MARYLAND
Department of Health
Larry Hogan, Governor · Boyd K. Rutherford, Lt. Governor · Robert R. Neall, Secretary

December 12, 2018

The Honorable Larry Hogan
Governor
State of Maryland
Annapolis, MD 21401-1991

The Honorable Thomas V. Mike Miller, Jr.
President of the Senate
H-107 State House
Annapolis, MD 21401-1991

The Honorable Michael E. Busch
Speaker of the House
H-101 State House
Annapolis, MD 21401-1991

RE: Health-General Article, §13-1207, Annotated Code of Maryland - 2018 Annual Report Maryland Maternal Mortality Review

Dear Governor Hogan, President Miller, and Speaker Busch:

Pursuant to Health-General Article, §13-1207 and Senate Bill 459, Chapter 74 of the Acts of 2000, the Department of Health submits this legislative report on the findings, recommendations, and program actions of the Maternal Mortality Review Program.

If you have questions concerning this report, please contact Webster Ye, Deputy Chief of Staff, Office of the Secretary, at (410) 767-6480.

Sincerely,

Robert R. Neall
Secretary

MARYLAND
Department of Health

MARYLAND MATERNAL MORTALITY REVIEW 2018 ANNUAL REPORT

Health – General Article § 13-1207

Larry Hogan
Governor

Boyd Rutherford
Lt. Governor

Robert R. Neall
Secretary of Health

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ACKNOWLEDGEMENTS

This review of maternal deaths in Maryland would not be possible without the data, expertise, and collaboration of the Maryland Department of Health's Vital Statistics Administration and the Office of the Chief Medical Examiner. The Maternal Mortality Review Program would like to also offer special thanks to the volunteer members of its Maternal Mortality Review Committee for the hours spent in discussion and the serious attention given to this important public health project. The Program is also grateful for the diligent work of the case abstractors in their careful and thorough abstraction of case materials. The Program also thanks MedChi, the Maryland State Medical Society for their collaboration in the administrative support of the Committee. Special thanks to all those who participated in this year's Committee meetings and case reviews:

Committee Member	**Hospital / Affiliation**
Cristina Aquia, RN	University of Maryland St. Joseph Medical Center
Pablo Argeles, MD	University of Maryland Baltimore Washington Medical Center
Pedro Arrabal, MD	Sinai Hospital
Robert Atlas, MD	Mercy Medical Center
Carol Ator, RN	University of Maryland St. Joseph Medical Center
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Ann Burke, MD	Holy Cross Hospital
Diana Cheng, MD	MMR Abstractor
Andreea Creanga, MD, PhD	Johns Hopkins Bloomberg School of Public Health
Deborah Doerfer, CNM	Johns Hopkins Hospital
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Jan Kriebs, CNM	MMR Abstractor
Lorraine Milio, MD	Johns Hopkins Bayview Medical Center, Center for Addiction and Pregnancy, MMR Abstractor
Judith Rossiter, MD	University of Maryland St. Joseph Medical Center
S. Lee Woods, MD, PhD	Maryland Department of Health, MMR Program Director

Staff to the Committee:

Shayna Banfield
Clara Richards

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 (the Department) 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, health care providers, health care facilities, and the general public.

The Maternal Mortality Review Committee (the MMR Committee), which was established by the Program and is made up of volunteer heath care and public health professionals, conducts maternal mortality case reviews. The Department collaborates 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 the Department's MMR Committee. The MMR Committee provides an in-depth review of maternal deaths to determine pregnancy-relatedness and preventability. The MMR Committee then develops recommendations for the prevention of maternal deaths, and disseminates their findings and recommendations.

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 **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 Centers for Disease Control and Prevention (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."
- 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."
- The **pregnancy-related mortality rate** is the number of pregnancy-related deaths per 100,000 live births in the same time period.

The three terms "maternal death," "pregnancy-associated death," and "pregnancy-related death," create a challenge when comparing data from different sources and reports for different jurisdictional entities. 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.

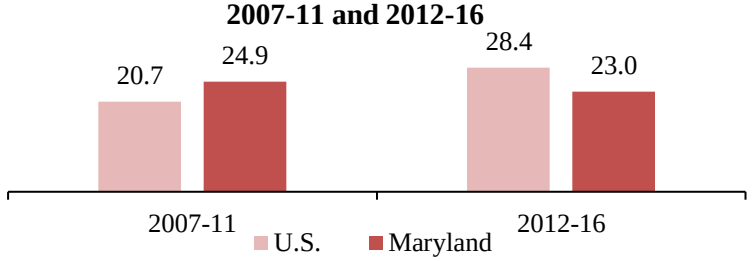
In more developed countries with improved medical care, many deaths related to pregnancy occur beyond 42 days after the end of pregnancy. In 1986, the CDC and the American College of Obstetricians and Gynecologists (ACOG) collaborated to recommend the use of expanded definitions to more accurately identify deaths among women 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 will be discussed below.

Rising Rates of Maternal Deaths

Nationally, maternal deaths as defined above have declined dramatically since the 1930s when the MMR was 670 maternal deaths per 100,000 live births. The U.S. MMR was at its lowest level in 1987 at 6.6 maternal deaths per

100,000 live births. However, the MMR has risen since that time, and was 31.2 maternal deaths per 100,000 live births in 2016, the latest year for which national data are available. To compare Maryland's MMR with the national rate, a five-year average is used. This stabilizes the Maryland rate because maternal deaths are relatively infrequent events that may vary considerably year to year, particularly in a small state like Maryland. The Maryland MMR had consistently been higher than the national average. However, for the period from 2011 to 2015, the Maryland MMR was slightly lower than the national rate for the first time, and the most recent data (Figure 1) show that the Maryland MMR is now 19% less than the national rate. Between the two 5-year periods shown, the U.S. MMR increased by 37.2 percent and the Maryland rate decreased by 7.6 percent. Both, however, remain above the Healthy People 2020 Objective MICH-5 target of 11.4 maternal deaths per 100,000 live births.

Figure 1. Maternal Mortality Rates*, U.S. and Maryland 2007-11 and 2012-16



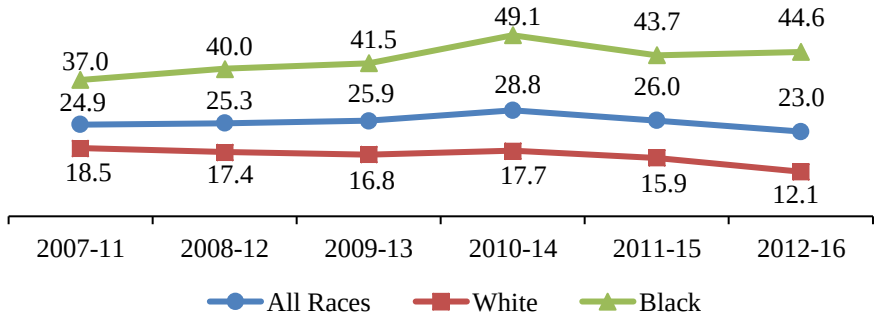
* Rate of maternal deaths per 100,000 live births
Data Source: CDC, NVSS; Maryland Department of Health (MDH), Vital Statistics Administration (VSA)

The reason for the increase in MMR since the 1980s is unclear. Many studies have shown an increase in chronic health conditions among pregnant women in the United States, including obesity, hypertension, diabetes, and heart disease.[1, 2, 3] These conditions likely put pregnant women at higher risk of adverse outcomes.

