STATE OF MARYLAND
DHMH
Maryland Department of Health and Mental Hygiene
201 W. Preston Street • Baltimore, Maryland 21201
Martin O'Malley, Governor – Anthony G. Brown, Lt. Governor – Joshua M. Sharfstein M.D., Secretary

DEC 0 4 2012

The Honorable Martin O'Malley
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 §13-1207 and SB 688 (Ch. 262 of the Acts of 2003)
2012 Legislative Report on the Maternal Mortality Review Program

Dear Governor O'Malley, President Miller and Speaker Busch:

Pursuant to Health-General Article, §13-1207, Annotated Code of Maryland, the Department of Health and Mental Hygiene 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 Ms. Marie Grant, Director, Office of Governmental Affairs, at (410) 767-6481. The Department looks forward to working with you and other members of the General Assembly as we continue to explore ways to reduce maternal deaths in Maryland.

Sincerely,

Joshua M. Sharfstein, M.D.
Secretary

Enclosure

cc: Marie Grant, J.D.
Frances B. Phillips, R.N., M.H.A.
Donna Gugel, M.H.S.
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Ms. Sarah Albert, MSAR #2181

MARYLAND DEPARTMENT OF HEALTH AND MENTAL HYGIENE
PREVENTION AND HEALTH PROMOTION ADMINISTRATION
MATERNAL AND CHILD HEALTH BUREAU

MARYLAND MATERNAL MORTALITY REVIEW
2012 ANNUAL REPORT

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Joshua M. Sharfstein, M.D.
Secretary
Department of Health and Mental Hygiene

Frances B. Phillips, R.N., M.H.A.
Deputy Secretary, Public Health Services
Department of Health and Mental Hygiene

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ACKNOWLEDGEMENTS

This review of deaths would not be possible without the data, cooperation, and expertise of the Department's Vital Statistics Administration (VSA) and the Office of the Chief Medical Examiner (OCME). The Maternal Mortality Review Program (the 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:

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S. Patrick	Donegan, MD	Baltimore Washington Medical Center
Diana	Cheng, MD	Department of Health and Mental Hygiene
Catherine	Denver, MPH, RN	Department of Health and Mental Hygiene
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Lorraine	Goldstein, CNM	Maryland General Hospital
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Lauren	Rodgers, MD	Prince George's Hospital Center
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BACKGROUND

Health-General Article, §§13-1203-1207, Annotated Code of Maryland) establishes a Maternal Mortality Review Program in Maryland. The statute requires: (1) identification of maternal death cases; (2) review of medical records and other relevant data; (3) determination of preventability of death; (4) development of recommendations for the prevention of maternal deaths; and (5) dissemination of findings and recommendations to policymakers, health care providers, health care facilities, and the general public. The three-year sunset provision on this Committee was removed during the 2003 legislative session.

The Maryland Department of Health and Mental Hygiene (the Department) conducts maternal mortality reviews in consultation with MedChi, the Maryland State Medical Society. Funding has been made available from the Department's Maternal and Child Health Bureau to MedChi since June 2001 to assist in the maternal mortality review process. MedChi's Maternal and Child Health Subcommittee assists in obtaining medical records, abstracting cases, and convening a committee of clinical experts from across the State, the Maternal Mortality Review Committee (MMR Committee), to provide an in-depth review of maternal deaths to determine pregnancy-relatedness and preventability. The 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 International Classification of Diseases Ninth and Tenth Revisions (ICD-9 and ICD-10) to be "the death of a woman while pregnant or within 42 days of conclusion 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." This definition of maternal death is used by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) in calculating state and national maternal mortality rates.
- The **maternal mortality rate (MMR)** is defined as the number of maternal deaths per 100,000 live births in the same time period. MMR is also frequently referred to as the maternal mortality ratio.

In 1986, the Centers for Disease Control and Prevention (CDC) and the American College of Obstetricians and Gynecologists (ACOG) collaborated to issue a statement recommending the use of enhanced surveillance definitions as an approach to more accurately identify deaths among women in which pregnancy was a contributing factor. This collaboration led to the development of the following additional definitions.

- A **pregnancy-associated death** is defined 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 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 NCHS uses strict criteria to define deaths to be included in the MMR based upon information from the death certificates alone. An enhanced surveillance method is 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 MMR was at its lowest level in 1987 at 6.6 maternal deaths per 100,000 live births. However, the MMR has generally risen since that time and was 12.7 maternal deaths per 100,000 live births in 2007, the latest year for which national data are available. During the last two decades, maternal deaths from hemorrhage and hypertensive disorders have decreased. However, there appears to be an increase in deaths from other medical conditions, including cardiovascular and neurological problems. Some of the increase in MMR since the mid-1980s could be expected because of the recommendations for enhanced surveillance. Enhanced surveillance using multiple data sources, including case review, will lead to additional cases being identified at the state level. It is expected that as Maryland and other states implement these changes, the MMR will increase due to this improved identification process.

The Healthy People 2020 MMR target is 11.4 maternal deaths per 100,000 live births (MICH-5). This goal is significantly higher than the Healthy People 2010 goal of 3.3 maternal deaths per 100,000 live births, which was not met. Maryland’s MMR is higher than the national rate. The average national MMR for 2003-2007 (the most recent 5-year interval for which U.S. data are available) was 13.3 maternal deaths per 100,000 live births. For the same period, Maryland’s MMR was 20.5.

Although 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. These enhanced surveillance methods resulted in more than doubling of the number of maternal deaths identified in Maryland compared with data from the 1980s and early 1990s.

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 similar large disparity between the rates among Black and White women (see Figure 1). (A five-year average is used to stabilize the Maryland rate because maternal deaths are relatively infrequent events that may vary considerably year-to-year, particularly in a small state like Maryland.)

