MARYLAND
Department of Health

Larry Hogan, Governor · Boyd K. Rutherford, Lt. Governor · Robert R. Neall, Secretary

May 3, 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 - 2017 Annual Report – Maryland Maternal Mortality Review

Dear Governor Hogan, President Miller, and Speaker Busch:

Pursuant to Health-General Article, §13-1207 and Senate Bill 688, Chapter 262 of 2003, 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, at (410) 767-6480 or webster.ye@maryland.gov.

Sincerely,

Robert R. Neall
Secretary

Enclosure

cc: Sarah Albert, MSAR #2181

MARYLAND DEPARTMENT OF HEALTH
PREVENTION AND HEALTH PROMOTION ADMINISTRATION

MARYLAND MATERNAL MORTALITY REVIEW
2017 ANNUAL REPORT

Health – General Article § 13-1207

Larry Hogan
Governor

Boyd K. Rutherford
Lieutenant Governor

Robert R. Neall
Secretary

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ACKNOWLEDGEMENTS

This review of maternal deaths would not be possible without the data, cooperation, and expertise 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 thank the volunteer Committee members 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 the cases. Special thanks to all those who participated in this year's case review and policy meetings:

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BACKGROUND

Md. Ann. Code Health-General Art., §13-1203—1207, establishes the Maternal Mortality Review Program (the Program) in the Maryland Department of Health 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 Maryland Department of Health (the Department) conducts maternal mortality reviews in collaboration with MedChi, the Maryland State Medical Society. The Department provides funding to MedChi to assist in the maternal mortality review process by obtaining medical records, abstracting cases, and hosting a committee of clinical experts from across the State, the Maternal Mortality Review Committee (the 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 to policy makers, health care providers, health care facilities, and the general public.

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.
- 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.
- 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.

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.

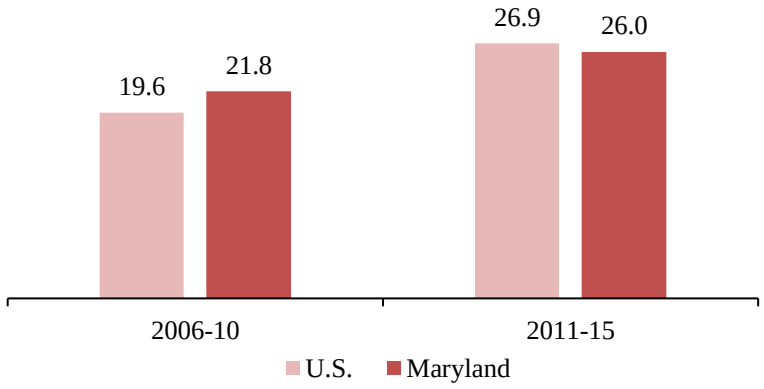
In more developed countries with improved medical care, many deaths related to pregnancy occur beyond 42 days after the end of pregnancy. In 1986, the CDC and the American College of Obstetricians and Gynecologists (ACOG) collaborated to recommend the use of expanded definitions to more accurately identify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

Rising Rates of Maternal Mortality

Nationally, maternal mortality has 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 28.7 maternal deaths per 100,000 live births in 2015, 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 has generally been higher than the national average, although for the period from 2011 to 2015, the Maryland MMR was slightly lower than the national rate (Figure 1). Both are well above the Healthy People 2020 Objective MICH-5 target of 11.4 maternal deaths per 100,000 live births. Between the two 5-year periods shown, the U.S. MMR increased by 37 percent and the Maryland rate increased by 19 percent.

Figure 1. Maternal Mortality Rates*, U.S. and Maryland 2006-10 and 2011-15



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

While Maryland's high MMR is concerning, it is also a reflection of the State's intense efforts to more accurately identify maternal deaths since the mid-1990s. To facilitate identification of maternal deaths, the Maryland death certificate was revised in January 2001 to include questions about pregnancy within the year prior to death. This enhanced surveillance resulted in a more than doubling of the number of maternal deaths identified in Maryland compared with data from the 1980s and early 1990s. Whether the actual risk of a woman dying during pregnancy or within 42 days after has increased is unclear. Many studies have shown an increase in chronic health conditions among pregnant women in the United States, including hypertension, diabetes, and heart disease.[1, 2, 3] These conditions may put pregnant women at higher risk of adverse outcomes.

[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

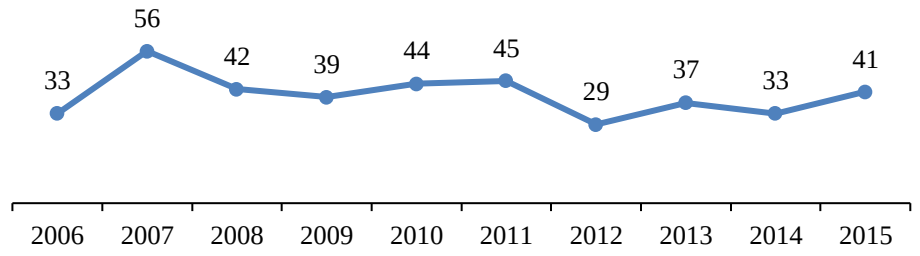
Cases for review are limited to women who were residents of Maryland at the time of their death. Maryland residents who died in other states are also included in the MMR case reviews.