Racial Disparity

In the U.S., Black women have an MMR 2.4 times greater than White women, a disparity that has persisted since the 1940s. In Maryland, there is also a large disparity between the rates among Black and White women. Figure 2 shows the MMR by race in Maryland for six overlapping 5-year periods over the past decade. Compared to 2007-2011, the 2012-2016 White MMR in Maryland decreased 34.6 percent and the Black MMR increased 20.5 percent, increasing the racial difference. The 2012-2016 Black MMR is 3.7 times the White MMR. Given this racial disparity, it appears that the recent decrease in the Maryland MMR is a result of the decrease in the White MMR.

Figure 2. Five Year Rolling Average Maternal Mortality Rate* by Race, Maryland, 2007-2016



*Rate of maternal deaths per 100,000 live births. Data Source: MDH, VSA

[1] Kuklina EV, Ayala C, Callaghan WM. Hypertensive disorders and severe obstetric morbidity in the United States: 1998–2006.Obstet Gynecol. 2009;113(6):1299–1306.
[2] Albrecht SS, Kuklina EV, Bansil P et al. Diabetes trends among delivery hospitalizations in the United States, 1994–2004.Diabetes Care. 2010;33(4):768–773.
[3] Kuklina EV, Callaghan WM. Chronic heart disease and severe obstetric morbidity among hospitalizations for pregnancy in the USA: 1995–2006. Br J Obstet Gynaecol. 2011;118(3):345–352.

METHODOLOGY

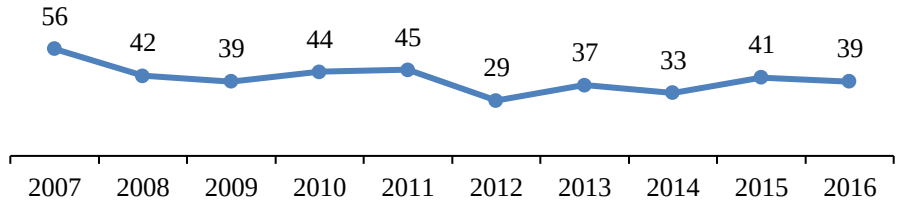
Case Identification

Cases for review are limited to women who were residents of Maryland at the time of their death. Maryland residents who died in other states are not included in the MMR case reviews. Maternal deaths are determined by cause of death and pregnancy information on the death certificates 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.[4, 5]

Pregnancy-associated deaths are identified in one of three ways in Maryland. Individual death certificates are the first method of identifying pregnancy-associated deaths through the use of 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 women 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. Thirdly, cases reported to the Office of the Chief Medical Examiner are reviewed to identify evidence of pregnancy in deceased women.

All deaths occurring during pregnancy or within 365 days of pregnancy conclusion are designated as pregnancy-associated and investigated further. Using the three methods above, 39 pregnancy-associated deaths were identified in 2016. These cases are reviewed in detail in this report. Figure 3 shows the numbers of pregnancy-associated deaths in Maryland from 2007 to 2016. An average of 41 pregnancy-associated deaths occurred per year during this period.

Figure 3. Number of Pregnancy-Associated Deaths*, Maryland, 2007 - 2016



*Deaths of women from any cause while pregnant or within 365 days of pregnancy. Data Source: MDH, VSA

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, Medical Examiner records, and other available materials for all cases and prepare case summaries that go to the MMR Committee for review. All 2016 pregnancy-associated deaths from all causes (medical, injury, substance use, homicide, and suicide) were reviewed for cause of death, pregnancy-relatedness, and preventability.

Pregnancy-relatedness and potential preventability of the deaths are determined through Committee discussion. The MMR Committee includes obstetric, maternal fetal medicine, nurse-midwifery, nursing and social work specialties, as well as public health professionals, including representatives from the Department's Maternal and Child Health Bureau. The Committee discussions incorporate the CDC framework for case review outlined in "Strategies to

[4] 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.
[5] Horon IL, Cheng D. Effectiveness of pregnancy check boxes on death certificates in identifying pregnancy-associated mortality. Pub Health Reports. 2011; 126:195-200.

Reduce Pregnancy-Related Deaths: From Identification and Review to Action."[6] This approach takes into account medical and non-medical factors contributing to maternal death, and examines quality and content of medical care. Cases discussed by the Committee are de-identified and all members sign confidentiality agreements.

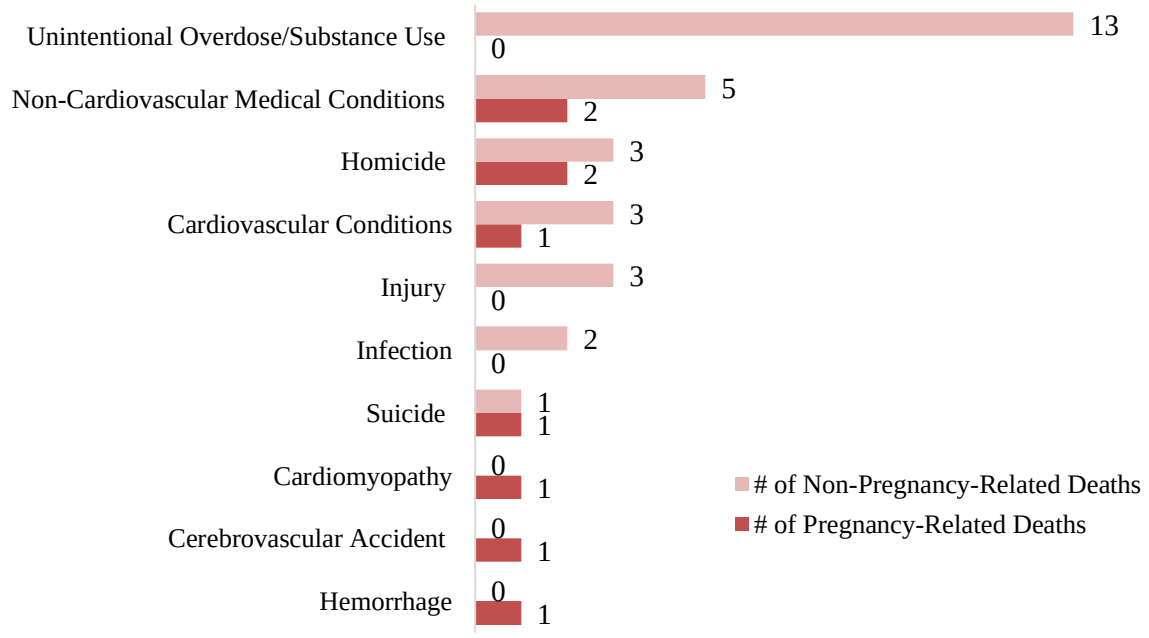
2016 CASE FINDINGS

A total of 39 pregnancy-associated deaths were identified in 2016 for a pregnancy-associated mortality rate of 53.4 deaths per 100,000 live births. For further analysis, these deaths were divided into pregnancy-related and non-pregnancy-related deaths, which represent two non-overlapping groups. Of the 39 pregnancy-associated deaths, nine were determined to be pregnancy-related, for a pregnancy-related mortality rate of 12.3 deaths per 100,000 live births. The remaining 30 deaths were determined to be non-pregnancy-related.