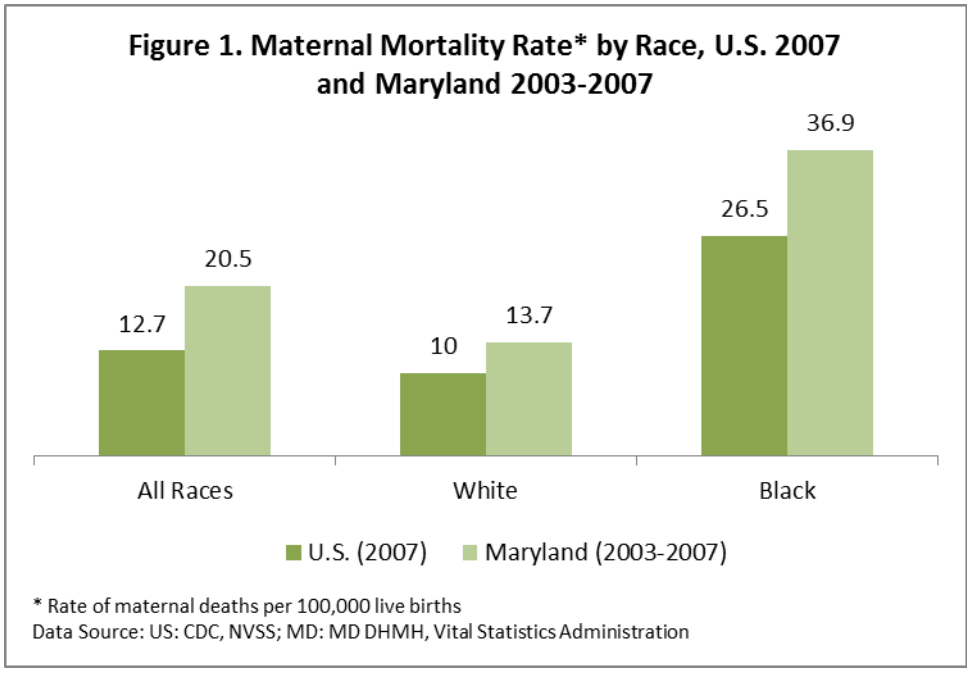
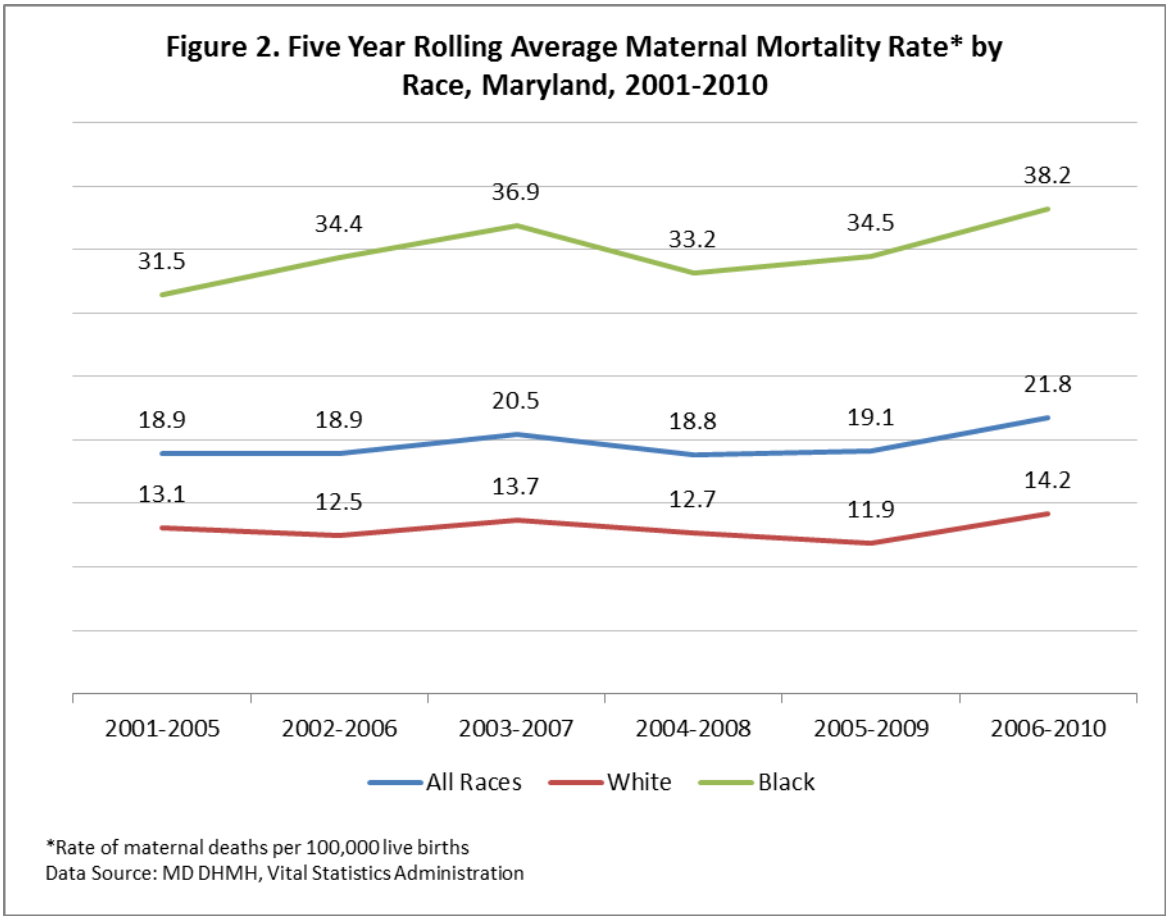


Figure 2 shows the MMR by race in Maryland for six overlapping 5-year periods over the past decade. Compared to 2001-2005, the 2006-2010 White MMR in Maryland increased 8 percent and the Black MMR increased 21 percent. The 2006-2010 Black MMR remains over two and a half times higher than the White MMR.



METHODOLOGY

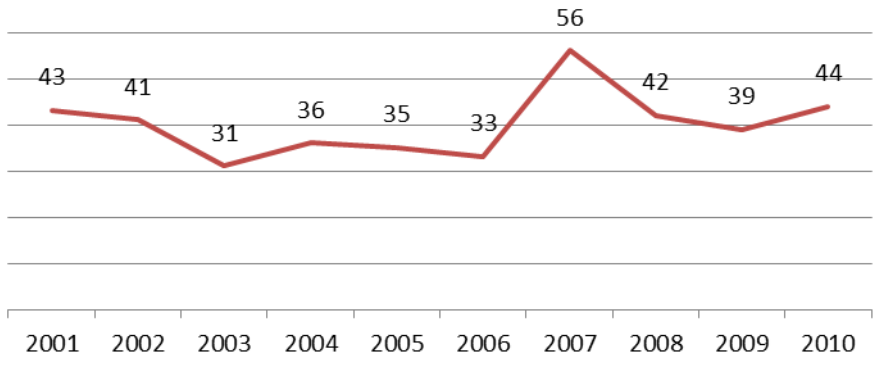
Case Identification

Cases for review are limited to women of childbearing age 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 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 5-10 percent of the 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 41 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. Only 62 percent of Maryland maternal deaths in the years 1993-2000 were identified by cause of death information alone (Horon, 2005). With the addition of the pregnancy checkbox, 98 percent of maternal deaths are now identified (Horon and Cheng, 2011).

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, such as in the case of 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 OCME are subject to a manual review process to identify evidence of pregnancy in deceased women. All deaths occurring within 365 days of pregnancy conclusion are subsequently designated as pregnancy-associated and further investigated. Using these three methods, 44 pregnancy-associated deaths were identified in 2010. Figure 3 shows the numbers of pregnancy-associated deaths in Maryland from 2001 to 2010. There was an average of 40 pregnancy-associated deaths per year during this period.

Figure 3. Number of Pregnancy-associated Deaths*, Maryland, 2001-2010



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: MD DHMH

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 consultants review death certificates, hospital records, and OCME records for all cases and prepare summaries on those cases that will go to workgroups of the Committee for review of pregnancy-relatedness. All 2010 cases involving a death from medical causes, substance abuse, or suicide were reviewed for pregnancy-relatedness.

