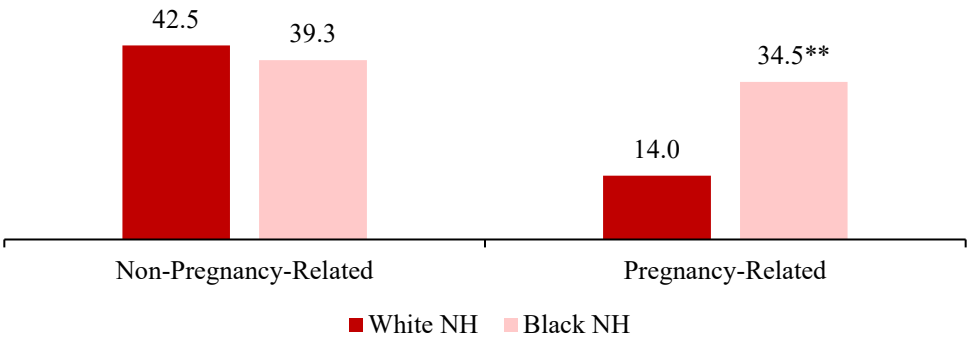
Six individuals who died from an overdose had a documented history of intimate partner violence (IPV) and six individuals who died of non-overdose causes reported experiencing IPV. The data from 2020 cases continue to show that substance use disorders, IPV, depression, and other behavioral health disorders have a significant effect on pregnant individuals and their families, and are contributing factors to maternal health, morbidity, and mortality.

Racial Disparities in Pregnancy-Related Mortality

Figure 2 shows the ten-year trends and racial disparities in the Maryland MMR. As noted, the MMR has increased slightly over the past ten years but remains below the national average. Racial disparities have been consistent throughout the ten-year period. The MMR, however, includes only deaths from pregnancy-related causes that can be identified by the death certificate and that occurred during pregnancy or within 42 days of pregnancy conclusion. The increase in Maryland MMR suggests that more pregnancy-related deaths are occurring during pregnancy and in the immediate postpartum period.

The rates of non-pregnancy-related and pregnancy-related death by race during the period from 2011 to 2020 are shown below in Figure 14. While Black NH individuals had a slightly lower rate of non-pregnancy-related mortality than Black NH individuals, the pregnancy-related mortality rate was significantly higher among Black NH individuals compared to White NH individuals.

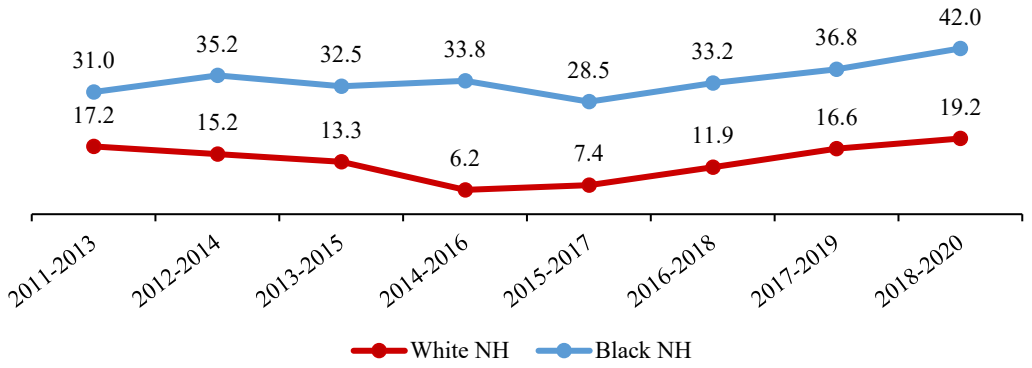
Figure 14: Rate of Non-Pregnancy-Related and Pregnancy-Related Deaths by Race, Maryland, 2011-2020*



*Number of deaths per 100,000 live births. Data Source: VSA and Maryland MMR Program as of 12/2022.
**Denotes statistically significant difference in rates by race, $p<0.001$.
Figure 14 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

The trend over time in pregnancy-related mortality rate by race is shown in Figure 15. Rates are shown as rolling three-year averages because of the small number of cases in each category. Since 2011, the Black NH pregnancy-related mortality rate was consistently higher than the White NH rate. Comparing rates from 2011-2013 and 2018-2020, there was a 35 percent increase in the Black NH rate. The White NH rate increased by 12 percent during this same time-period. In the most recent three-year average, the Black NH rate is 2.2 times higher than the White NH rate. Both rates have increased for the last three years.