Cases by Cause of Death Category

Figure 4 shows pregnancy-related and non-pregnancy-related deaths by category of cause of death. The leading cause of non-pregnancy-related death was substance use with unintentional overdose, accounting for 13 deaths (43 percent of non-pregnancy-related deaths and 33 percent of all pregnancy-associated deaths in 2016). This is the highest number of overdose deaths reported in one year. Other leading causes of non-pregnancy-related death were non-cardiovascular medical conditions (predominantly cancer), followed by homicide, cardiovascular conditions, and injury (predominantly motor vehicle accidents).

Figure 4. Number of Pregnancy-Related* and Non-Pregnancy-Related Deaths by Category of Cause of Death, Maryland, 2016 (Total Deaths = 39)**



*Deaths of women while pregnant or within 365 days of pregnancy from a cause related to or aggravated by pregnancy or its management.
** Deaths of women while pregnant or within 365 days of pregnancy from any cause not related to or aggravated by pregnancy or its management.
Data Source: MDH, VSA, and Maryland Maternal Mortality Review Program.

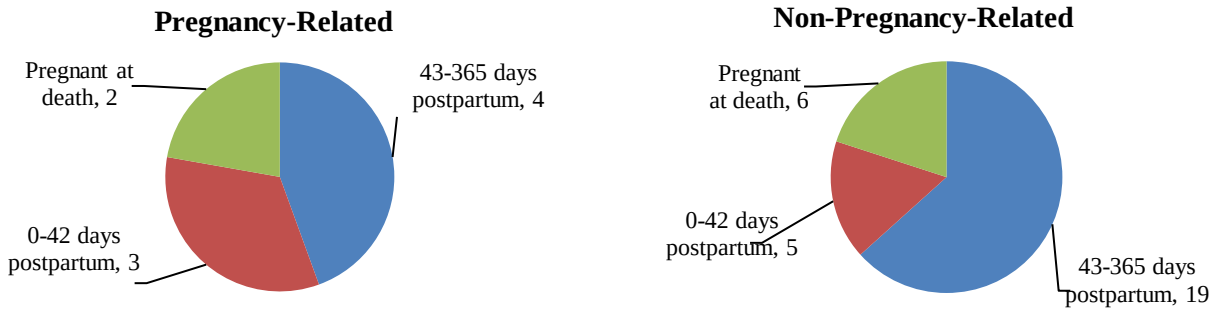
Among the nine pregnancy-related deaths in 2016, the leading causes of death were non-cardiovascular medical conditions and homicide, each accounting for two deaths. The remaining pregnancy-related deaths were single cases of cardiovascular conditions, suicide, cardiomyopathy, cerebrovascular accident, and hemorrhage.

[6] 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>.

Cases by Timing of Death in Relation to Pregnancy

Among the nine pregnancy-related deaths in 2016, four (44 percent) occurred between 43-365 days postpartum, three (33 percent) occurred within 42 days postpartum, and in two cases (22 percent) the woman was pregnant at the time of death (Figure 5). Of the 30 non-pregnancy-related deaths, 19 deaths (63 percent) occurred between 43-365 days postpartum, five (17 percent) occurred within 42 days postpartum, and six deaths (20 percent) occurred during pregnancy. Deaths in the early postpartum period, before the traditional six-week postpartum visit, were almost twice as frequent among pregnancy-related deaths compared to non-pregnancy-related deaths.

Figure 5. Number of Pregnancy-Related* and Non-Pregnancy-Related Deaths by Timing of Death, Maryland, 2016**

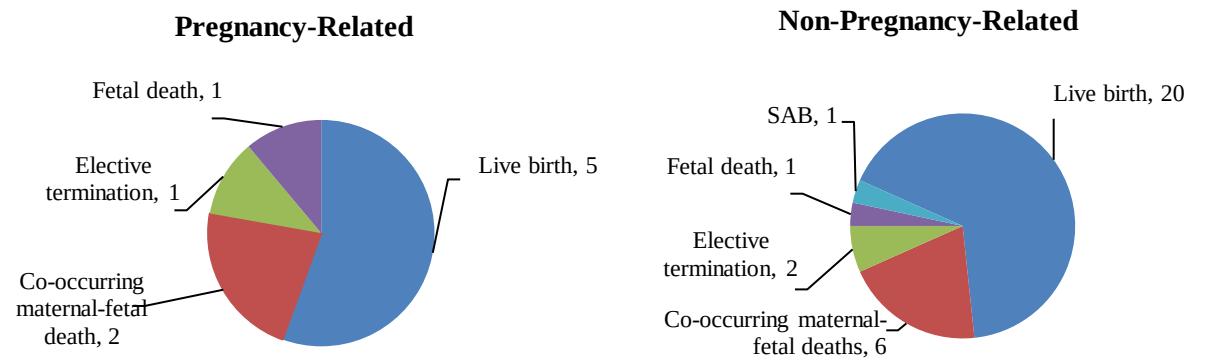


*Deaths of women while pregnant or within 365 days of pregnancy from a cause related to or aggravated by pregnancy or its management.
** Deaths of women while pregnant or within 365 days of pregnancy from any cause not related to or aggravated by pregnancy or its management.
Data Source: Maryland Maternal Mortality Review Program

Cases by Outcome of Pregnancy

Among the nine pregnancy-related deaths in 2016, five cases (56 percent) had a live birth, two (22 percent) involved co-occurring maternal and fetal deaths, one had an elective termination, and one involved a fetal death prior to the mother's death (Figure 6). Among the 30 non-pregnancy-related deaths, 20 cases (67 percent) had a live birth, six (20 percent) involved co-occurring maternal and fetal deaths, two (7 percent) had elective terminations, one involved a fetal death and one involved a spontaneous abortion.