Pregnancy-relatedness and opportunities for prevention of deaths are determined through workgroup discussion. The MMR Committee workgroups include general obstetric, perinatology, nurse-midwifery, and nursing specialties, as well as representatives from the Department's Maternal and Child Health Bureau, VSA, and the OCME. Representatives from all birthing 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 to Action." 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 the 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.

CASE FINDINGS

A total of 44 pregnancy-associated deaths were identified in 2010 for a pregnancy-associated mortality rate of 59.6 deaths per 100,000 live births. Of the 44 deaths, 21 were determined to be pregnancy-related, while the remaining 23 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 28.5 deaths per 100,000 live births.

CASES BY CLASSIFICATION OF DEATH

Figure 4 shows the categories of causes of death for pregnancy-associated and pregnancy-related deaths.

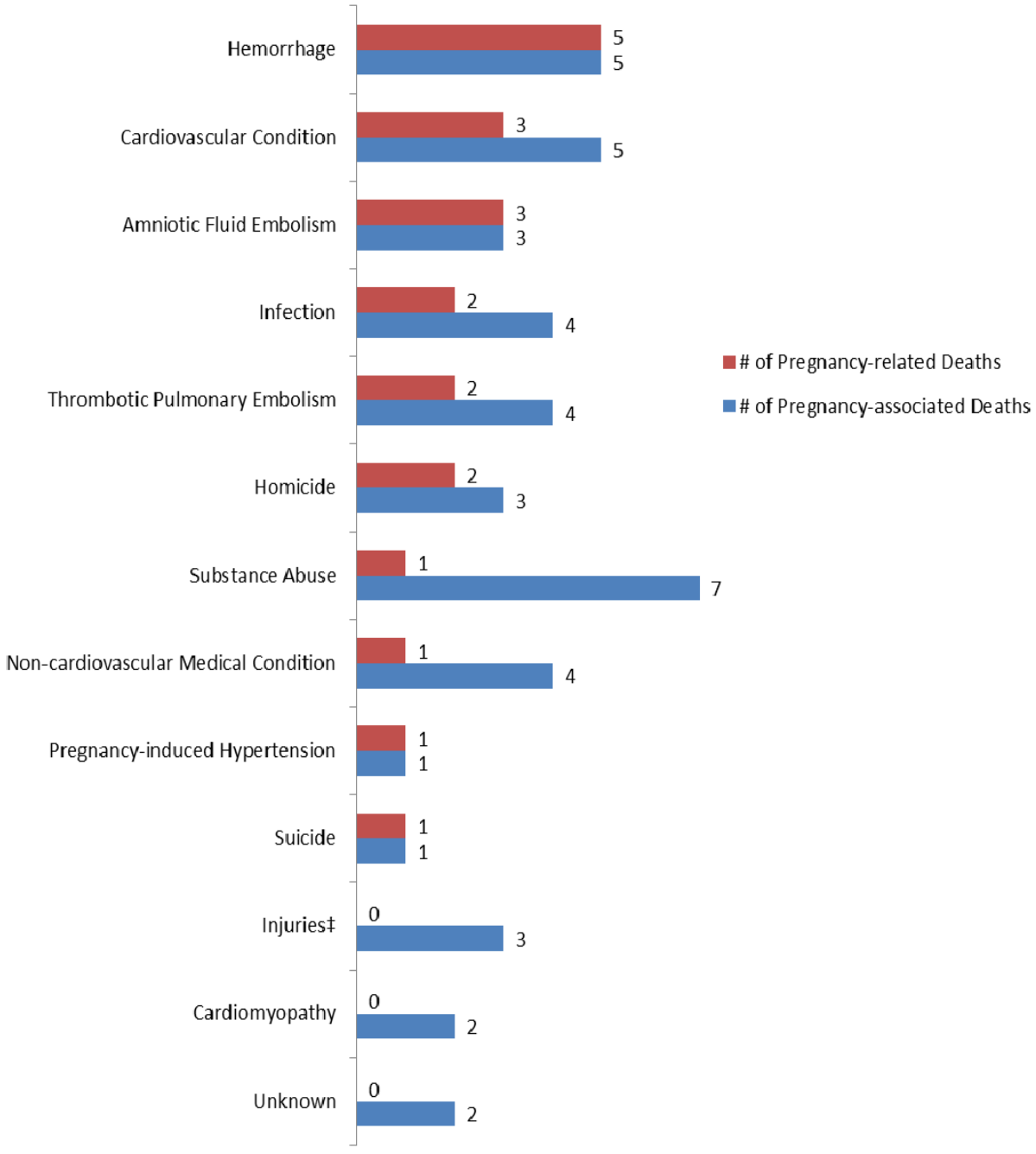
Pregnancy-associated Deaths

The leading causes of pregnancy-associated deaths in 2010 were substance abuse and cardiac disease (including cardiomyopathy), followed by hemorrhage. Sixty-four percent of pregnancy-associated deaths were due to natural causes (excluding unintentional injury, homicide, substance abuse, and suicide). An additional 16 percent were due to substance abuse, 7 percent to unintentional injury, 7 percent to homicide, and 2 percent to suicide.

Pregnancy-related Deaths

Among the 21 pregnancy-related deaths in 2010, the leading cause of death was hemorrhage, accounting for 24 percent of pregnancy-related deaths. Cardiac disease accounted for 14 percent, and other medical conditions accounted for an additional 43 percent of pregnancy-related deaths. Two homicides and one suicide death were considered to be pregnancy-related.

Figure 4. Number of Pregnancy-associated* and Pregnancy-related Deaths by Category of Cause of Death***, Maryland, 2010**



* 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

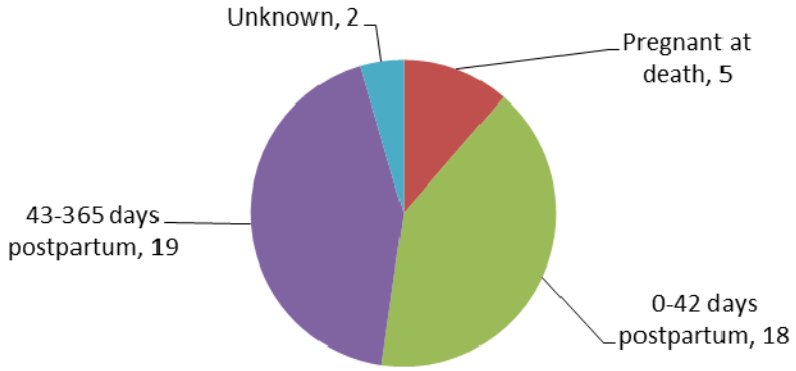
‡Injuries were not included in the review of pregnancy related deaths

