

MARYLAND DEPARTMENT OF HEALTH AND MENTAL HYGIENE
PREVENTION AND HEALTH PROMOTION ADMINISTRATION

**MARYLAND MATERNAL
MORTALITY REVIEW
2016 ANNUAL REPORT**

Health – General Article § 13-1203—1207

Larry Hogan
Governor

Boyd K. Rutherford
Lieutenant Governor

Dennis R. Schrader
Secretary

(This page intentionally left blank)

TABLE OF CONTENTS

Acknowledgements	1
Background	2
Methodology	4
Case Findings	6
Cases by Cause of Death Category	6
Cases by Timing of Death in Relation to Pregnancy	7
Cases by Outcome of Pregnancy	8
Cases by Maternal Race and Ethnicity	9
Cases by Maternal Age	9
Cases by Timing of Prenatal Care Initiation	10
Cases by Jurisdiction of Residence and Occurrence	11
Preventability of Deaths	13
Focus on Chronic or Concurrent Medical Conditions	13
2016 MMR Recommendations.....	15
Summary	16
Appendix A: Maryland Maternal Mortality Review Case Discussion Guide	17

(This page intentionally left blank)

ACKNOWLEDGEMENTS

This review of maternal deaths would not be possible without the data, cooperation, and expertise of the Department of Health and Mental Hygiene's Vital Statistics Administration and the Office of the Chief Medical Examiner. The Maternal Mortality Review Program would like to thank the volunteer participants 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:

Name

Lillian Blackmon, MD

Joseph Morris, MD

Henry Sobel, MD

Mishka Terplan, MD, MPH

Gia Firth, CNM

Chelsea Crabtree, MD

Diana Cheng, MD

Ebony Parker, DNP, MSN, RNC-OB

S. Lee Woods, MD, PhD

Donovan Dietrick, MD

Anne Burke, MD

Mary Carol Jennings, MD, MPH

Lorraine Milio, MD

Jill Edwardson, MD

Maureen Grundy, MD

Clark Johnson, MD

Jeanne Sheffield, MD

Shayna Banfield, MS, CHES

Robert Atlas, MD

Casey Fay, MS, CHES

Claudia Richardson, MD

Pedro Arrabal, MD

Deborah Doerfer, CNM

Lorraine Goldstein, CNM

Judith Rossiter, MD

Shobana Bharadwaj, MD

Stephen Contag, MD

Sarah Crimmons, MD

Jenifer Fahey, CNM, MSN, MPH

Stacy Fisher, MD

Hospital/ Affiliation

Maternal Mortality Review Committee Chair,
MedChi Maternal and Child Health Subcommittee

Anne Arundel Medical Center

Anne Arundel Medical Center

Behavioral Health System Baltimore

Chase Brexton

Chase Brexton

Department of Health and Mental Hygiene

Department of Health and Mental Hygiene

Department of Health and Mental Hygiene

Franklin Square Hospital Center

Holy Cross Hospital

Johns Hopkins Bloomberg School of Public Health

Johns Hopkins University School of Medicine

Johns Hopkins University School of Medicine

Johns Hopkins University School of Medicine

Johns Hopkins University School of Medicine

Johns Hopkins University School of Medicine

MedChi

Mercy Medical Center

Planned Parenthood of Maryland

Planned Parenthood of Maryland

Sinai Hospital

Sinai Hospital

Sinai Hospital

St. Joseph Medical Center

University of Maryland School of Medicine

University of Maryland School of Medicine

University of Maryland School of Medicine

University of Maryland School of Medicine

University of Maryland School of Medicine

BACKGROUND

Md. Ann. Code Health-General Art., §13-1203—1207, establishes and describes the scope of the Maternal Mortality Review Program (the Program) in Maryland. 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 and Mental Hygiene (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. MedChi's Maternal and Child Health Subcommittee assists in obtaining medical records, abstracting cases, and hosting a committee of clinical experts from across the State, the Maternal Mortality Review Committee (the MMR Committee), to provide 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 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.
- 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.

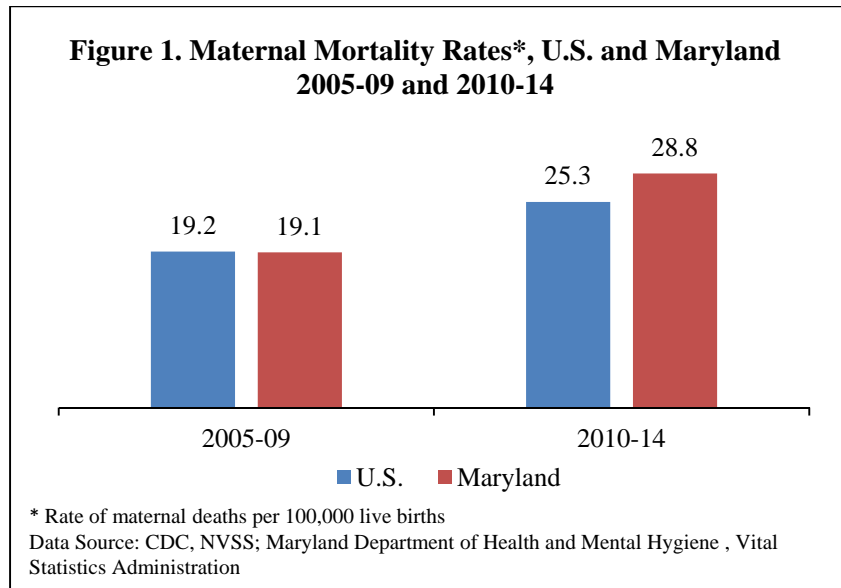
The three terms "maternal death," "pregnancy-associated death," and "pregnancy-related death," create a challenge when comparing data from different sources and reports for different jurisdictional entities. The WHO monitors maternal deaths worldwide as a key indicator of population health, and of social 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 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 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 23.8 maternal deaths per 100,000 live births in 2014, 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 2005 to 2009, the Maryland MMR was slightly lower than the national rate (Figure 1). For the period from 2010 to 2014, the Maryland MMR is again higher than the national rate. Both are 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 32 percent and the Maryland rate increased by 51 percent.



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.