Maternal deaths are determined by cause of death 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. Maryland is one of 42 states plus the District of Columbia that now include questions on the death certificate specifically designed to improve identification of maternal deaths. The 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 on the death certificate, or because the cause of death is clearly related to pregnancy (e.g. ruptured ectopic pregnancy or 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 subject to a manual review process 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 these three methods, 41 pregnancy-associated deaths were identified in 2015. These cases are reviewed in detail in this report. Figure 2 shows the numbers of pregnancy-associated deaths in Maryland from 2006 to 2015. An average of 40 pregnancy-associated deaths occurred per year during this period.

Figure 2. Number of Pregnancy-Associated Deaths*, Maryland, 2006 - 2015



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

[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.

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, and Medical Examiner records for all cases and prepare case summaries that go to the MMR Committee for review. All 2015 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 representatives from the Department's Maternal and Child Health Bureau, Vital Statistics Administration, and the Office of the Chief Medical Examiner. Representatives from all delivery hospitals in Maryland are encouraged to participate. The Committee discussions incorporate the CDC framework for case review outlined in "Strategies to 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 members sign confidentiality agreements. The Committee holds one meeting annually to review issues identified through case reviews and to develop recommendations.

CASE FINDINGS

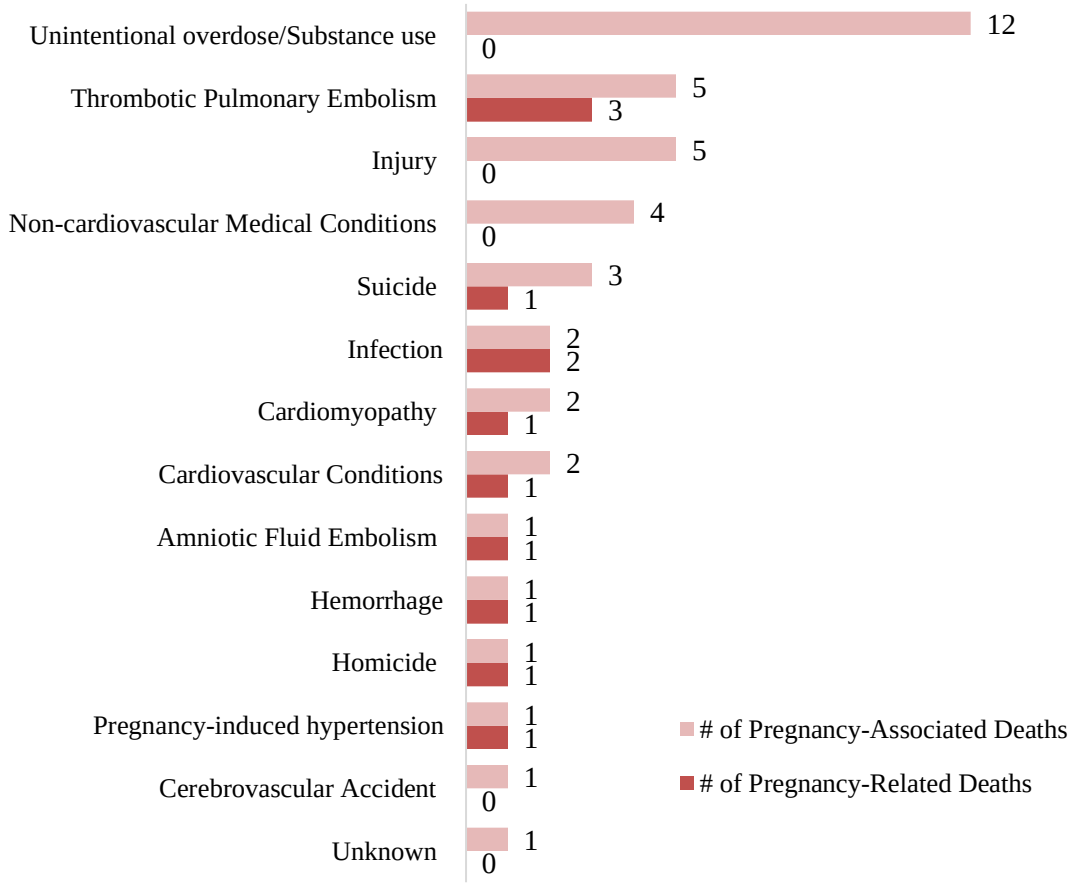
A total of 41 pregnancy-associated deaths were identified in 2015 for a pregnancy-associated mortality rate of 55.7 deaths per 100,000 live births. Of the 41 deaths, 12 were determined to be pregnancy-related, while the remaining 29 were either determined not to be related to pregnancy or the relatedness to pregnancy could not be determined. The resulting pregnancy-related mortality rate was 16.3 deaths per 100,000 live births.

Cases by Cause of Death Category

Figure 3 shows the categories of cause of death for pregnancy-associated and pregnancy-related deaths. The leading cause of death among the 41 pregnancy-associated deaths in 2015 was substance use with unintentional overdose, accounting for 12 deaths (29 percent), the greatest number recorded in one year. Injury accounted for five pregnancy-associated deaths (12 percent), suicide for three (seven percent), and homicide an additional one (two percent). The remaining 20 pregnancy-associated deaths (49 percent) were due to natural causes.