Data Source: MD DHMH

CASES BY TIMING OF DEATH IN RELATION TO PREGNANCY

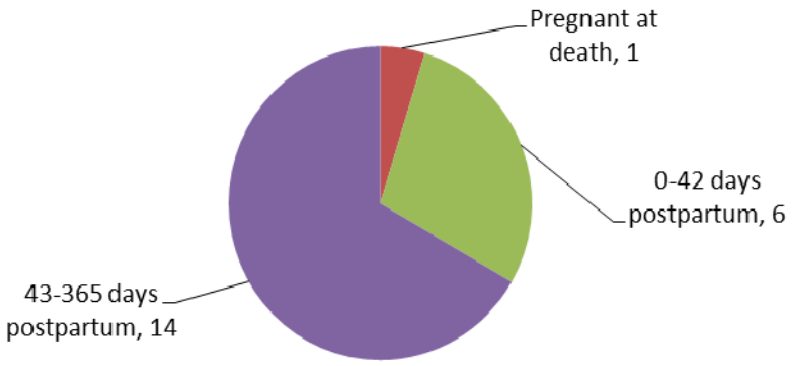
Of all pregnancy-associated deaths in 2010, 11 percent occurred during pregnancy, 41 percent within 42 days postpartum, and 43 percent occurred between 43-365 days postpartum (see Figure 5). Among pregnancy-related deaths in 2010, 5 percent occurred during pregnancy, 28 percent occurred within 42 days postpartum, and 67 percent occurred between 43-365 days postpartum (see Figure 6).

Figure 5. Number of Pregnancy-associated Deaths* by Timing of Death, Maryland, 2010



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: MD DHMH

Figure 6. Number of Pregnancy-related Deaths* by Timing of Death, Maryland, 2010

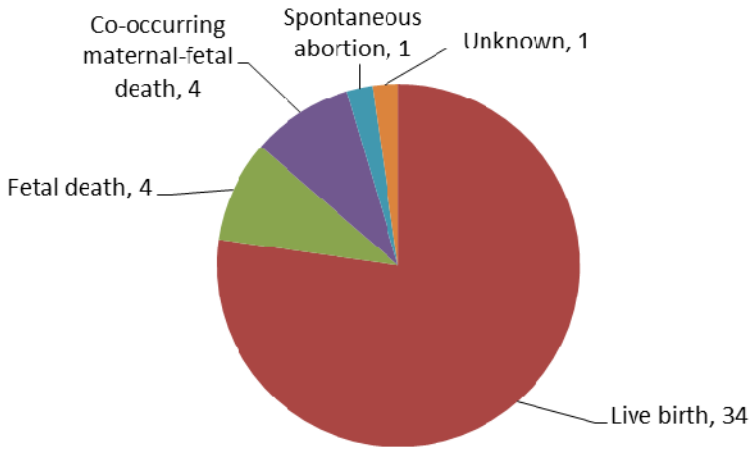


*Deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: MD DHMH

CASES BY OUTCOME OF PREGNANCY

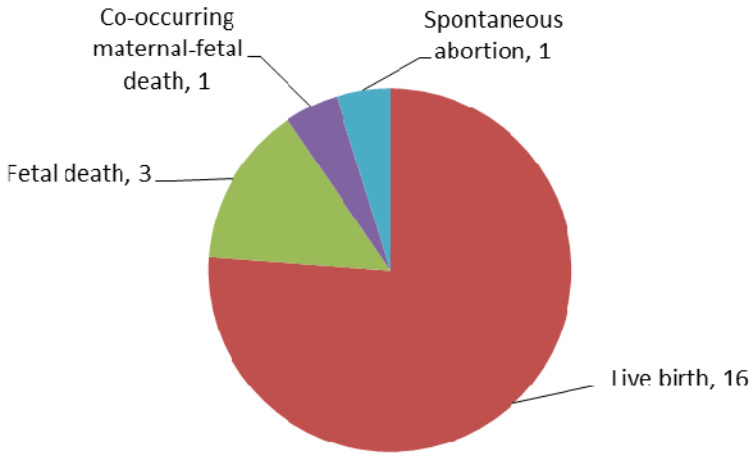
In 2010, among pregnancy-associated death cases, 77 percent had a live birth and 9 percent had co-occurring maternal-fetal deaths, as shown in Figure 7. Among pregnancy-related death cases, the pregnancy outcomes were similar with 76 percent live births and 5 percent with co-occurring maternal-fetal deaths (see Figure 8).

Figure 7. Number of Pregnancy Outcomes for Pregnancy-associated Deaths*, Maryland, 2010



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: MD DHMH

Figure 8. Number of Pregnancy Outcomes for Pregnancy-related Deaths*, Maryland, 2010

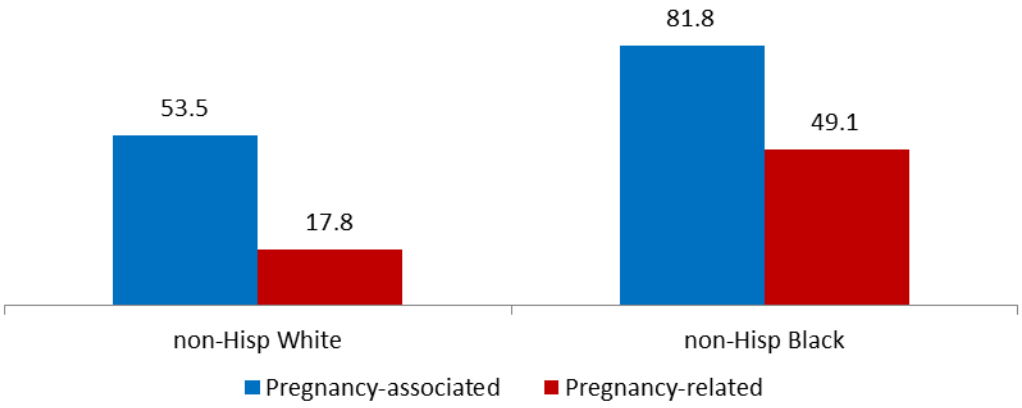


*Deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: MD DHMH

CASES BY MATERNAL RACE AND ETHNICITY

Selected racial distributions of pregnancy-associated and pregnancy-related mortality rates in 2010 are shown in Figure 9. There were 18 pregnancy-associated deaths among non-Hispanic White women, 20 deaths among non-Hispanic Blacks, 3 non-Hispanic Asian deaths, and 3 deaths among Hispanic women (rates for race/ethnicities with fewer than 5 deaths are not displayed). There were 6 pregnancy-related deaths among non-Hispanic White women, 12 deaths among non-Hispanic Blacks, 1 non-Hispanic Asian death, and 2 deaths among Hispanic women (rates for race/ethnicities with fewer than 5 deaths are not displayed).

