Maryland
DEPARTMENT OF HEALTH

Maryland Maternal Mortality Review

2023 Annual Report
Health – General Article §13-1212

Wes Moore
Governor

Aruna Miller
Lt. Governor

Meena Seshamani, MD, Ph.D
Secretary

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This review of maternal deaths in Maryland would not be possible without the data, expertise, and collaboration of the Maryland Department of Health Vital Statistics Administration (VSA) and the Office of the Chief Medical Examiner. The Maternal Mortality Review Program (the Program) would also like to offer special thanks to the volunteer members of its Maternal Mortality Review Team (MMRT) for the hours spent in discussion and the serious attention given to this important public health project. The Program is grateful for the diligent work of the abstractors in their careful and thorough abstraction of case materials. The Program also thanks the Maryland Patient Safety Center for their collaboration in the administrative support of the MMRT. A list of MMRT members and staff can be found in Appendix B. The Program is grateful for the Maryland Department of Health Maternal and Child Health Bureau (MCHB) staff for their contributions, including Dr. Shelly Choo, Dr. Ben Wormser, Iliana Siarmalis, NaToya Mitchell, Cassidy Spence, Nina Martin, Jessica Hernandez, Lindsey Hall, and Ashka Mehta.

Finally, the Program and MMRT wish to acknowledge the people who passed away during or after their pregnancy and who are described in this report. Each death represents a person's life that ended too early, and it is in humble respect for their lives lived and the lives of all birthing people in Maryland that this report is presented.

Summary

Maryland's maternal mortality rate (MMR) in the most recent five-year period (2017-2021) is six percent below the national rate. However, both the United States (U.S.) and Maryland have seen increases in their MMR rates, and both are higher than the Healthy People 2030 target of 15.7 deaths per 100,000 live births. Additionally, significant racial disparities in maternal deaths remain.

There were 42 pregnancy-associated deaths of Maryland residents in 2021, 16 fewer deaths (a 28 percent decrease) compared to 2020. Among these deaths, 15 (36 percent) were determined to be pregnancy-related, and 27 (64 percent) were determined to be non-pregnancy-related. Similar to 2020, the leading cause of all pregnancy-associated deaths in 2021 was behavioral health conditions, which includes substance use disorder.[1] Substance use and overdose continues to be the leading underlying cause of pregnancy-associated deaths for the ninth consecutive year. The leading causes of pregnancy-related deaths in 2021 included infection, cardiovascular conditions, and hemorrhage, while behavioral health conditions were the leading cause of non-pregnancy-related deaths.

The pregnancy-associated mortality rate shows considerable variability from 2012 to 2021, with a 54 percent increase in this period. In contrast, the 2021 pregnancy-related mortality rate remains similar to previous years and shows a smaller increase of 15 percent since 2012. The upward trend in the pregnancy-associated mortality rate is mostly driven by the increase in non-pregnancy-related deaths. This is largely due to increasing numbers of overdose deaths in the last several years. The majority of 2021 deaths (80 percent of pregnancy-related deaths and 82 percent of non-pregnancy-related deaths) were considered preventable.

Recommendations from the Maternal Mortality Review Team (MMRT) and the Maternal Mortality Review Team Stakeholder Group (MMRSG)[2] are included as Appendices B-C to this report. The recommendations address key topics that arose during this year's review, including but not limited to substance use and harm reduction, insurer engagement in care coordination, the need for people with lived experiences to provide feedback in clinical healthcare settings, considerations for interpregnancy and reproductive health planning, and standard investigation procedures concerning pregnancy-associated deaths. The MMRT will continue to disseminate the findings of this review process and promote collaboration among all providers caring for pregnant and postpartum persons to reduce pregnancy-associated deaths in Maryland.

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Certain data were provided by VSA, Maryland Department of Health, Baltimore, Maryland. VSA disclaims responsibility for any analyses, interpretations or conclusions.

[1] Based on Pregnancy Monitoring Surveillance System (PMSS) codes for mental health 100.1-100.5 and 100.9

[2] 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.

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Background

The Maryland Maternal Mortality Review Program (the Program) was enacted 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 [3];
(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 Program is divided into three pillars (Figure 2): the Review Groups, which conduct reviews of pregnancy-associated deaths and provides recommendations; Epidemiology and Data, which encompasses the Program's analyses against other maternal health data and trends; and Dissemination and Action, which supports the translation of Program recommendations into action. In 2021, the Program was awarded funding from the Centers for Disease Control and Prevention (CDC)'s Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) program. This funding supports agencies and organizations to coordinate comprehensive, multidisciplinary maternal mortality reviews. The Program has utilized this funding to strengthen its review processes, and support implementation of its recommendations.

Figure 1 – Structure of Maryland's Maternal Mortality Review Program

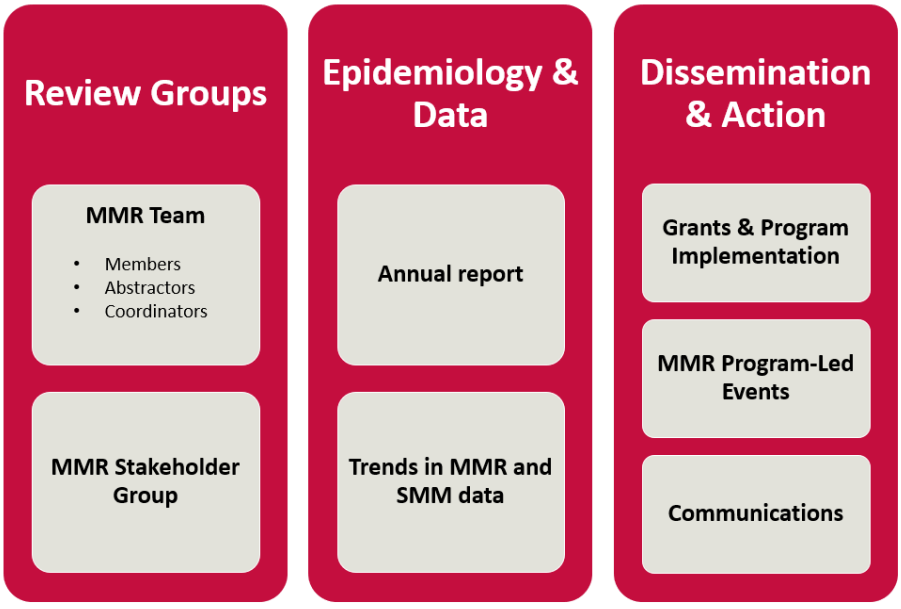

Figure 2 – Structure of Maryland's Maternal Mortality Review Program

[3] Defined as "the death of a woman during pregnancy or within 1 year after the woman ceases to be pregnant", Md. Ann. Code Health-General Art., §13-1201

The Maternal Mortality Review Team (the MMRT) is the Program arm that conducts comprehensive reviews of all pregnancy-associated deaths. The MMRT comprises a diverse, multidisciplinary membership, including health care providers, advanced practice practitioners such as nurse midwives, public health professionals, mental health specialists, community birth workers, individuals with quality improvement expertise, and individuals with lived experience.

MDH contracted with the Maryland Patient Safety Center from July 2022 through June 2024 to provide administrative support to the Program by obtaining medical records, abstracting cases, and hosting meetings of MDH's MMRT. The MMRT provides an in-depth review of maternal deaths to determine pregnancy-relatedness and preventability following a standardized question structure developed by the CDC.[4] The MMRT then develops recommendations for the prevention of maternal deaths and disseminates their findings through this report and structured outreach. Additional recommendations are provided by MMRSG (see Appendix B). The Program hosted its first ever statewide summit in May 2024, and is exploring the frequency of this and other Program-led events to share findings and bring together partners.

Additionally, Health-General §13-1212 requires the Secretary to submit an annual report on the findings, recommendations, and actions of the Program to the Governor and the General Assembly, which includes a summary of stakeholder feedback and information related to racial disparities.

[4] CDC. Maternal Mortality Review Committee Decisions Form. Maternal Mortality Prevention. https://www.cdc.gov/maternal-mortality/php/mmrc/decisions-form.html

Key Definitions

Figure 2: Key Definitions

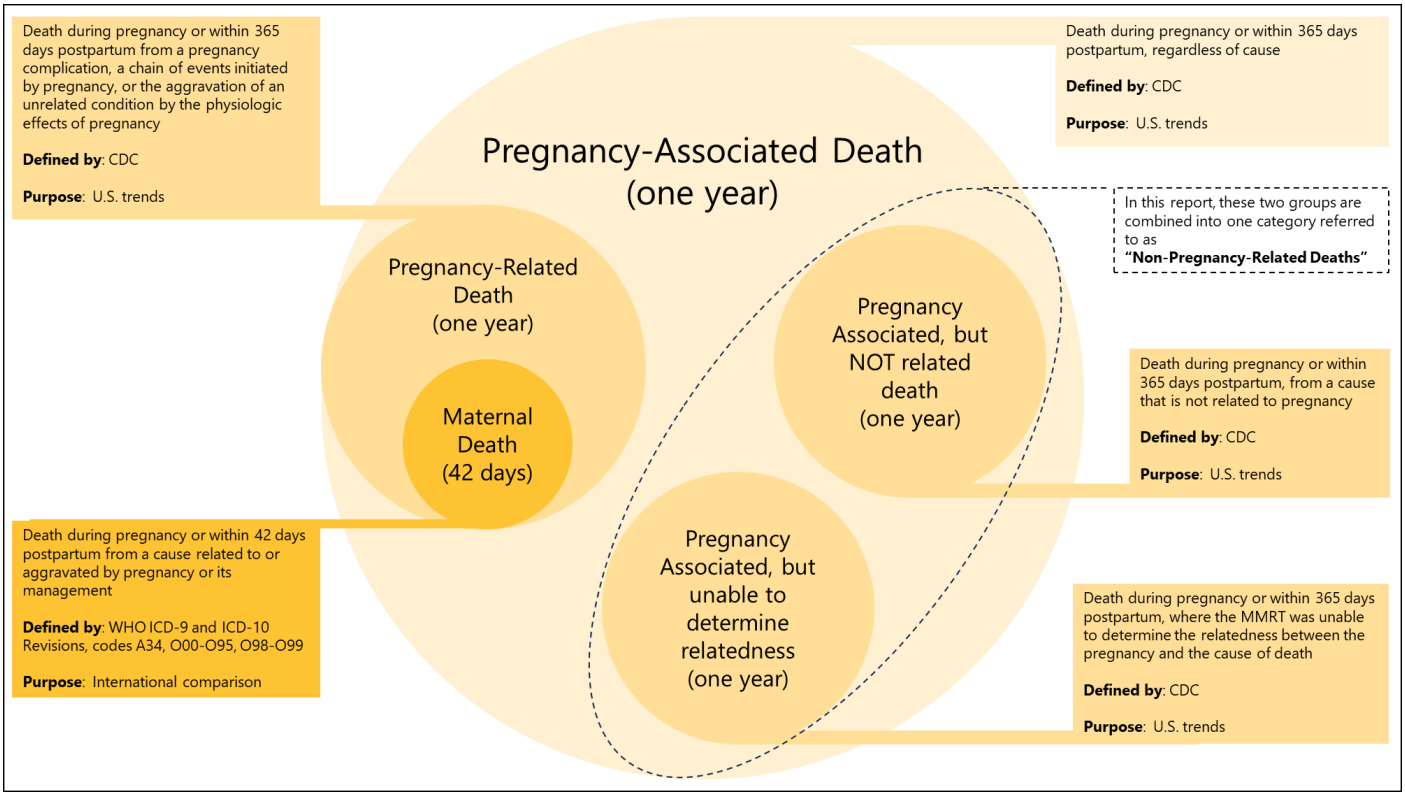

Figure 3 - Key Definitions

Note: Prior to the issuance of the Program's 2020 report, annual reports used different definitions of maternal deaths and MMR, which included all International Classification of Diseases Tenth Revision (ICD-10) codes O00-O99. The Program's annual reports from 2020 onwards have updated the definition to exclude codes O96-O97 to align with the WHO definition.

Globally, a maternal death is defined by the World Health Organization (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" [5, 6] and is expressed in the maternal mortality rate (MMR).[7] While this measure is important to establish an international indicator of population health that can be compared across nations, maternal deaths consider a limited period of time and may miss deaths that occur in the later postpartum period. 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 Maryland, the 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

[5] Cresswell, J. Maternal Deaths. Indicator Metadata Registry List; World Health Organization. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4622

[6] The ICD-10 codes used to identify maternal deaths are A34, O00-O95, and O98-O99

[7] The number of maternal deaths per 100,000 live births in the same time-period.

checkbox has significantly increased identification of maternal deaths beyond those recognized by cause of death alone.[8]

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 people where pregnancy was a contributing factor. In addition to the MMR, the CDC and national programs utilize pregnancy-associated deaths, which encompass deaths that occur during pregnancy and up to 1 year after the end of a pregnancy. These are further subdivided into categories based on the cause of death and the relatedness to pregnancy and its impacts (

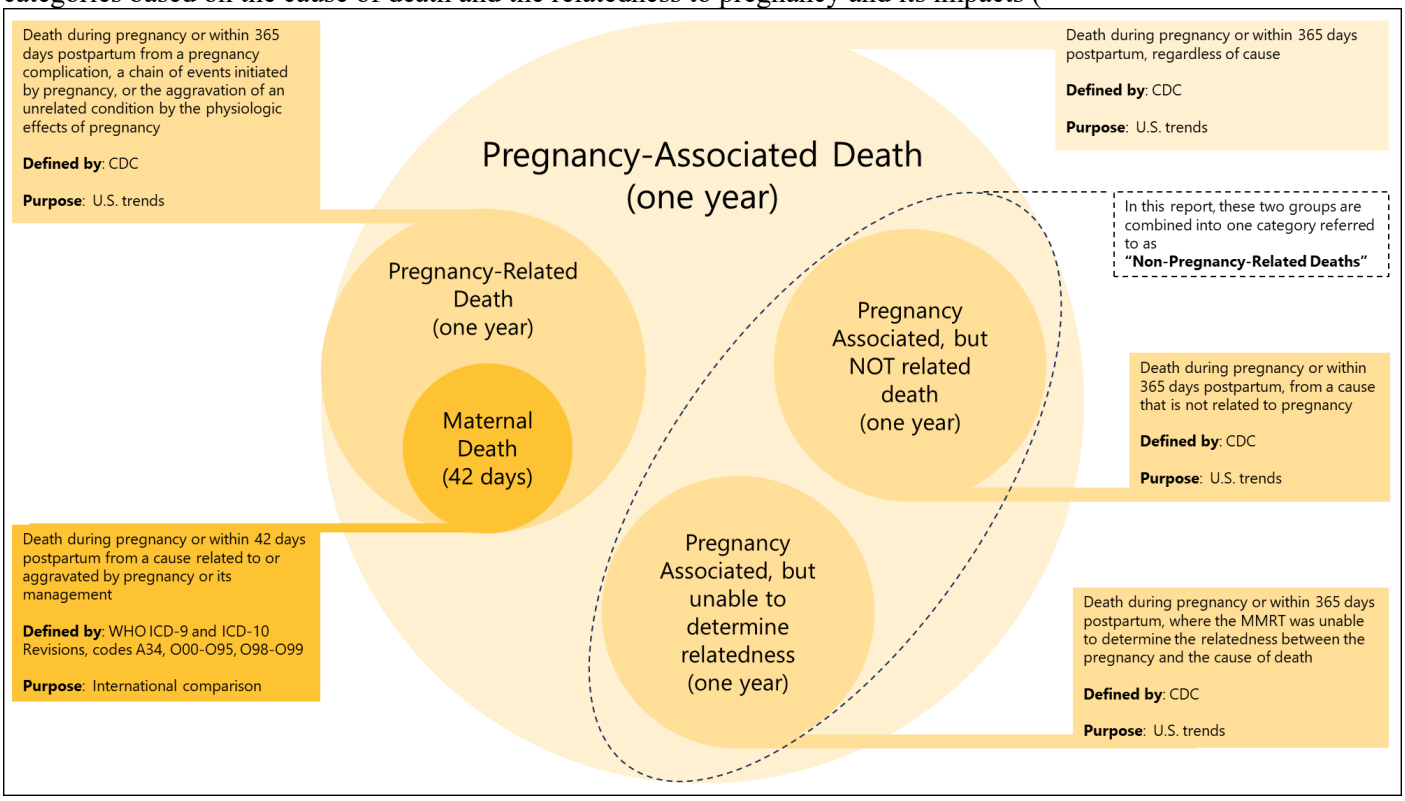

Figure 3). See Appendix A for a full list of definitions regarding maternal and pregnancy-associated deaths.

Maternal Deaths in Context

Nationally, maternal deaths have significantly decreased since the 1930s when the MMR was 670 maternal deaths per 100,000 live births. Since the late 1980s the national 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.[9] In order to stabilize rates, the Program presents rolling five-year U.S. and Maryland MMR rates in this report because maternal deaths, specifically in Maryland, are relatively infrequent events that may vary considerably year to year.

[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] Hoyert, Donna. "Maternal Mortality Rates in the United States, 2021." Centers for Disease Control and Prevention, 16 Mar. 2023, www.cdc.gov/nchs/data/hestat/maternal-mortality/2021/maternal-mortality-rates-2021.htm.