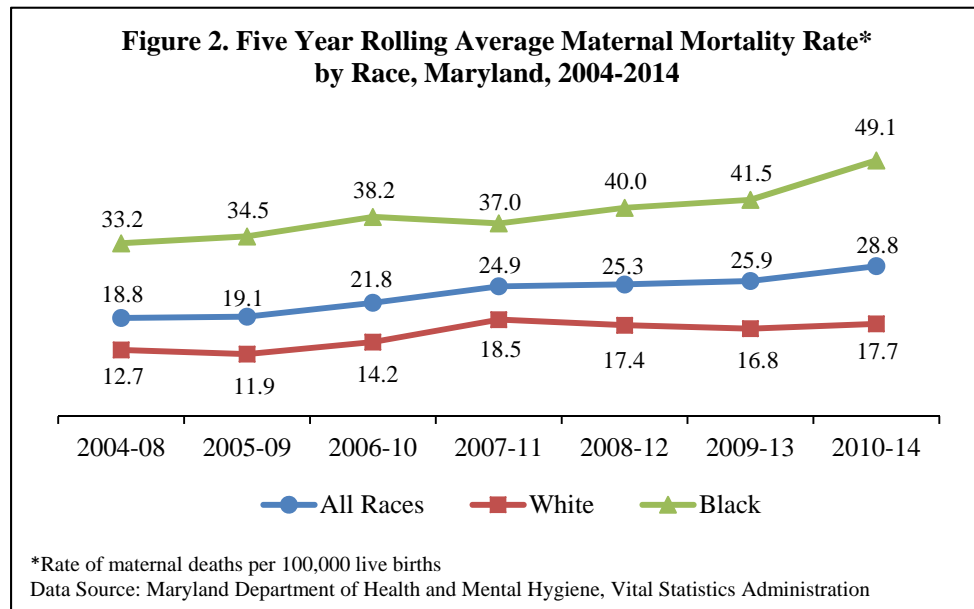
² Albrecht SS, Kuklina EV, Bansil P et al. Diabetes trends among delivery hospitalizations in the United States, 1994–2004. *Diabetes Care.* 2010;33(4):768–773.

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.

Racial Disparity

In the U.S., Black women have an MMR more than two and a half times greater than that for White women, a disparity that has persisted since the 1940s. In Maryland, there is a similarly large disparity between the rates among Black and White women.

Figure 2 shows the MMR by race in Maryland for seven overlapping 5-year periods over the past decade. Compared to 2004-2008, the 2010-2014 White MMR in Maryland increased 39 percent and the Black MMR increased 48 percent. The 2010-2014 Black MMR is 2.8 times the White MMR.



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 counted in the official Vital Statistics reports, but they are not included in the MMR case reviews because of the difficulty in obtaining records across states. These out-of-state deaths account for a maximum of two to four cases per year, or approximately five to ten percent of total pregnancy-associated deaths.

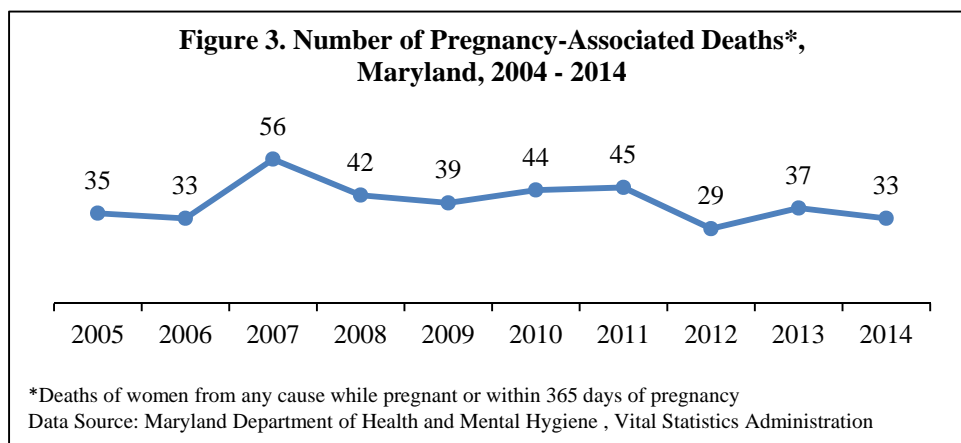
Maternal deaths are determined by information on the death certificates alone. The Maryland death certificate was revised in January 2001 to include questions about pregnancy status, pregnancy outcome, and date of delivery for the 12 months preceding death. Maryland is one of 42 states plus the District of Columbia that now include questions specifically designed to improve identification of maternal deaths on the death certificate. The pregnancy checkbox has significantly increased identification of maternal deaths beyond those recognized by cause of death alone.^{4,5}

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.

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). 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 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, 33 pregnancy-associated deaths were identified in 2014. These cases are reviewed in detail in this report. Figure 3 shows the numbers of pregnancy-associated deaths in Maryland from 2005 to 2014. An average of 39 pregnancy-associated deaths occurred per year during this period.



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 consultants review death certificates, hospital records, and Office of the Chief Medical Examiner records for all cases and prepare case summaries that go to workgroups of the MMR Committee for review of pregnancy-relatedness. All 2014 pregnancy-associated deaths from all causes (medical, injury, substance use, homicide, or suicide) were reviewed for pregnancy-relatedness.

Pregnancy-relatedness and potential preventability of the deaths are determined through workgroup discussion. The MMR Committee workgroups include 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 workgroup 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 (see Appendix A, *Maryland Maternal Mortality Review Case Discussion Guide*). Cases discussed by MMR Committee workgroups are de-identified and members sign confidentiality agreements. The full MMR Committee meets to review issues identified through case reviews and to develop recommendations.