[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>.

Figure 3. Number of Pregnancy-Associated* and Pregnancy-Related Deaths by Category of Cause of Death***, Maryland, 2015**



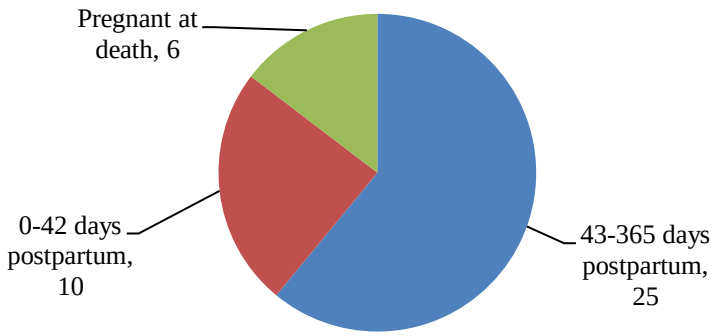
* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy
** Number of deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
***Category as determined by Maternal Mortality Review Committee
Data Source: Maryland Department of Health, Vital Statistics Administration

Among the 12 pregnancy-related deaths in 2015, the leading cause of death was thrombotic pulmonary embolism, accounting for three deaths (25 percent). An additional seven deaths (58 percent) resulted from other medical causes. The remaining two pregnancy-related deaths (17 percent) resulted from non-natural causes, including one homicide and one suicide.

Cases by Timing of Death in Relation to Pregnancy

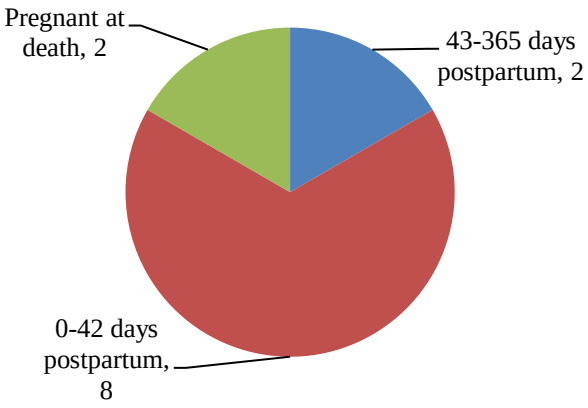
Of the 41 pregnancy-associated deaths in 2015, six deaths (15 percent) occurred during pregnancy, ten deaths (24 percent) occurred within 42 days postpartum, and 25 deaths (61 percent) occurred between 43-365 days postpartum (see Figure 4). Among the 12 pregnancy-related deaths, two (17 percent) occurred during pregnancy, eight (66 percent) within 42 days postpartum, and two (17 percent) between 43-365 days postpartum (see Figure 5).

Figure 4. Number of Pregnancy-Associated Deaths* by Timing of Death, Maryland, 2015



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Figure 5. Number of Pregnancy-Related Deaths* by Timing of Death, Maryland, 2015

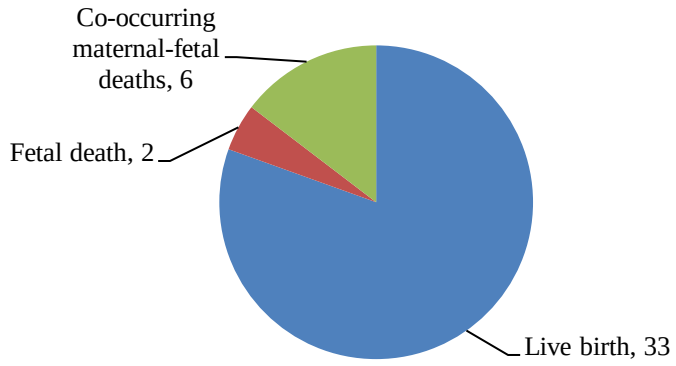


*Deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Cases by Outcome of Pregnancy

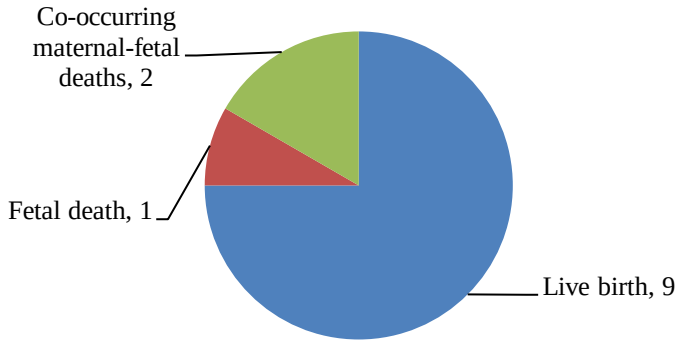
Among 41 pregnancy-associated deaths in 2015, 33 cases (80 percent) had a live birth, six (15 percent) had co-occurring maternal and fetal deaths, and two cases (five percent) involved a fetal death prior to the mother's death (see Figure 6). Among 12 pregnancy-related deaths, nine cases (75 percent) had a live birth, two (17 percent) had co-occurring maternal and fetal deaths, and one case (eight percent) involved a fetal death (see Figure 7).