The U.S. and Maryland MMR rates for two distinct five-year periods are shown in Figure 4; the earlier period from 2012 to 2016 is compared to the subsequent period from 2017 to 2021. The Maryland MMR was seven percent and six percent lower than the national rate in both periods, respectively. Between the two five-year periods, the U.S. MMR increased by nine percent, and the Maryland rate increased by ten percent. Both the U.S. and Maryland rates remain above the Healthy People 2030 Maternal, Infant, and Child Health Objective Four (MICH-04) target of 15.7 maternal deaths per 100,000 live births.[10]

Figure 3: Maternal Mortality Rates*, U.S. and Maryland 2012-2016 and 2017-2021

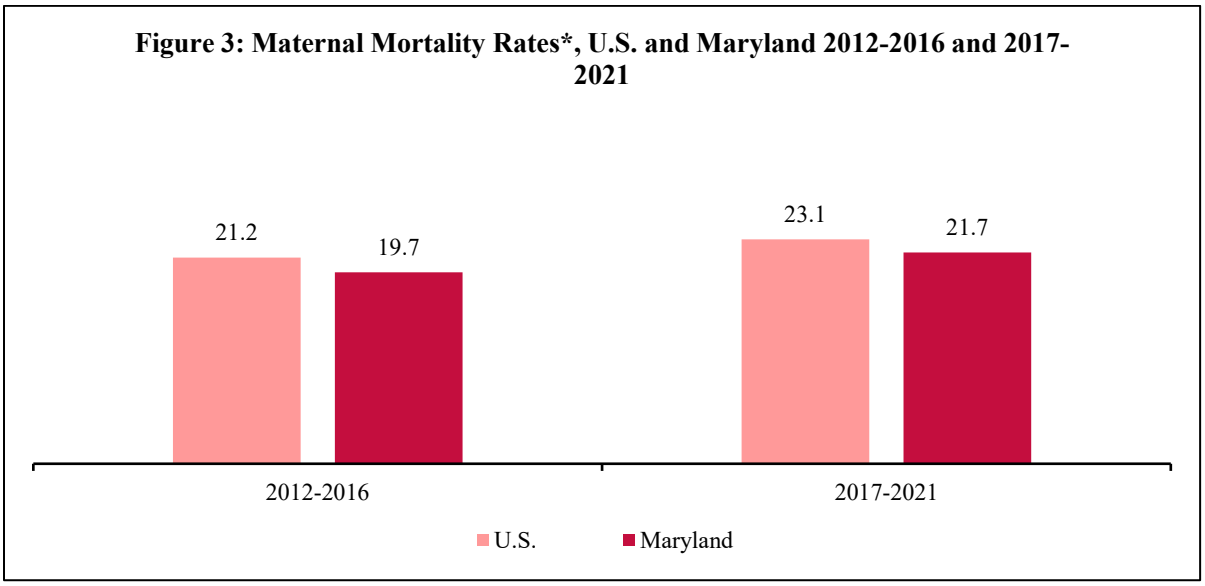

Figure 4
* Rate of maternal deaths per 100,000 live births.
Data Source: CDC WONDER as of 05/2024.
Note: The MMR Program presents rates with one significant figure after the decimal. All figures showing percentages or prevalence do not include decimals.

Racial Disparity

In the U.S. between 2017 and 2021, 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 MMR among Black NH and White NH individuals.[11] Figure 5 shows the MMR by race in Maryland for six overlapping five-year periods dating back to 2012. The 2017-2021 Black NH MMR was 1.7 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.

In Maryland, like in many other states across the nation, there are long-standing racial disparities in maternal deaths, with Black NH birthing people and other non-White racial groups disproportionately impacted. These disparities are driven by policies and cultural forces, both explicit and implicit, that are rooted in racism and inequity. One of the goals of this review is to uncover ways in which these factors manifest in the care of birthing people during pregnancy and in the postpartum period. By making recommendations that target change at the institutional and systems levels (see Appendix B and C), the MMRT strives to address these drivers and create a healthy and safe future for all birthing Marylanders.

[10] Healthy People 2030. "Reduce Maternal Deaths — MICH-04 - Healthy People 2030 | Health.gov." Healthy People 2030, health.gov/healthypeople/objectives-and-data/browse-objectives/pregnancy-and-childbirth/reduce-maternal-deaths-mich-04.
[11] This report utilizes race and ethnicity categories as defined by the Maryland Vital Statistics Administration. See Page xi, https://health.maryland.gov/vsa/Documents/Reports%20and%20Data/Annual%20Reports/2021AnnualReport_Final_v1023.pdf

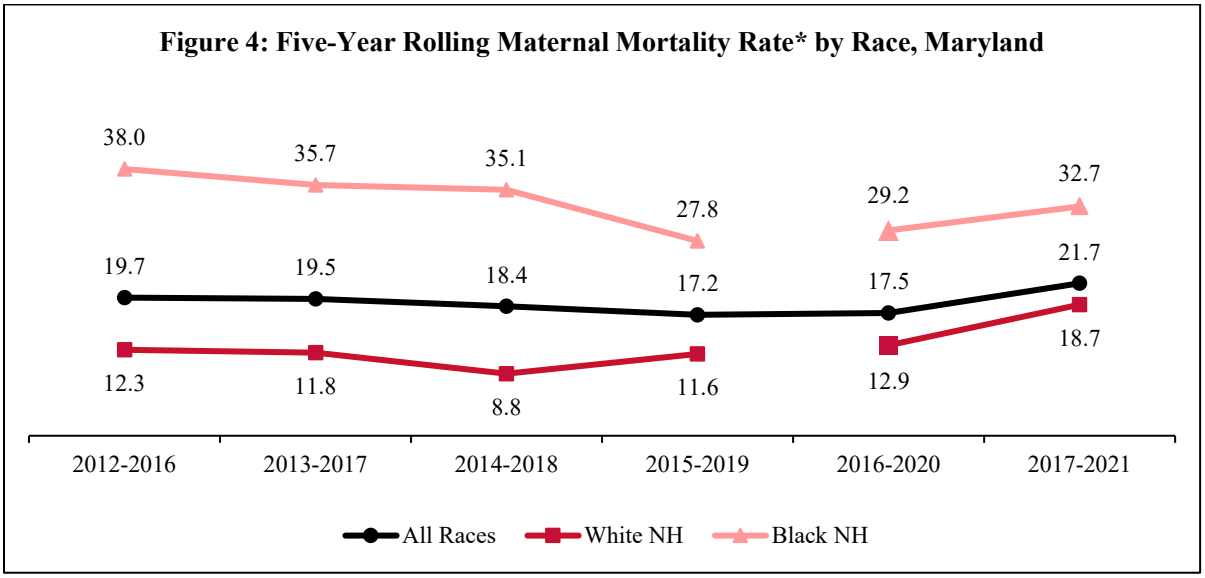

Figure 5
* Rate of maternal deaths per 100,000 live births.
Data Source: CDC WONDER as of 05/2024.
Ranges 2012-2016 through 2015-2019: MMR for White NH and Black NH individuals are calculated using bridged race data
Ranges 2016-2020 through 2017-2021: MMR *estimates* for White NH and Black NH individuals are calculated using single race data where available, and bridged race data where single race data are not available.
As a result of the rate calculations, the disaggregated rate estimates for White NH and Black NH individuals for periods including and beyond 2016-2020 are not directly comparable to rates from previous periods or estimates in subsequent 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, National Center for Health Statistics (NCHS) website: https://web.archive.org/web/20250131112416/https://www.cdc.gov/nchs/hus/sources-definitions/nhis.htm

Methodology

Case Identification

The Program reviews deaths of individuals who were residents of Maryland at the time of their death. Residents of other states who died in Maryland are not included in the reviews. Information regarding these cases is transferred to the respective mortality review committees in those states and are subject to their review. Every effort is made to obtain medical records and information regarding Maryland residents who die in other states.[12]

Pregnancy-associated deaths are identified in one of three ways in Maryland by VSA. 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 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.

[12] 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/.

The MMRT 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 (see

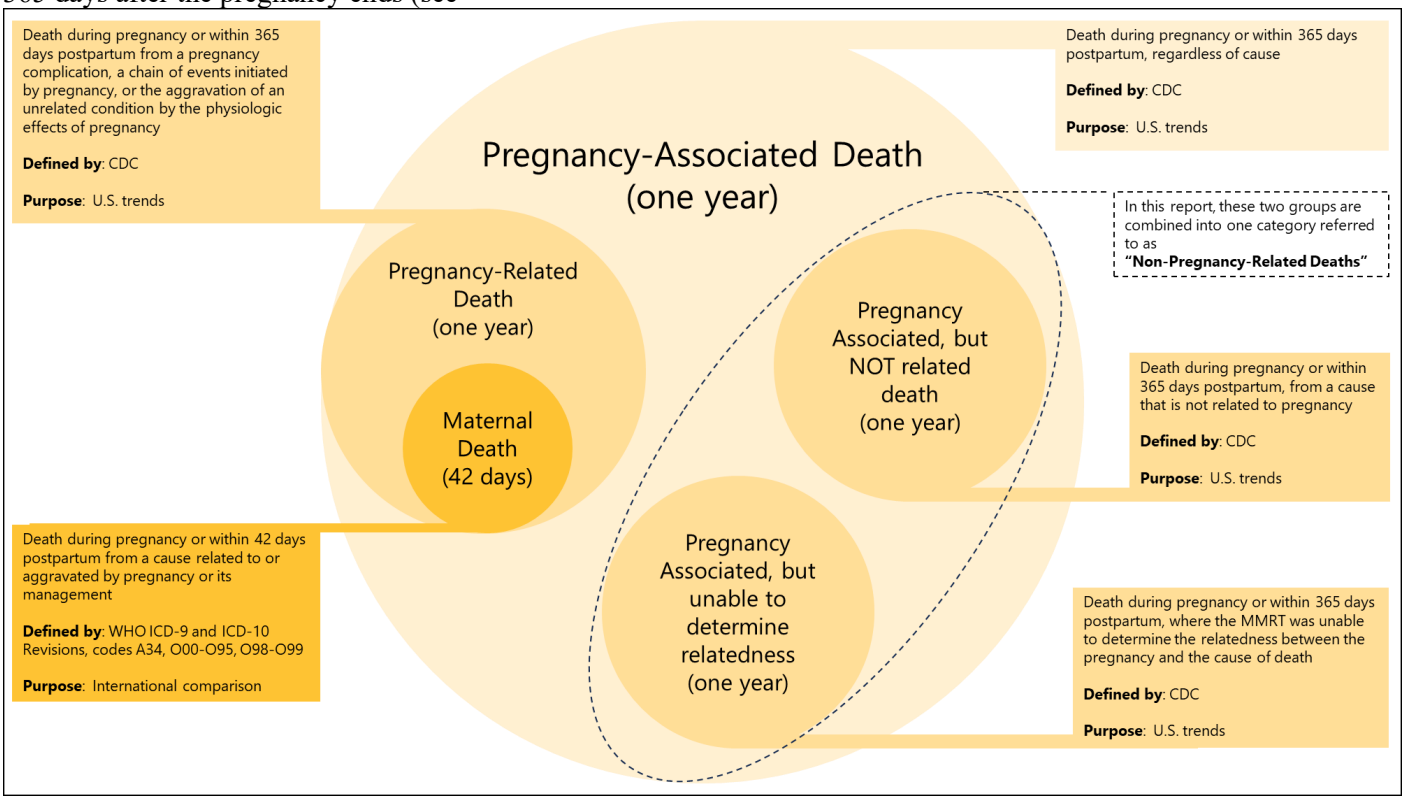

Figure 3).

Using the three methods above, 51 possible pregnancy-associated deaths were identified in 2021. Further review identified six false positive cases (where individuals were noted as pregnant or recently pregnant by one of the three methods but found upon investigation to not have been pregnant) and three out-of-scope cases (where decedents were residents of other states and whose cases are reviewed by those states). Excluding those cases, the Program reviewed 42 deaths (
Figure 7).

Figure 6 – Flow Diagram of 2022 Pregnancy-Associated Deaths Evaluated by MMR Program

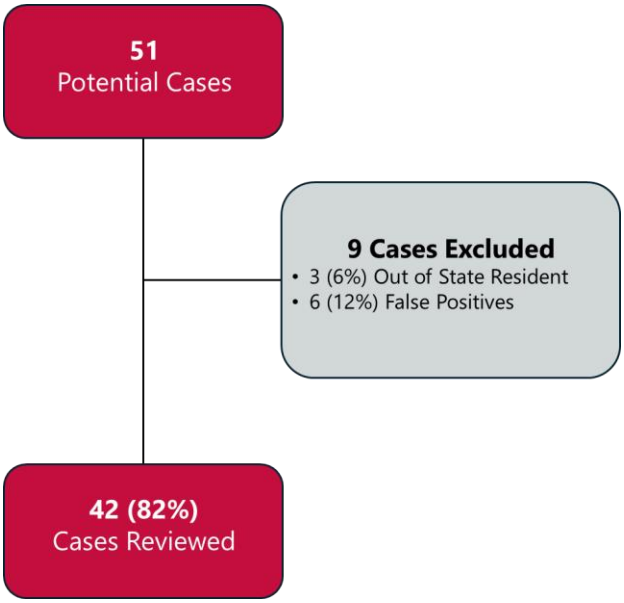

Figure 7
Data Source: Maryland MMR Program and VSA as of 06/2024.

Figure 8 shows the annual number of pregnancy-associated deaths in Maryland from 2012-2021. An average of 40 pregnancy-associated deaths occurred per year during this period.

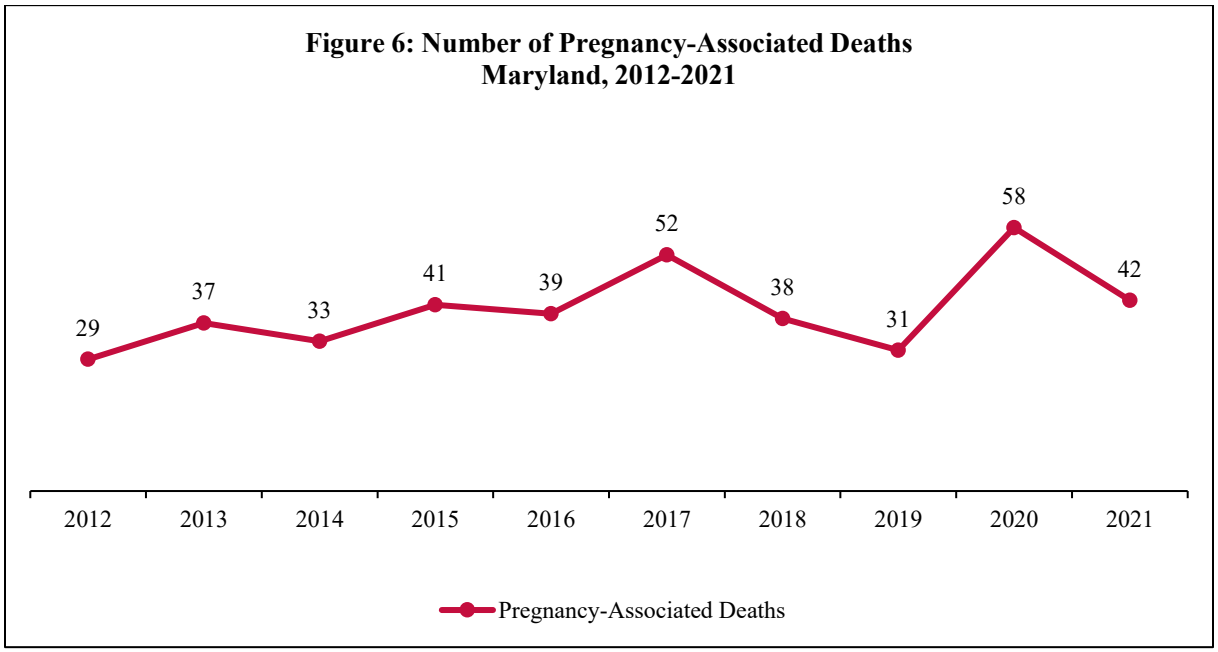

Figure 8
Data Source: Maryland MMR Program as of 06/2024.

Case Review

The Program conducts several stages of review of pregnancy-associated deaths. Once cases are identified and determined to be within scope, 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, social media, obituaries or news articles, social records, findings from interviews with close family and friends (if possible), and other available materials to create a cohesive de-identified summary of the events leading up to and context surrounding an individual's death. These case summaries are submitted to the MMRT for review during monthly meetings.[13] The Program uses the Maternal Mortality Review Information Application (MMRIA) system, designed by the CDC to facilitate Maternal Mortality Review Committee (MMRC) functions "through a common data language."[14]

Pregnancy-relatedness and potential preventability of the deaths are determined through MMRT discussion. The MMRT includes a wide range of expertise to conduct comprehensive, multidisciplinary reviews.

The review 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.[15] Each case is considered through the lens of five questions:

1. Was the death pregnancy related?
2. What was the underlying cause of death?
3. Was the death preventable?
4. What are the contributing factors to the death?
5. What specific and feasible actions might have changed the person's course and prevented the death?

Cases discussed by the MMRT are de-identified and all members sign confidentiality agreements prior to starting the review. Through these reviews, MMRT members produce recommendations to address factors that contributed to the individual's death. A summary of recommendations based on each year's key themes is presented in Appendix A.

2021 Case Findings

The Program identified a total of 42 pregnancy-associated deaths in 2021, resulting in a pregnancy-associated mortality rate (PAMR) of 61.5 deaths per 100,000 live births. For further analysis, the MMRT divided these deaths into pregnancy-related and non-pregnancy-related deaths, which represent two non-overlapping groups. Of the 42 pregnancy-associated deaths, 15 were determined to be pregnancy-related. The remaining deaths were split into 16 pregnancy-associated, not related deaths and 11 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 27 deaths. Mortality rates for each group are presented in 1.

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[13] The Maternal Mortality Review Committee 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.

[14] For additional information about MMRIA, see https://www.cdc.gov/maternal-mortality/php/mmrc/guides-tools.html. The Program has established a DUA with the CDC governing the use of data entered into MMRIA.