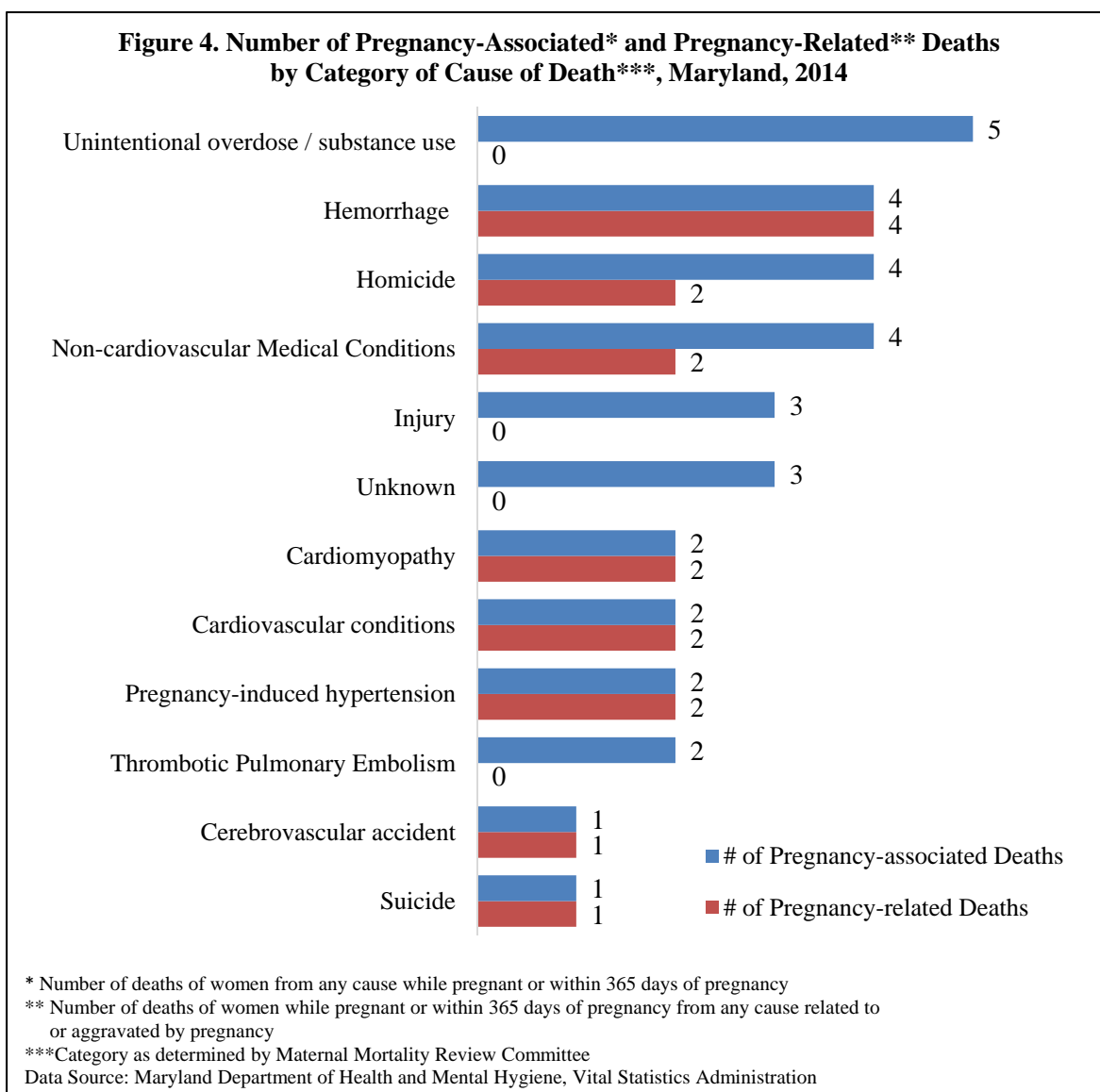
⁶ Berg C, Danel I, Atrash H, Zane S, Bartlett L (Editors). Strategies to reduce pregnancy-related deaths: from identification and review to action. Atlanta: Centers for Disease Control and Prevention; 2001 <<https://stacks.cdc.gov/view/cdc/6537>>.

CASE FINDINGS

A total of 33 pregnancy-associated deaths were identified in 2014 for a pregnancy-associated mortality rate of 44.8 deaths per 100,000 live births. Of the 33 deaths, 16 were determined to be pregnancy-related, while the remaining 17 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 21.7 deaths per 100,000 live births.

Cases by Cause of Death Category

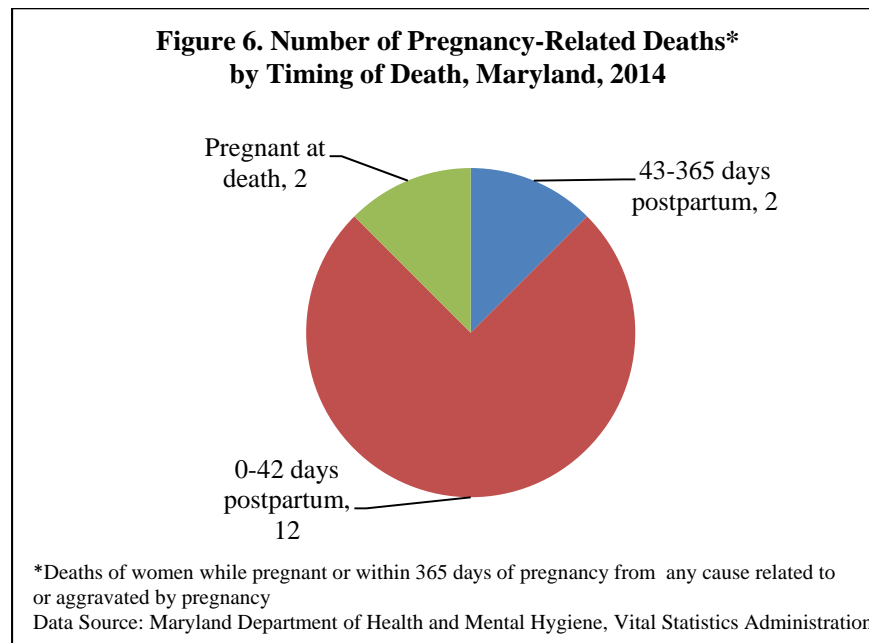
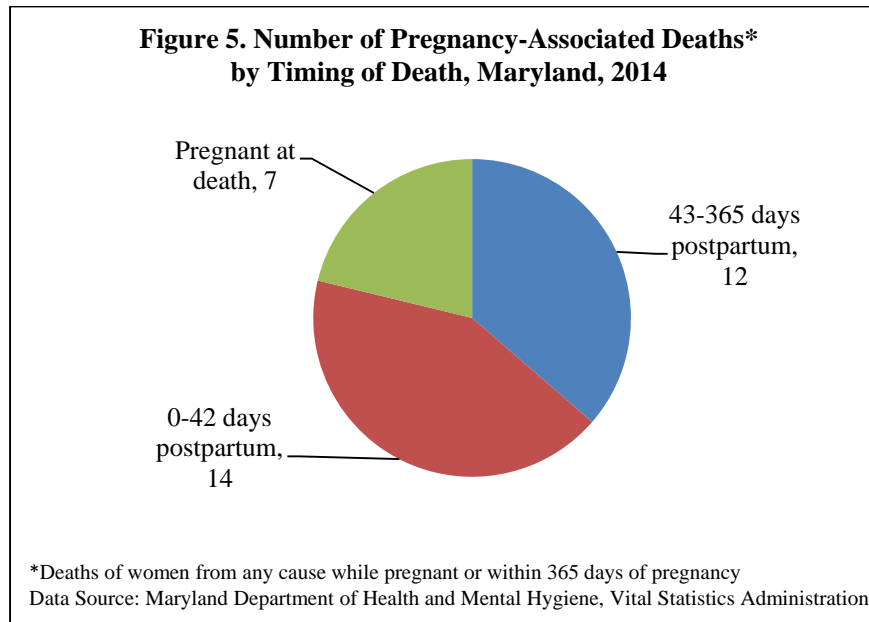
Figure 4 shows the categories of cause of death for pregnancy-associated and pregnancy-related deaths. The leading cause of death among the 33 pregnancy-associated deaths in 2014 was substance use with unintentional overdose, accounting for five deaths (15 percent). Homicide accounted for four pregnancy-associated deaths (12 percent), injury for three (nine percent), and suicide an additional one (three percent). In three percent of cases, the cause of death remained unknown. The remaining 58 percent of pregnancy-associated deaths were due to natural causes.