Figure 6. Number of Pregnancy-Related* and Non-Pregnancy-Related Deaths by Pregnancy Outcome, Maryland, 2016**

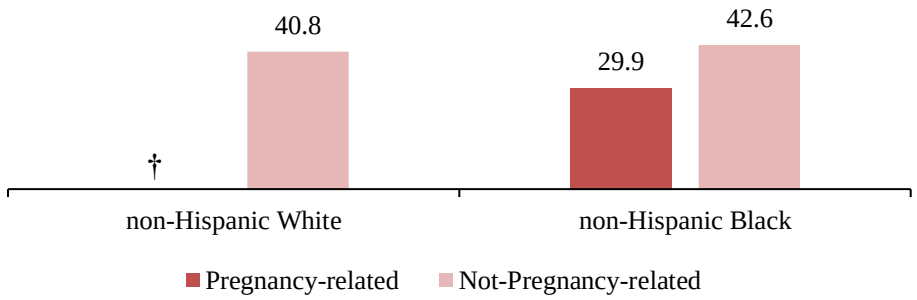


*Deaths of women while pregnant or within 365 days of pregnancy from a cause related to or aggravated by pregnancy or its management.
** Deaths of women while pregnant or within 365 days of pregnancy from any cause not related to or aggravated by pregnancy or its management.
SAB: spontaneous abortion. Data Source: Maryland Maternal Mortality Review Program

Cases by Maternal Race and Ethnicity

Of the 9 pregnancy-related deaths occurring in 2016, one case involved a non-Hispanic White woman and one an Asian woman. The remaining seven pregnancy-related deaths (78 percent) were among non-Hispanic Black women. Among non-pregnancy-related deaths, 13 (43 percent) occurred among non-Hispanic White women, 10 (33 percent) among non-Hispanic Black women, six (20 percent) among Hispanic women, and one case involved a woman with race listed as other. Pregnancy-related and non-pregnancy-related mortality rates among non-Hispanic Black and non-Hispanic White women in 2016 are shown in Figure 7. A rate is not displayed if there are fewer than five deaths within a group.

Figure 7. Pregnancy-Related and Non-Pregnancy-Related Mortality Rates* by Selected Race/Ethnicities, Maryland, 2016



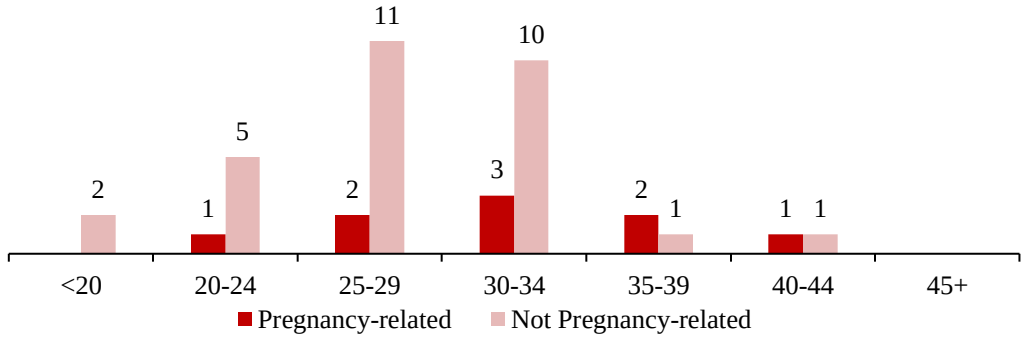
* Number of deaths per 100,000 live births. † Rate suppressed due to fewer than 5 deaths.
Data Source: Maryland Maternal Mortality Review Program

The rate of non-pregnancy-related deaths is similar between non-Hispanic White and non-Hispanic Black women. Although a rate cannot be calculated for pregnancy-related deaths among non-Hispanic White women since there was only one case, it is clear that the preponderance of pregnancy-related deaths are occurring among non-Hispanic Black women.

Cases by Maternal Age

The distribution of pregnancy-related and non-pregnancy-related deaths by maternal age group is shown in Figure 8. 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 events are unstable and would not be reported.

Figure 8. Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Maternal Age, Maryland, 2016

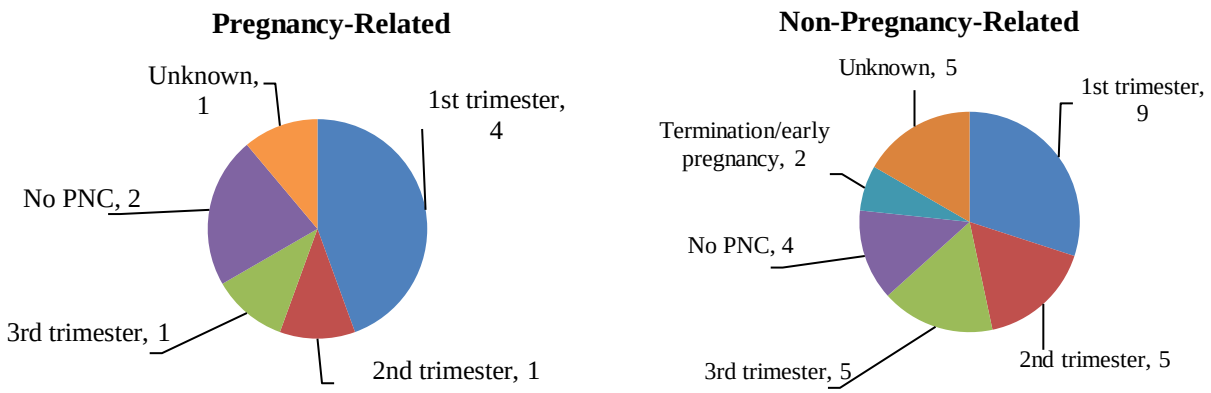


Data Source: MDH, VSA, and Maryland Maternal Mortality Review Program

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. Of the nine pregnancy-related deaths, five (56 percent) were among women who initiated care in the first or second trimester of pregnancy. Among the 30 non-pregnancy-related deaths, 14 (47 percent) of the women began prenatal care in the first or second trimester. In one pregnancy-related and five non-pregnancy-related cases, timing of prenatal care initiation was unknown.