[15] 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.

Table 1: Mortality rates among 2021 pregnancy associated deaths, by relatedness category.

Category	Number of Deaths	Rate
Pregnancy-associated deaths	42	61.5 deaths per 100,000 live births
Pregnancy-related deaths	*15*	*22.0 deaths per 100,000 live births*
Non-pregnancy related deaths (incl. pregnancy-associated, not related and pregnancy-associated, unable to determine relatedness)	*27*	*39.6 deaths per 100,000 live births*

Cases by Cause of Death Category

Figure 9 shows pregnancy-related and non-pregnancy-related deaths by category of cause of death.[16] The leading cause of all pregnancy-associated deaths was behavioral health conditions. These accounted for one pregnancy-related and nine non-pregnancy-related deaths in 2021. Substance use disorder was the main condition leading to death in all ten deaths due to behavioral health conditions.

Among the 15 pregnancy-related deaths in 2021, the leading cause of death was infection which accounted for three deaths, followed by hemorrhage and cardiovascular conditions which each accounted for two deaths. Substance use, cancer, non-amniotic fluid embolism, amniotic fluid embolism, cardiomyopathy, collagen vascular/autoimmune disease, hematologic conditions, and hypertensive disorder of pregnancy each accounted for one pregnancy-related death.

The leading causes of death for non-pregnancy-related deaths was behavioral health conditions, accounting for nine of 27 (33 percent) cases. There were eight non-pregnancy-related deaths due to injury: six homicides due to gunshot wounds, and two deaths due to motor vehicle crashes. Other causes of non-pregnancy related deaths included cancer, infection, non-amniotic fluid embolism, and cerebrovascular accident.[17]

[16] 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.

[17] In this report, unless otherwise specified, "injury" includes both intentional (e.g. suicide, homicide) and unintentional (e.g. motor vehicle collisions) causes. In the Program's 2021 Annual Report and prior reports, intentional and unintentional injuries were separate.

Figure 7: Number of Pregnancy Associated Deaths by Relatedness and Cause of Death Category, Maryland, 2021

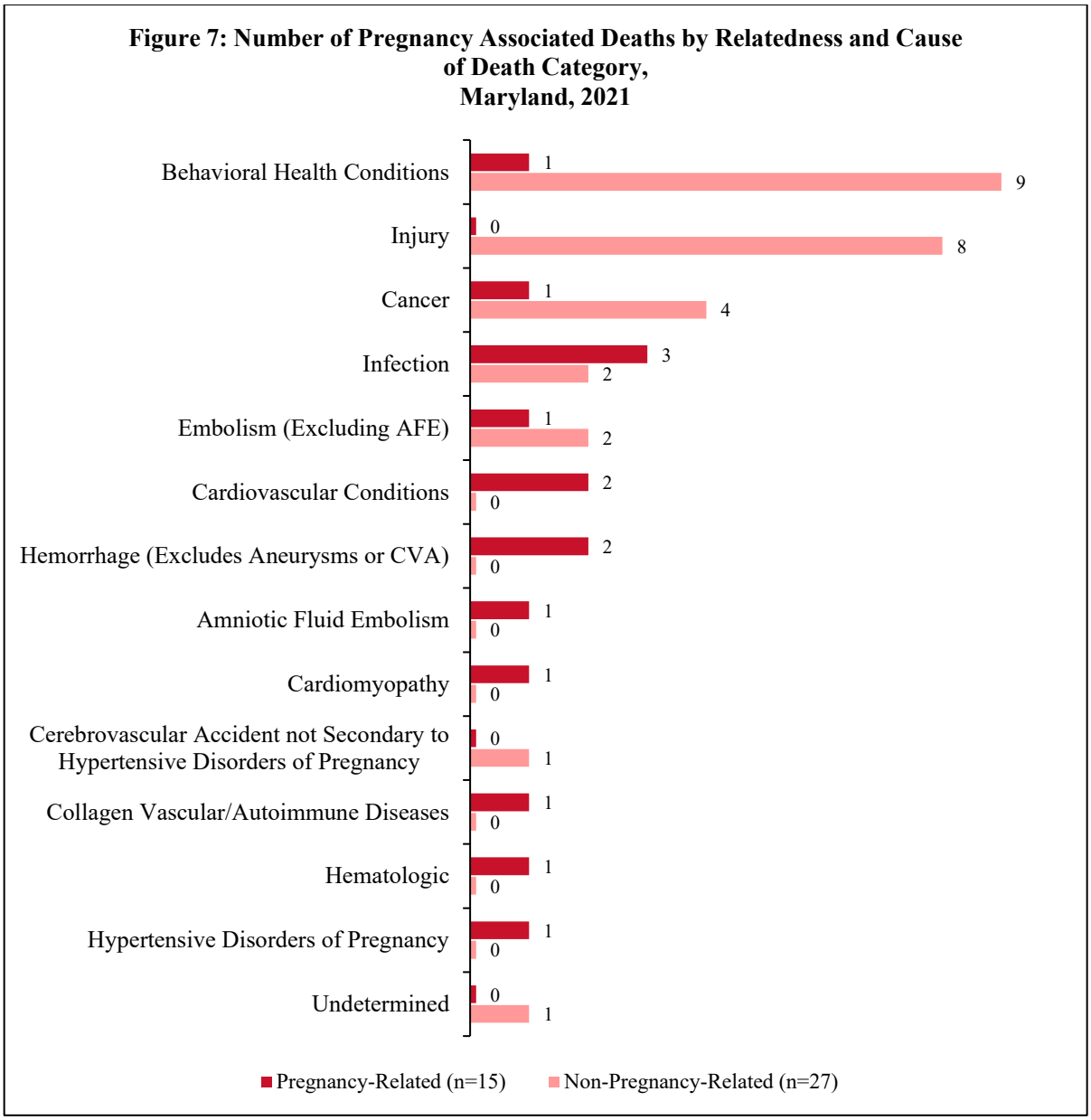

Figure 9
Data Source: Maryland MMR Program as of 06/2024.
AFE: Amniotic Fluid Embolism
CVA: Cerebrovascular Accident

COVID-19 and Pregnancy-Associated Deaths

COVID-19 was classified under "infection" in this report. In 2021, there were four pregnancy-associated deaths where COVID-19 was the underlying cause of death. These four deaths represent 10 percent of all 42 pregnancy-associated deaths, and almost all (80 percent) of the deaths due to infection. Two of these deaths were determined to be pregnancy-related, and two were determined to be non-pregnancy-related.

Cases by Timing of Death in Relation to Pregnancy

Among the 15 pregnancy-related deaths in 2021, five (33 percent) occurred during pregnancy, two (13 percent) on the day of delivery, five (33 percent) within 42 days postpartum, and three (20 percent) between 43 and 365 days postpartum. In contrast, of the 27 non-pregnancy-related deaths, over half (15 deaths) occurred between 43 to 365 days postpartum. Seven (26 percent) occurred during pregnancy, four (14 percent) within 42 days postpartum, and the timing of one death was unknown (Figure 10).

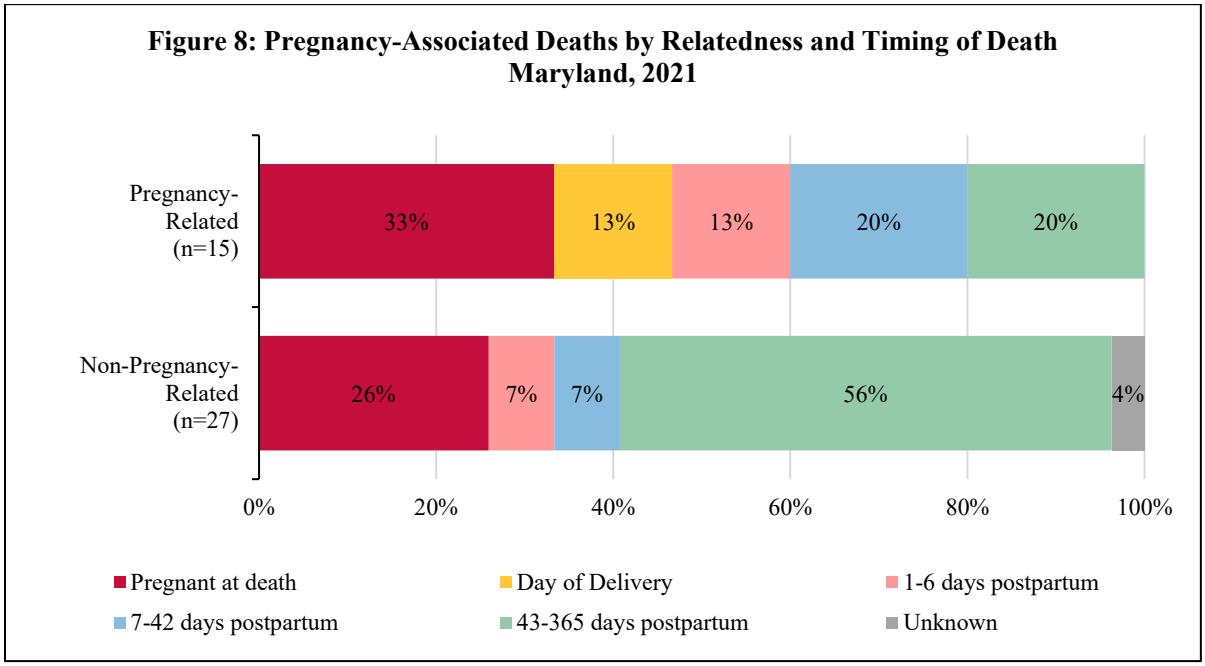

Figure 10
Data Source: Maryland MMR Program as of 06/2024.
Note: Percentages may not total 100 due to rounding.

Cases by Outcome of Pregnancy

Among the 15 pregnancy-related deaths, six (40 percent) had a live birth, five (33 percent) involved a stillbirth or fetal death, two (13 percent) resulted in a spontaneous abortion, one (seven percent) involved an ectopic pregnancy, and one (seven percent) was pregnant at the time of their death. Among the 27 non-pregnancy-related deaths, 16 (59 percent) had a live birth, four (15 percent) involved a stillbirth or fetal death, one (four percent) involved a spontaneous abortion, three (11 percent) involved an induced abortion, and two (seven percent) were pregnant at the time of their death. The outcome was unknown for one (four percent) non-pregnancy-related death (Figure 11).

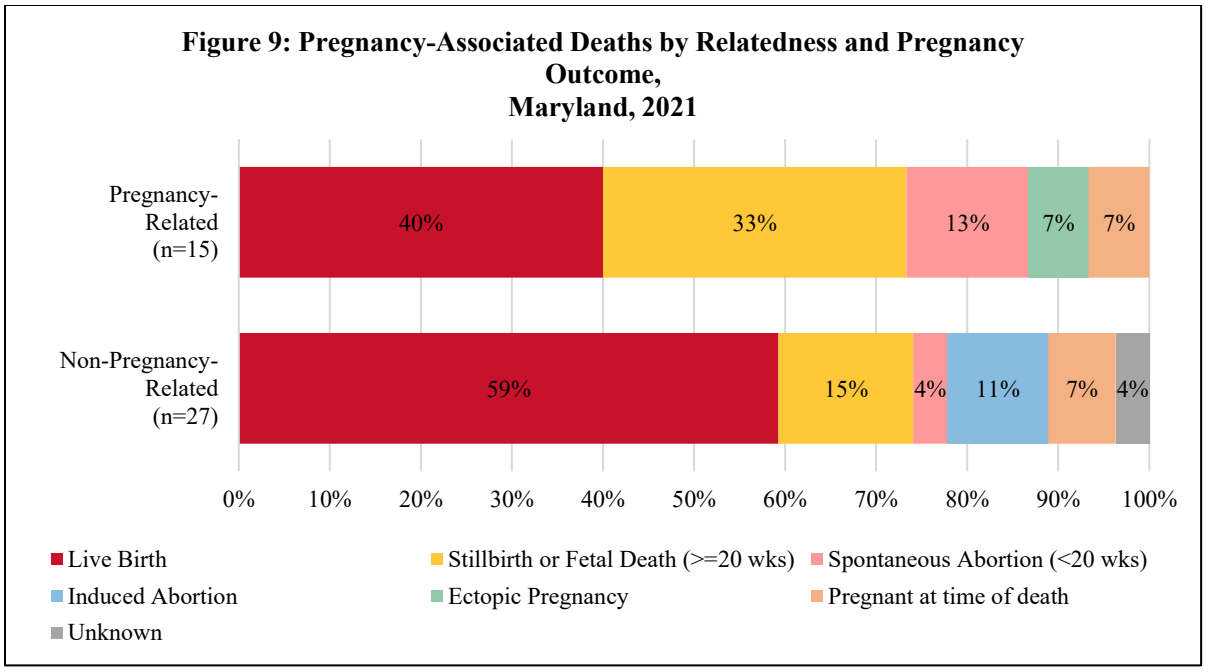

Figure 11
Data Source: Maryland MMR Program as of 06/2024.
Note: Percentages may not total 100 due to rounding.

Cases by Maternal Race and Ethnicity

Of the 15 pregnancy-related deaths occurring in 2021, three cases (20 percent) were among White NH individuals, eight cases (53 percent) were among Black NH individuals, three cases (20 percent) were among Hispanic individuals, and one case (seven percent) was a NH individual of other race. Of the 27 non-pregnancy-related deaths, 11 cases (41 percent) were among White NH individuals, 12 cases (44 percent) were among Black NH individuals, three cases (11 percent) were among Hispanic individuals, and one case (four percent) was an Asian NH individual.

Pregnancy-related and non-pregnancy-related mortality rates among Black NH and White NH individuals in 2021 are shown in Figure 12. The rate of non-pregnancy-related deaths among Black NH individuals was 1.5 times higher than that of White NH individuals. The rate of pregnancy-related deaths in Black NH individuals was 3.7 times higher than that of White NH individuals, illustrating the persistent racial disparity in these rates in Maryland.

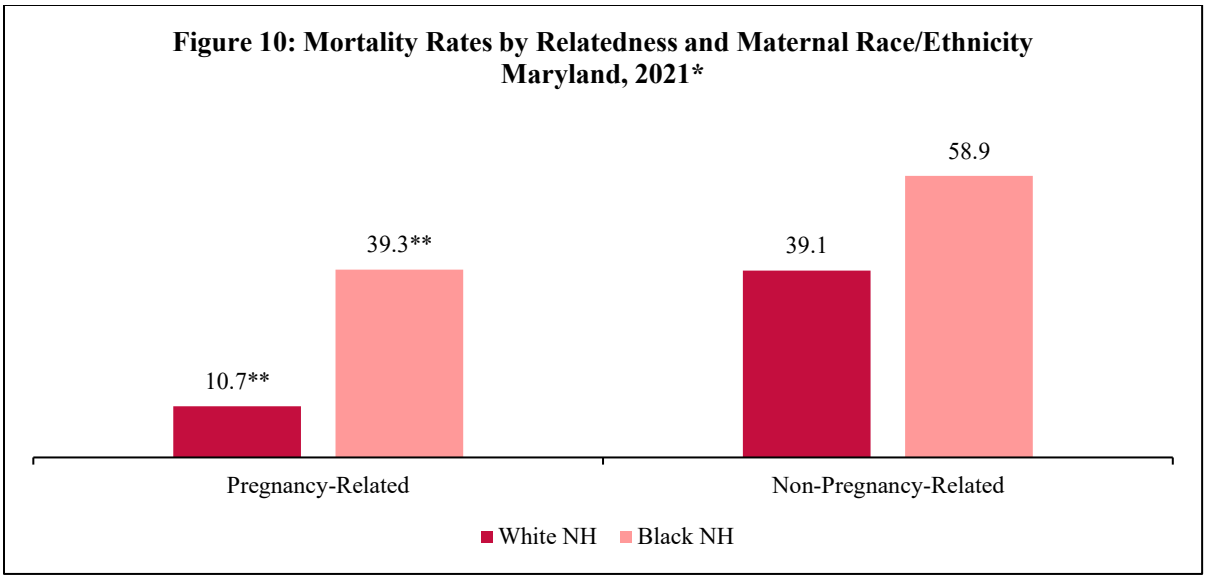

Figure 12
* Rate of pregnancy-related and non-pregnancy-related deaths per 100,000 live births.
** Mortality rates are based on counts <10; rates should be interpreted with caution.
Data Source: Maryland MMR Program and VSA as of 06/2024.

Cases by Maternal Age

The distribution of pregnancy-related and non-pregnancy-related deaths by maternal age group is shown in Figure 13. The median age at death among pregnancy-related deaths was 35 years compared to 32 years among non-pregnancy related deaths. The counts of deaths in most groups are small (< 10); therefore, rates by age group are unstable and are not presented.