Figure 9. Pregnancy-associated* and Pregnancy-related Mortality Rates by Selected Race/Ethnicities, Maryland, 2010**



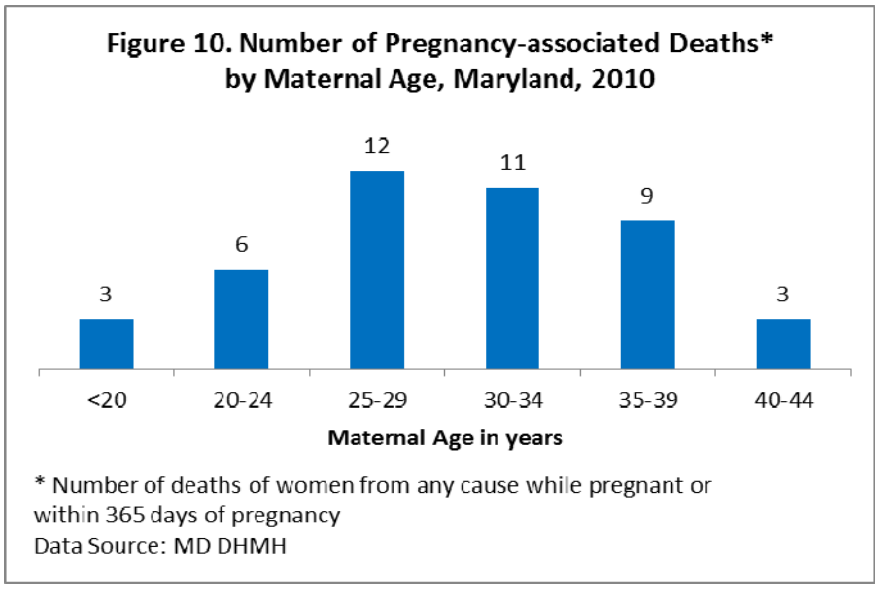
* Number of deaths of women from any cause while pregnant or within 365 days of pregnancy per 100,000 live births

** 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

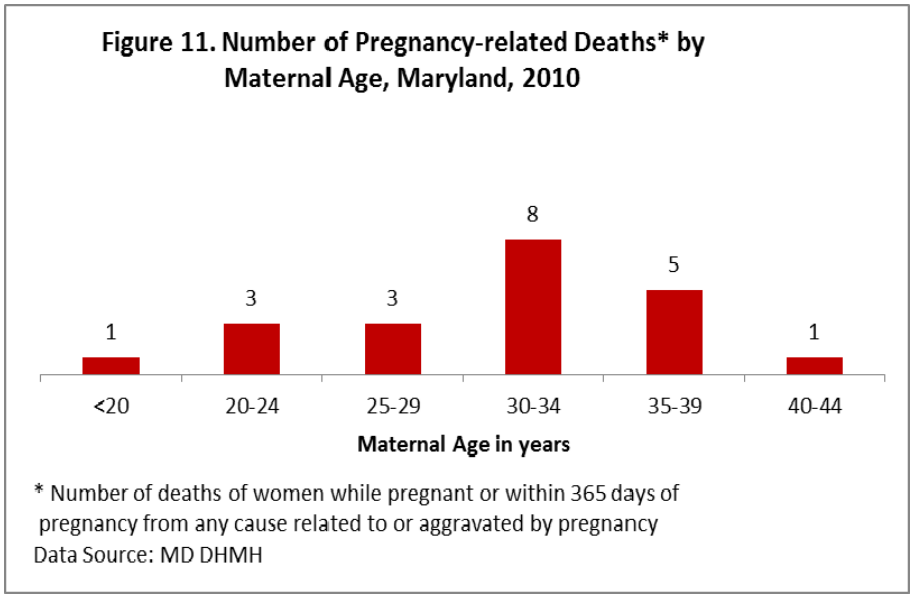
Data Source: MD DHMH

CASES BY MATERNAL AGE

The distribution of pregnancy-associated deaths by maternal age group is shown in Figure 10. The highest pregnancy-associated mortality rate occurred among women ages 35-39 years, at 84.7 deaths per 100,000 live births. The lowest rate occurred among women ages 20-24 years, at 41.1 deaths per 100,000 live births. Intermediate were death rates for women ages 30-34 years at 55.3 deaths per 100,000, and women ages 25-29 years at 59.1 deaths per 100,000 live births. (Death rates for women <20 and >39 years are not reported due to small numbers of deaths leading to unstable rates).



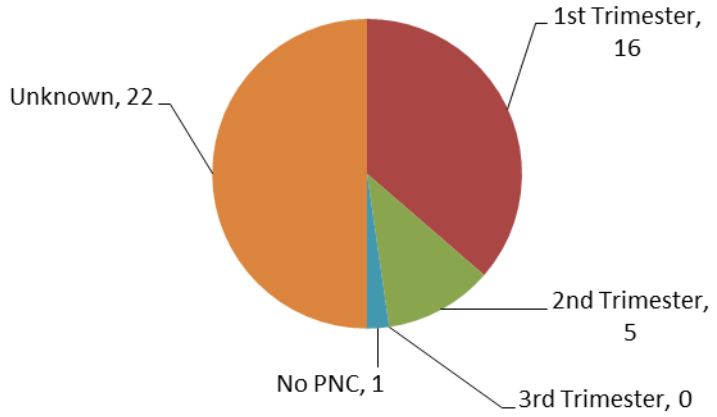
The distribution of pregnancy-related deaths by maternal age group is shown in Figure 11. Similar to pregnancy-associated deaths, the highest pregnancy-related mortality rate occurred among women ages 35-39 years, at 47.0 deaths per 100,000 live births, followed by the rate among women ages 30-34 years at 40.2 deaths per 100,000 live births. (Death rates for other age groups are not reported due to small numbers of deaths leading to unstable rates).



CASES BY TIMING OF PRENATAL CARE INITIATION

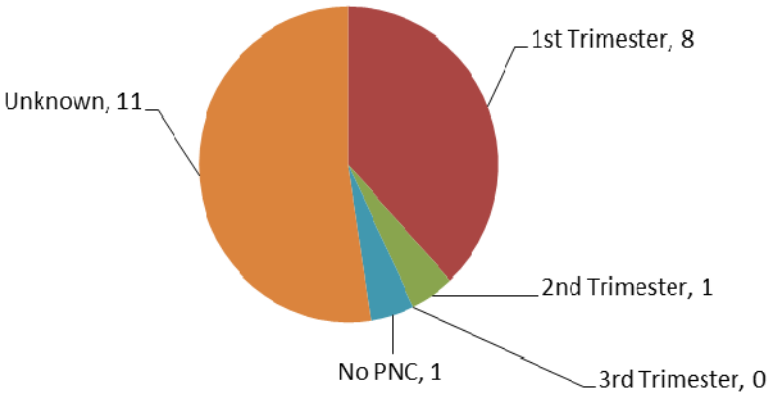
The distribution of pregnancy-associated and pregnancy-related deaths by when women initiated prenatal care are shown in Figures 12 and 13, respectively. For the majority of cases, the timing of prenatal care initiation could not be determined.