Figure 6. Number of Pregnancy Outcomes for Pregnancy-Associated Deaths*, Maryland, 2015



*Deaths of women while pregnant or within 365 days of pregnancy
**SAB: spontaneous abortion
Data Source: Maryland Department of Health, Vital Statistics Administration

Figure 7. Number of Pregnancy Outcomes for Pregnancy-Related Deaths*, Maryland, 2015

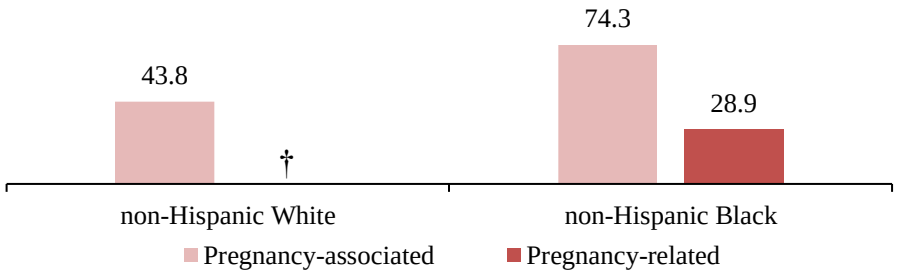


*Deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Cases by Maternal Race and Ethnicity

Of the 41 pregnancy-associated deaths during 2015, 19 (46 percent) occurred among non-Hispanic White women, 18 (44 percent) among non-Hispanic Black women, three (seven percent) among Asian women, and one (two percent) to a Hispanic woman. Two (17 percent) of the 12 pregnancy-related deaths were among non-Hispanic White women, seven (58 percent) among non-Hispanic Black women, two (17 percent) among Asian women, and one (8 percent) to a Hispanic woman. Pregnancy-associated and pregnancy-related mortality rates by race in 2015 are shown in Figure 8. Rates for racial or ethnic groups with fewer than five deaths are not displayed.

Figure 8. Pregnancy-Associated* and Pregnancy-Related Mortality Rates by Selected Race/Ethnicities, Maryland, 2015**



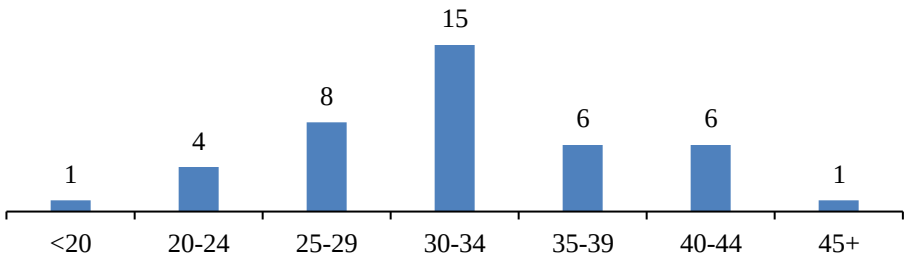
* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy per 100,000 live births.
** Number of deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy per 100,000 live births.
† Rate suppressed due to fewer than 5 deaths. Data Source: Maryland Department of Health, Vital Statistics Administration

Among 2015 deaths, the pregnancy-associated mortality rate for non-Hispanic Black women was 1.7 times higher than the rate for non-Hispanic White women. Sixty-seven percent of the unintentional overdose deaths were among non-Hispanic White women. Of deaths due to all medical causes, 32 percent occurred among non-Hispanic White women, 10 percent among Asian women, and 58 percent among non-Hispanic Black women.

Cases by Maternal Age

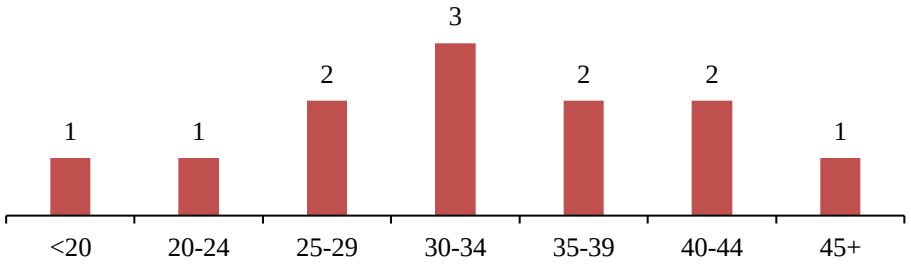
The distribution of pregnancy-associated deaths by maternal age group is shown in Figure 9. The distribution of pregnancy-related deaths by maternal age group is shown in Figure 10.