Among the 16 pregnancy-related deaths in 2014, the leading cause of death was hemorrhage, accounting for four deaths (25 percent). An additional nine deaths (56 percent) resulted from other medical causes. The remaining 19 percent of pregnancy-related deaths resulted from non-natural causes, including two homicides and one suicide.

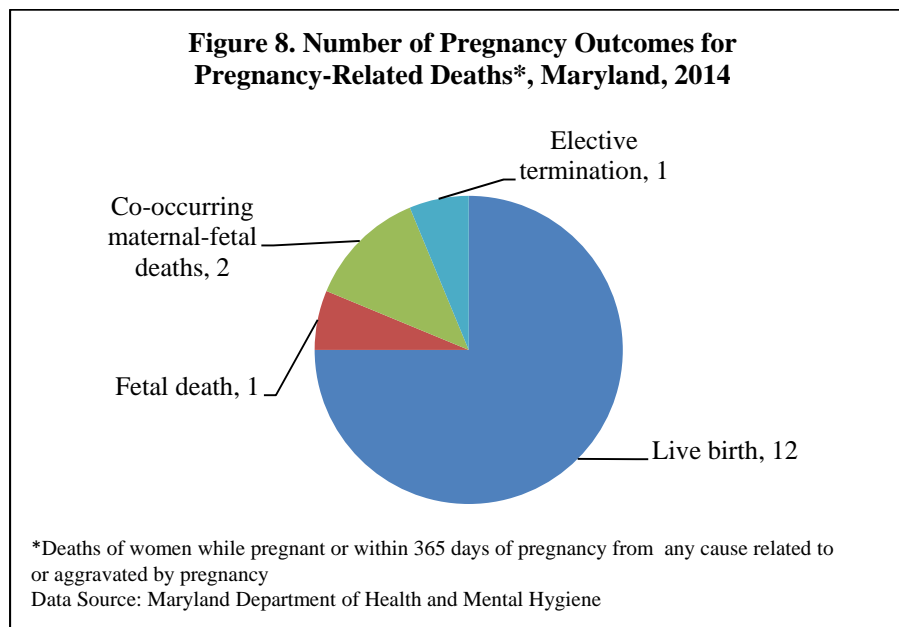
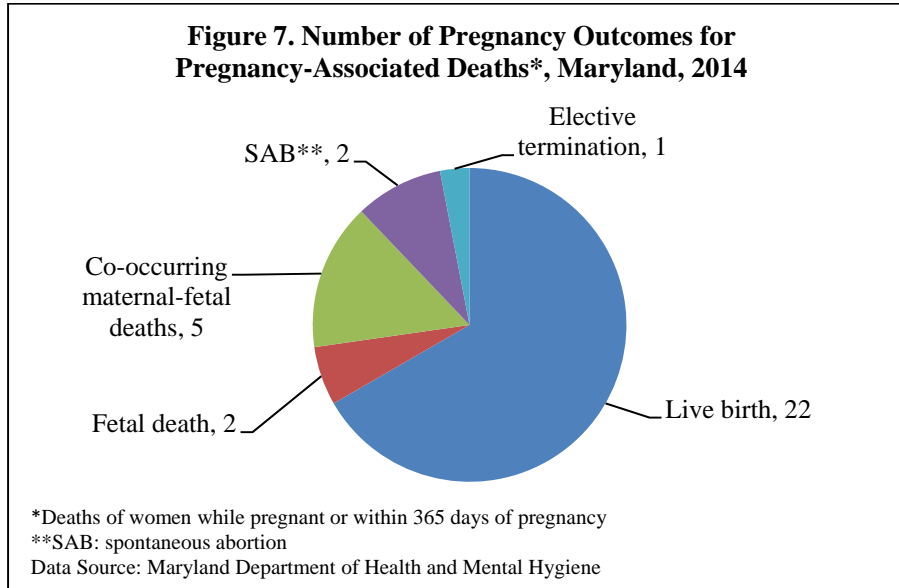
Cases by Timing of Death in Relation to Pregnancy

Of the 33 pregnancy-associated deaths in 2014, seven deaths (21 percent) occurred during pregnancy, 14 deaths (42 percent) occurred within 42 days postpartum, and 12 deaths (36 percent) occurred between 43-365 days postpartum (see Figure 5). Among the 16 pregnancy-related deaths, two (13 percent) occurred during pregnancy, 12 (75 percent) within 42 days postpartum, and two (13 percent) between 43-365 days postpartum (see Figure 6).



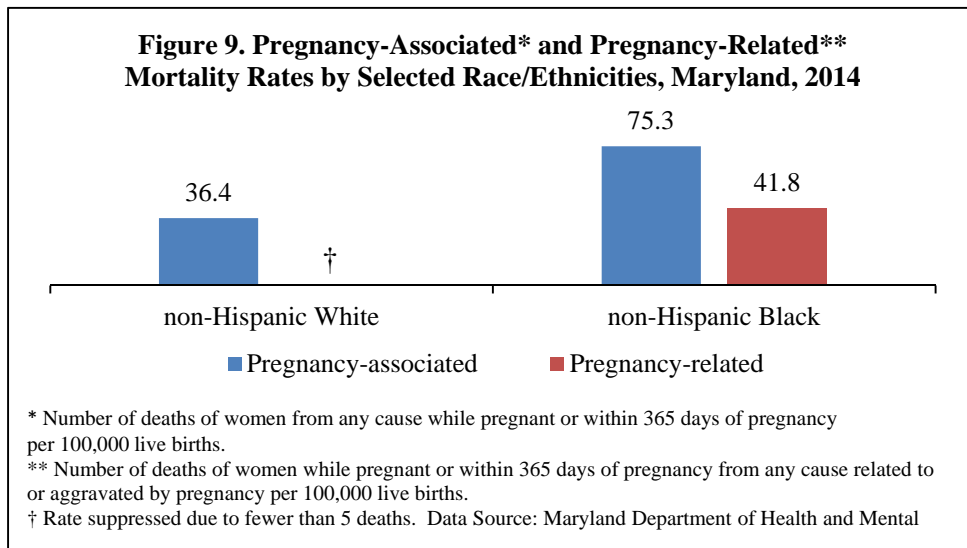
Cases by Outcome of Pregnancy

Among 33 pregnancy-associated deaths in 2014, 22 cases (67 percent) had a live birth, five (15 percent) had co-occurring maternal and fetal deaths, two cases (six percent) involved a fetal death prior to the mother’s death, two (six percent) had a spontaneous abortion, and one case involved an elective termination (see Figure 7). Among 16 pregnancy-related deaths, 12 cases (75 percent) had a live birth, two (13 percent) had co-occurring maternal and fetal deaths, one case involved a fetal death, and one case involved an elective termination (see Figure 8).