Figure 12. Number of Pregnancy-associated Deaths* by Timing of Prenatal Care Initiation, Maryland, 2010



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: MD DHMH

Figure 13. Number of Pregnancy-related Deaths* by Timing of Prenatal Care Initiation, Maryland, 2010

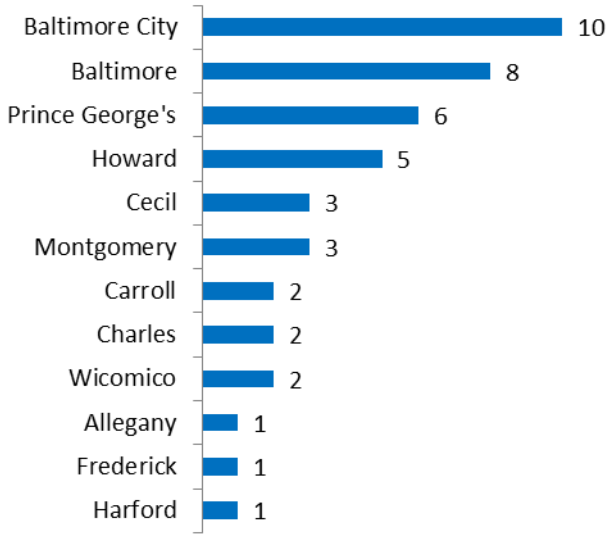


*Deaths of women while pregnant or within 365 days of pregnancy from any cause related to or aggravated by pregnancy
Data Source: MD DHMH

CASES BY JURISDICTION OF RESIDENCE AND OCCURRENCE

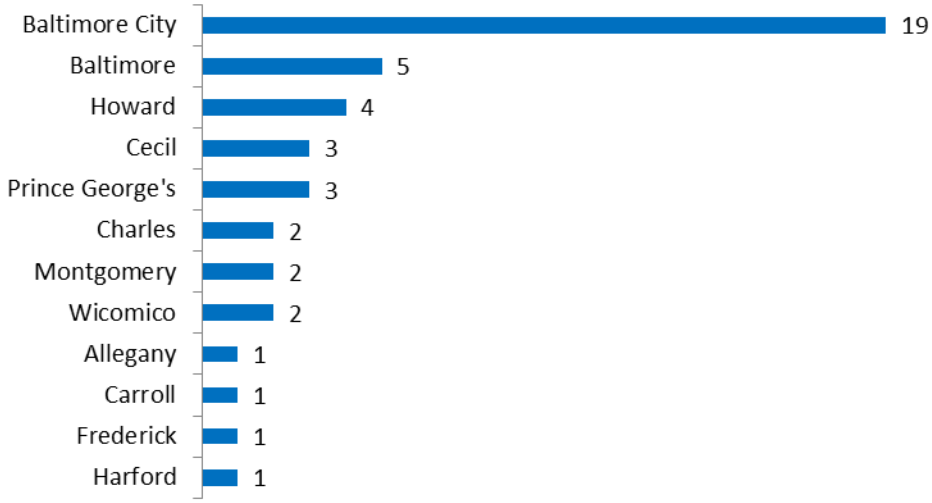
Twenty-three percent of the 2010 pregnancy-associated deaths were among residents of Baltimore City (see Figure 14). Forty-three percent of the pregnancy-associated deaths occurred in Baltimore City (see Figure 15).

Figure 14. Number of Pregnancy-associated Deaths* by Jurisdiction of Residence, Maryland, 2010



*Deaths of women from any cause while pregnant or within 365 days of pregnancy
Data Source: MD DHMH

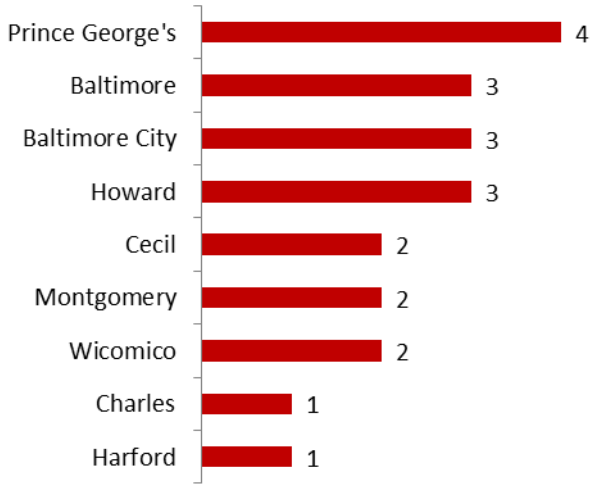
Figure 15. Number of Pregnancy-associated Deaths* by Jurisdiction of Occurrence, Maryland, 2010



*Deaths of women while pregnant or within 365 days of pregnancy from any cause
Data Source: MD DHMH

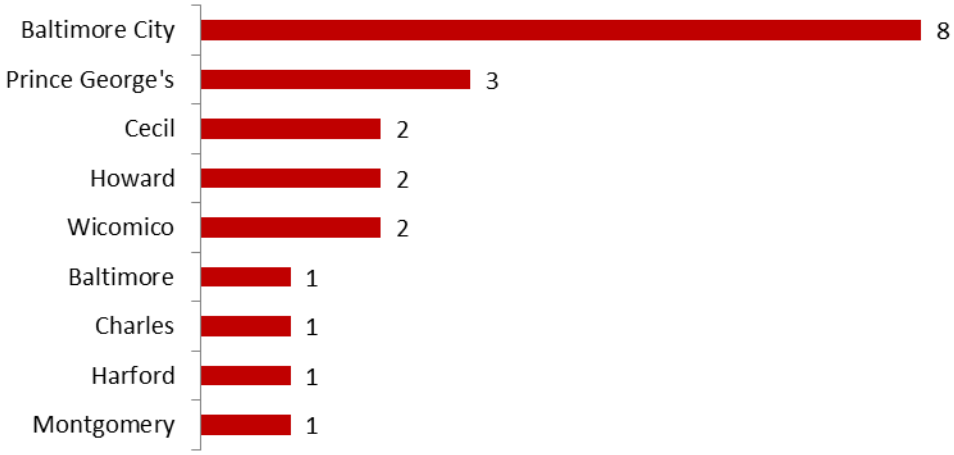
In 2010, 19 percent of pregnancy-related deaths were among residents of Prince George's County (see Figure 16). Thirty-eight percent of the pregnancy-related deaths occurred in Baltimore City (see Figure 17).

Figure 16. Number of Pregnancy-related Deaths* by Jurisdiction of Residence, Maryland, 2010



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

Figure 17. Number of Pregnancy-related Deaths* by Jurisdiction of Occurrence, Maryland, 2010



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

FOCUS ON HOMICIDE DEATHS

A summary of the 119 maternal homicide deaths that occurred from 1993 to 2010 was presented to the MMR Committee, along with a detailed review of the three homicides that occurred during 2010. The legal counsel from the House of Ruth, who also chairs the Baltimore City Domestic Violence Fatality Review Team, was present for the review. In 2010, homicide continues to be a significant cause of pregnancy-associated death. Pregnancy-associated homicide rates were highest among women who were younger than 25 years of age (7.8 deaths per 100,000 live births) and Blacks (10.4 deaths per 100,000 live births). Firearms were the most common method of death and caused 60 percent of all homicide deaths. The majority of homicides (56 percent) were perpetrated by a current or former intimate partner. If the cases in which the victim-offender relationship could not be identified are excluded (n=16), 65 percent of homicides were committed by an intimate partner.