Figure 9. Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Prenatal Care Initiation, Maryland, 2016



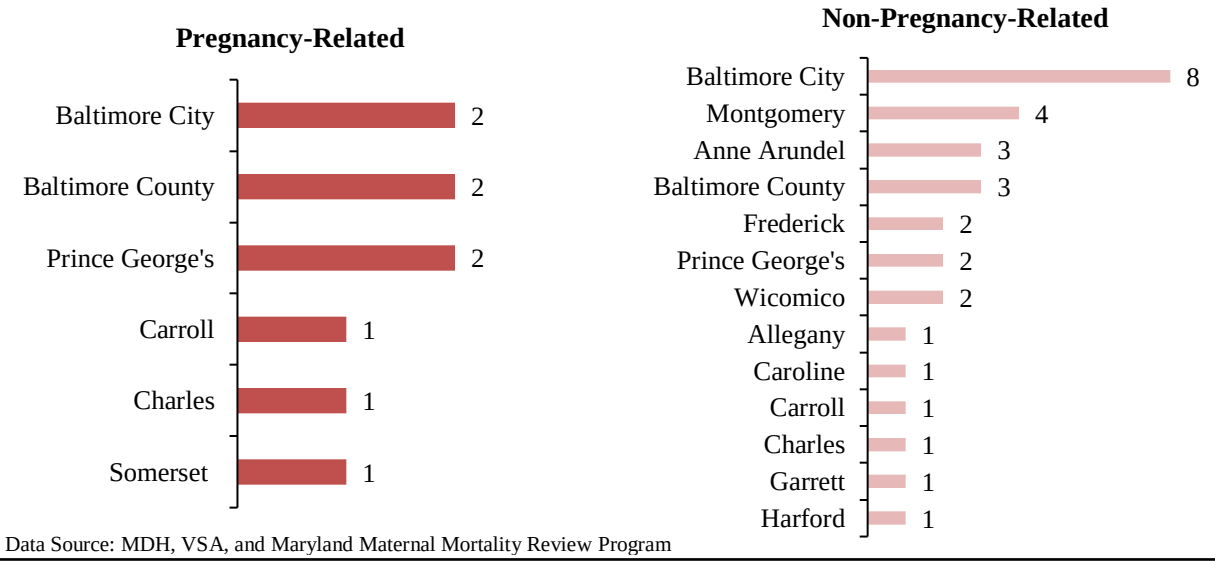
Data Source: Maryland Maternal Mortality Review Program

Cases by Jurisdiction of Residence and Occurrence

Figure 10 shows pregnancy-related and non-pregnancy-related deaths by jurisdiction of residence. Six (67 percent) of the nine pregnancy-related deaths were among residents of Baltimore City, Baltimore County and Prince George's County. There were single death cases among residents of Carroll, Charles, and Somerset Counties. Of the 30 non-pregnancy-related deaths, eight (27 percent) occurred among residents of Baltimore City and an additional ten cases (33 percent) among residents of Montgomery, Anne Arundel, and Baltimore Counties. Residents of nine other counties accounted for the remaining deaths.

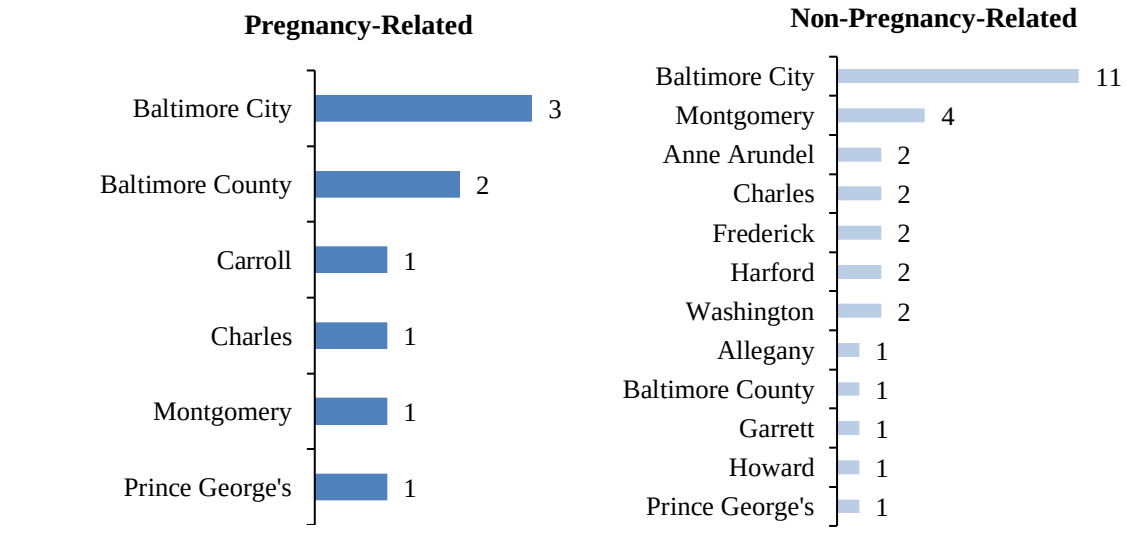
Figure 11 shows pregnancy-related and non-pregnancy-related deaths by jurisdiction in which the death occurred. Three (33 percent) of the nine pregnancy-related deaths occurred in Baltimore City and two (22 percent) in Baltimore County. Single deaths occurred in Carroll, Charles, Montgomery, and Prince George's Counties. Eleven (37 percent) of the non-pregnancy-related deaths occurred in Baltimore City and four (13 percent) in Montgomery County. The remaining deaths occurred in ten other counties.

Figure 10. Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Jurisdiction of Residence, Maryland, 2016



Data Source: MDH, VSA, and Maryland Maternal Mortality Review Program

Figure 11. Number of Pregnancy-Related and Non-Pregnancy-Related Deaths by Jurisdiction of Occurrence, Maryland, 2016



Data Source: MDH, VSA, and Maryland Maternal Mortality Review Program

Preventability of Deaths

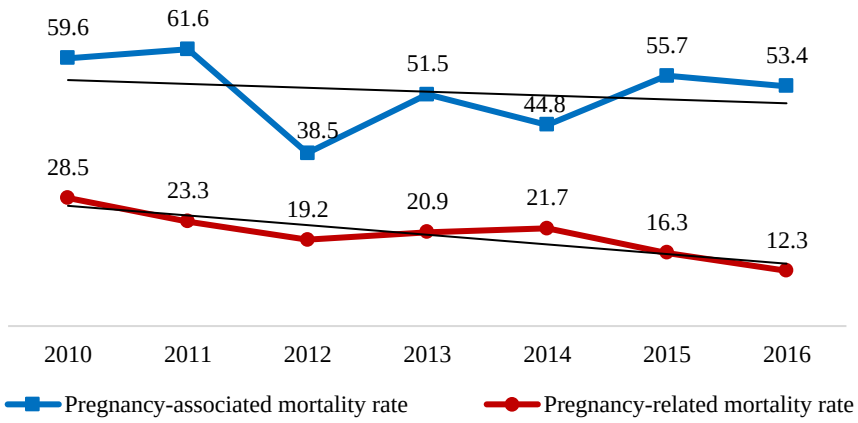
A death was considered preventable if the death "may have been averted by one or more changes in the health care system related to clinical care, facility infrastructure, public health infrastructure and/or patient factors."[7] Whether the death was clearly preventable or only potentially preventable by some intervention is a decision made by the MMR Committee. Of the 9 pregnancy-related deaths, eight (89 percent) were judged to be preventable or potentially preventable. One case was considered an unpreventable death. Among the 30 non-pregnancy-related deaths, 21 (70 percent) were judged to be preventable or potentially preventable. In three cases, preventability could not be determined, and six deaths were considered unpreventable. All of the unintentional overdose deaths were considered potentially preventable, as were the two suicide and five homicide deaths. Two of the three injury deaths were also considered potentially preventable. The seven deaths considered unpreventable involved medical causes of death (including cardiovascular conditions and cancer) and one motor vehicle accident death.