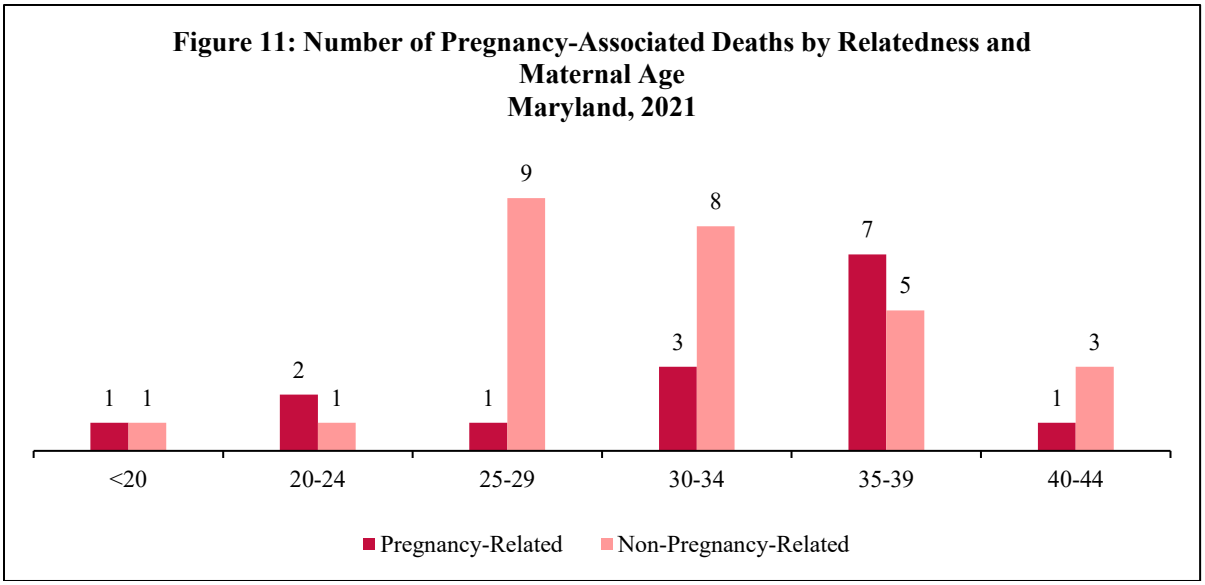

Figure 13
Data Source: Maryland MMR Program as of 06/2024.

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 14. Of the 15 pregnancy-related deaths, 12 (80 percent) were among individuals who initiated prenatal care in the first or second trimester of pregnancy. Among the 27 non-pregnancy-related deaths, 15 (56 percent) were among individuals who began prenatal care in the first or second trimester. The timing of prenatal care initiation was unknown among one pregnancy-related case and seven non-pregnancy-related cases.

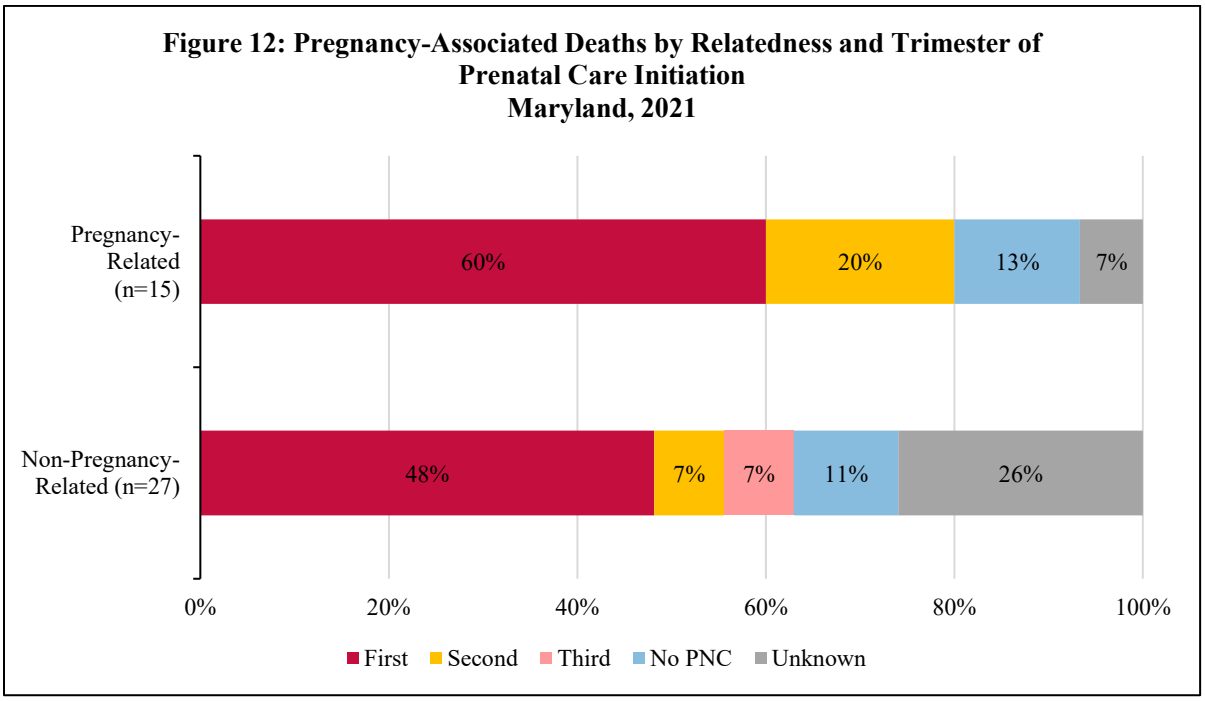

Figure 14
Data Source: Maryland MMR Program as of 06/2024.
Note: Percentages may not total 100% due to rounding.

Cases by Residence and Occurrence

Figure 15 and Figure 16 show pregnancy-related and non-pregnancy-related deaths by VSA-defined region of residence and by jurisdiction of residence, respectively.[18] Forty-five percent of all pregnancy-associated deaths occurred among residents of the Baltimore Metro region. Among the 15 pregnancy-related deaths, three were residents of Baltimore County (20 percent), three were residents of Montgomery County (20 percent), two were residents of Baltimore City (13 percent), and two were residents of Howard County (13 percent). There were single (7 percent) pregnancy-related deaths among residents of Cecil, Frederick, Prince George's, St. Mary's,, and Worcester counties. Of the 27 non-pregnancy-related deaths, six (22 percent) were among residents of Baltimore City. Three individuals were residents of Cecil County (11 percent), three were residents of Anne Arundel County (11 percent), two were residents of Baltimore County (7 percent), two were residents of Montgomery County, two were residents of Prince George's County, and two were residents of Wicomico County. Single non-

[18] 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

pregnancy-related deaths (4 percent) occurred among residents of St. Mary's, Carrol, Talbot, and Washington counties. The jurisdiction of residence was unknown in three non-pregnancy-related deaths.

Figure 13: Number of Pregnancy-Associated Deaths by Relatedness and Region of Residence, Maryland, 2021

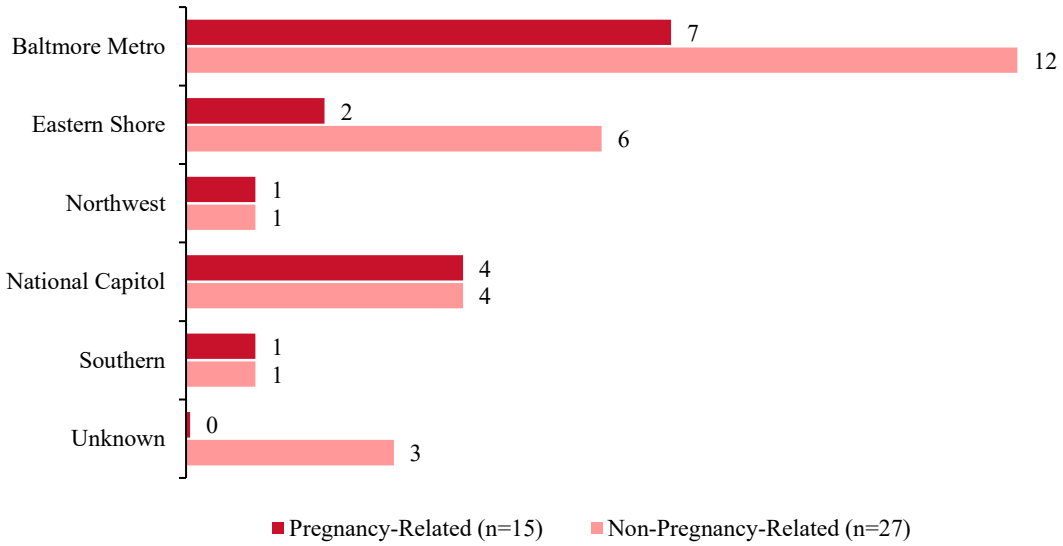

Figure 15
Data Source: Maryland MMR Program as of 06/2024.

Figure 14: Number of Pregnancy-Associated Deaths by Relatedness and Jurisdiction of Residence, Maryland, 2021

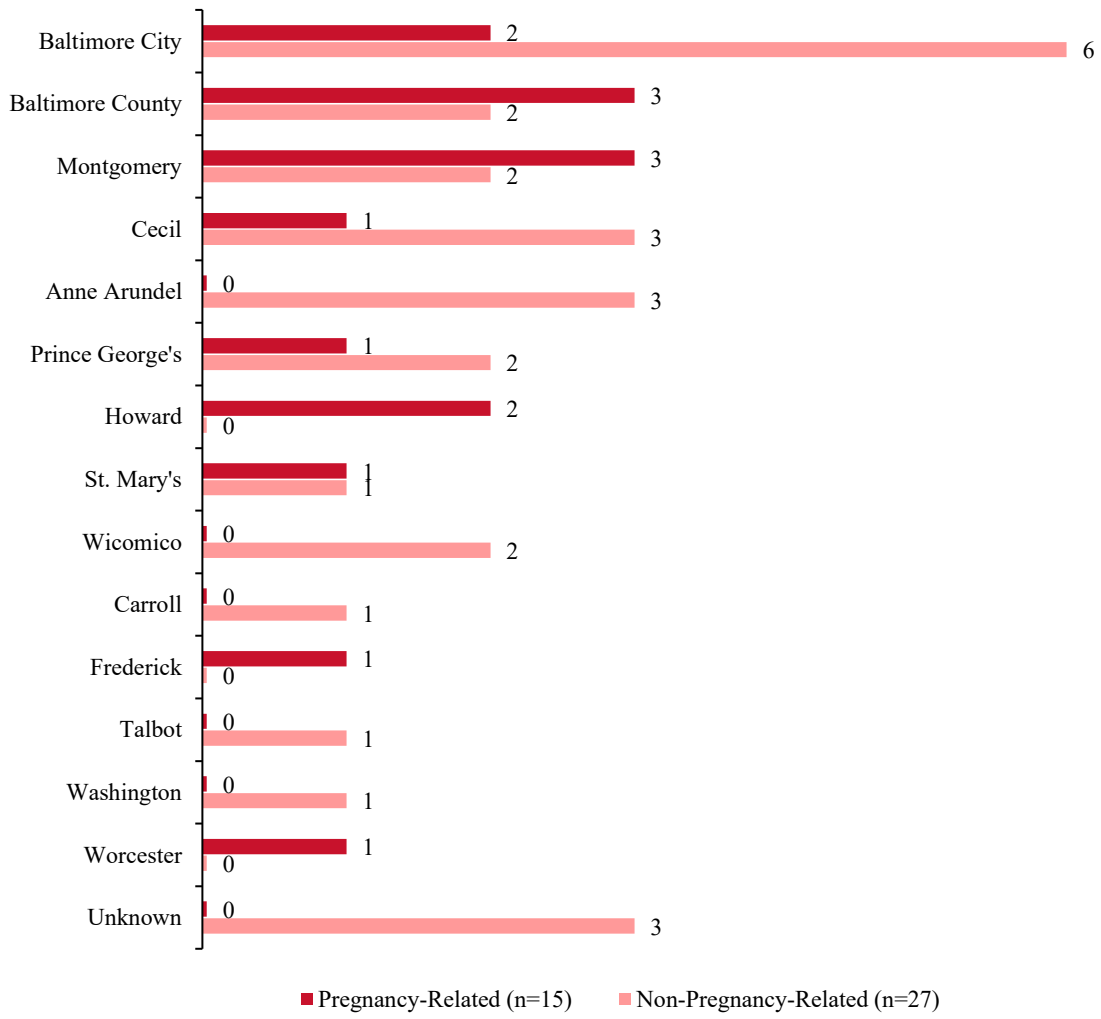

Figure 16
Data Source: Maryland MMR Program as of 06/2024.

Figure 17 shows pregnancy-related and non-pregnancy-related deaths by jurisdiction in which the death occurred. Five (33 percent) of the 15 pregnancy-related deaths occurred in Baltimore City, three (20 percent) occurred in Montgomery County, and two (13 percent) occurred in Baltimore County. There were single (seven percent) deaths that occurred in Cecil, Howard, Prince George's, Frederick, and St. Mary's counties. Among the 27 non-pregnancy-related deaths, 10 (37 percent) occurred in Baltimore City, three (11 percent) occurred in each Baltimore, Cecil, and Anne Arundel counties, and two (seven percent) occurred in Wicomico County. There was one (four percent) death each in Harford, Howard, Montgomery, Prince George's, Talbot, and Washington counties.

Figure 15: Number of Pregnancy-Associated Deaths by Relatedness and Jurisdiction of Occurrence, Maryland, 2021

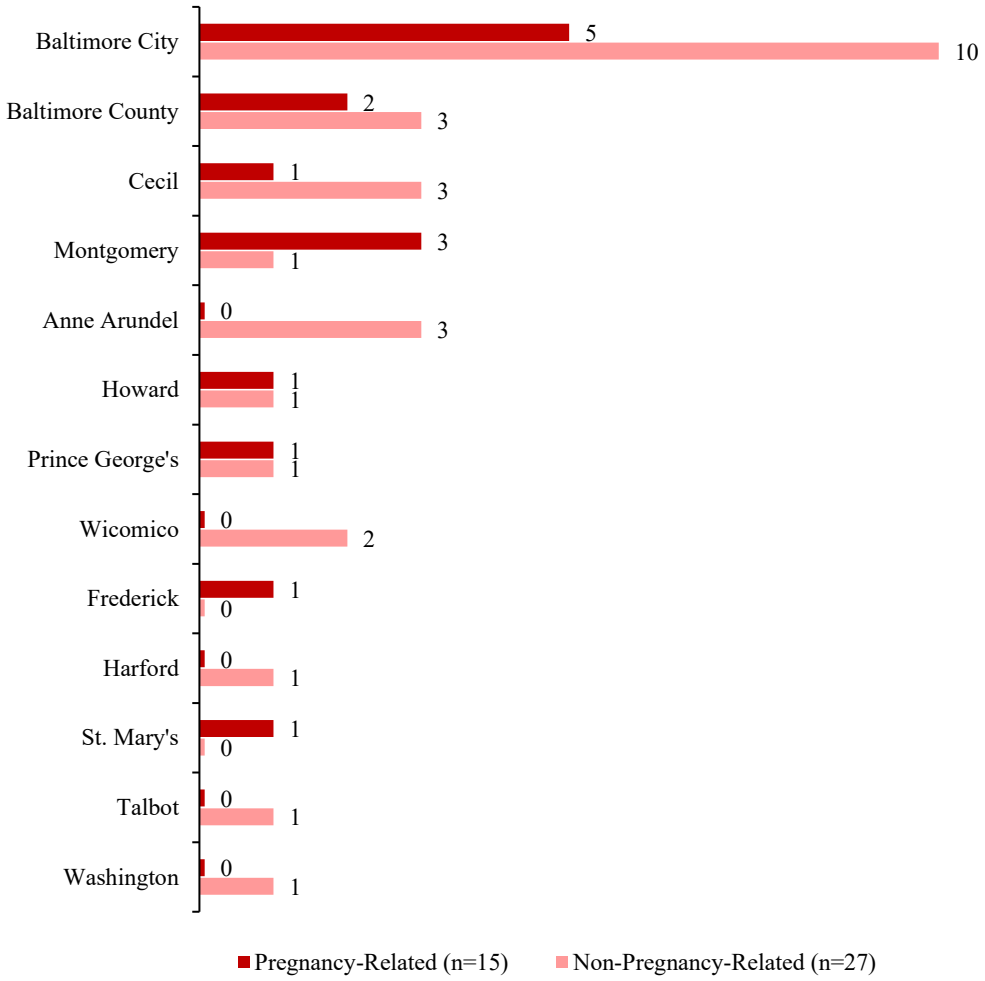

Figure 17
Data Source: Maryland MMR Program as of 06/2024.

Cases by Maternal Country of Birth

During its review of the 2021 cases, the Program noted a high number of cases where the individual was born outside the US. The distribution of country of birth by pregnancy-relatedness among 2021 pregnancy-associated deaths is shown in Figure 18. Foreign-born individuals represented almost half (40 percent) of pregnancy-related deaths compared to only 11 percent of non-pregnancy related deaths. Countries of birth included nations in the Caribbean, Latin America, Southeast Asia, and West Africa. This has implications for implementation of Program recommendations and outreach to key groups within Maryland, and is something the Program will work with local partners to assess.

Figure 16: Pregnancy-Associated Deaths by Relatedness and Country of Birth Maryland, 2021

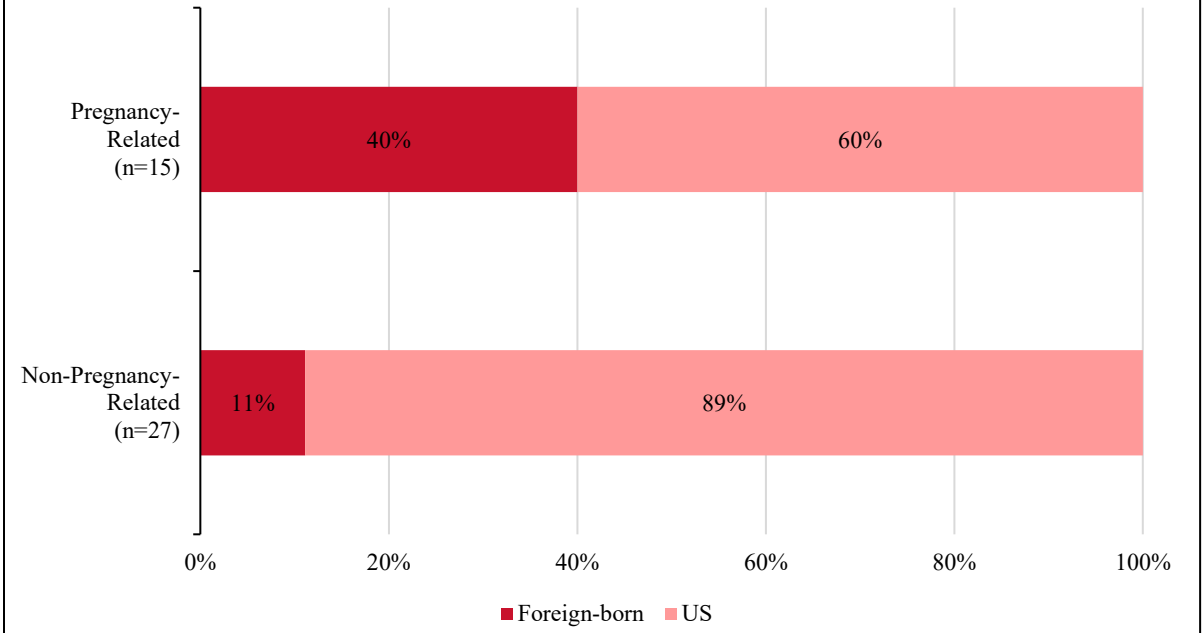

Figure 18
Data Source: Maryland MMR Program as of 06/2024.