Cases by Maternal Race and Ethnicity

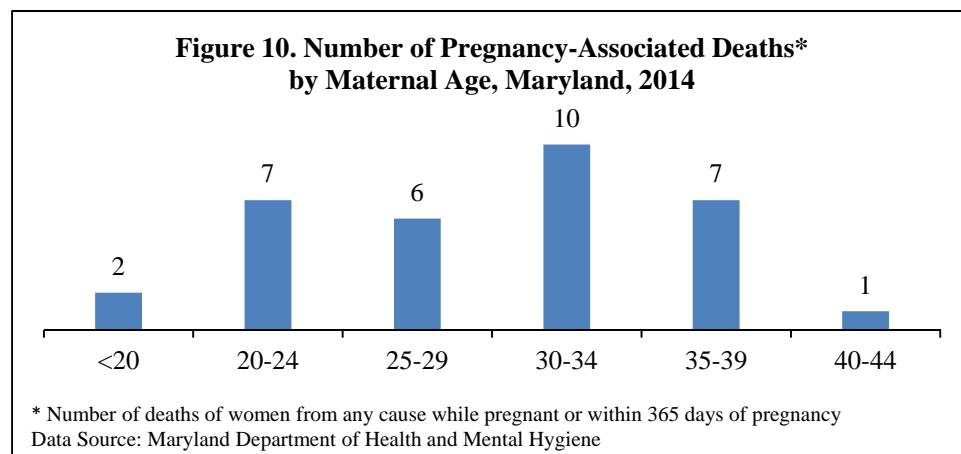
Of the 33 pregnancy-associated deaths during 2014, 12 (36 percent) occurred among non-Hispanic White women, 18 (55 percent) among non-Hispanic Black women, and three (nine percent) among Hispanic women. Three (19 percent) of the 16 pregnancy-related deaths were among non-Hispanic White women, ten (63 percent) among non-Hispanic Black women, and three (19 percent) among Hispanic women. Pregnancy-associated and pregnancy-related mortality rates by race in 2014 are shown in Figure 9. Rates for racial or ethnic groups with fewer than five deaths are not displayed.

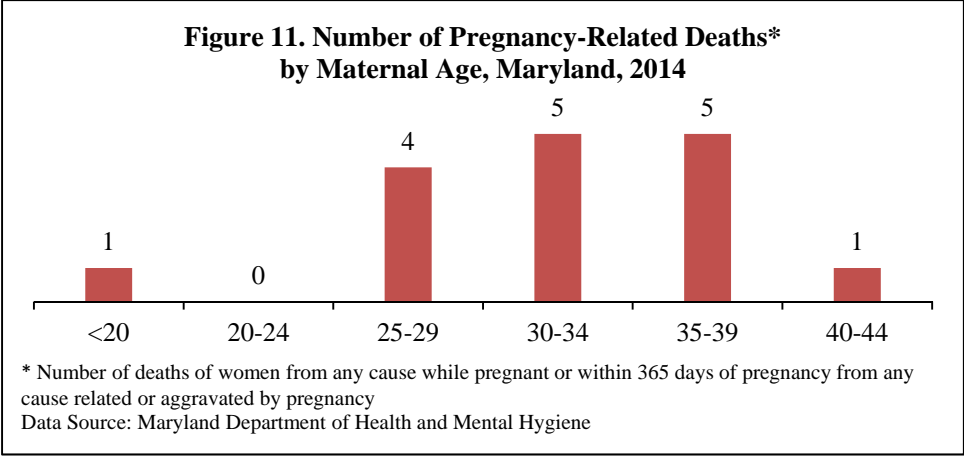


Among 2014 deaths, the pregnancy-associated mortality rate for non-Hispanic Black women was 2.1 times higher than the rate for non-Hispanic White women. All five of the unintentional overdose deaths were among non-Hispanic White women. Three of the four homicide deaths were among non-Hispanic Black women. Of deaths due to all medical causes, 18 percent occurred among non-Hispanic White women, 18 percent among Hispanic women, and 65 percent among non-Hispanic Black women.

Cases by Maternal Age

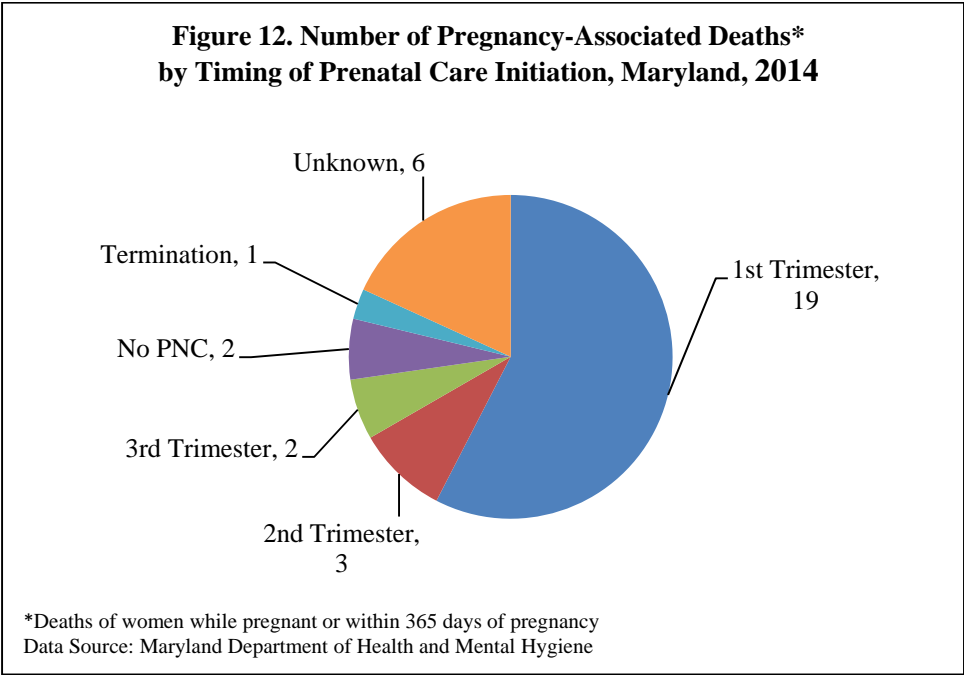
The distribution of pregnancy-associated deaths by maternal age group is shown in Figure 10. The distribution of pregnancy-related deaths by maternal age group is shown in Figure 11.