Figure 9. Number of Pregnancy-Associated Deaths* by Maternal Age, Maryland, 2015



* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Figure 10. Number of Pregnancy-Related Deaths* by Maternal Age, Maryland, 2015

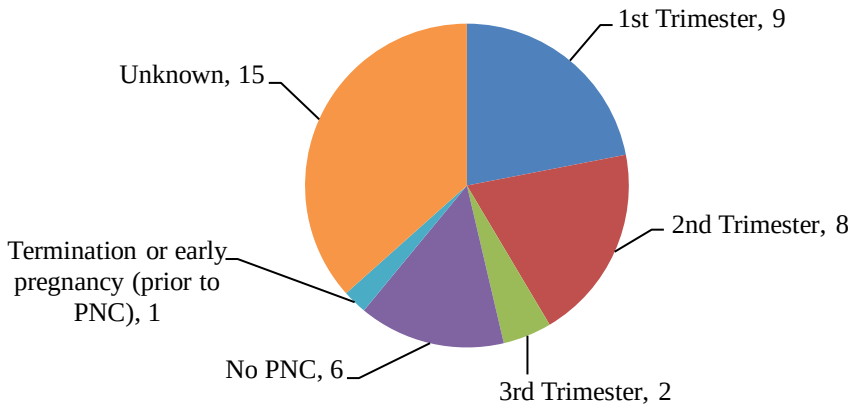


* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy from any cause related or aggravated by pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Cases by Timing of Prenatal Care Initiation

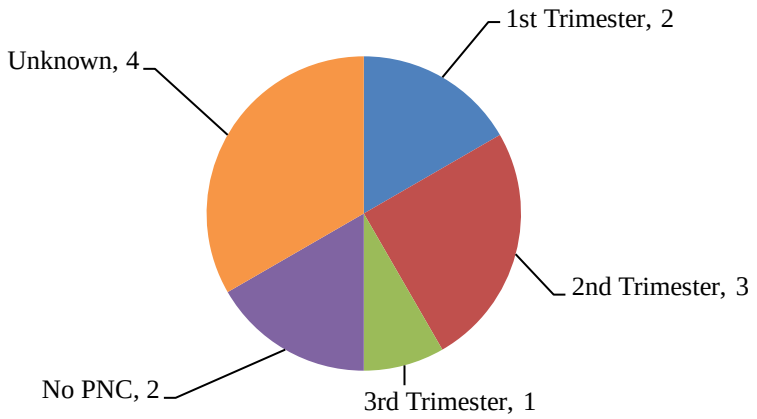
The distributions of pregnancy-associated and pregnancy-related deaths by the trimester when women initiated prenatal care (PNC) are shown in Figures 11 and 12, respectively. Nine (22 percent) of the 41 pregnancy-associated deaths were among women who initiated care in the first trimester of pregnancy. In 15 (37 percent) of the pregnancy-associated deaths, timing of prenatal care was unknown. Among the 12 pregnancy-related deaths, two (17 percent) were among women who received first trimester prenatal care. Timing of prenatal care was unknown in four pregnancy-related deaths (33 percent).

Figure 11. Number of Pregnancy-Associated Deaths* by Timing of Prenatal Care Initiation, Maryland, 2015



*Deaths of women while pregnant or within 365 days of pregnancy
Data Source: Maryland Department of Health

Figure 12. Number of Pregnancy-Related Deaths* by Timing of Prenatal Care Initiation, Maryland, 2015

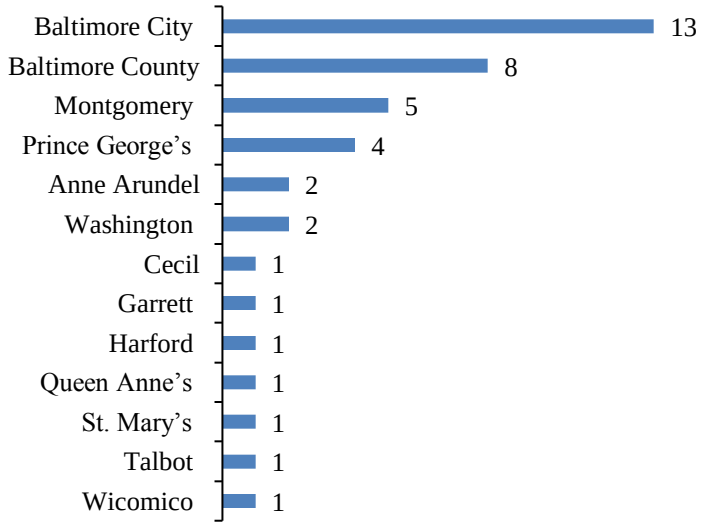


*Deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: Maryland Department of Health

Cases by Jurisdiction of Residence and Occurrence

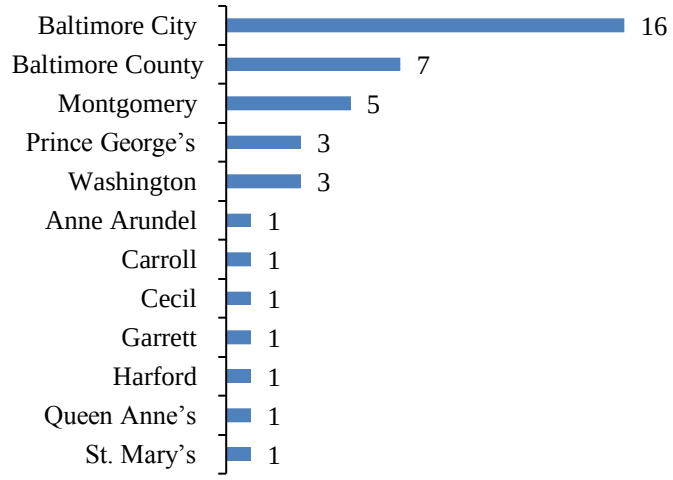
Thirteen (32 percent) of the 41 pregnancy-associated deaths were among residents of Baltimore City and eight (20 percent) were among residents of Baltimore County (see Figure 13). Sixteen (39 percent) of the deaths occurred in Baltimore City and seven (17 percent) occurred in Baltimore County (see Figure 14).