TRENDS IN PREGNANCY-ASSOCIATED AND PREGNANCY-RELATED DEATHS

Figure 2 above showed the trend and racial disparity in the Maryland maternal mortality rate (MMR). As noted, the MMR has dropped over the past ten years and is now below the national average, but the racial disparity has widened. 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 decrease in the Maryland MMR suggests that fewer early pregnancy-related deaths are occurring, and this decrease has occurred primarily among White maternal deaths.

The cases reviewed by the Maryland Maternal Mortality Review 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. All pregnancy-associated deaths are reviewed for pregnancy-relatedness, creating a subgroup of pregnancy-related deaths. The trends in pregnancy-associated and pregnancy-related mortality rates from 2010 to 2016 are shown in Figure 12. The pregnancy-associated mortality rate shows considerable variability over the seven-year period and has dropped by 10.4 percent over that time. The pregnancy-related mortality rate, however, shows a steady decrease of 56.8 percent over the seven-year period.

Figure 12. Pregnancy-Associated and Pregnancy-Related Mortality Rates*, Maryland, 2010-2016



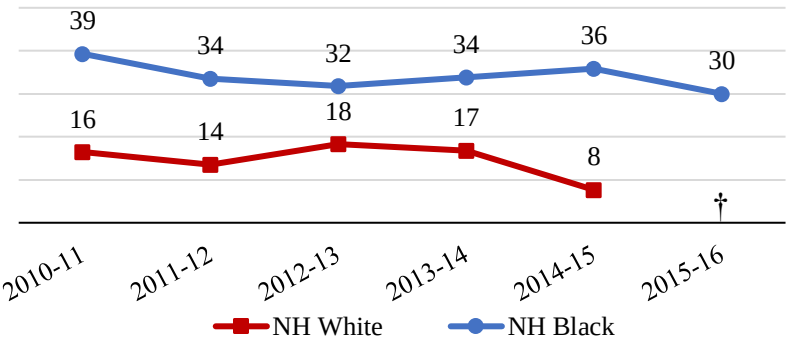
* Number of pregnancy-associated and pregnancy-related deaths per 100,000 live births.
Data Source: MDH, VSA, and Maryland Maternal Mortality Review Program

[7] 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.

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. It does appear, however, that the number of deaths from hemorrhage and amniotic fluid embolus are decreasing.

Pregnancy-related mortality rates were calculated for non-Hispanic White and non-Hispanic Black women to see if the same trends were evident as seen for the MMR in Figure 2. Rates are shown as rolling two-year averages because of small numbers of cases when looking at deaths by race by individual year. Over the seven-year period, the non-Hispanic Black pregnancy-related mortality rate was consistently higher than the non-Hispanic White rate. Comparing rates from 2010-2011 and 2015-2016, there was a 23 percent decrease in the non-Hispanic Black rate. The non-Hispanic White rate decreased by at least 50 percent during this time period, but a rate for 2015 to 2016 could not be calculated because there were fewer than five deaths in this group during those two years.

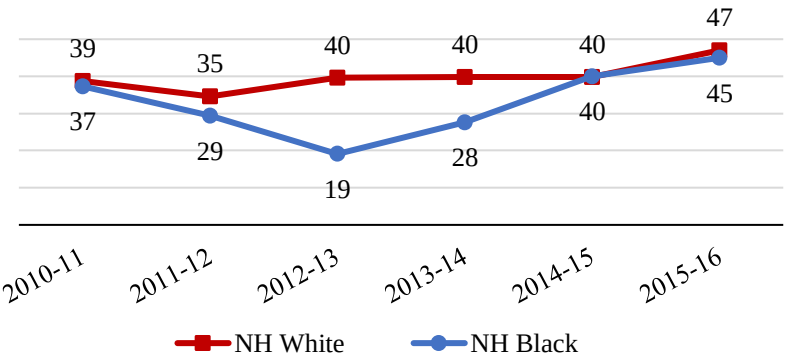
Figure 13. Pregnancy-Related Mortality Rates*



*Number of pregnancy-related deaths per 100,000 live births. † Rate suppressed due to fewer than 5 deaths. Data Source: Maryland Maternal Mortality Review Program

Non-pregnancy-related mortality rates by race were also calculated (Figure 14). Deaths from unintentional overdose have contributed increasingly to these deaths in the past several years. Overdose deaths have been predominantly among non-Hispanic White women, but the number of such deaths among other racial and ethnic groups has increased, which may be contributing to the increase in the non-pregnancy-related mortality rate among Black non-Hispanic women seen in Figure 14. Unintentional overdose deaths are reviewed in detail in the following section.

Figure 14. Non-Pregnancy-Related Mortality Rates* by Race/Ethnicity, Maryland, 2010-2016



*Number of non-pregnancy-related deaths per 100,000 live births.
Data Source: Maryland Maternal Mortality Review Program

FOCUS ON SUBSTANCE USE DISORDER AND OVERDOSE DEATHS

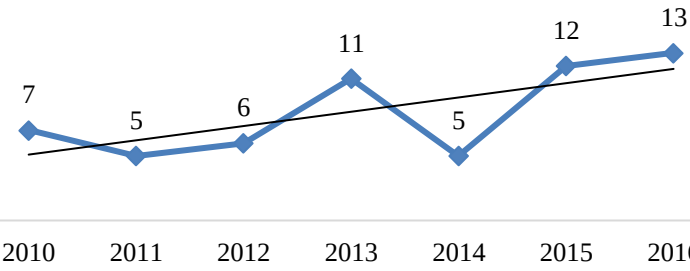
In 2016, for the fourth consecutive year, unintentional drug overdose was the leading cause of pregnancy-associated death in Maryland. Thirteen of the 39 total deaths (33 percent) resulted from substance use and unintentional overdose. All of the overdose deaths were considered to be non-pregnancy-related. The 13 overdose deaths accounted for 43 percent of the 30 non-pregnancy-related deaths. All of these deaths involved opioids. In 12 of the 13 cases (92 percent), two or more drugs were found by postmortem toxicology testing. Nine of the 12 multi-drug cases (75 percent) involved two or more different opioids. Ten of the overdose deaths (77 percent) involved the potent opioid fentanyl or one of its analogs. Alcohol was detected in three cases, cocaine in three cases, and marijuana in two cases.