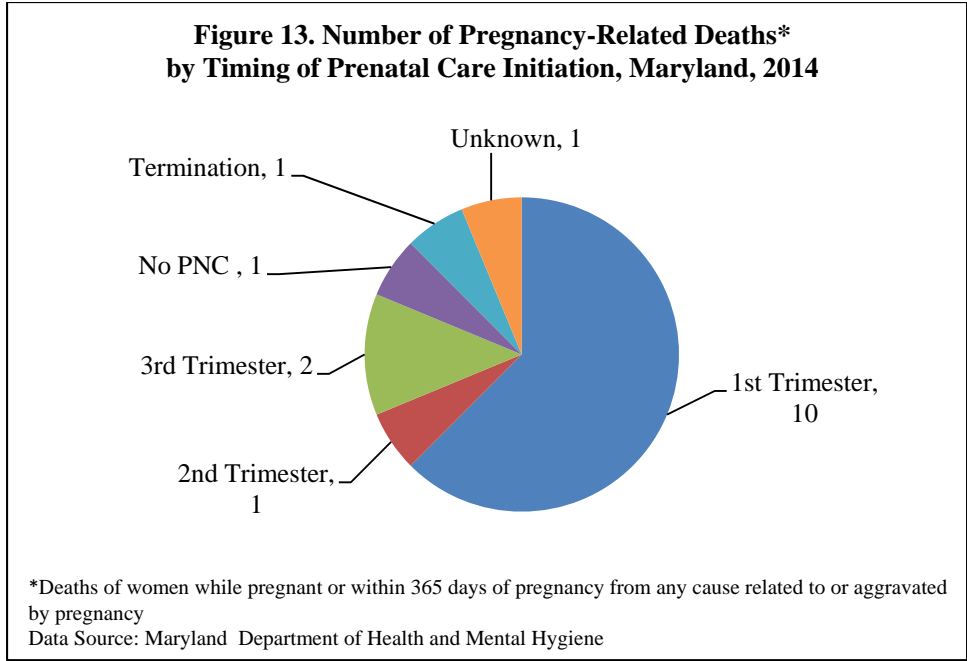




Cases by Timing of Prenatal Care Initiation

The distributions of pregnancy-associated and pregnancy-related deaths by the trimester when women initiated prenatal care are shown in Figures 12 and 13, respectively. Nineteen (58 percent) of the 33 pregnancy-associated deaths were among women who initiated care in the first trimester of pregnancy. In six (18 percent) of the pregnancy-associated deaths, timing of prenatal care was unknown. Among the 16 pregnancy-related deaths, 10 (63 percent) were among women who received first trimester prenatal care.





Cases by Jurisdiction of Residence and Occurrence

Nine (27 percent) of the 33 2014 pregnancy-associated deaths were among residents of Baltimore City and five (15 percent) were among residents of Montgomery County (see Figure 14). Thirteen (39 percent) of the deaths occurred in Baltimore City and five (15 percent) occurred in Montgomery County (see Figure 15).

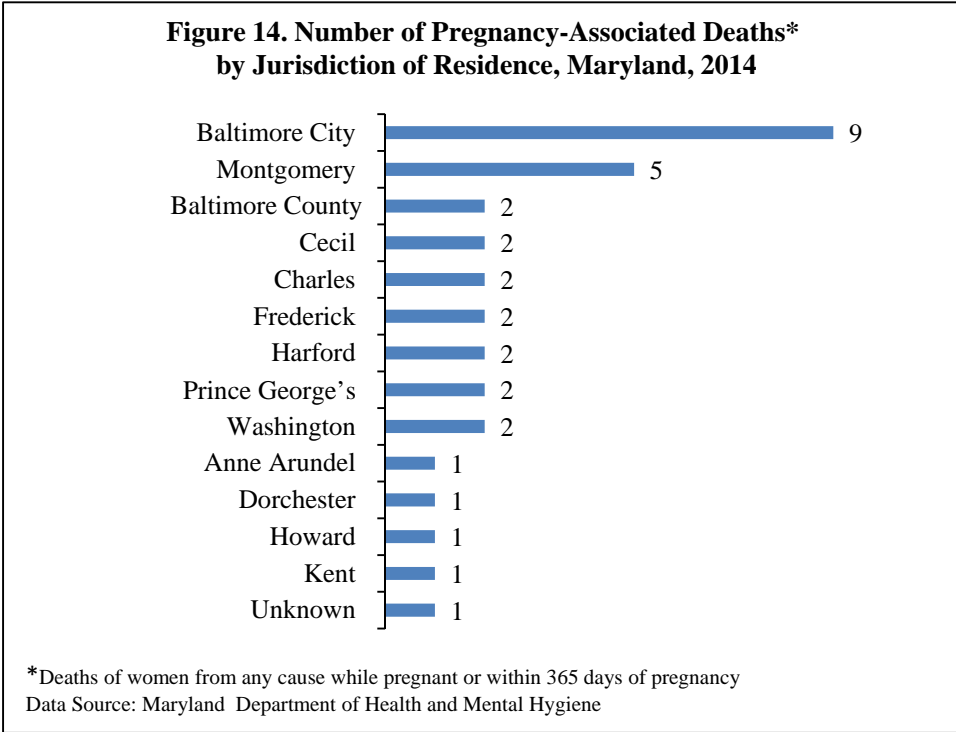
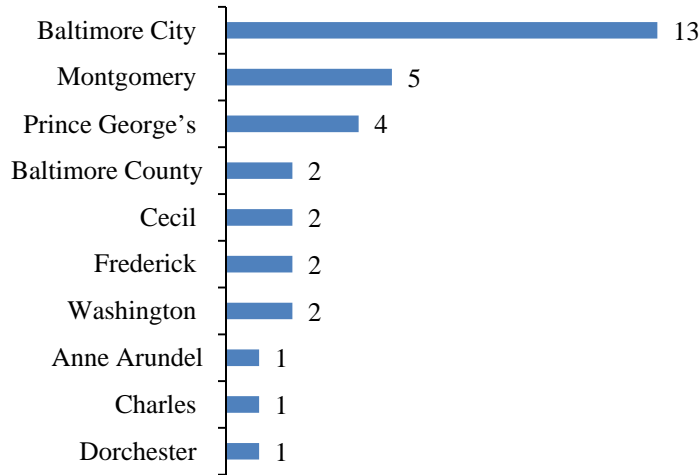