Figure 13. Number of Pregnancy-Associated Deaths* by Jurisdiction of Residence, Maryland, 2015



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

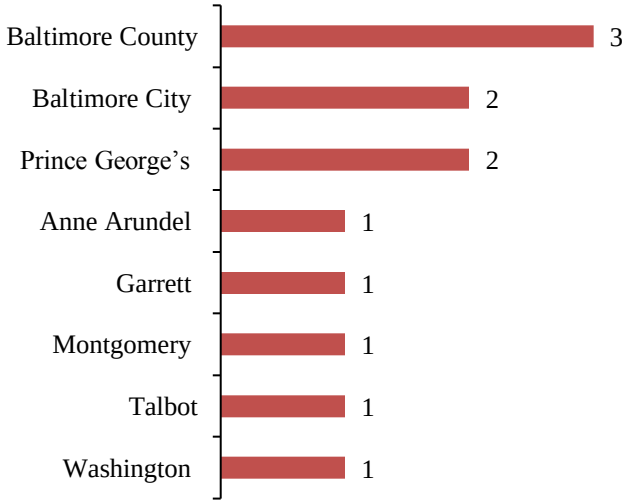
Figure 14. Number of Pregnancy-Associated Deaths* by Jurisdiction of Occurrence, Maryland, 2015



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

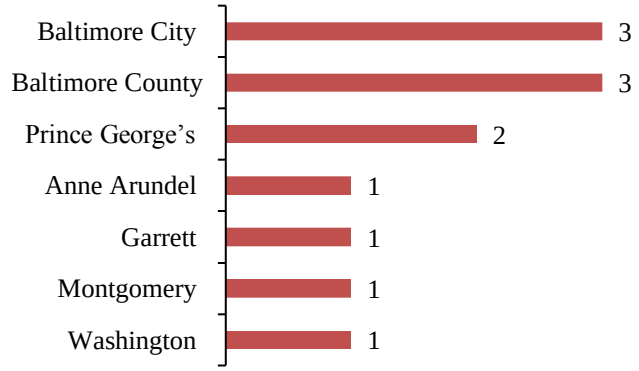
In 2015, three (25 percent) of the 12 pregnancy-related deaths were among residents of Baltimore County, and two (17 percent) each were among residents of Baltimore City and Prince George's County (see Figure 15). Three (25 percent) of the pregnancy-related deaths occurred in Baltimore City and three (25 percent) in Baltimore County (see Figure 16).

Figure 15. Number of Pregnancy-Related Deaths* by Jurisdiction of Residence, Maryland, 2015



*Deaths of women from any cause while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Figure 16. Number of Pregnancy-Related Deaths* by Jurisdiction of Occurrence, Maryland, 2015



*Deaths of women from any cause while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: Maryland Department of Health, Vital Statistics Administration

Preventability of Deaths

Of the 41 pregnancy-associated deaths, 33 (80 percent) were determined to be preventable or potentially preventable. In two cases (5 percent), preventability could not be determined, and six cases (15 percent) were considered unpreventable deaths. Among the 12 pregnancy-related deaths, ten (83 percent) were thought to be preventable or potentially preventable. Two cases (17 percent) were considered unpreventable deaths.

All of the unintentional overdose deaths were considered potentially preventable, as were the three suicide deaths and the one homicide death. Four of the five injury deaths were also considered potentially preventable. The six deaths considered unpreventable involved medical causes of death, including thrombotic pulmonary embolism, cardiovascular conditions, postpartum autoimmune disorders, and cancer.

FOCUS ON SUBSTANCE USE DISORDER AND OVERDOSE DEATHS

In 2015 for the third consecutive year, drug overdose was the leading cause of pregnancy-associated death in Maryland. Twelve of 41 deaths (29 percent) resulted from substance use and unintentional overdose. All of these deaths involved opioids. In 10 of the 12 cases (83 percent) of pregnancy-associated death resulting from substance use and unintentional overdose, two or more drugs were found by postmortem toxicology testing. Three overdose deaths (25 percent) involved the potent opioid fentanyl. A benzodiazepine was present in four cases (33 percent), and alcohol was detected in two cases. The risk of fatal overdose is substantially increased when opioids are combined with other central nervous system depressants such as benzodiazepines or alcohol.