Figure 15: Pregnancy-Related Mortality Rates* by Race/Ethnicity, Maryland, 2011-2020



*Number of pregnancy-related deaths per 100,000 live births.
Data Source: VSA and MMR Program as of 12/2022.
Figure 15 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

In Table 3, the racial and ethnic distribution of births in Maryland from 2011 to 2020 is compared with the distribution of non-pregnancy-related and pregnancy-related deaths. Black NH individuals represented over half (54 percent) of pregnancy-related deaths. For non-pregnancy-related deaths, White NH individuals represented the majority (54 percent) of deaths.

Table 3. Live Births, Non-Pregnancy-Related Deaths, Pregnancy-Related Deaths by Race and Ethnicity, Maryland 2011-2020
Data presented as number (%)

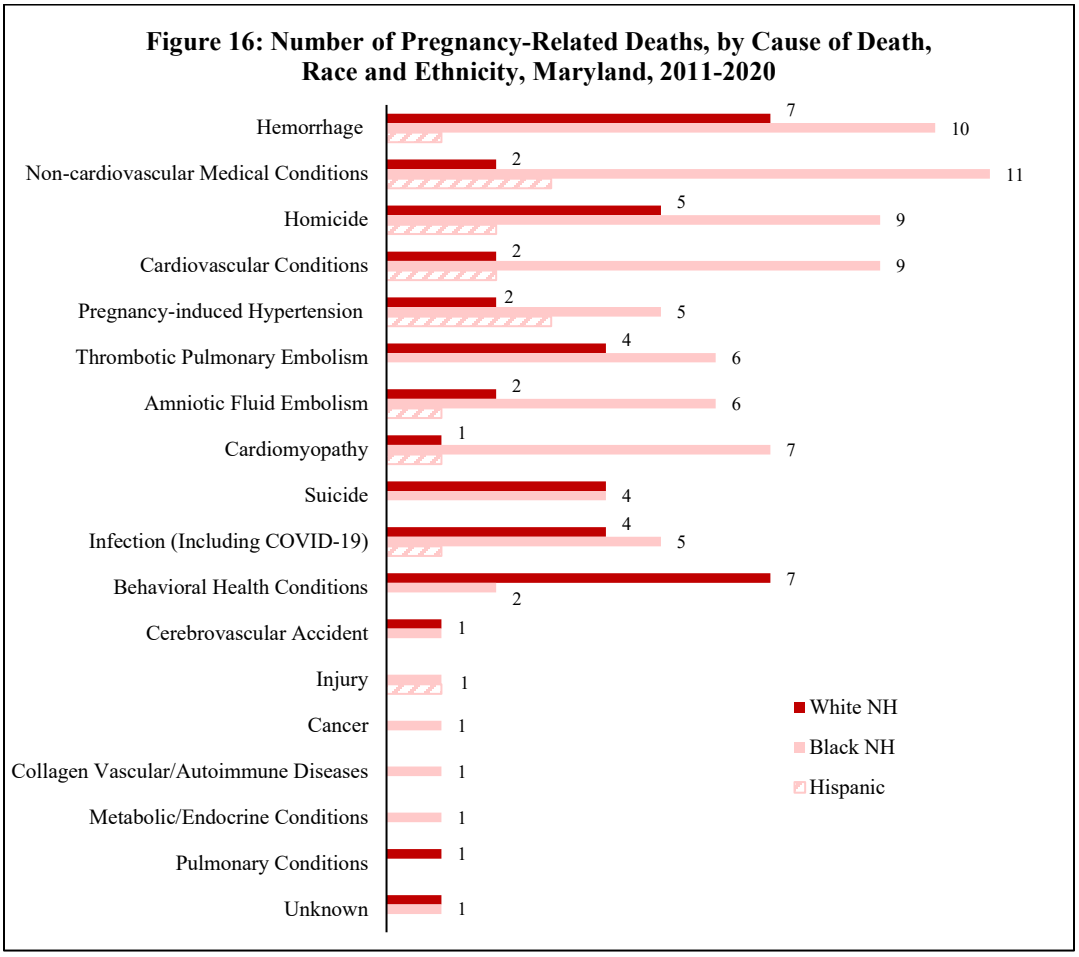
	Total (Maryland)	White NH	Black NH	Hispanic	Asian/Pacific Islander
Live Births	719,116 (100)	315,131 (44)	231,629 (32)	116,136 (16)	53,078 (7)
Non-pregnancy-related Deaths	252 (100)	134 (54)	91 (37)	17 (7)	5 (2)
Pregnancy-related Deaths	150 (100)	44 (30)	80 (54)	15 (10)	9 (6)