Preventability of Deaths

A death was considered preventable if there was either a "good chance" or "some chance" of the death "being averted by one or more reasonable changes to patient, family, provider, facility, system, and/or community factors."[19] Whether the death was preventable by some intervention is a decision made by the MMRT after reviewing the case. The MMRT determined that 81 percent of all pregnancy-associated deaths were preventable. Of the 15 pregnancy-related deaths, 12 (80 percent) were determined to be preventable, and among the 27 non-pregnancy-related deaths, 22 (81 percent) were determined to be preventable (Figure 19). The eight (19 percent) pregnancy-associated deaths that were determined to not be preventable included four cancer-related deaths, one collagen vascular/autoimmune related death, one hematologic death, one infectious death, and one death due to injury.

[19] ERASE MM Maternal Mortality Review Committee Decisions Form v23. https://reviewtoaction.org/sites/default/files/2024-05/mmria-form-v23-fillable.pdf

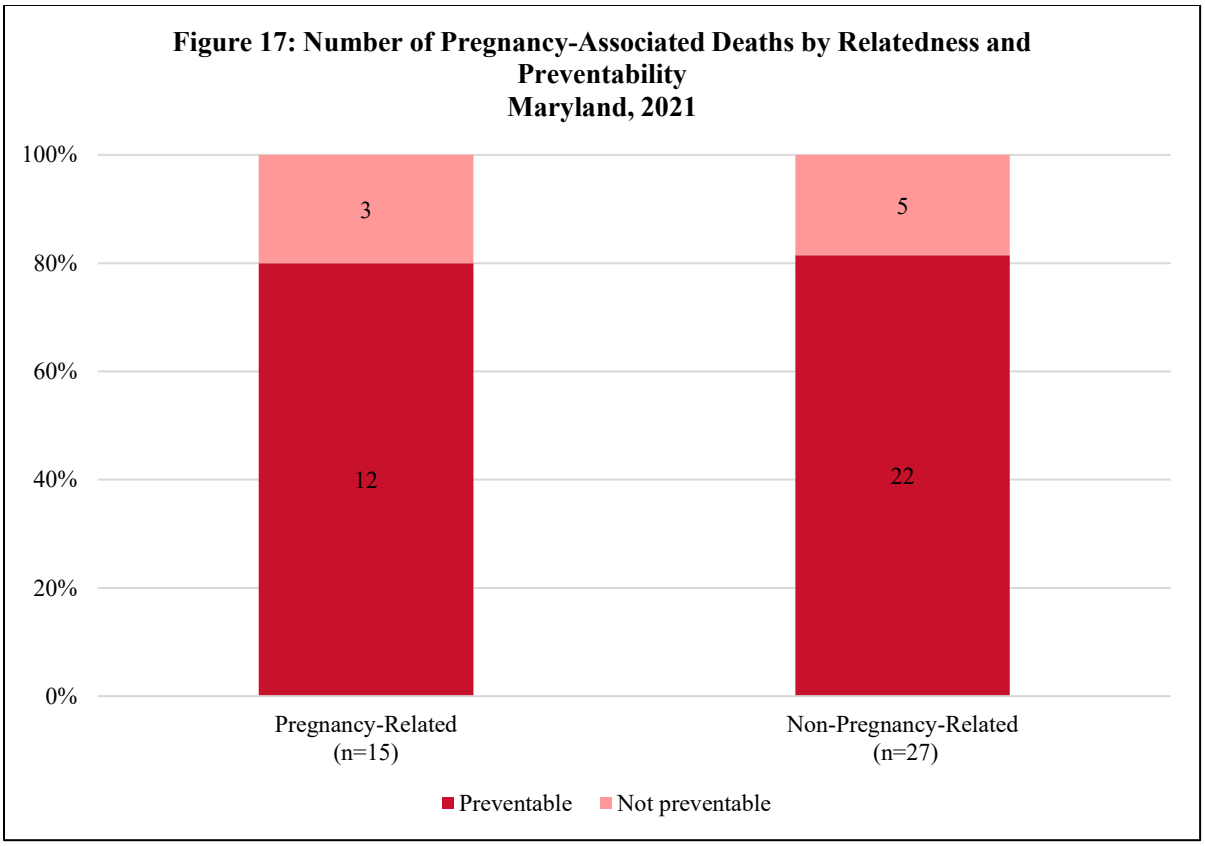

Figure 19
Data Source: Maryland MMR Program as of 06/2024.

Circumstances Surrounding Death

The MMRT determined whether four specific circumstances – obesity, discrimination, mental health conditions other than substance use disorder, and substance use disorder – contributed ("yes" or "probably") to each pregnancy-associated death. Multiple circumstances may contribute to a single death. In 2021, the MMRT determined that obesity contributed to three (7 percent) deaths, discrimination contributed to 14 (33 percent) deaths, mental health conditions contributed to 11 (26 percent) deaths, and substance use disorder contributed to 11 (26 percent) deaths (Figure 20).

Figure 18: Circumstances Surrounding Pregnancy-Associated Deaths Maryland, 2021

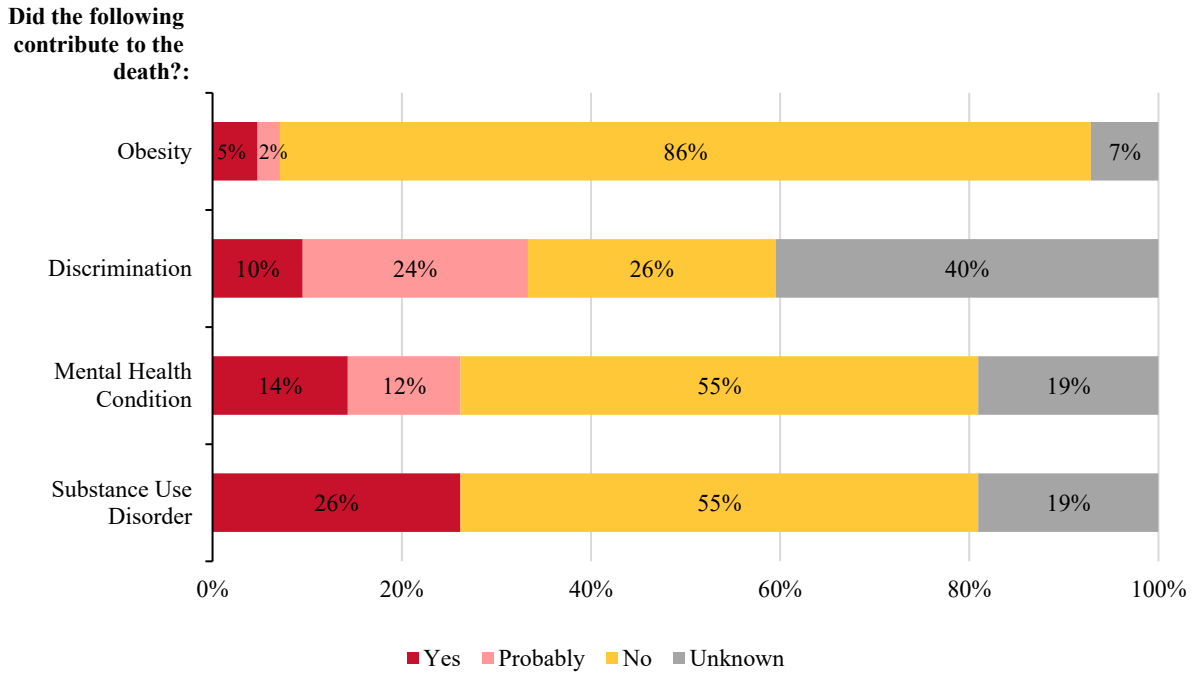

Figure 20
Data Source: Maryland MMR Program as of 06/2024.
Note: Multiple circumstances may contribute to a single death.

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Trends in Pregnancy-Associated and Pregnancy-Related Deaths

As noted in Figure 4 and Figure 5, the Maryland MMR has increased slightly over the past 10 years but remains 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 MMRT reviews all pregnancy-associated deaths, which is a more comprehensive measure that includes deaths from any cause that occur during pregnancy or up to 365 days after the conclusion of pregnancy. Of note, one pregnancy-associated death which occurred in 2012 did not undergo full review by the MMRT. Therefore, the MMRT 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, pregnancy-related, and non-pregnancy-related mortality rates from 2012 to 2021 are shown in Figure 21. The pregnancy-associated mortality rate shows considerable variability over the ten-year period, with a 54 percent increase from 2012 to 2021. In contrast, the 2021 pregnancy-related mortality rate remains similar to previous years and shows a smaller increase of 15 percent since 2012. This is largely due to increasing numbers of overdose deaths in the last several years, the majority of which are categorized as non-pregnancy-related deaths. This is explored further in the "Behavioral Health Conditions and Diagnoses" section.

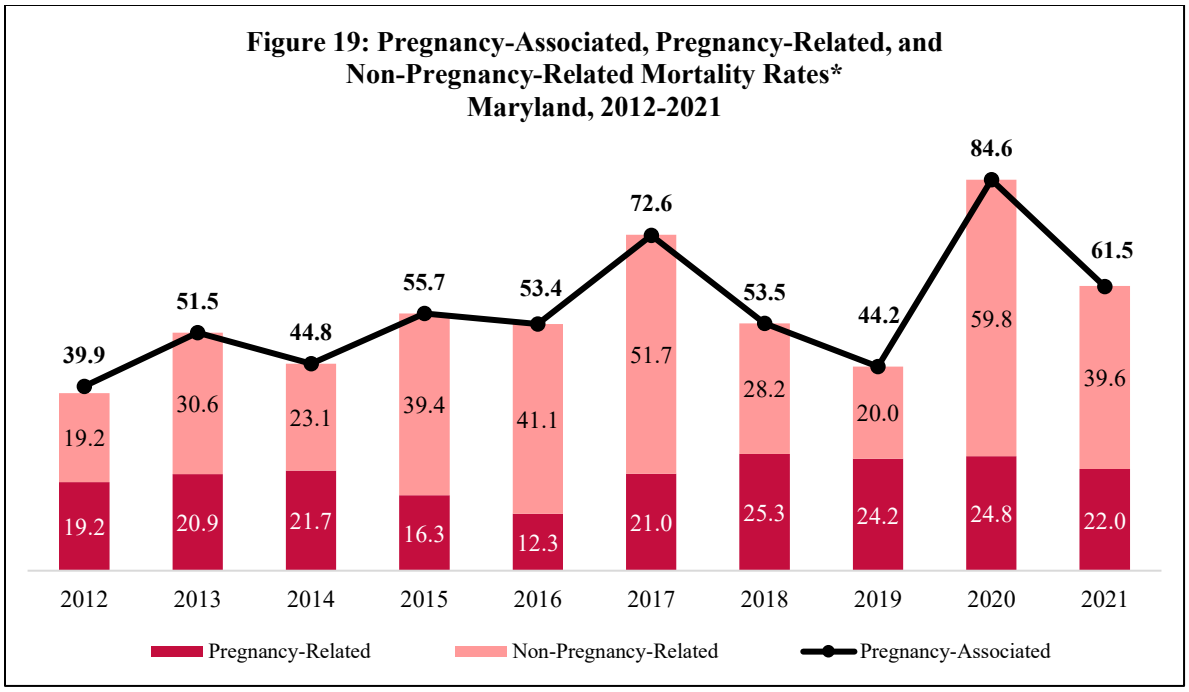


Figure 21

* Rates calculated as number of deaths per 100,000 live births. The sum of the pregnancy-related rate and the non-pregnancy-related rate for a given year may not total the pregnancy-associated rate for that year due to rounding.

Data Source: VSA and Maryland MMR Program as of 06/2024.

The Pregnancy-Related Mortality Rate and Non-Pregnancy-Related Mortality Rate in Figure 19 excludes a pregnancy-associated death from 2012 for which the MMRT 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 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.

Approximately one-quarter (26 percent) of live births in Maryland from 2012 to 2021 were among rural residents (data not shown). Mortality rates by pregnancy-relatedness and rurality of residence are presented in Figure 22. While differences in mortality rates between rural and non-rural residents were not statistically significant, it is important to note that the non-pregnancy related mortality rate was slightly higher among rural residents. The Program will continue monitoring trends, evaluating distance to care, and exploring additional factors that impact access to care for rural residents.

Figure 20: Non-Pregnancy-Related and Pregnancy-Related Mortality Rates* by Rurality of Residence, Maryland, 2012-2021

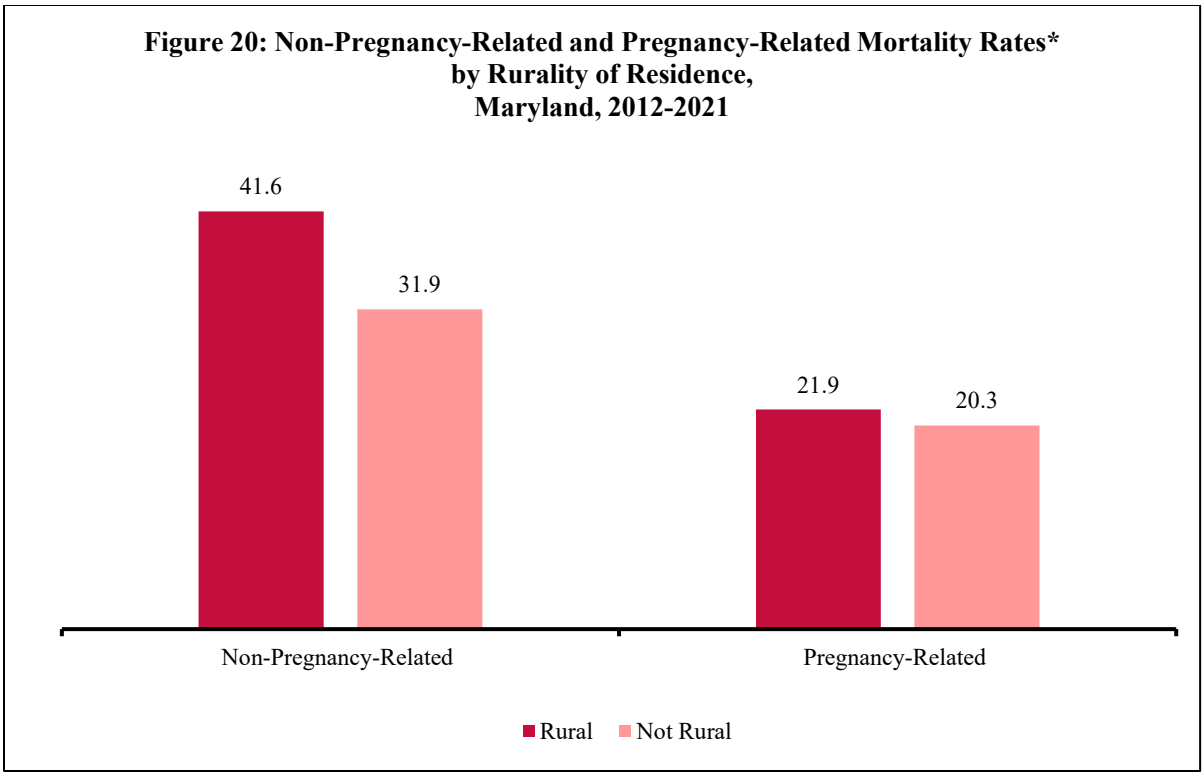


Figure 22
*Rates calculated as number of deaths per 100,000 live births, among cases where residence data was available.
Data Source: VSA and Maryland MMR Program as of 06/2024.
Figure 20 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.
Note: Rurality was defined using guidance from the Maryland State Office of Rural Health, "The State of Maryland recognizes 18 of its 24 jurisdictions as rural. Maryland's rural counties include: Allegany, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Kent, Queen Anne's, Somerset, St. Mary's, Talbot, Washington, Wicomico, and Worcester."
https://health.maryland.gov/pophealth/Pages/Rural-health.aspx#:~:text=%E2%80%8BThe%20State%20of,Washington%2C%20Wicomico%2C%20and%20Worcester

Racial Disparities in Pregnancy-Related Mortality

Figure 5 delineates the racial disparities in MMR that have been consistent from 2012 to 2021 in Maryland. Similar trends are observed among pregnancy-related deaths in this period (Figure 23). While Black NH individuals had a slightly lower rate of non-pregnancy-related mortality than White NH individuals (42.2 vs 43.3), the pregnancy-related mortality rate was significantly higher among Black NH individuals compared to White NH individuals (36.7 vs 13.9).