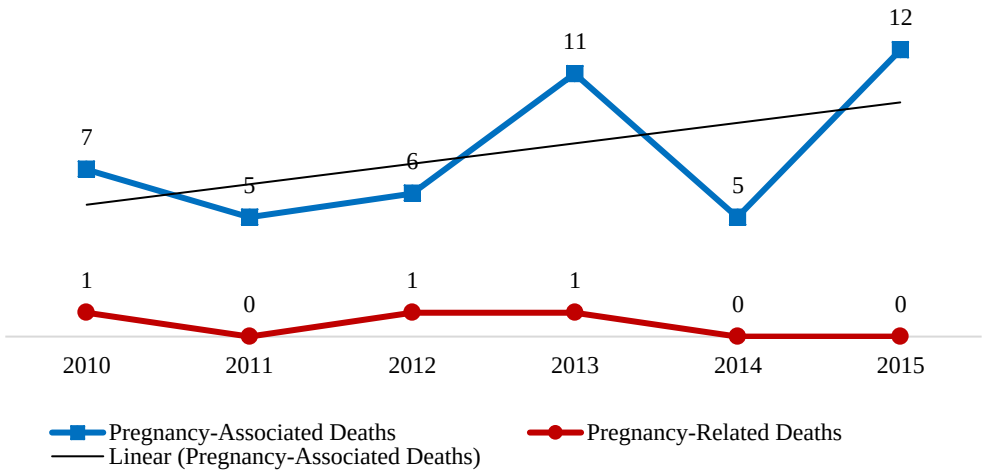
The average age at death among the 12 pregnancy-associated deaths resulting from substance use and unintentional overdose was 32 years (range 23 to 41 years). Eight deaths (67 percent) were among non-Hispanic White women, four (33 percent) among non-Hispanic Black women. Only one woman was pregnant at the time of death. The other 11 women (92 percent) had delivered live born infants, and the average timing of death was 166 days postpartum. Only two deaths occurred in the traditional postpartum period up to 42 days after the conclusion of pregnancy, and nine occurred between 43 and 365 days postpartum. Eleven of the 12 women (92 percent) had a known history of substance use. In all 12 cases,

there was a history of one or more mental health diagnosis, with depression documented in 11 cases, anxiety in ten cases, and bipolar disorder in three cases.

Multiyear Review of Overdose Deaths

To better understand factors involved in overdose deaths, a review of pregnancy-associated deaths in Maryland from 2010 to 2015 was undertaken. Over this six-year period, substance use and unintentional overdose was the leading cause of pregnancy-associated death, accounting for 46 of 228 pregnancy-associated deaths (20 percent). Figure 17 shows the number of unintentional overdose deaths by year, with the highest number of cases occurring in 2015. As shown, very few of these cases were considered pregnancy-related.

Figure 17: Number of Pregnancy-Associated*and Pregnancy-Related Unintentional Overdose Deaths, Maryland, 2010-2015**



* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy
** Number of deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: Maryland Department of Health , Vital Statistics Administration

Of the 46 overdose deaths, 44 (96 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 the 44 cases involving opioids. The most frequently detected opioid was morphine, a metabolite of heroin, followed by methadone and oxycodone. Fentanyl was detected in three cases from 2015, one case from 2014, and none occurring earlier. In 42 (91 percent) of the 46 overdose deaths, two or more drugs were detected by postmortem testing. In 11 (26 percent) of the 42 multiple drug cases, two or three different opioids were identified. Benzodiazepines were detected in 14 (33 percent) and alcohol in 11 (26 percent) of the cases involving multiple drugs.

Table 1. Opioid Identified Postmortem, Pregnancy-Associated Unintentional Overdose Deaths, Maryland, 2010-2015	
Opioid	**Number of cases (n=44)**
Morphine (heroin)	16
Methadone	13
Oxycodone	8
Unspecified opioid	5
Fentanyl	4
Tramadol	3
Codeine	2
Buprenorphine	1
Hydrocodone	1
Hydromorphone	1
Meperidine	1
Oxymorphone	1

Data Source: Maryland Department of Health
NOTE: The values in the table do not add up to the sample size of 44 because multiple drugs can be detected in a single case.

The average age at death was 29 years among the 46 unintentional overdose deaths from 2010 to 2015. Thirty-eight (83 percent) of these deaths were among non-Hispanic White women and eight (17 percent) among non-Hispanic Black women. Seven women (15 percent) were pregnant at the time of death and five (11 percent) had a spontaneous abortion or fetal demise prior to death. The remaining 34 women (74 percent) delivered live born infants. Only four deaths (nine percent) occurred at 42 days or less postpartum; seven (15 percent) were pregnant at death; and the remaining 35 (76 percent) occurred between 43 and 365 days postpartum. The average timing of death was 197 days postpartum. In 39 cases (85 percent), one or more mental health diagnosis was documented. Anxiety was diagnosed in 30 cases (65 percent), depression in 29 (63 percent) and bipolar disorder in 16 (35 percent). Forty-two (91 percent) of the women who died of overdose had a known history of substance use and twenty-two (48 percent) had documentation of some substance use treatment.

In Table 2, the 46 overdose cases are compared with the 182 non-overdose cases that occurred between 2010 and 2015. 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 74 percent of pregnancies among the overdose group and 69 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.

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 (91 percent vs. 19 percent). Women who died of overdose were more than four-times as likely to have one or more mental health diagnosis (85 percent vs. 19 percent), and were more than three-times as likely to smoke (85 percent vs. 24 percent). Also, 44 of 46 overdose deaths (96 percent) were considered preventable or potentially preventable, compared with 56 percent of the non-overdose deaths.