The average age at death was 27.5 years (range 19 to 34 years). Six overdose deaths (46 percent) were among non-Hispanic White women, four (31 percent) among non-Hispanic Black women, two among Native American women, and one involved a Hispanic woman. Nine of the 13 women (69 percent) had delivered live born infants and the average timing of death was 193 days postpartum. Two women were pregnant at the time of death, one had a spontaneous abortion, and one had an elective termination. None of the overdose deaths occurred in the traditional postpartum period up to 42 days after the conclusion of pregnancy. All 13 of the overdose victims had a known history of substance use. In nine (69 percent) of the 13 cases, there was a history of one or more mental health diagnosis, with depression documented in eight cases, anxiety in four, and bipolar disorder in four.

Multiyear Review of Overdose Deaths

To better understand factors involved in overdose deaths, a review of all pregnancy-associated deaths in Maryland from 2010 to 2016 was undertaken. Over this seven-year period, substance use and unintentional overdose was the leading cause of death, accounting for 59 (22 percent) of 267 pregnancy-associated deaths. Figure 15 shows the number of unintentional overdose deaths by year, with the highest number of cases occurring in 2016.

Figure 15. Number of Pregnancy-Associated* Deaths From Unintentional Overdose, Maryland, 2010-2016



* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy.
Data Source: MDH, VSA, and Maryland Maternal Mortality Review Program

Of the 59 overdose deaths, 57 (97 percent) involved opioids (one of the remaining two cases involved alcohol, and the other involved alcohol plus the amphetamine methylone). Table 1 shows the specific opioid(s) identified by toxicology testing at the time of death in these cases. The most frequently detected opioid was morphine, a metabolite of heroin, followed by methadone and fentanyl (including fentanyl analogs). Fentanyl was not detected in any overdose death prior to 2014. One case from 2014, three cases from 2015, and ten cases from 2016 involved fentanyl or a fentanyl analog. In 54 (92 percent) of the 59 overdose deaths, two or more drugs were detected by postmortem testing. In 20 (37 percent) of the multiple drug cases, two to four different opioids were identified. Benzodiazepines were detected in 14 (24 percent) and alcohol in 14 (24 percent) of the 59 overdose death cases. The risk of fatal overdose is substantially increased when opioids are combined with other central nervous system depressants such as benzodiazepines or alcohol.

Table 1. Opioid Identified Postmortem, Pregnancy-Associated Unintentional Overdose Deaths, Maryland, 2010-2016	
Opioid	**Number of cases (n=57)**
Morphine (heroin)	23
Methadone	15
Fentanyl / fentanyl analogs	14
Oxycodone	10
Unspecified opioid	6
Tramadol	4
Codeine	3
Oxymorphone	2
Buprenorphine	1
Hydrocodone	1
Hydromorphone	1
Meperidine	1

Data Source: Maryland Maternal Mortality Review Program
NOTE: The values in the table do not add up to the sample size of 57 because multiple drugs can be detected in a single case.

Among the 59 unintentional overdose deaths occurring from 2010 to 2016, the average age at death was 29 years. Forty-four (75 percent) of these deaths were among non-Hispanic White women and 12 (20 percent) among non-Hispanic Black women, with two cases (three percent) among non-Hispanic Native American women and one case (two percent) in a Hispanic woman. Prior to 2016, non-Hispanic White and non-Hispanic Black were the only racial or ethnic groups represented among the overdose deaths. Among overdose deaths from 2010 to 2015, 83 percent were among non-Hispanic White women and 17 percent among non-Hispanic Black women. In 2016, the distribution of unintentional overdose deaths was 46 percent non-Hispanic White, 31 percent non-Hispanic Black, 22 percent Native American, and 11 percent Hispanic, suggesting that the problem of substance use and risk of overdose is increasing among non-Hispanic Black women and women of other racial and ethnic groups.

Nine women (15 percent) among the 59 deaths were pregnant at the time of death and seven (12 percent) had had an elective termination, spontaneous abortion or fetal demise prior to death. The remaining 43 women (73 percent) delivered live born infants. Only four deaths (7 percent) occurred at 42 days or less postpartum; the remaining 46 (78 percent) occurred between 43 and 365 days postpartum. The average timing of death was 194 days postpartum. In 48 cases (81 percent), one or more mental health diagnosis was documented. Depression was diagnosed in 37 cases (63 percent), anxiety in 34 cases (58 percent), and bipolar disorder in 20 (34 percent). Fifty-five (93 percent) of the women who died of overdose had a known history of substance use and twenty-five (42 percent) had documentation of some substance use treatment.

In Table 2, the 59 overdose deaths are compared with the 208 non-overdose deaths that occurred between 2010 and 2016. Average age at death was comparable in both groups. However, the racial distribution is strikingly different, with a preponderance of non-Hispanic White women among the overdose deaths and overrepresentation of non-Hispanic Black women among the non-overdose deaths. A similar percentage of women were pregnant at the time of death in both groups, but deaths after the conclusion of pregnancy occurred on average much later among the overdose group. Pregnancy outcome was similar in both groups, with 73 percent of pregnancies among the overdose group and 68 percent among the non-overdose group resulting in a live birth. Timing of prenatal care initiation was similar, with more than half of women in both groups starting prenatal care in the first or second trimester.

Table 2: Incident Characteristics of Pregnancy-Associated Deaths, Maryland, 2010-2016

Data presented as mean ± standard deviation, or number (%)

Characteristic	Overdose Deaths (n=59)	Non-overdose Deaths (n=208)
Demographics		
Average age at death (years)	29 ±5	31 ±7
White non-Hispanic	44 (75)	75 (36)
Black non-Hispanic	12 (20)	102 (49)
Native American non-Hispanic	2 (3)	14 (7)
Hispanic	1 (2)	17 (8)
Timing of death		
Pregnant at death	9 (15)	39 (19)
0-42 days postpartum	4 (7)	84 (41)
43-365 days postpartum	46 (78)	84 (40)
Average days postpartum	194 ±89	107 ±116
Pregnancy outcome		
Live born infant	43 (73)	141 (68)
Co-occurring maternal-fetal deaths	9 (15)	38 (18)
Spontaneous abortion / fetal death	6 (10)	18 (9)
Prenatal care initiation		
1st trimester	19 (32)	86 (41)
2nd trimester	14 (24)	23 (11)
3rd trimester	5 (9)	7 (3)
No prenatal care	6 (10)	18 (9)
Termination or death in early pregnancy	4 (7)	7 (3)
Unknown	11 (19)	67 (32)
Behavioral health / social factors		
Known history of substance use	55 (93)	42 (20)
Any history of substance use treatment (among those with known history of substance use)	25 (46)	17 (41)
Smoking	47 (80)	52 (25)
Mental health diagnosis(es)	48 (81)	44 (21)
Intimate partner violence	5 (9)	18 (9)
Preventability		
Death preventable / potentially preventable	57 (97)	115 (55)

Data Source: Maryland Maternal Mortality Review

There were large differences, however, between the two groups related to several behavioral health factors. Women who died of overdose were more than four-times as likely as women who died of other causes to have a known history of substance use (93 percent vs. 20 percent), although a similar proportion of each group with a history of

substance use had received any substance use treatment. Women who died of overdose were more than three-times as likely to smoke (80 percent vs. 25 percent) and almost four-times as likely to have one or more mental health diagnosis (81 percent vs. 21 percent). Also, 57 of 59 overdose deaths (97 percent) were considered preventable or potentially preventable, compared with 55 percent of the non-overdose deaths.