Data Source: VSA and Maryland MMR Program as of 12/2022. Births and deaths to non-Hispanic mothers of other races are not included in table but are included in totals in the second column.
The total in Table 3 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

Review of the causes of death by race and ethnicity revealed that among pregnancy-related deaths, hemorrhage and behavioral health conditions were the leading cause of death for White NH pregnant individuals as illustrated in Figure 16 below. Among Black NH individuals, the leading cause of death was non-cardiovascular medical conditions, accounting for 14 percent of deaths. This category includes medical conditions such as seizure disorders, asthma, cancer, and collagen vascular diseases such as lupus. Starting with 2020 cases, the non-cardiovascular medical conditions category is broken out into individual conditions, such as metabolic/endocrine conditions or renal diseases. Although total numbers were small, the leading cause of pregnancy-related deaths among Hispanic pregnant individuals from 2011 to 2020 were pregnancy-induced hypertension and non-cardiovascular medical conditions.

Between 2011-2020, non-cardiovascular medical conditions were the second leading cause of pregnancy-related death overall, with the vast majority occurring among Black NH individuals. Homicide was the third leading cause of pregnancy-related deaths overall between 2011-2020. The number of homicide deaths among Black NH pregnant or postpartum individuals was 1.8 times the number among White NH pregnant or postpartum individuals.

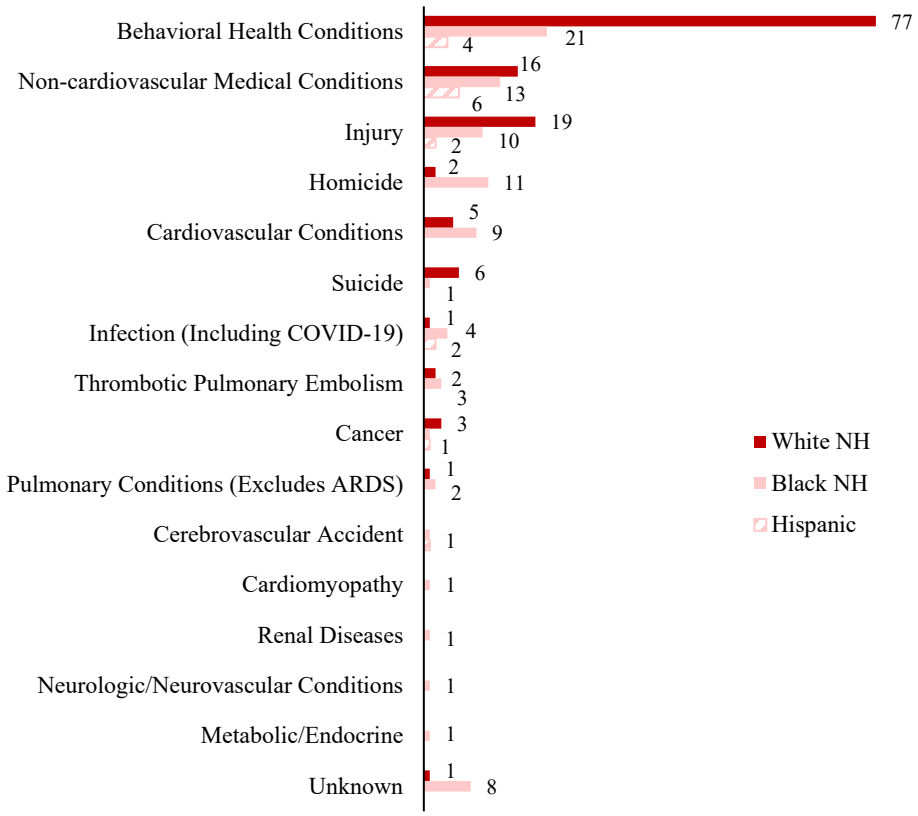
Figure 16: Number of Pregnancy-Related Deaths, by Cause of Death, Race and Ethnicity, Maryland, 2011-2020



Data Source: Maryland MMR Program as of 12/2022.
Figure 16 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

For non-pregnancy-related deaths (Figure 17), the leading cause of death was behavioral health conditions, representing 41 percent of these deaths overall. Most behavioral health conditions were classified as substance use disorder. Behavioral health conditions, which include cases where the leading cause of death was unintentional overdose, were significantly more common among White NH pregnant individuals, with the number of deaths being 3.7 times higher than among Black NH pregnant individuals. The second leading cause of non-pregnancy-related death was non-cardiovascular medical conditions. Injury was the third leading cause, most of which were categorized as "multiple injuries."