Figure 21: Non-Pregnancy-Related and Pregnancy-Related Mortality Rates* by Race Maryland, 2012-2021

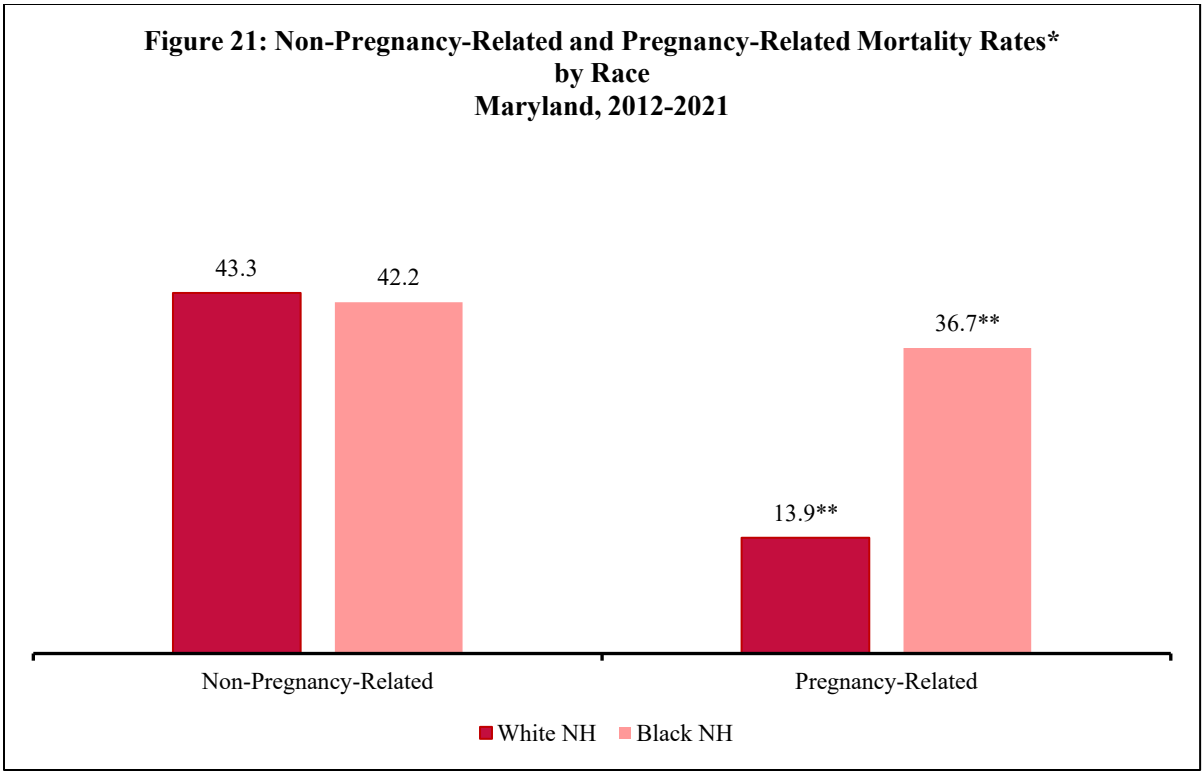


Figure 23
*Rates calculated as number of deaths per 100,000 live births.
**Denotes statistically significant difference in rates by race, p<0.001.
Data Source: VSA and Maryland MMR Program as of 06/2024.
Figure 21 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.

Disparities in pregnancy-associated deaths may also be evaluated by comparing the racial and ethnic distribution of births in Maryland from 2012 to 2021 with the distribution of non-pregnancy-related and pregnancy-related deaths (Figure 24). While Black NH individuals made up 31 percent of live births in this ten-year period, they represent a disproportionate share (55 percent) of pregnancy-related deaths. In contrast, White NH individuals represented the majority (52 percent) of non-pregnancy-related deaths.

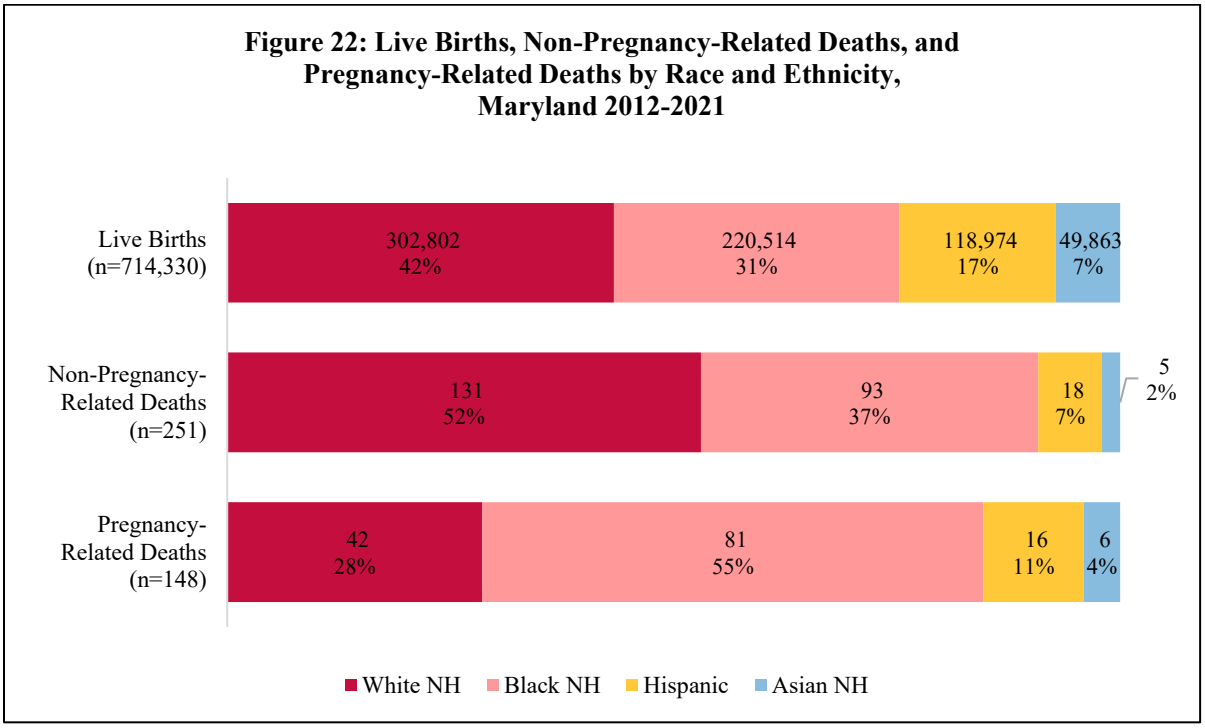
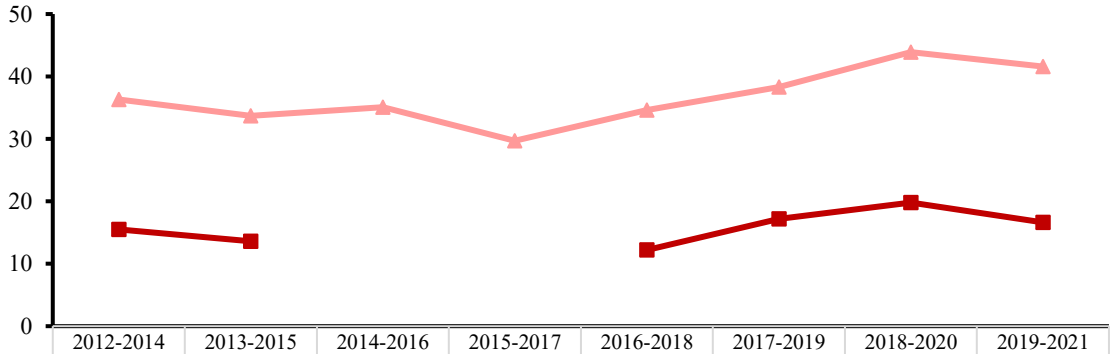


Figure 24
Data Source: VSA and Maryland MMR Program as of 06/2024.
Note: The percentages do not total 100% as births and deaths to NH mothers of other races are not included.
Figure 22 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.

The trend over time in pregnancy-related mortality rate by race and ethnicity is shown in Figure 25. Rates are shown as rolling three-year averages due to the small number of cases in each category. Even so, there were fewer than ten deaths among White NH individuals for the time periods 2014-2016 and 2015-2017 and thus, rates are not presented. Since 2012, the Black NH pregnancy-related mortality rate has been consistently higher than the White NH rate. From the initial 2012-2014 period to the most recent 2019-2021 period, there was a 15 percent increase in the Black NH rate (36.3 to 41.6) compared to a 7 percent increase in the White NH rate (15.5 to 16.6). In the most recent three-year period, the Black NH rate is 2.5 times higher than the White NH rate (see "Disparity Gap: Rate Ratio"), representing an excess of 25.1 deaths among Black NH individuals (see "Disparity Gap: "Rate Difference").

Figure 23: Pregnancy-Related Mortality Rates* by Race/Ethnicity
Maryland, 2012-2021



	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021
Black NH	36.3	33.7	35.1	29.7	34.6	38.3	43.9	41.6
White NH	15.5	13.6	**	**	12.2	17.2	19.8	16.6
Disparity Gap: Rate Ratio	2.3	2.5	**	**	2.8	2.2	2.2	2.5
Disparity Gap: Rate Difference	20.8	20.1	**	**	22.4	21.2	24.0	25.1

Figure 25
*Rates calculated as number of deaths per 100,000 live births.
** Rates, rate ratios, rate differences not calculated when counts of deaths are <10
Data Source: VSA and Maryland MMR Program as of 06/2024.
Figure 25 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.
Note: Totals may vary by +/- 0.1 due to rounding.
Methodology: Pregnancy-related mortality rates stratified by race/ethnicity are calculated using single race methodology. As a result of the updated race/ethnicity categorization methodology, rates presented in this table vary from rates presented in previous annual reports where bridged-race methodology was used to calculate rates. 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

Review of the causes of death by race and ethnicity revealed that among pregnancy-related deaths (Figure 26), behavioral health conditions, hemorrhage, homicide, and non-amniotic fluid embolism were the leading cause of death for White NH pregnant persons. Among Black NH individuals, the leading cause of death was non-cardiovascular medical conditions. This category includes conditions like seizure disorders, asthma, cancer, and collagen vascular diseases such as lupus. Starting with the 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 causes of pregnancy-related deaths among Hispanic pregnant persons from 2012 to 2021 were pregnancy-induced hypertension, cardiovascular conditions, and non-cardiovascular medical conditions.

Overall, between 2012 and 2021, hemorrhage and non-cardiovascular medical conditions were the leading causes of pregnancy-related deaths, followed by cardiovascular conditions and homicide (including homicides where intimate partner violence (IPV) was a factor). The number of homicide deaths among Black NH pregnant or postpartum individuals was 1.4 times the number among White NH pregnant or postpartum individuals.

Figure 24: Pregnancy-Related Deaths by Underlying Cause of Death and Race/Ethnicity, Maryland, 2012-2021

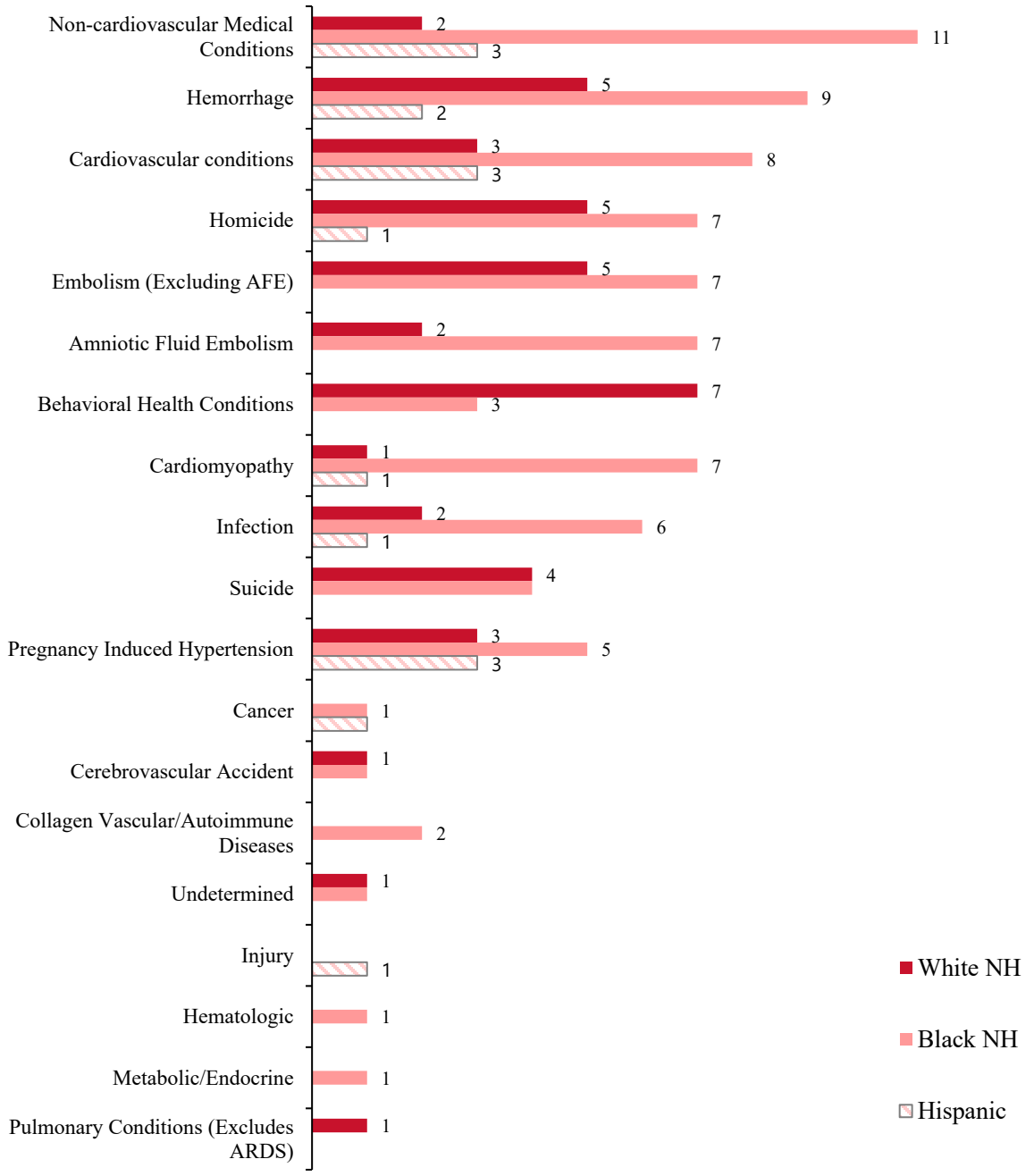


Figure 26

Data Source: Maryland MMR Program as of 06/2024.

Figure 26 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.

For non-pregnancy-related deaths (Figure 27), the leading cause of death was behavioral health conditions. 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 more common among White NH pregnant persons, with the number of deaths being 3.6 times higher than among Black NH pregnant persons. The second leading cause of non-pregnancy-related death was injury, followed by non-cardiovascular medical conditions.

Figure 25: Non-Pregnancy-Related Deaths by Underlying Cause of Death and Race/Ethnicity, Maryland, 2012-2021

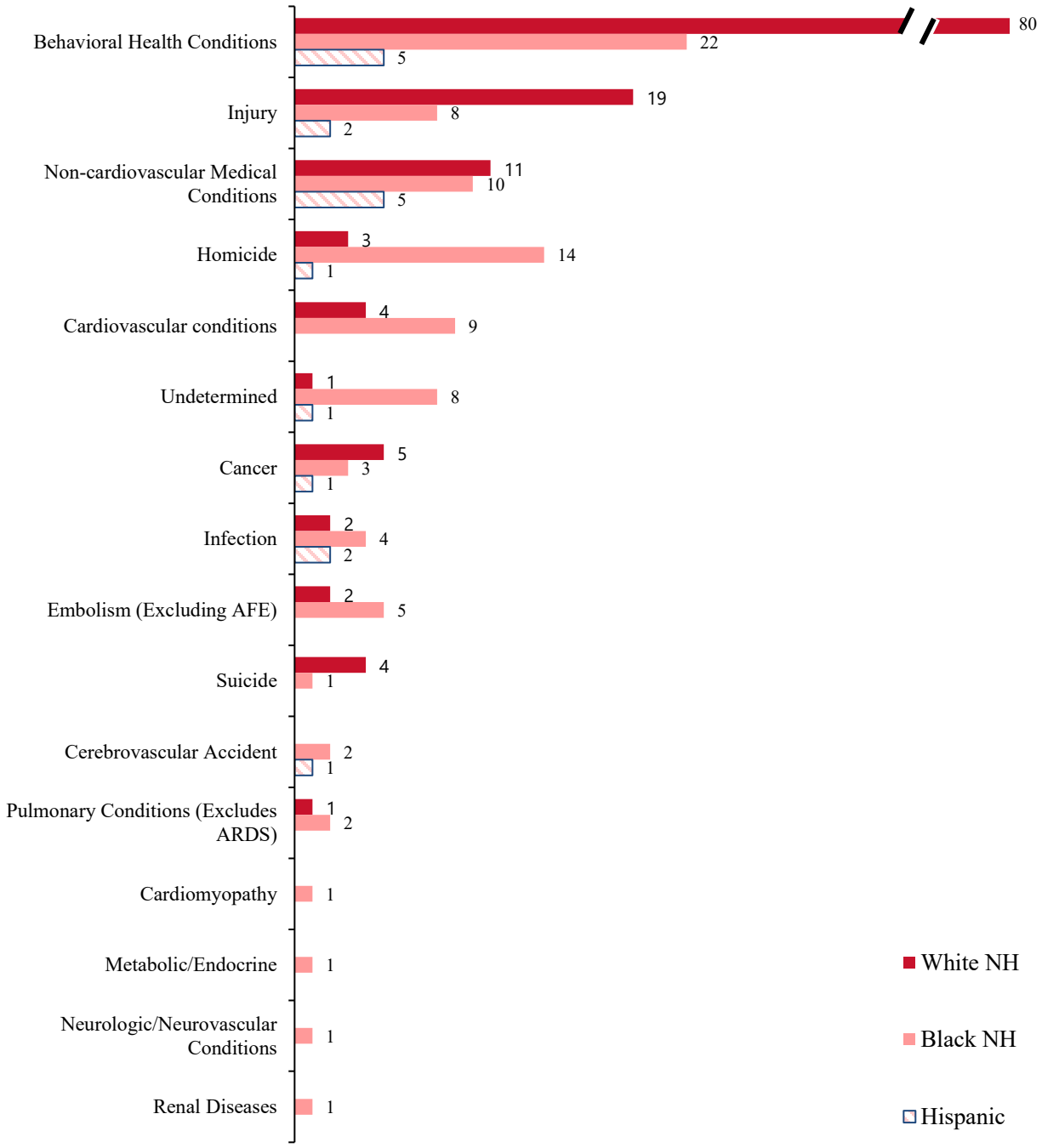


Figure 27

Data Source: Maryland MMR Program as of 06/2024.