All three of the 2010 maternal homicide deaths were perpetrated by an intimate partner. One death occurred during pregnancy, one six weeks postpartum and one two days after a 1st trimester miscarriage. In cases where a medical chart was available, there was no indication of any intimate partner violence (IPV) assessment. The postpartum case had multiple interactions with health care providers, including more than ten prenatal visits and a labor and delivery admission, and she was seen by Women, Infants, and Children (WIC) staff (WIC chart not available).

The following recommendations were developed related to IPV and homicide deaths:

1. In accordance with the ACOG Committee Opinion, "Intimate Partner Violence", women should be assessed for IPV at the initial prenatal visit, once each trimester, and postpartum.
    a. Disseminate ACOG Committee Opinion through the Maryland Chapter of ACOG and the Maryland Perinatal-Neonatal Learning Network.
    b. Distribute relationship safety cards to providers as a way to facilitate discussion with patients about IPV and provide them with referral resources.
    c. Integrate IPV screening questions into routine prenatal care.
    d. Establish and maintain linkages with local domestic violence programs.
    e. Make training and education about IPV assessment available to providers.

2. Increase provider awareness that homicide is a leading cause of pregnancy-associated death and that IPV has a large impact on health.
    a. Educate providers about the health impact of IPV (hospital grand rounds, continuing medical education (CME) activities, research articles, and other meeting presentations).
    b. Disseminate link to DHMH "Intimate Partner Violence, A Guide for Health Care Providers" and other IPV resources on the DHMH IPV website http://fha.dhmh.maryland.gov/mch/Documents/IPV-providers.pdf.
    c. Promote IPV assessment at sites where reproductive-aged women are seen, e.g. family planning clinics, WIC clinics, sexually transmitted infection (STI) clinics, and pediatrician offices.
    d. Develop brochure specifically about pregnancy and IPV.

3. The Program will review all homicide cases going forward for pregnancy-relatedness and report on homicide cases in the annual report.

Recent activities to address the issue of intimate partner violence and pregnancy-associated and pregnancy-related homicide include:

1. Creation of DHMH website, www.dhmh.maryland.gov/IPV, to provide resources to the public and to help providers assess for IPV.
2. Collaboration with Mercy Medical Center's Family Violence Response Program to create a new brochure for pregnancy and postpartum women about IPV.
3. Safety cards, including healthy relationship facts and IPV referral resources, are being made available free of charge to providers or service agencies through DHMH.
4. DHMH task force established to improve IPV assessment among primary care providers (ER physicians, OBs, internists, family physicians, nurse midwives, nurse practitioners, physician assistants, psychiatrists, nurses, pediatricians, and social workers).
5. IPV assessment presented at Greater Baltimore Medical Center and at the family planning, STI, and WIC programs.

RECOMMENDATIONS

Of the maternal deaths occurring in 2010, two causes of death stood out and were the main focus of recommendations developed by the full MMR Committee - hemorrhage and substance abuse.

Hemorrhage Deaths - The leading cause of pregnancy-related death in 2010 was hemorrhage. In previous years, death from hemorrhage was infrequent. Two issues of concern were identified: (1) the difficulty in objectively quantifying blood loss and the resulting inaccuracy in identifying massive hemorrhage, and (2) lack of a formal protocol in place to respond to massive hemorrhage. Both of these factors can contribute to a delay in response and inadequacy of that response. The Committee recommends:

1. That all Maryland delivery hospitals implement a standardized protocol for massive hemorrhage. The Committee will review existing protocols and current hospital practices.
2. That model policies be disseminated through the MD Chapter of ACOG and the Maryland Perinatal-Neonatal Learning Network.

Substance Abuse Deaths - The leading cause of pregnancy-associated death in 2010 was substance abuse. Issues identified included: (1) lack of care coordination, often with multiple providers prescribing medications (obstetrics, mental health, substance abuse treatment, and primary care); (2) drug interactions, especially narcotics and benzodiazepines, resulting in death; and (3) lack of standards for substance abuse treatment during pregnancy with high methadone dosing during pregnancy by substance abuse treatment providers. The Committee recommends:

1. The Committee begin a dialogue with the Alcohol and Drug Abuse Administration (ADAA) to establish standards for substance abuse treatment during pregnancy (e.g. methadone dosage and weaning).
2. Providers utilize the Maryland Prescription Drug Monitoring Program to identify issues of multiple prescribers.

See Appendix B, *Issues and Recommendations, 2010 Pregnancy-related Deaths*, for other discussion points and recommendations.

SUMMARY

Maryland continues to have a high maternal mortality rate compared to the U.S. average and the Healthy People 2020 goal of 11.4 deaths per 100,000 live births. This in part reflects Maryland's increased surveillance efforts to accurately identify maternal deaths in the State. Maryland has been at the forefront of states working to implement enhanced surveillance methods to identify maternal deaths. These methods include revision of the death certificate to include questions about pregnancy within the year prior to death, review of medical examiner records, linkage of women's death certificates with birth certificates and fetal death certificates from the previous year, and detailed case review by the MMR Committee. Forty-four pregnancy-associated deaths were identified in 2010. Substance abuse was the leading cause of pregnancy-associated deaths.

All cases involving a death from medical causes, substance abuse, or suicide were reviewed for pregnancy-relatedness. In addition, for the first time, all homicide cases for the year were also reviewed for pregnancy-relatedness. Twenty-one cases, including two of the three identified homicide deaths, were determined to be pregnancy-related, with the cause of death related to or aggravated by the pregnancy or its management. Hemorrhage was the leading cause of pregnancy-related deaths.

Moving forward, the Maternal Mortality Review Program will broaden its dissemination of findings and recommendations in this report, and promote communication and collaboration with providers outside of obstetrics (in fields such as substance abuse treatment, cardiology, and mental health) to support efforts to reduce maternal deaths in Maryland.

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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 abuse, 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: _____

_____

_____

3. 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: _____

_____

_____

4. This case was:

___Preventable (__individual __provider __institutional/systems issues)

___Potentially Preventable (__individual __provider __institutional/systems issues)

___Undetermined

___Not Preventable

5. Resources or services needed but __not used or __not available:

_____

_____

_____

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

_____

_____

_____

Appendix B.