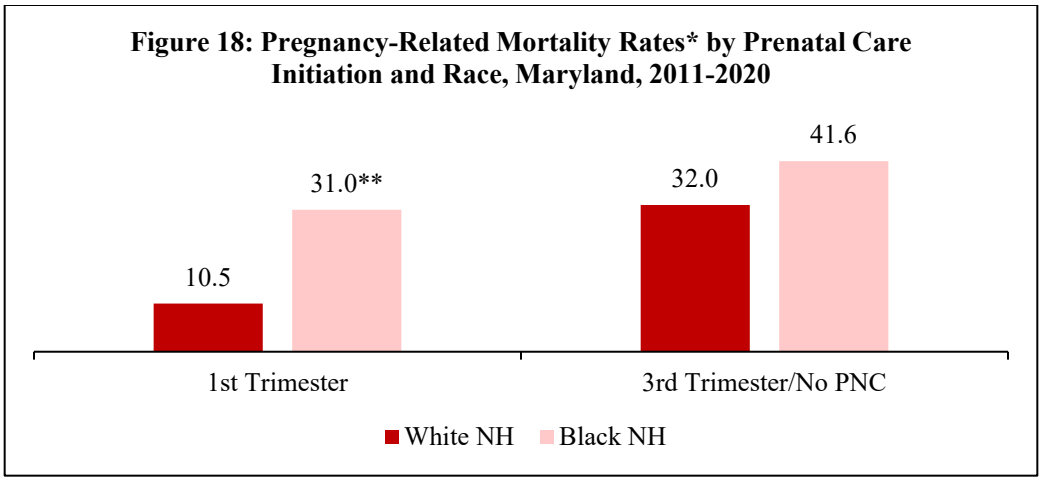
Figure 17: Number of Non-Pregnancy-Related Deaths, by Cause of Death, Race and Ethnicity, Maryland, 2011-2020



Data Source: Maryland MMR Program as of 12/2022.
Figure 17 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

Calculation of the pregnancy-related mortality rates by race and selected maternal characteristics revealed notable differences. Figure 18 shows pregnancy-related mortality rates among White NH and Black NH individuals by timing of prenatal care initiation. Among pregnant individuals initiating prenatal care during the first trimester, the pregnancy-related mortality rate was close to three times higher in Black NH individuals compared to White NH individuals between 2011-2020. Early initiation of prenatal care did not eliminate the racial disparity in pregnancy-related deaths. The pregnancy-related mortality rate increased by 205 percent with late or no prenatal care for White NH individuals and 34 percent for Black NH individuals.

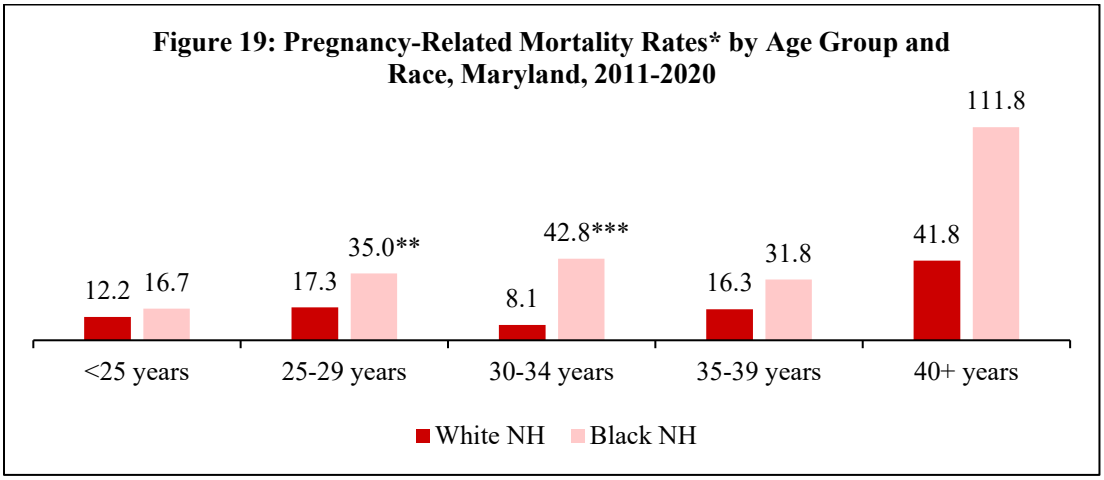
Figure 18: Pregnancy-Related Mortality Rates* by Prenatal Care Initiation and Race, Maryland, 2011-2020



* Number of pregnancy-related deaths per 100,000 live births.
** Denotes statistically significant difference between Black NH and H White, p<0.001. Data Source: VSA and Maryland MMR Program as of 12/2022.
Figure 18 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

As shown in Figure 19 below, racial differences also appeared when examining pregnancy-related mortality rates by maternal age from 2011 to 2020. During this period the Black NH mortality rate was higher than that of White NH individuals at all ages, with significantly higher rates in the 25-29 year and 30–34 year age groups. In the 25–29 year age group, the pregnancy-related mortality rate was 2.0 times higher in Black NH individuals compared to White NH individuals. The mortality rate among Black NH individuals between 30 and 34 years of age was 5.3 times higher than that among White NH individuals in the same age range.