Table 2: Incident Characteristics of Pregnancy-Associated Deaths, Maryland, 2010-2015		
Characteristic	**Overdose Deaths (n=46)**	**Non-overdose Deaths (n=182)**
	Data presented as mean ± standard deviation, or number (%)	
Demographics		
Average age at death (years)	29 ±5	31 ±7
White non-Hispanic	38 (83)	68 (37)
Black non-Hispanic	8 (17)	89 (49)
Other non-Hispanic	0 (0)	13 (7)
Hispanic	0 (0)	12 (7)
Timing of death		
Pregnant at death	7 (15)	35 (19)
0-42 days postpartum	4 (9)	74 (41)
43-365 days postpartum	35 (76)	72 (40)
Average days postpartum	197 ±93	103 ±117
Pregnancy outcome		
Live born infant	34 (74)	125 (69)
Co-occurring maternal-fetal deaths	7 (15)	35 (19)
Spontaneous abortion / fetal death	5 (11)	14 (8)
Prenatal care initiation		
1st trimester	16 (35)	76 (42)
2nd trimester	13 (28)	18 (10)
3rd trimester	2 (4)	4 (2)
No prenatal care	5 (11)	14 (8)
Termination or very early pregnancy	1 (2)	6 (3)
Unknown	9 (20)	64 (35)
Behavioral health / social factors		
Known history of substance use	42 (91)	34 (19)
Any history of substance use treatment	22 (48)	15 (8)
Smoking	39 (85)	43 (24)
Mental health diagnosis(es)	39 (85)	35 (19)
Intimate partner violence	5 (11)	17 (9)
Preventability		
Death preventable / potentially preventable	44 (96)	101 (55)

Data Source: Maryland Department of Health, Vital Statistics Administration

2017 MMR RECOMMENDATIONS

Unintentional overdose deaths and other behavioral health issues were reviewed in the 2015 MMR Report and detailed recommendations were put forward to address these issues. These recommendations continue to be relevant, as unintentional overdose remains the leading cause of pregnancy-associated death in Maryland. The Committee, therefore, maintains its support of the recommendations related to substance use disorder and unintentional overdose made in the 2015 MMR Report. These recommendations are presented below and the full 2015 report is available at: http://phpa.dhmh.maryland.gov/mch/Documents/2015MMR_FINAL.pdf.

2015 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, domestic violence, primary care, oral health, etc.). • Promote interdisciplinary case management among substance use, mental health, and intimate partner violence programs. • Improve safe opioid prescribing practices. • Encourage Prescription Drug Monitoring Program (PDMP) utilization by providers. • Encourage naloxone co-prescribing and 3rd party prescribing. • 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 providers' accessing referral sources. • Promote integration of reproductive life planning and preconception counseling into health care visits by all disciplines. • Encourage use of Long Acting Reversible Contraception 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 comprehensive information of the patient's behavioral health care. • Establish a liaison between the MMR Program and the Heroin and Opioid Emergency Task Force, the Task Force on Maternal Mental Health, and intimate partner violence programs. • 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. • Develop a consultation resource about perinatal and reproductive health issues for substance use treatment providers.

The Committee would like to develop a more consistent and identifiable means of disseminating maternal mortality review findings and recommendations to the provider community. The Committee will develop a standardized ***Provider Alert*** that can be used to disseminate information about specific causes of maternal deaths in Maryland, and recommendations to improve practices and prevent future deaths. Based on the current review of maternal deaths, the MMR Committee puts forward the following additional recommendations:

Substance Use Disorders and Unintentional Overdose

Recommendation 1:
Increase provider awareness of the contribution of substance use and unintentional overdose to maternal mortality in Maryland.

> **Action:** Develop a ***Provider Alert*** on substance use as a key contributor to maternal mortality in the State and distribute it widely to obstetric care providers, substance use treatment providers, delivery hospital leadership and staff, and professional organizations.

Recommendation 2:
Support the Maryland Department of Health efforts to coordinate the care of pregnant women with substance use disorders.

> **Action:** Collaborate with the Opioid Operational Command Center and the Behavioral Health Administration to compile a list of substance use treatment providers by jurisdiction and distribute it widely to women's health care providers, obstetric care providers, and delivery hospitals.

Late Postpartum Deaths - Care Transitions Beyond 42 Days Postpartum

Recommendation:
Increase provider awareness that: 1) the majority of pregnancy-associated deaths, including those from unintentional overdose, occur well beyond 42 days postpartum; 2) continuity of maternal medical and behavioral health care beyond the traditional six-week postpartum period is critical in preventing late maternal deaths; and 3) the transitional period from perinatal care to primary and/or specialty care is a time of particular health vulnerability for women.

> **Action:** Develop a ***Provider Alert*** on the importance of postpartum care transition, encouraging that every woman has a documented postpartum care plan and care team identified during the prenatal period.

> **Action:** Make available to prenatal care providers and delivery hospitals resources from and linkage to the Council on Patient Safety in Women's Healthcare's "*Postpartum Care Basics for Maternal Safety*."