Maryland Maternal Mortality Review Committee
Health Systems Issues and Recommendations
2010 Pregnancy-related Deaths

Cause of Death (Committee Determination)	Findings/Issues	Recommendations	Action Items
Hemorrhage	Poor quantification of blood loss, underestimated blood loss. Delay/inadequate replacement with blood products. No protocol for massive blood loss. Timeliness of patient seeking treatment.	1. Improved quantification of blood loss. 2. Massive blood loss/ transfusion protocol. 3. Patient education.	Educate all members of delivery staff regarding objective quantification of peripartum and postpartum blood loss. Recommend that all Maryland delivery hospitals implement a standardized protocol for massive hemorrhage. Committee will review existing protocols and current hospital practices. Disseminate model protocols (e.g. California Collaborative - http://www.cmqcc.org/ob_hemorrhage and http://www.cmqcc.org/resources/ob_hemorrhage/protocols_guidelines) through MD Chapter of ACOG and Perinatal-Neonatal Learning Network. Work with the Perinatal-Neonatal Learning Network discharge planning initiative to include information on hemorrhage.
Substance Abuse	Lack of care coordination: • Multiple prescribers for medications (OB, mental health, substance abuse, primary care). • Resulting drug interactions – narcotic and benzodiazepine. Lack of communication between OB provider and substance abuse treatment providers. High methadone dosing during pregnancy by substance abuse providers. Polysubstance abuse - drug interactions, drugs, and alcohol.	1. Improve communication between OB and other providers (mental health, substance abuse, primary care) so all providers are aware of all prescribed drugs and dosage. 2. Screening for drug interaction by all providers. 3. Patient education regarding drug interaction and toxicity. 4. Assure standardized toxicology screen on all Medical Examiner cases.	Remove regulatory restrictions that inhibit communication between OB and substance abuse treatment providers. Establish standards for substance abuse treatment during pregnancy (e.g. methadone dosage and weaning). Increase screening for substance abuse during prenatal care and at delivery. Provide obstetricians with list of substance abuse treatment program coordinators by jurisdiction to assist with referrals. Maintain ADAA priority treatment of women with known substance abuse disorders through the first year postpartum. Use Maryland Prescription Drug Monitoring Program to identify cases of multiple prescribers. Standardize toxicology screen on Medical Examiner's cases.

Cause of Death (Committee Determination)	Findings/Issues	Recommendations	Action Items
Cardiovascular Conditions	Co-occurrence with obesity. Lack of cardiac evaluation prior to or during pregnancy for women with pre-existing disease. Inadequate treatment and monitoring of hypertension. Timeliness of patient recognition of symptoms, seeking treatment, and adherence to medical treatment.	1. Cardiac evaluation for obese, hypertensive patients. 2. Prenatal cardiac evaluation for women with pre-existing heart disease. 3. Patient education on signs and symptoms of heart disease.	Recommend that morbidly obese women (BMI ≥40) with pre-pregnancy hypertension have a cardiac evaluation. Recommend that women with a history of underlying structural heart disease or cardiac arrhythmia have a prenatal cardiac consultation. Disseminate recommendations through MD Chapter of ACOG and Perinatal-Neonatal Learning Network. Work with the Perinatal-Neonatal Learning Network discharge planning initiative to include information on risk assessment, care coordination, and signs and symptoms of heart disease.
Non-cardiovascular Medical Conditions (Asthma, acetaminophen toxicity, breast cancer)	Management and treatment of asthma. Excessive acetaminophen use. Obesity. Unclear from patient medical chart which service was assuming primary responsibility for care of the patient.	1. Patient education about excessive acetaminophen use. 2. Patient education about headache in late pregnancy and warning signs of pre-eclampsia.	Educate obstetricians and primary care providers on the associated risks and appropriate management of pregnant asthmatics, or utilize consultant (pulmonology) in their management. Education of patients and health care providers regarding the risks of excessive acetaminophen use. Ensure proper documentation of BMI in medical record. Sleep apnea monitoring for obese patients. Recognition of resources needed to handle morbidly obese women at delivery - anesthesia expertise, monitoring capabilities, operating tables, and methods for lifting and transporting patients.
Infection, Pneumonia	Management of signs of possible infection at discharge. Appropriate transport to tertiary care center for surgical complication; surgery at hospital with no SICU.	1. Evaluation of patient for fever at time of discharge. 2. If adhesions lysed at surgery, bowel should be fully inspected.	Establish uniform criteria for patient vital signs necessary for discharge.
Pregnancy-induced Hypertension	Failure to address hypertension prior to surgery.	1. Stabilize patient with hypertension prior to surgical procedure.	Develop standardized guidelines for management of pregnancy-induced hypertension for obstetric units and emergency departments.

Cause of Death (Committee Determination)	Findings/Issues	Recommendations	Action Items
Amniotic Fluid Embolism	Initiating hysterectomy in presence of disseminated intravascular coagulation Delayed response to sudden cardiovascular collapse.	1. Improve response to sudden unexpected events.	Encourage development of Rapid Response teams for cardiovascular collapse and use of simulation drills.
Thrombotic Pulmonary Embolism (DVT/PE)	Lack of DVT/PE prophylaxis in pregnancy and postpartum. Lack of obstetric and primary care coordination; withholding medical intervention due to recent pregnancy. Timeliness of patient recognition of symptoms, seeking treatment, adherence to medical treatment.	1. Risk assessment in prenatal care and at discharge. 2. Hospital policy on DVT/PE prophylaxis for obstetric patients. 3. Coordination of care between obstetric and primary care providers. 4. Patient education on signs and symptoms of DVT/PE.	Recommend use of risk assessment and intervention guidelines for prenatal and postpartum periods. Encourage use of prophylaxis in pregnancy and postpartum for DVT/PE if indicated. Ensure coordination of care and communication between OB and primary care providers in cases of DVT/PE risk. Work with the Perinatal-Neonatal Learning Network discharge planning initiative to include risk assessment, care coordination, and patient information on DVT/PE.
Homicide/IPV	Homicide remains a significant cause of pregnancy-associated and pregnancy-related death. In majority of these homicides, an intimate partner is the perpetrator. Criminal justice system was involved because of IPV but failed to act prior to homicide.	1. Women should be assessed for intimate partner violence at each trimester. 2. Increase provider awareness that homicide is a significant cause of death during and following pregnancy.	Build assessment for IPV into medical history forms. Establish and maintain linkages with local domestic violence programs. Provider education on how to screen for IPV and how to refer patients who screen positive or disclose abuse. Timely action from the criminal justice system in domestic violence cases. IPV education at WIC, pediatric visits, other points of interaction with women, as well as for men. Patient education about the seriousness of threats in the face of domestic violence.
Suicide	Missing information about psychiatric postpartum care.	1. Improved communication between obstetric and mental health providers.	Obstetricians should assess for depression and suicide risk during prenatal visits ask patients about any plan to discontinue psychiatric medications during pregnancy. Screen for presence of firearms in the home of a patient with mental health issues.

Systems Recommendations

No process exists for hospitals to correct cause of death on the death certificate when the certificate is signed before the completion of an autopsy. Recommend developing a means to amend death certificates after results of autopsy become available.

Appendix C.

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