Figure 19: Pregnancy-Related Mortality Rates* by Age Group and Race, Maryland, 2011-2020

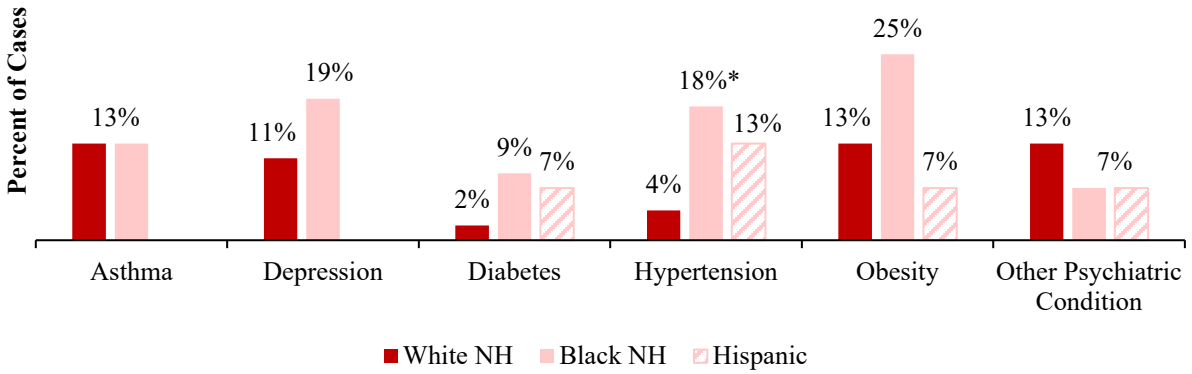


*Number of pregnancy-related deaths per 100,000 live births. **Denotes statistically significant difference between Black NH and White NH, p<0.05. *** Denotes statistically significant difference, p<0.001.
Data Source: Maryland MMR Program as of 12/2022.
Figure 19 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

The prevalence of pre-existing medical conditions was also determined by race among pregnancy-related death cases (Figure 20). Most conditions evaluated were more prevalent among Black NH individuals than among White NH and Hispanic individuals. The greatest

differences between White NH and Black NH individuals were seen for hypertension and obesity, with hypertension proving to be a statistically significant difference.

Figure 20: Prevalence of Pre-Existing Medical Conditions by Race and Ethnicity, Pregnancy-Related Deaths, Maryland, 2011-2020



*Denotes statistically significant difference between Black NH and White NH, p<0.05.
Data Source: Maryland MMR Program as of 12/2022. Note: Percentages add up to more than 100% due to some individuals having more than one pre-existing condition.
Figure 20 excludes a pregnancy-associated death from 2012 for which the MMR Committee did not assign a cause of death or determine pregnancy-relatedness.

Conclusion

While progress has been made, there continue to be disparities in pregnancy-related mortality between Black NH birthing individuals and their White counterparts. A key step to addressing these disparities is facilitating the translation of recommendations into action. The Program is actively working to increase its dissemination of information to key partners, including community organizations and birthing individuals, and its support for community organizations and partners working to address drivers of pregnancy-associated deaths. In 2024, the State will host its first-ever summit to bring together birth workers, community partners, clinicians, and other stakeholders. The goal of the event to foster learning, collaboration, and innovation in the pursuit of eliminating preventable maternal mortality and its associated disparities in care, access, and outcomes for birthing individuals. The Program is also working closely with the Statewide Integrated Health Improvement Strategy (SIHIS) and the Maternal Health Innovation Program (MDMOM) to understand the drivers of severe maternal morbidity and their connections to maternal mortality.

Appendix A: Maternal Mortality Review Committee

MATERNAL MORTALITY REVIEW COMMITTEE

[DATE]

The Honorable Wes Moore
Governor
State of Maryland
Annapolis, MD 21401-1991

The Honorable Bill Ferguson
President of the Senate
Maryland General Assembly
H-107 State House
Annapolis, MD 21401-1991

The Honorable Adrienne Jones
Speaker of the House
Maryland General Assembly
H-101 State House
Annapolis, MD 21401-1991

RE: Health-General Article §13-1212, Annotated Code of Maryland - 2022 Annual Report – Maryland Maternal Mortality Review (MSAR #8248)

Dear Governor Moore, President Ferguson, and Speaker Jones:

Pursuant to Health-General Article, §13-1212; Senate Bill 459, Chapter 74 of the Acts of 2000; and House Bill 1518, Chapter 308 of the Acts of 2018, and based on the report of the Maternal Mortality Review Program, the Maternal Mortality Review Committee submits these recommendations related to maternal mortality in Maryland. The Maternal Mortality Review Committee thanks the Governor and the Maryland General Assembly for their leadership and interest in maternal mortality in Maryland, and looks forward to working with you for continued improved outcomes in this important public health issue.

If you have questions concerning this report, please contact Sarah Case- Herron, Director, Office of Governmental Affairs at sarah.case-herron@maryland.gov.

Sincerely,

Clark Johnson, MD, MPH
Maternal Mortality Review Committee Chair

Enclosure

Cc: Sarah Case-Herron, JD, Director of Governmental Affairs
Dr. Nilesh Kalyanaraman, MD, FACP, Deputy Secretary, Public Health Services
Dr. Elizabeth Kromm, PhD, MSc, Director, Prevention and Health Promotion Administration
Shelly Choo, MD, MPH, Director, Maternal and Child Health Bureau
Sarah T. Albert, Department of Legislative Services (5 copies)

Maternal Mortality Review Committee, 2020 Review

Turn Around Inc. Tania Araya, MSW	**University of Maryland Baltimore Washington Medical Center** Pablo Argeles, MD
Sinai Hospital Pedro Arrabal, MD	**Mercy Medical Center** Robert Atlas, MD
St. Joseph's Medical Center Carol Ator	**University of Maryland Medical System** Shobana Bharadwaj, MD
Holy Cross Hospital Ann Burke, MD	**Johns Hopkins Bloomberg School of Public Health** Andreea Creanga, MD, PhD
University of Maryland Medical System Andrea Desai, MD	**Johns Hopkins Hospital** Deborah Doerfer, CNM
Johns Hopkins Bayview Medical Center, Maternal Mortality Review Abstractor Jill Edwardson, MD	**University of Maryland Medical System** Jen Fahey, CNM
University of Maryland Medical System Stacy Fisher, MD	**Maternal Mortality Review Abstractor** Lorraine Goldstein, CNM
University of Maryland St. Joseph Medical Center Cristina Aquia Haas, RN	**Community Representative** Desiree Israel, LCSW-C
Sinai Hospital, Maternal Mortality Review Committee Chair Clark Johnson, MD, MPH	**Maternal Mortality Review Abstractor** Jan Kriebs, CNM
Anne Arundel Medical Center Christine Laky	**Johns Hopkins Bayview Medical Center, Center for Addiction and Pregnancy** Lorraine Milio, MD
Community Nursing Representative Maxine Reed-Vance, PhD, MS, RN	**University of Maryland St. Joseph Medical Center** Judith Rossiter, MD
Maryland Department of Health, Maternal Mortality Review Program Director Benjamin Wormser, MD, MPH	**Staff to the Committee, MedChi** Shayna Banfield
Staff to the Committee, MedChi Debbie Sciabarrasi	

Maternal Mortality Review Committee Recommendations, 2020 Case Review

In 2020, for the eight consecutive year, unintentional drug overdose or substance use disorder was the leading cause of pregnancy-associated death in Maryland. Twenty-two of the 58 total deaths (38 percent) resulted from substance use disorder. Fifteen of these deaths (58 percent) involved opioids. Of the deaths involving opioids, all 15 of them involved the potent opioid fentanyl or one of its analogs. The MMR Committee makes the following recommendations based on the findings in this report.

Warm Handoffs (care coordination)

In reviewing maternal deaths, we have recognized significant problems with the coordination of postpartum care that affects the ability of patients to transition from the birth setting into the outpatient space and access continuing care. All postpartum individuals in Maryland should be offered a referral to a home visiting program or community health worker (embedded in the hospital or clinic setting) during their delivery hospitalization. Prior to discharge, delivery hospitals should ensure that all follow-up appointments are scheduled and that these details are documented in both the patient's medical record and discharge paperwork and provide resources for any issues related to social determinants of health (SDOH). The referral would have the details regarding "who, what, and where" the patient is scheduled to be seen upon discharge by making definite appointments (date, time, location, contact, and secure transportation). Additional resources are needed to support embedded community health workers in the clinic and hospital setting to assist with these warm handoffs. Therefore, we recommend commercial and government payers support initiatives to assist with patient navigation from pregnant to beyond the postpartum state.

Moving Towards Birth Equity

While striving to ensure every pregnant individual in Maryland receives adequate case management services that actively supports access to care, whether through Medicaid or alternative measures, the Committee recommends the following actions:

1. Supporting Birth Equity Initiatives in Maryland
    - The Maryland Patient Safety Center promoting Breaking Inequality Reimagining Transformative Healthcare (B.I.R.T.H) is an example of an initiative.
    - MDMOM has set out to better understand disparities in maternal morbidity. Efforts to support analyzing causes of longstanding disparities in birth outcomes and moving toward prevention will help reduce inequities in maternal health outcomes.

2. Social Determinants of Health (SDOH) Data Integration in Obstetric Care
    - The integration of SDOH into obstetric management is essential to help identify pregnancies at highest risk and provide appropriate resources in real time. The root cause of this initiative is provider uptake of prenatal social needs screening.
    - Recommendation: The Committee recommends that all prenatal providers in Maryland screen for social needs in the prenatal and postpartum periods and connect their patients with positive screens to services.

Pregnancy Planning

In the deaths that were reviewed, chronic illness prevention and management were common underlying causations. Primary preventative measures are needed to address this causation including increased access to complex family planning services and reproductive health services. In light of these concerns, the Committee recommends the following measures:

1. Promoting health education starting in childhood through adulthood, focusing on education on diet and blood pressure. This includes education on overcoming barriers to healthy activity including food deserts, modified school lunches (increased vegetables with decreased simple carbohydrates), and supporting physical education programs in schools.

2. Advocating for increased uptake of preconception care and counseling. This should include assessment of cardiovascular and other pregnancy-related risks at primary care and cardiology appointments, along with anticipatory guidance in pregnancy age individuals.

3. Anticipating pregnancy care in the next pandemic by improving communication portals between patients and providers and increasing accessibility to telehealth services.

Technical/Committee Work Recommendations

Multiple cases were not reviewed by the medical examiner that would have provided pertinent autopsy information in the case review. The Committee recommends working with the OCME office to increase autopsy rates for pregnancy-related and pregnancy-associated deaths.

Appendix B: Maternal Mortality Review Stakeholder Group

Maternal Mortality Review Stakeholder Group Background

House Bill 1518, enacted during the 2018 legislative session of the Maryland General Assembly, established a Maternal Mortality Review Stakeholder Group (MMRSG) in Md. Ann. Code Health – General Art. §13-1208. The statute requires MMRSG to meet at least twice a year to review the findings and recommendations in the annual Maternal Mortality Review Report. This group includes representatives of the Maryland Office of Minority Health and Health Disparities, the Maryland Patient Safety Center, the Baltimore Healthy Start Program, women's health advocacy organizations, community organizations engaged in maternal health and family support issues, family members that have experienced a maternal death, local health department staff, and health care providers that provide maternal health services (a full membership listing is included in this Appendix).

MMRSG is charged with reviewing and adding to the recommendations of the Maternal Mortality Review Report, examining issues resulting in disparities in maternal deaths, and identifying new recommendations with a focus on initiatives to address disparities in maternal deaths. Recommendations from MMRSG follow those put forward by the MMR Committee.

Maternal Mortality Review Stakeholder Group, 2022

Maryland Department of Health Benjamin Wormser, MD, MPH	**Baltimore Healthy Start, Inc.** Teneele Bruce, MBS
Maryland Commission for Women Jenny Pena-Dias, PhD, MPH, MS	**Maryland Patient Safety Center** Blair Eig, MD
Black Mamas Matter Alliance Vacant	**Community Representative** Pastor Meldon Dickens
Comprehensive Women's Health, Inc. Angela Marshall, MD, FACP	**Office of Minority Health and Health Disparities** David Mann, MD, PhD
Women's Health Care Provider Meghana Rao, MD	**Baltimore Healthy Start** Maxine Reed Vance, PhD, RN
Family Representative, University of Maryland School of Nursing Rosemarie DiMauro Satyshur, PhD, RN	**Community Representative and Pediatric Physician** Toni Thompson-Chittams, MD, FAAP
Community Representative Doris Titus-Glover, PhD, MSN	**Prince George's County Health Department** Diane Young
Chrysalis House, Inc. Vacant	**Maryland Association of County Health Officers** Vacant
Queen Anne's County Health Department Melissa Aftoora	**Black Women's Health Initiative** Vacant
House of Ruth Maryland Vacant	**Healthy New Moms/Mental Health Association of Maryland** Vacant

Maternal Mortality Review Stakeholder Group Recommendations, 2020 Case Review

Additions to the recommendations in the Maternal Mortality Review 2022 Annual Report

SDOH Screening and Care Coordination

Obstetrical providers play an important role in a birthing individual's care and should continue to perform screenings for social determinants of health during the pre-pregnancy, perinatal, postpartum, and interpregnancy periods.

1. SDOH screenings and referrals should be subject to an enhanced payment/reimbursement by all payers, including Medicaid. Providers should also be encouraged to utilize existing tools for care coordination, such as the Medicaid Prenatal Risk Assessment (PRA) form.
    - MDH and Medicaid should work together to identify how the PRA or similar process can be expanded to all payers.

2. There needs to be increased harmonization of referral and care coordination pathways to ensure patients receive the services they need.
    - A streamlined process for care coordination throughout the course of an individual's reproductive health should be developed. Currently the PRA is only utilized for Medicaid recipients or Medicaid eligible individuals in the prenatal period, and the Postpartum Infant and Maternal Referral (PIMR) form is only utilized during the postpartum period following a hospital delivery. No standardized referral mechanism exists for use in the postpartum/interpregnancy period.

3. MMRSG also recommends considering all avenues that SDOH screenings can be implemented in addition to obstetrical providers.

4. In addition to the recommendations for providers, CRISP and other partners should consider how to provide better real-time information on status, completion, and outcomes of SDOH screenings and referrals. This information will help providers and public health professionals better understand and address gaps in care coordination and handoffs.

5. MMRSG specifically recommends that trained Community Health Workers (CHW) working in partnership with other clinical social services personnel become part of the birthing individual's health care team during the antenatal period, in discharge planning after delivery and in the first 12 months post-delivery. The CHW would receive all SDOH referrals and access resources to help improve patients' abilities to fulfill the needs and follow-up on these referrals. These referrals would become part of the patient's medical records and entered into the EMR system. Every referral would require a disposition follow-up and if necessary other community follow-up, e.g. home visit, phone contact, etc.

COVID-19

6. MMRSG recommends that all maternal health stakeholders in the state explore the impacts of COVID-19 on birthing individuals' health in future years.

- Further, they encourage the state Maternal Mortality Review Program to analyze its available data on COVID-19 among pregnancy-associated deaths.

7. MMRSG recommends leveraging existing data to identify high-risk patients before, during, and after pregnancy and to connect them with resources to reduce their risk of poor outcomes

Appendix C: Five-Year Rolling Maternal Mortality Rates by Race, Maryland and United States, 2001-2020

Appendix C shows the five-year rolling MMR by race in Maryland going back to the 2001–2005-year period.

Table C1: Five-Year Rolling Maternal Mortality Rate* by Race/Ethnicity, Maryland and United States, 2003-2020

	Maryland			United States		
Year	**All Races**	**White NH**	**Black NH**	**All Races**	**White NH**	**Black NH**
2003-2007	21.6	13.3	41.1	13.3	9.8	33.9
2004-2008	21.2	13.0	38.1	13.9	10.5	34.6
2005-2009	21.9	14.5	38.6	14.6	11.4	35.5
2006-2010	24.1	17.6	40.2	15.0	11.7	35.1
2007-2011	25.7	20.9	37.5	16.1	13.3	36.7
2008-2012	25.5	20.6	39.8	17.6	14.5	40.4
2009-2013	24.5	20.4	39.8	18.9	16.0	43.5
2010-2014	25.7	18.7	45.2	19.9	17.0	45.2
2011-2015	23.5	17.6	40.5	20.7	18.1	47.2
2012-2016	19.7	12.3	38.0	21.2	18.6	48.3
2013-2017	19.5	11.8	35.7	21.6	19.1	48.2
2014-2018	18.4	8.8	35.1	20.7	18.2	45.4
2015-2019	17.2	11.6	27.8	20.4	17.9	44.1
2016-2020**	17.5	12.9	29.2	20.9	18.2	47.0

*Rate of maternal deaths per 100,000 live births. Source: CDC WONDER as of 05/02/2024.
Ranges 2003-2007 through 2015-2019: MMR for White NH and Black NH individuals are calculated using bridged race data
** Range 2016-2020: MMR for White NH and Black NH individuals are calculated using single race data where available, and bridged race data where single race data not available. As a result of the rate calculations, the 2016-2020 rates for White NH and Black NH individuals are not directly comparable to previous periods, indicated by a break in the table.
Additional information on the differences between bridged-race and single-race data may be found on the CDC, National Center for Health Statistics (NCHS) website: https://www.cdc.gov/nchs/hus/sources-definitions/race.htm