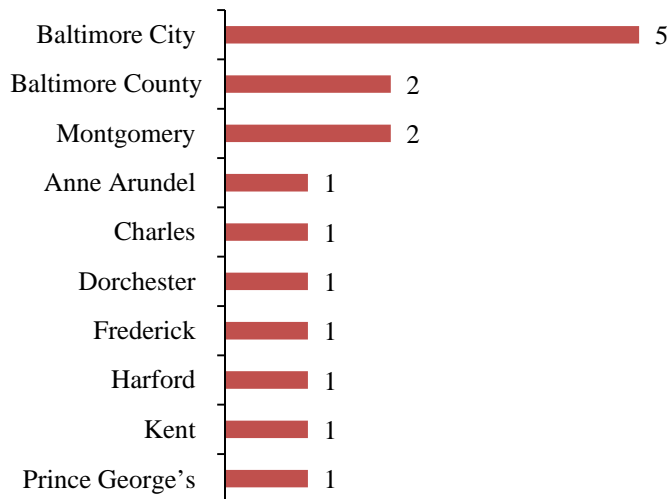
Figure 15. Number of Pregnancy-Associated Deaths* by Jurisdiction of Occurrence, Maryland, 2014



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
 Data Source: Maryland Department of Health and Mental Hygiene

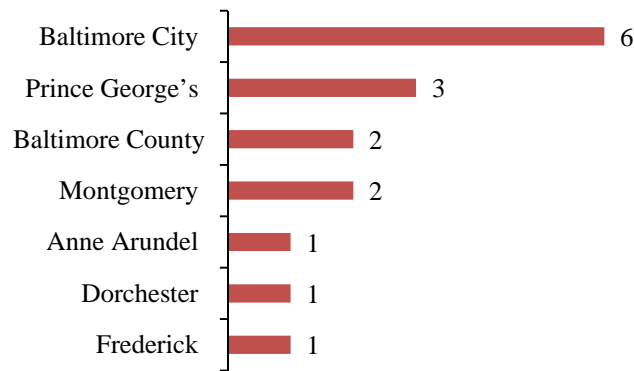
In 2014, five (31 percent) of the 16 pregnancy-related deaths were among residents of Baltimore City, and two (13 percent) each among residents of Baltimore and Montgomery Counties (see Figure 16). Six (38 percent) of the pregnancy-related deaths occurred in Baltimore City and three (19 percent) in Prince George's County (see Figure 17).

Figure 16. Number of Pregnancy-Related Deaths* by Jurisdiction of Residence, Maryland, 2014



*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 and Mental Hygiene

Figure 17. Number of Pregnancy-Related Deaths* by Jurisdiction of Occurrence, Maryland, 2014



*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 and Mental Hygiene

Preventability of Deaths

Of the 33 pregnancy-associated deaths, 23 (70 percent) were judged to be preventable or potentially preventable. In six cases (18 percent), preventability could not be determined, and four cases (12 percent) were considered unpreventable deaths. Among the 16 pregnancy-related deaths, 13 (81 percent) were felt to be preventable or potentially preventable. Preventability could not be determined in one case, and two cases were considered unpreventable deaths.

All of the unintentional overdose deaths were considered potentially preventable, as was the one suicide death and three of the four homicide deaths. Two of three injury deaths were also considered potentially preventable. The four deaths considered unpreventable involved medical causes of death and one injury death from smoke inhalation. Medical causes of unpreventable death included cancer and cerebrovascular accident.

FOCUS ON CHRONIC OR CONCURRENT MEDICAL CONDITIONS

A retrospective review of pregnancy-associated deaths occurring in Maryland during the five-year period from 2010 to 2014 was conducted. For each death, the MMR Committee determined a category of cause of death. These categories can be divided into three main groups:

1. Obstetric complications and acute medical events (hemorrhage, pregnancy-induced hypertension, amniotic fluid embolus, thrombotic pulmonary embolus, cerebrovascular accident, infection, anesthesia);
2. Injury and behavioral health conditions (injury, substance use disorder/unintentional overdose, homicide, suicide); and
3. Chronic or concurrent medical conditions (cardiomyopathy, other cardiovascular conditions, non-cardiovascular medical conditions).

The first two groups account for 69 percent of the 188 deaths reviewed in the past five years. In an additional six cases (three percent), the cause of death was unknown. Previous recommendations have

addressed issues related to deaths in the first two groups. Deaths due to unintentional overdose and other behavioral health issues were reviewed in detail in the 2015 MMR Report and recommendations were put forward to address these issues. The 2015 report is available at http://phpa.dhmh.maryland.gov/mch/Documents/2015MMR_FINAL.pdf. Pregnancy-associated deaths from unintentional overdose peaked in 2013 with 11 deaths, but this remains the leading cause of pregnancy-associated death among the 2014 cases reviewed in the current report. The Committee, therefore, continues its support of the recommendations made in the 2015 MMR Report.

The third group, chronic or concurrent medical conditions, accounts for 28 percent of pregnancy-associated deaths and covers a broad range of medical conditions. Common to all is the concern for early recognition of chronic conditions, stabilization of such conditions before pregnancy if possible, collaborative management of both pregnancy and the chronic or concurrent condition, and maintenance of continuity of care following delivery.

Between 2010 and 2014, there were 49 pregnancy-associated deaths involving chronic or concurrent medical conditions. As shown in Table 1, cardiovascular conditions (including cardiomyopathy) were identified in 18 (37 percent) of the deaths in this group. Eight of these deaths resulted from cardiomyopathy. Among the 31 non-cardiovascular conditions, malignancy, identified in 14 deaths (45 percent), was the most frequent diagnosis, followed by asthma and seizure disorder, which were identified in four deaths (13 percent) each. There were two cases of autoimmune disorders and other conditions were present as individual cases.

Table 1. Chronic/Concurrent Diagnoses for Pregnancy-Associated Deaths, Maryland, 2010-2014 (N = 49)

Cardiovascular conditions	18
Cardiomyopathy	8
Non-cardiovascular conditions	31
Malignancy	14
Asthma	4
Seizure disorder	4
Other (primarily individual cases)	9

Data source: Maryland Department of Health and Mental Hygiene

Body mass index (BMI) was calculated for 41 of the 49 cases for which height and weight were recorded. The mean BMI was 31.5, above the CDC definition of obesity (BMI equal to or greater than 30). In 15 cases the BMI was above 35 and in six cases above 40. The range of BMIs was from 16.5 to 53.5. Among the cardiovascular subgroup, the mean BMI was 35.6, and among cases of cardiomyopathy, the mean BMI was 37.9. Among cases with non-cardiovascular conditions, the mean BMI was 28.9. The mean BMI for cases not involving malignancy was 29.1. These data suggest that obesity is a comorbidity and potential contributing factor to cardiovascular deaths.