2018 MATERNAL MORTALITY REVIEW RECOMMENDATIONS

Substance use with unintentional overdose remains the leading cause of pregnancy-associated death for the fourth consecutive year in Maryland. The number and proportion of overdose deaths among deaths during pregnancy and the first year postpartum continue to increase, with overdose accounting for 33 percent of all pregnancy-associated deaths in 2016. The Committee, therefore, puts forward the following recommendations related to substance use disorder and unintentional overdose.

MMR Recommendations - Overdose Deaths	Action Items
• Promote universal screening at least once during pregnancy, at delivery, and postpartum for substance use, mental health, and intimate partner violence conditions. • Document screening tools used, referrals given, and treatment plans in perinatal records. • Reduce unintended pregnancy and encourage reproductive life planning. • Improve communication and collaboration between providers of prenatal care and other providers (mental health, substance use, primary care, oral health, etc.). • Promote interdisciplinary case management among substance use, mental health, and obstetric providers. • Improve safe opioid prescribing practices. • Encourage Prescription Drug Monitoring Program (PDMP) utilization by providers. • Encourage naloxone co-prescribing and 3rd party prescribing (prescribing for family or friends of individuals at risk of overdose). • Inform substance use treatment providers about perinatal health.	• Create and disseminate a resource list of valid screening tools for substance use, mental health, and intimate partner violence. • Create and disseminate a resource list of referral service options by Maryland jurisdiction. • Strive for a single point of contact for behavioral health services to facilitate provider access and care coordination among providers. • Promote integration of reproductive life planning and preconception counseling into health care visits by all disciplines. • Encourage use of Long Acting Reversible Contraception (LARC) for women who indicate they do not desire to become pregnant. • Promote the importance of establishing linkages and relationships to ongoing care during the perinatal and postpartum period. • Facilitate obtaining medical records from behavioral health service providers so that the obstetric chart has complete information of the patient's behavioral health care. • Provide obstetric support to behavioral health providers in the care of the pregnant patient. • Raise provider awareness about substance use during pregnancy and promote current resources and trainings. • Educate providers on the use and importance of the PDMP. • Train providers, patients, and families on naloxone use and response to opioid overdose. • Inform patients and families about the Maryland Good Samaritan law pertaining to response to an overdose emergency. • Develop consultation resources on perinatal and reproductive health issues for mental health and substance use treatment providers.

In addition, the Committee supports the Department's Perinatal Neonatal Quality Collaborative in partnership with the Maryland Patient Safety Center in its upcoming initiative related to substance use. The Collaborative is an effort among all Maryland delivery hospitals to address quality improvement in obstetric and neonatal care. In early 2019, the Collaborative will begin a quality improvement project to address care of the pregnant woman with substance use disorder.

The Committee also supports the Maryland SBIRT (Screening, Brief Intervention, and Referral to Treatment) Project in the Department's Behavioral Health Administration. SBIRT is an evidence-based approach to providing early intervention and treatment to patients with problem alcohol or drug use. Maryland SBIRT trains health care providers throughout Maryland in how to initiate conversations with patients about alcohol and drug use, and provide further assessment or referral when needed. Upcoming Maryland SBIRT efforts include SBIRT training for obstetric providers.

The Committee would also like to promote the resources made available by MedChi's Opioid Task Force. These provider resources include opioid-related educational materials and activities, information on opioid alternatives and opioid prescribing guidelines, substance use screening tools, and information and training on the Prescription Drug Monitoring Program (PDMP). MedChi has also made available an iPrescribe app which allows providers to easily access PDMP data from mobile devices.

The Committee is also continuing to develop *Provider Alerts* to disseminate information about maternal deaths in Maryland. One *Alert* will address overdose deaths to increase provider awareness of the contribution of substance use and unintentional overdose to maternal mortality in Maryland. Another will address recent guidance from ACOG and the Alliance for Innovation on Maternal Health to modernize paradigms of postpartum care, extending the postpartum period to improve maternal outcomes.

MATERNAL MORTALITY REVIEW STAKEHOLDER GROUP

House Bill 1518, enacted by the 2018 Maryland General Assembly, requires the Department to establish a Maternal Mortality Stakeholder Group to meet at least twice a year, to review the findings and recommendations in the annual Maternal Mortality Review Report. This group will include representatives of the Maryland Office of Minority Health and Health Disparities; the Maryland Patient Safety Center; the Maryland Healthy Start Program; women's health advocacy organizations; community organizations engaged in maternal health and family support issues; families that have experienced a maternal death; local health departments; and health care providers that provide maternal health services.

The Stakeholder Group is charged with examining issues resulting in disparities in maternal deaths, reviewing the status of implementation of previous recommendations, and identifying new recommendations with a focus on initiatives to address disparities in maternal deaths. House Bill 1518 requires that the Stakeholder Group meet once within 90 days of the publication this report and once 6 months after this report's annual publication. Members are currently being recruited for the Stakeholder Group, which will be convened for the first time in early 2019. The group will review the current report, and responses and recommendations from the stakeholders will be included in the 2019 Maternal Mortality Review Report.

SUMMARY

Maryland's MMR in the most recent five-year average data is 19 percent below the national rate for the first time. While the U.S. MMR continued to increase, the Maryland rate decreased by almost eight percent. Both rates, however, remain above the Healthy People 2020 goal of 11.4 deaths per 100,000 live births. While the MMR is limited in causes of death and timeframe of occurrence considered, this improvement is encouraging. However, significant racial disparities in maternal death persist.

Thirty-nine pregnancy-associated deaths were identified in 2016. Nine (23 percent) of these cases were determined

to be pregnancy-related, with the cause of death related to or aggravated by the pregnancy or its management. The remaining 30 cases were non-pregnancy-related deaths. The leading cause of non-pregnancy-related death for the fourth consecutive year was substance use and unintentional overdose. Non-cardiovascular medical conditions and homicide were the leading causes of pregnancy-related death. A majority of these deaths (70 percent of non-pregnancy-related deaths and 89 percent of pregnancy-related deaths) were considered preventable or potentially preventable.

In this report, the MMR Committee focused its recommendations on unintentional overdose deaths and improving its dissemination of maternal mortality review findings and recommendations to the provider community. The MMR Committee will continue to promote communication and collaboration among all providers caring for pregnant and postpartum women in an effort to reduce pregnancy-associated deaths in Maryland.