Figure 27 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.

Note: For visual clarity, a break is included in the bar representing deaths due to behavioral health conditions among White NH individuals.

Mortality rates as they relate to the timing of death and pregnancy-relatedness are shown in

Figure 28**Error! Reference source not found.** for White NH and Black NH individuals. Among pregnancy-related deaths, higher mortality rates were observed during pregnancy, in the early postpartum (0 to 42 days) period, and in the late postpartum (42 to 365 days) period in Black NH individuals compared to White NH individuals. Among non-pregnancy-related deaths, higher mortality rates were observed in the late postpartum period (43 to 365 days postpartum) among White NH individuals.

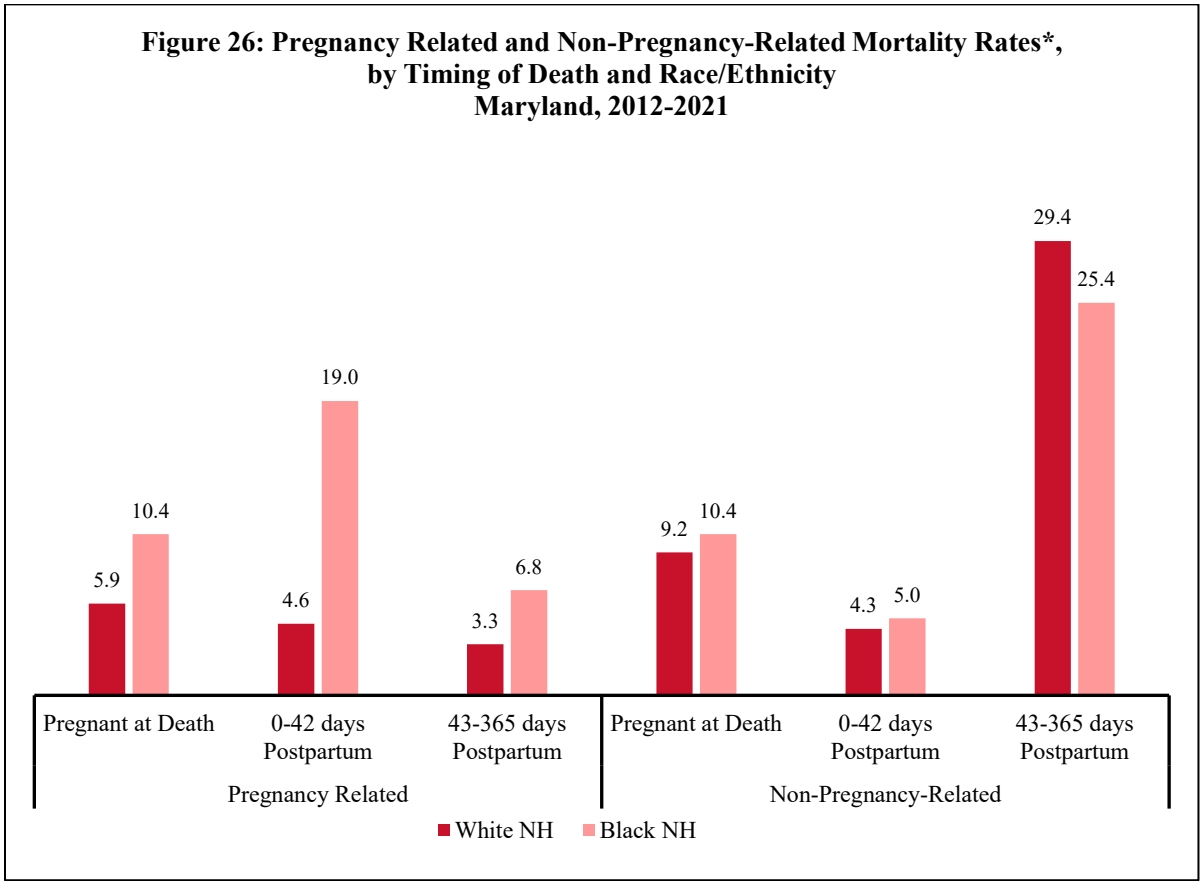


Figure 28
*Rates calculated as number of deaths per 100,000 live births.
Data Source: VSA and Maryland MMR Program as of 06/2024.
Note: Additional race/ethnicity categories are not presented due to low counts of deaths (<10) and thus unreliable rates.

Calculation of the pregnancy-related mortality rates by race and selected maternal characteristics revealed notable differences. Figure 29 shows pregnancy-related mortality rates among White NH and Black NH individuals by timing of prenatal care initiation. Among pregnant persons initiating prenatal care during the first trimester, the pregnancy-related mortality rate was 3.1 times higher in Black NH individuals compared to White NH individuals between 2012 and 2021. Early initiation of prenatal care did not eliminate the racial disparity in pregnancy-related deaths.

The pregnancy-related mortality rate was 5.6 times higher among White NH individuals and 1.4 times higher among Black NH individuals who received late or no prenatal care compared to those who received early prenatal care.

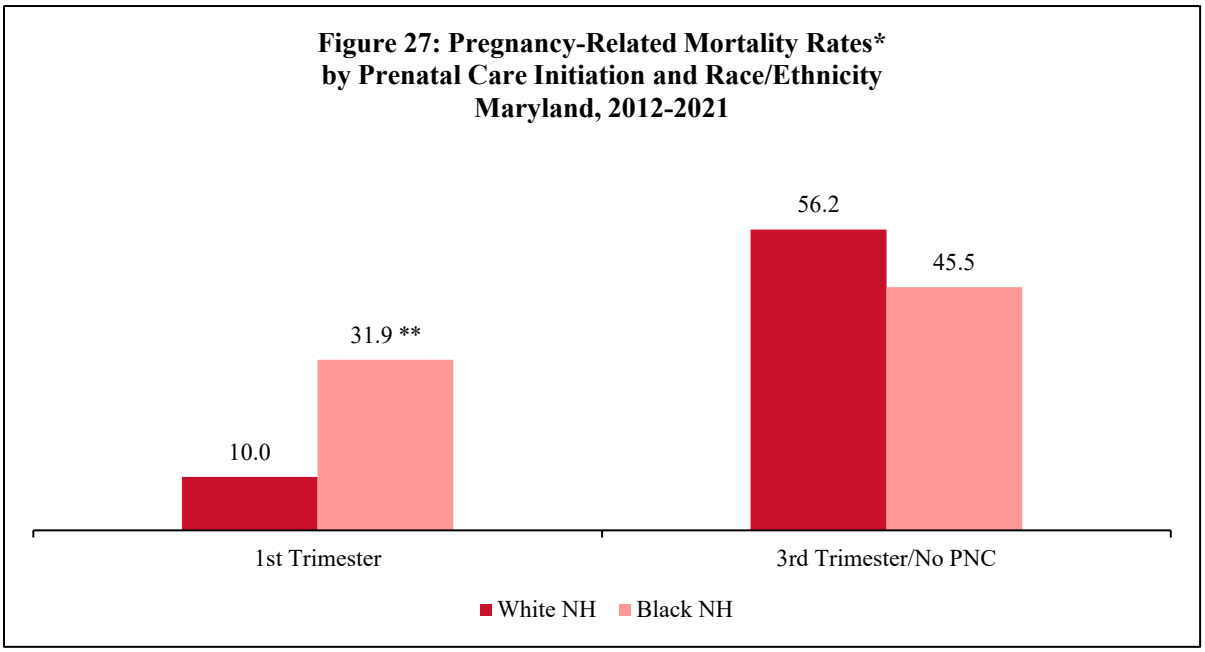


Figure 29
* Number of pregnancy-related deaths per 100,000 live births.
** Denotes statistically significant difference between Black NH and White NH, p<0.001.
Data Source: VSA and Maryland MMR Program as of 06/2024.
Figure 29 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.
Note: Additional race/ethnicity categories are not presented due to low counts of deaths (<10) and thus unreliable rates.

As shown in Figure 30, racial differences also appeared when examining pregnancy-related mortality rates by maternal age from 2012 to 2021. During this period the Black NH mortality rate was higher than that in White NH individuals at all ages, with significantly higher rates in the 25-29 year, 30–34 year, and 35-39 year age groups. The Black NH pregnancy-related mortality rate was 2.1 times higher in the 25-29 year group, 4.6 times higher in the 30-34 year group, and 2.7 times higher in the 35-39 year group.

Figure 28: Pregnancy Related Mortality Rates* by Age Group and Race/Ethnicity
Maryland, 2012-2021

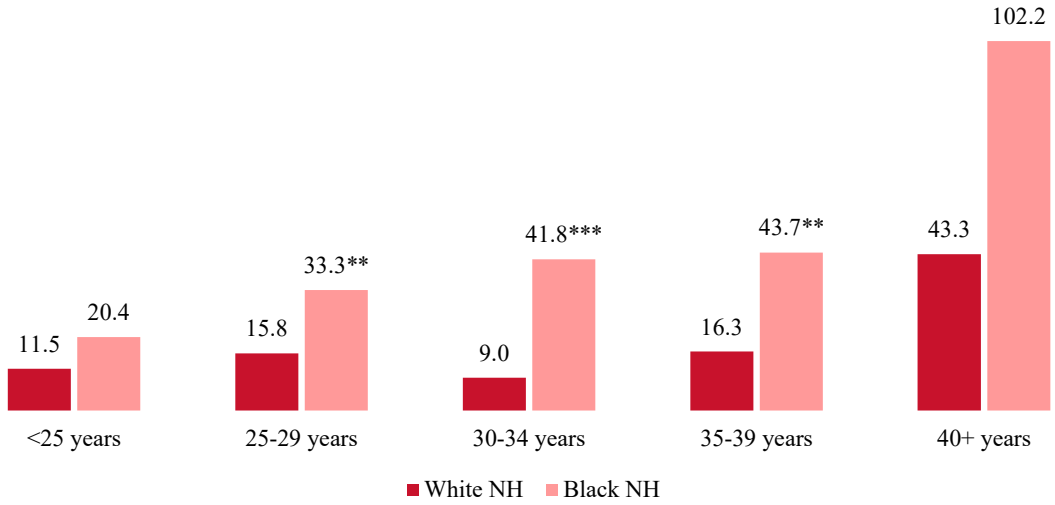


Figure 30
* Number of pregnancy-related deaths per 100,000 live births.
** Denotes statistically significant difference between Black NH and White NH, $p<0.05$.
*** Denotes statistically significant difference between Black NH and White NH, $p<0.001$.
Data Source: Maryland MMR Program as of 06/2024.
Figure 30 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.
Note: Additional race/ethnicity categories are not presented due to low counts of deaths (<10) and thus unreliable rates.

The prevalence of pre-existing medical conditions was also determined by race among pregnancy-related death cases from 2012 to 2021 (Figure 31). Diabetes and hypertension were more frequently observed as pre-existing conditions among Black NH individuals compared to White NH individuals, with the difference in pre-existing hypertension proving to be statistically significant. Other psychiatric conditions (e.g. anxiety, bipolar disorder) were more frequently observed as a pre-existing condition in White NH individuals compared to Black NH individuals. Pre-existing depression was documented in 26% of pregnancy-related deaths among White NH individuals and 22% of pregnancy-related deaths among Black NH individuals.

Figure 29: Prevalence of Pre-existing Medical Conditions among Pregnancy-Related Deaths, by Race/Ethnicity Maryland, 2012-2021

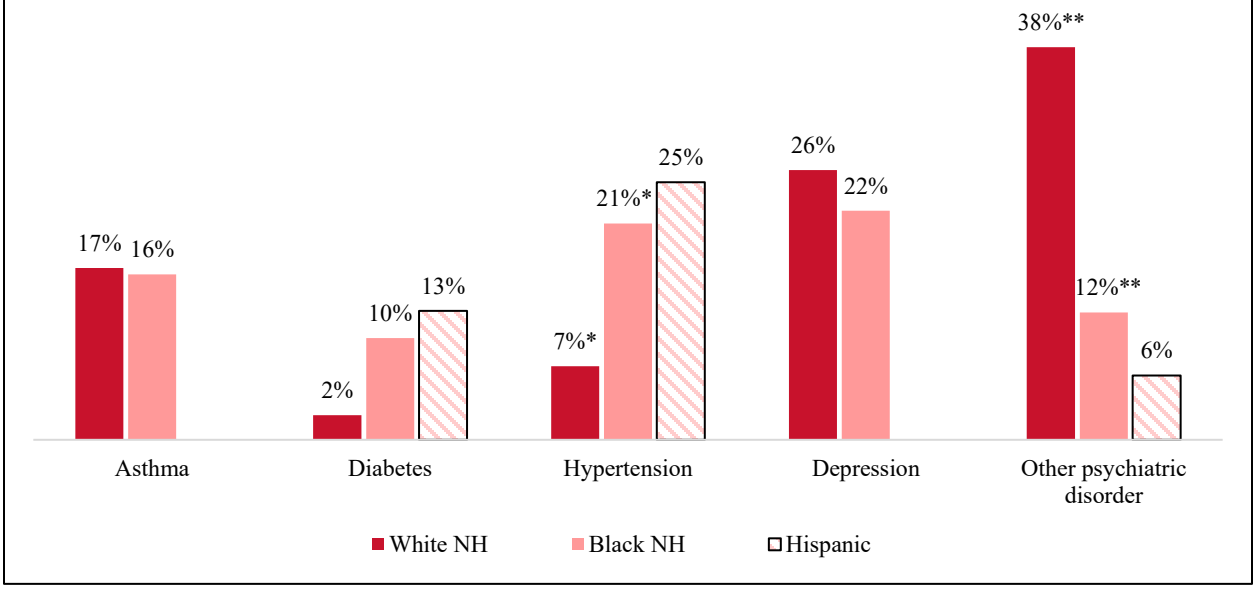


Figure 31
* Denotes statistically significant difference between Black NH andWhite NH, p<0.05.
** Denotes statistically significant difference between Black NH and White NH, p<0.01.
Data Source: Maryland MMR Program as of 06/2024.
Figure 31 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.
Note: "Other psychiatric disorder" includes anxiety, bipolar disorder, psychotic disorder, and other unspecified psychiatric disorders. Individuals may have more than one pre-existing condition.

Behavioral Health Conditions and Diagnoses

Beginning with the 2022 report, the Program began using the cause of death category "Behavioral Health Conditions". This category encompasses both mental health related deaths (i.e. a death due to depression or anxiety) and deaths due to substance use disorder and overdose. The number of deaths in Maryland due to mental health causes are too small to determine trends. Therefore, we focus on pre-existing mental health conditions and deaths due to substance use disorder and overdose in this report. We also use the terms "overdose deaths" and "deaths due to substance use disorder" to refer to the same cause of death.

Multiyear Review of Overdose Deaths, 2012-2021

To better understand factors involved in overdose deaths, a review of pregnancy-associated deaths in Maryland from 2012 to 2021 was undertaken. Over this ten-year period, substance use and overdose was the underlying cause of death in 120 (30 percent) of 399 pregnancy-associated deaths where a cause of death was determined. **Error! Reference source not found.** shows the number of pregnancy-associated overdose deaths by year, with the highest number of cases occurring in 2020.

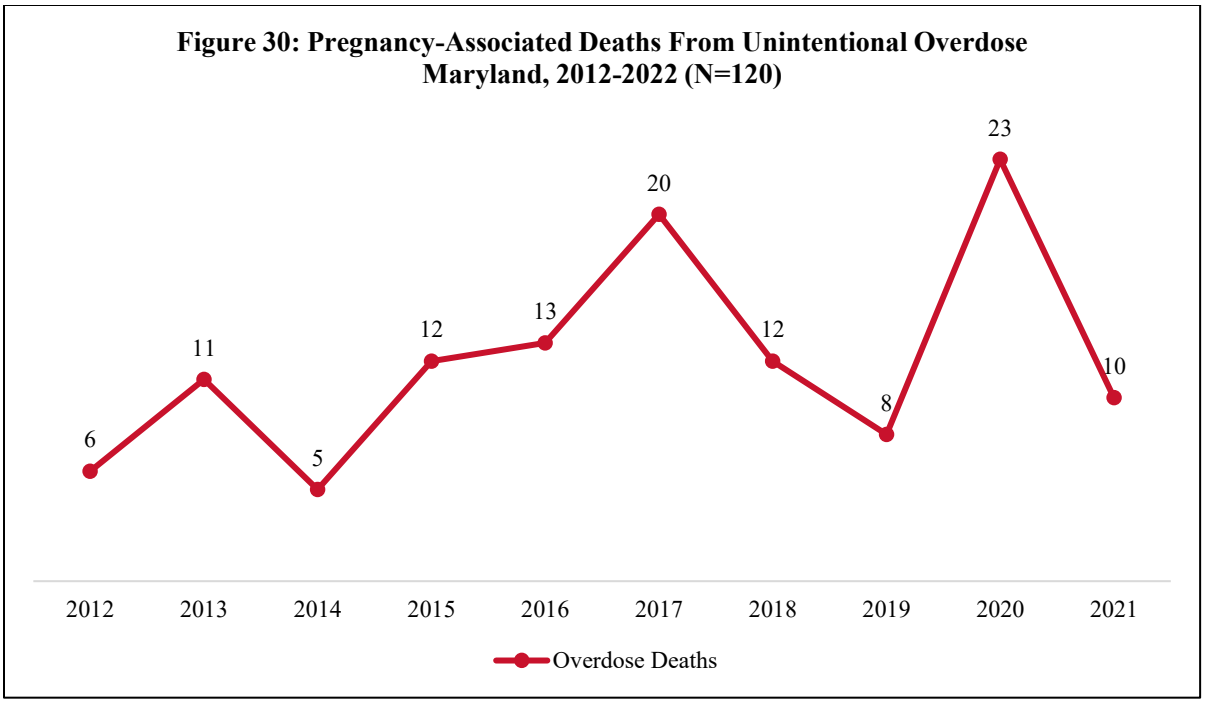


Figure 32
Data Source: VSA and Maryland MMR Program as of 06/2024.
Figure 32 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.
Note: The number of overdose deaths from 2020 varies from the Program's 2022 Annual Report due to updated data and analysis methodology. The analysis for this current report evaluates underlying cause of death.

In Table 2, the 120 overdose deaths are compared with the 279 non-overdose deaths that occurred between 2012 and 2021. Most notably, the racial distribution is strikingly different, with nearly three quarters (72 percent) of overdose deaths occurring among White NH persons and over half (53 percent) of non-overdose deaths occurring among Black NH persons. The average age at death was comparable among both groups (30 years in overdose cases and 31 years in non-overdose cases).

A similar percentage of individuals were pregnant at the time of death in both the overdose (27%) and non-overdose (26%) groups, but more than half (63 percent) of deaths in the overdose group occurred in the late postpartum period. Deaths following the conclusion of pregnancy occurred, on average, two months later among the overdose group (179 days vs 120 days).

There were large differences between the two groups related to several behavioral health factors. Individuals who died of overdose were more than four times as likely as individuals who died of other causes to have a known history of substance use (94 percent vs. 23 percent). Individuals who died of overdose were almost three times as likely to smoke (71 percent vs. 25 percent) and were also almost three times as likely to have one or more behavioral health diagnoses (70 percent vs. 25 percent). One out of five individuals who died of an overdose had a documented history of IPV, which is more than twice of what was seen among those non-overdose deaths.

Strikingly, 100 percent of the overdose deaths were considered preventable or potentially preventable, compared with 67 percent of the non-overdose deaths.

Table 2: Incident Characteristics of Pregnancy-Associated Deaths, Maryland, 2012-2021
Data presented as mean ± standard deviation, or number (%)

Characteristic	Overdose Deaths (n=120)	Non-overdose Deaths (n=279)
Demographics		
Average age at death (years)	30 ± 5	31 ± 7
White NH	86 (72)	87 (31)
Black NH	25 (21)	149 (53)
Non-Hispanic Other	4 (3)	14 (5)
Hispanic	5 (4)	29 (10)
Timing of death		
Pregnant at death	32 (27)	73 (26)
0-42 days postpartum	12 (10)	83 (30)
43-365 days postpartum	75 (63)	118 (42)
Unknown	1 (1)	5 (2)
Average days postpartum*	179 ± 102	120 ±115
Behavioral health / social factors		
Known history of substance use	113 (94)	64 (23)
Smoking	85 (71)	70 (25)
Behavioral health diagnosis(es)	84 (70)	69 (25)
Intimate partner violence	24 (20)	26 (9)
Preventability		
Death preventable or potentially preventable	120 (100)	188 (67)

* Among individuals whose death occurred in the postpartum period and exact timing of death in relation to the end of pregnancy was known.
Data Source: Maryland MMR Program as of 06/2024.
Note: Total of overdose and non-overdose deaths in Table 1 excludes a pregnancy-associated death from 2012 for which the MMRT did not assign a cause of death or determine pregnancy-relatedness.

Current Year Review of Overdose Deaths, 2021

Pre-existing Mental Health Conditions and Social and Emotional Stressors, 2021

Pre-existing behavioral health disorders were documented among 19 (45 percent) of the 42 pregnancy associated deaths in 2021. Either alone or co-occurring with other conditions: twelve individuals (29 percent) had an anxiety disorder, seven individuals (17 percent) had a diagnosis of depression, seven individuals (17 percent) had a substance use disorder, and five (12 percent) had bipolar disorder. Seven (17 percent) individuals had a documented history of IPV.

The data from 2021 cases continue to show that substance use disorders, IPV, depression, and other behavioral health disorders have a significant effect on pregnant persons and their families, and are contributing factors to maternal health, morbidity, and mortality.

Substance Use Disorder and Overdose Deaths, 2021

In 2021, for the ninth consecutive year, unintentional drug overdose or substance use disorder was the leading cause of pregnancy-associated death in Maryland. Ten of the 42 pregnancy-associated deaths (24

percent) resulted from overdose and all were considered to be non-pregnancy-related. Further, the ten non-pregnancy-related overdose deaths accounted for 37 percent of the 27 non-pregnancy-related deaths. All ten overdose deaths (100 percent) involved the potent opioid fentanyl or one of its analogs. Cocaine was also involved in three overdose deaths and xylazine, increasingly found to be involved in opioid related deaths, was found in one overdose case.

The average age at death was 31 years (range 25-39 years). Six overdose deaths (60 percent) were among White NH individuals, three (30 percent) were among Black NH individuals, and one (10 percent) was a Hispanic individual. Six individuals (60 percent) delivered live born infants, three (30 percent) had a fetal death >20 weeks gestation, and one (10 percent) had a spontaneous abortion <10 weeks gestation. Two (20 percent) of the overdose victims were pregnant at the time of death, two (20 percent) deaths occurred within 42 days of the end of the pregnancy, and six (60 percent) deaths occurred from 43 days to one year after the conclusion of pregnancy. The average timing of death among all eight postpartum deaths was 118 days (4 months) postpartum. Eight (80 percent) of the overdose victims had a known history of substance use and six (60 percent) had received substance use disorder treatment.

Of the ten overdose cases in 2021, eight (80 percent) individuals had one or more pre-existing behavioral health conditions. Either alone or co-occurring with other conditions: five (50%) individuals experienced anxiety, five (50 percent) individuals had substance use disorder, three (30 percent) individuals had bipolar disorder, and two (20 percent) individuals had depression. Five (50 percent) of the ten individuals who died from an overdose in 2021 had a documented history of IPV.

In addition to the individuals who died from overdose in 2021, there were eight individuals who had a documented history of substance use but died from other causes. Of those individuals, only two received treatment for substance use disorder. Thus overall, 16 (38 percent) of the 42 individuals who died within a year of pregnancy in 2021 had some documented history of substance use disorder. Further, there were two individuals for whom the MMRT cited substance use disorder as a contributor to death but who had non-overdose underlying causes of death.

Contributing Factors and Recommendations Related to Substance Use/Overdose, 2021

The MMRT identified 52 contributing factors for the ten overdose cases in 2021, and assigned a recommendation to address each contributing factor. Seventeen (17) distinct contributing factors were identified, with the most cited factors including mental health conditions (15 percent), substance use disorder (15 percent), continuity of care/care coordination (13 percent), and access to care/financial barriers (8 percent). Of the corresponding 52 recommendations, nearly half (46 percent) were made towards the system level, one-quarter (27 percent) were on the provider level, 20 percent were on the facility level, and the remaining 8 percent were on the community level. Care coordination, warm handoffs, and case management were commonly cited recommendations at the systems level. The MMRT further highlighted the importance of access to trauma informed care in the vulnerable pregnancy and postpartum period.

Conclusion

Preventable maternal mortality continues to exist in Maryland with persistent disparities in pregnancy-related mortality between Black NH birthing people and their White NH counterparts. This report describes pregnancy-associated deaths from across the state with specific recommendations to prevent future deaths that are based on a careful review of each death by a multidisciplinary team. The next step

towards 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 people, and its support for community organizations and partners working to address drivers of pregnancy-associated deaths. In 2024, the State hosted its first-ever summit to bring together birth workers, community partners, clinicians, and other stakeholders. The goal of the event was 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 people. 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: Definitions

- A pregnancy-associated death is defined by the CDC as "a death during or within one year of pregnancy, regardless of the cause. These deaths make up the universe of maternal mortality; within that universe are pregnancy-related deaths and pregnancy-associated, but not related deaths." [20]
- 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 "a death 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 physiologic effects of pregnancy."[21]
- 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 "a death during or within one year of pregnancy, from a cause that is not related to pregnancy." [21]
- A pregnancy-associated, but unable to determine pregnancy-relatedness death is defined as a death during or within one year of pregnancy, where the team was unable to determine the relatedness between the pregnancy and the cause of death.

[20] CDC. "About Maternal Mortality Review Committees." Maternal Mortality Prevention, 20 May 2024, www.cdc.gov/maternal-mortality/php/mmrc/index.html.
[21] Maternal Mortality Review Terminology. (2025). YouTube; CDC Foundation. https://youtu.be/8zdotEjKks4

Appendix B: Maternal Mortality Review Team

MATERNAL MORTALITY REVIEW COMMITTEE

July 22, 2025

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 - 2023 Annual Report – Maryland Maternal Mortality Review

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 Team Chair

Enclosure

Cc:
Elizabeth Kromm, PhD, MSc, Acting Deputy Secretary, Public Health Services
Shelly Choo, MD, MPH, Director, Maternal and Child Health Bureau
Sarah T. Albert, MSAR #8248

Maternal Mortality Review Team Recommendations, 2021 Case Review

In 2021, for the ninth consecutive year, unintentional drug overdose or substance use disorder was the leading cause of pregnancy-associated death in Maryland. Ten of the 42 pregnancy-associated deaths (24 percent) resulted from substance use, all of which involved the potent opioid fentanyl or one of its analogs. The MMRT makes the following recommendations based on the findings in this report.

Substance Use Disorder

1. This year's case review saw multiple birthing people who were offered substance use treatment resources but who chose not to engage in this care at that time. For individuals not yet ready to access treatment services, easily accessible safe use sites should be established, in accordance with the growing evidence base demonstrating their positive impacts. Safe use sites should be staffed by trained personnel who are equipped to provide education, referrals to substance use disorder treatment, and other resources to people who use drugs.
2. Sustainably fund integrated substance use programs or expand existing programs tailored for pregnant and postpartum individuals and accessible in all regions of Maryland to immediately address the leading cause of maternal deaths over the past decade. "Integrated" means providing an array of services that comprehensively address the needs of pregnant and postpartum individuals with substance use disorder. These include mental health services, transportation services beyond those provided by Medicaid, case management, direct access to SNAP and other social services, parenting classes, domestic violence services, smoking cessation resources, job placement assistance, education financial aid assistance, etc. These programs should be run by staff who understand the communities they serve.
3. Encourage prenatal practices to embed a licensed behavioral health therapist and/or mental health nurse practitioner into their office setting at least 1-2 days/week to both facilitate referral compliance and to better integrate behavioral health and prenatal care. Having behavioral health backup will likely make obstetricians and nurse midwives feel more comfortable prescribing buprenorphine to their pregnant patients. This should be a priority in obstetric practices owned by larger hospital systems.

Warm handoffs & Insurer engagement in care coordination

1. Insurance companies, including HealthChoice MCOs, Medicare, and private third-party insurance, should provide care management services at no cost to the patient and should be held responsible for making access to this care management easy with limited time/effort by both the patient and clinical care team. Care management services should include (but are not limited to) dedicated staff to manage and complete referrals, systems to track and report on referral completion rates, and publicly available lists of services that insurers connect patients to.

Bias, Racism, and Discrimination

1. Hospital systems should create advisory boards that are responsible for providing feedback to and collaborating with perinatal system staff to identify patient-driven solutions to improve birthing and perinatal outcomes and to counter implicit bias in the local healthcare setting. Members of these boards should include birthing people who have delivered recently at the facility and their advocates and should reflect the racial and ethnic make-up of the population served by the hospital.
2. The Maryland Department of Health should provide technical assistance, training, and education that centers reproductive justice to hospital systems on best practices for implementing these advisory boards.

COVID-19

In response to future pandemics and healthcare disruptions, public health agencies, including the Maryland Department of Health and local health departments, should be prepared to develop communications that are responsive to misinformation and address the needs of people of reproductive age.

Preconception and interconception health

This year the MMRT reviewed a number of cases of individuals with chronic conditions that would make a pregnancy higher risk for poor outcomes. In these cases, the MMRT found missed opportunities for high-quality reproductive health counseling by specialists and other members of their health care team.

1. The Maryland Department of Health should support the creation of training on current reproductive health and contraception education for health care providers who do not typically provide reproductive health counseling. Providers should be prepared to engage in conversations regarding the potential impact of reproductive plans with their patients, and be knowledgeable in where to refer a patient to support their reproductive autonomy.
2. All individuals should have access to reliable, high quality contraception and education to support their reproductive planning decisions. Individuals should be supported by healthcare providers, systems, insurers, and employers to make decisions that best align with their needs.

Language-congruent care

1. Healthcare systems should establish scheduling protocols that allow for appropriate time needed when meeting with patients requiring language support. To permit healthcare systems to do so, insurers should increase the reimbursement rate for translation services.

2. Public health systems should recognize trained interpreters as a key workforce category that is currently understaffed and should be further developed.

Violence

Six of 42 deaths (14%) reviewed in 2021 were due to gun violence. Policymakers should develop ways of restricting gun access and improving safety measures, such as passing legislation, to limit the public health impact of gun violence. These include, but are not limited to, increased gun safety and safe storage education and access to gun locks, universal screening for the presence of guns in the home, and implementation of red flag laws.

Appendix C: 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 MMRT.

Maternal Mortality Review Stakeholder Group Membership

Melissa Aftoora, Queen Anne's County Health Department
Asjouré Brown, House of Ruth Maryland
Teneele Bruce, MBS, Baltimore Healthy Start, Inc.
Adriane Burgess, PhD, RNC-OB, Maryland Patient Safety Center
Jennifer Corder, MD, Maryland Association of County Health Officers
Pastor Meldon Dickens, Community Representative
Kathryn Fiddler, DNP, Maryland Commission for Women
David Mann, MD, PhD, Maryland Department of Health, Office of Minority Health and Health Disparities
Meghana Rao, MD, Women's Health Care Provider
Maxine Reed Vance, PhD, RN, Baltimore Healthy Start
Rosemarie DiMauro Satyshur, PhD, RN, Family Representative, University of Maryland School of Nursing
Doris Titus-Glover, PhD, MSN, Community Representative
Ben Wormser, MD, MPH, Maryland Department of Health
Diane Young, DrPH, MS, RN, Prince George's County Health Department

Maternal Mortality Review Stakeholder Group Recommendations, 2021 Case Review

Additions to the recommendations in the Maternal Mortality Review 2023 Annual Report

Violence Prevention and Maternal Mortality

The MMRSG discussed recommendations made by the Maternal Mortality Review Team (MMRT) concerning gun violence, and specifically discussed the subset of pregnancy-associated deaths due to gun violence where intimate partner violence (IPV) was a contributor.

- The MMRSG recommended that the Maryland Department of Health and other groups further consider the unique recommendations that may be needed to address IPV, which may be different from other forms of violence.
- The MMRSG also recommended that there need to be increased availability of safe housing options for people experiencing IPV, particularly for pregnant and postpartum individuals.
    - Members noted that restrictions on the length of stay may need to be adjusted for someone who is pregnant or postpartum, as these individuals may need longer stays.

Reproductive Health Counseling Access

In the 2021 cases the MMRT reviewed several cases where there were missed opportunities for reproductive health counseling to be provided.

- The MMRSG echoed the MMRT's recommendations that reproductive care training should be provided for subspecialists, such as rheumatologists and cardiologists who may care for pregnant people with conditions that put them at higher risk for pregnancy complications, and that high-quality reproductive health education should be generally available through other institutions where people may receive care, such as school-based health centers.
- The MMRSG also supported the need to train providers on anticipatory guidance for reproductive health planning for people with chronic conditions associated with higher risks during pregnancy.

Doula Services

- The MMRSG recommended the review of perinatal outcomes related to doula services covered by Medical Assistance.

Appendix D: Five-Year Rolling Maternal Mortality Rates by Race and Ethnicity, Maryland and United States, 2003-2021

Appendix D shows the five-year rolling MMR by race in Maryland from 2003 to 2021.

Table C1: Five-Year Rolling Maternal Mortality Rate* by Race/Ethnicity, Maryland and United States, 2003-2021

	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
2017-2021	21.7	18.7	32.7	23.1	19.5	50.6

*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.
Ranges 2016-2020 through 2017-2021: MMR *estimates* for White NH and Black NH individuals are calculated using single race data where available, and bridged race data where single race data are not available.
As a result of the rate calculations, the disaggregated rate estimates for White NH and Black NH individuals for periods including and beyond 2016-2020 are not directly comparable to rates from previous periods or estimates in subsequent 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://web.archive.org/web/20250131112416/https://www.cdc.gov/nchs/hus/sources-definitions/nhis.htm