The timing of death in relation to the end of pregnancy among women with chronic or concurrent conditions is shown in Table 2. In six cases, death occurred during pregnancy. Post-delivery, deaths occurred from the day of delivery to 365 days postpartum. In three cases the timing of death relative to the end of pregnancy was unknown.

Table 2. Timing of Death Relative to End of Pregnancy for Chronic/Concurrent Diagnoses, Maryland, 2010-2014 (N = 49)

Pregnant at death	6
Within 24 hours of delivery	2
PPD 1-14	7
PPD 15-42	9
PPD 43- 90	8
PPD 91-180	7
PPD 181- 365	7
Unknown	3

PPD – postpartum day

Data source: Maryland Department of Health and Mental Hygiene

Within the cardiovascular subgroup, timing of death was unknown in one case, one death occurred during pregnancy, and the remaining 16 deaths occurred between one and 297 days postpartum, with a mean of 61 days. Deaths among cardiomyopathy cases occurred between 19 and 71 days postpartum (mean of 41 days) in seven of eight cases; the eighth cardiomyopathy death occurred on day 297.

Among non-cardiovascular conditions, timing of death was unknown in two cases, and five deaths occurred during pregnancy. The remaining 24 deaths occurred from the day of delivery to day 365 postpartum, with a mean of 117 days. Among deaths from malignancies, timing of death was unknown in one case, and the remaining 13 deaths occurred between postpartum day 10 and 287, with a mean of 135 days. In cases not involving malignancy, timing of death was unknown in one case and five deaths occurred during pregnancy. Three of the deaths during pregnancy were due to seizure disorder and two to asthma. The remaining 11 deaths occurred from the day of delivery to day 365, with a mean of 95 days postpartum.

Determination of the preventability of a death requires careful consideration of the circumstances leading to the death, including the quality and content of care, individual compliance with care, and adequacy of the system of care. In nine of the 49 cases, preventability could not be determined either because of lack of records or poor documentation. Of the remaining 40 cases, 21 were considered preventable or potentially preventable. Nineteen deaths were categorized as not preventable, including 11 of 14 deaths from malignancies and five of the 18 cardiovascular deaths.

A significant factor in many deaths was a lack of available documentation of the management of the chronic or concurrent medical condition that ultimately led to the death. Another factor was gaps in continuity of care, particularly following hospital discharge after delivery. These deficits are addressed in the following recommendations from the MMR Committee.

2016 MMR RECOMMENDATIONS

Recommendation 1

Improve recognition of those chronic or concurrent medical disorders that increase the risk of maternal death during pregnancy or within one year of the end of pregnancy.

Action: Distribute an alert bulletin regarding high risk cardiovascular conditions to prenatal care providers, maternal fetal medicine specialists, and cardiologists in Maryland.

Action: Distribute a pre-eclampsia alert bulletin to prenatal care providers and maternal fetal medicine specialists emphasizing the ACOG recommendation for early blood pressure measurement postpartum (within seven to 10 days postpartum).

Recommendation 2

Improve communication and collaboration between care providers for women with chronic or high risk medical conditions during the preconception, peripartum, and postpartum periods. Pregnancy intention and inter-pregnancy spacing should be addressed.

Action: Encourage obstetrical services to distribute records including Emergency Department visit summaries and hospital discharge summaries for all admissions of pregnant or postpartum women to the woman's prenatal care provider, consulting specialists, and the source of primary care if different from the prenatal care provider.

Recommendation 3

Improve the continuity of care in the transition from pregnancy-related care to ongoing management of chronic or concurrent medical disorders following delivery.

Action: Encourage obstetrical services to implement scheduling of post-discharge appointments as part of the standard discharge process.

Action: Encourage prenatal care providers to implement measures to improve compliance with postpartum appointments within their practice, especially for women with chronic or concurrent medical conditions.

SUMMARY

Maryland continues to have a slightly higher maternal mortality rate than the U.S. average, and substantially higher than the Healthy People 2020 goal of 11.4 deaths per 100,000 live births. This in part reflects efforts in the State to accurately identify maternal deaths. Enhanced surveillance methods include questions on the death certificate about pregnancy within the year prior to death, linkage of women's death certificates with birth and fetal death certificates from the previous year, review of medical examiner records, and detailed case review by the MMR Committee.

Thirty-three pregnancy-associated deaths were identified in 2014. Sixteen (48 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 leading cause of pregnancy-associated death was substance use and unintentional overdose. Hemorrhage was the leading cause of pregnancy-related death. A majority of these deaths (70 percent of pregnancy-associated deaths and 81 percent of pregnancy-related deaths) were considered preventable or potentially preventable.

In this report, the MMR Committee focused its recommendations on chronic and concurrent medical conditions. The MMR Committee will continue to broaden its dissemination of findings and recommendations, and to promote communication and collaboration among all providers caring for pregnant and postpartum women in an effort to reduce pregnancy-associated deaths in Maryland.

Appendix A

Maryland Maternal Mortality Review Case Discussion Guide

Date: _____ Case # _____

Purpose: To review pregnancy-associated deaths in order to classify cases, identify trends in mortality, and develop recommendations for systems change.

Case Definition: Death of a woman while pregnant or within 365 days of pregnancy conclusion

1. Medical Care and Non-medical Causes Underlying the Death

Quality/content of medical care

- Preventive services
- Community and patient education
- Nutrition, substance use, and social services
- Preconception services
- Prenatal care
- Labor and delivery services
- Postpartum care and follow-up
- Management & treatment
- Diagnostic procedures
- Medical interventions
- Patient education and follow-up

Non-medical (social) causes underlying the death

- Intendedness of pregnancy
- Woman's and her family's knowledge about pregnancy & its possible complications
- Timeliness on the part of the woman in recognizing a problem & taking action
- Accessibility/acceptability of healthcare (cultural/experience/financial/geographic/transportation/logistic)
- Cultural competence and communication skills of health care providers
- Woman's adherence or non-adherence to medical advice and health interventions

2. Issues specific to this case

Individual Behavior: _____

Provider Practice: _____

Institutional/ Systems Issues: _____

Additional issues: _____

Sources of Information: _____

Information Missing: _____

1. Type of Case:

Pregnancy-related (causes related to or aggravated by pregnancy or its management)

Not Pregnancy-related (cause unrelated to pregnancy)

Undetermined

Due to: _____

2. This case was:

Preventable (individual provider institutional/systems issues)

Potentially Preventable (individual provider institutional/systems issues)

Undetermined

Not Preventable

3. Resources or services needed but not used or not available:

4. Recommendation(s) to address issues in this case:

