

MARYLAND DEPARTMENT OF HEALTH AND MENTAL HYGIENE
FAMILY HEALTH ADMINISTRATION
CENTER FOR MATERNAL AND CHILD HEALTH

Maternal Mortality Review Program

2008 ANNUAL REPORT

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Governor

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I. Introduction

During the 2000 Maryland General Assembly, Senate Bill 459 (Health-General Article, §§13-1201--1207, Annotated Code of Maryland) was enacted to establish maternal mortality review 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 public. The three-year sunset provision was removed during the 2003 legislative session. The Maryland Department of Health and Mental Hygiene (Department) conducts maternal mortality review in consultation with MedChi, the Maryland State Medical Society. Funding has been made available from the Department's Center for Maternal and Child Health to MedChi since June 2001 to investigate pregnancy-associated deaths in Maryland and identify opportunities to reduce maternal mortality. MedChi's Maternal and Child Health (MCH) Committee provides consultation to the Department regarding maternal mortality review activities, develops recommendations for the prevention of maternal deaths, and disseminates findings and recommendations to policy makers, health care providers, health care facilities, and the general public.

II. National and State Data

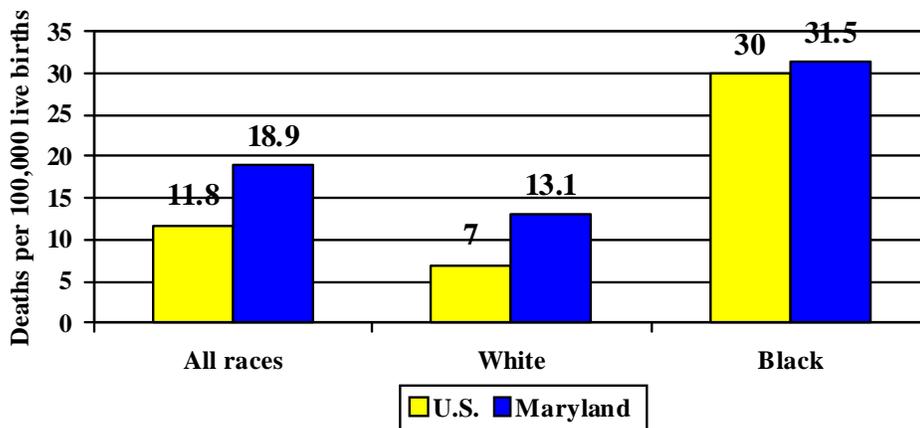
Maternal mortality is complicated by the use of various definitions. A **maternal death** is defined by the World Health Organization's (WHO) International Classification of Diseases Ninth Revision (ICD-9) and Tenth Revision (ICD-10) to be "the death of a woman while pregnant or within 42 days of conclusion 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 is used by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) in calculating the maternal mortality ratio (MMR) in the United States. The MMR is defined as the number of maternal deaths per 100,000 live-births in the same time period. This ratio is utilized for national and international comparisons.

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 an enhanced surveillance definition as an approach to more accurately identify deaths among women in which pregnancy was a contributing factor. This collaboration also defined pregnancy-associated deaths. A **pregnancy-associated death** is "the death of a woman while pregnant or within one year or 365 days of pregnancy conclusion, regardless of the cause of death." A **pregnancy-related death** was further 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 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. An enhanced surveillance method is necessary to determine pregnancy-associated deaths and will be discussed below.

The NCHS uses strict criteria to define deaths included in the MMR based upon information from the death certificates alone. Enhanced surveillance using multiple sources including case review will identify additional cases at the State level, which meet the WHO definition. It is expected that as Maryland and other states enhance surveillance, the MMR will increase by this improved identification process.

The Healthy People 2010 MMR target is 3.3 deaths per 100,000 live births, the same goal as Healthy People 2000, which was not met. Nationally, maternal mortality has declined dramatically since the 1930s when the MMR was 670 maternal deaths per 100,000 live births. The MMR achieved its lowest levels in the early 1980s. However, the MMR rose in the 1990s. The national MMR for 2001-2005 was 11.8 maternal deaths per 100,000 live births. For the same period, Maryland's MMR was 18.9. A five-year average ratio is used because maternal deaths are relatively infrequent events that may vary considerably year-to-year, particularly in a small state like Maryland. Figure 1. below provides a comparison between the maternal mortality ratio for the U.S. and Maryland by race.

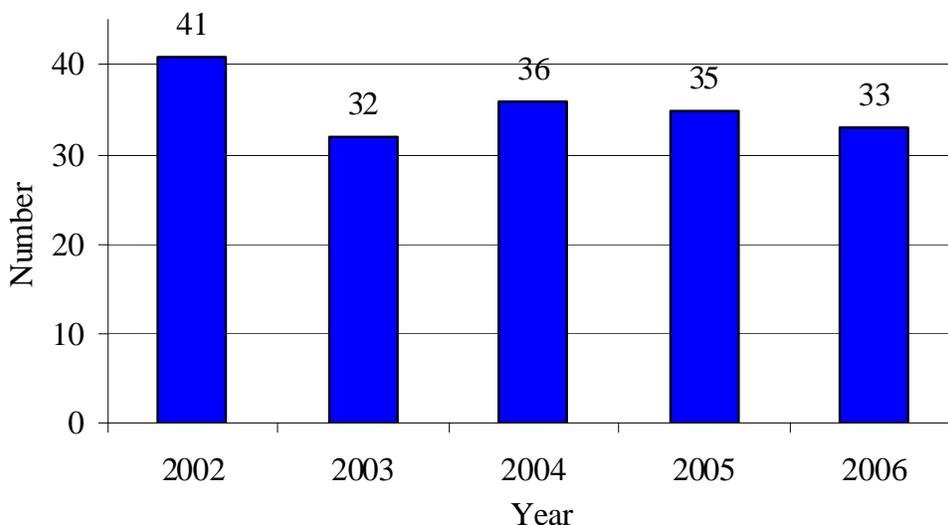
**Figure 1. Maternal Mortality Ratio by Race
U.S. and Maryland 2001-2005**



For 2005, the U.S. maternal mortality rate was 15.1 deaths per 100,000 live births. The national rate was 13 in 2004 and 12 in 2003, which was also the first year the maternal death rate was more than 10 since 1977.

In the U.S., black women have an MMR more than four times greater than that for white women, a disparity that has persisted since the 1940s. For Maryland, the MMR for black women is over twice the MMR for white women, and is slightly higher than the U.S. average while that for white women is nearly double the national average.

**Figure 2. Pregnancy-Associated Deaths
Maryland, 2002-2006**



In Maryland, the number of pregnancy-associated deaths, tracked by the Maternal Mortality Review Program between 2002 and 2006, demonstrates an average of 35 deaths per year.

III. Maternal Mortality Review Process in Maryland

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 jurisdictions 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 jurisdictions. These deaths account for a maximum of two to four per year or approximately 10-15 % of the total pregnancy-associated deaths.

Pregnancy-associated deaths are identified in one of two ways in Maryland. Individual death certificates are the first method of identifying pregnancy-associated deaths through the use of the checkbox questions or because the cause of death is clearly related to pregnancy, such as ruptured ectopic pregnancy. The Maryland death certificate was revised in January 2001 to include questions about pregnancy status and date of delivery for the 12 months preceding death. Maryland is one of at least 18 states that include questions specifically designed to improve identification of maternal deaths on the death certificate. The pregnancy checkbox has significantly increased identification of pregnancy-associated deaths from those recognized by cause of death alone. In a 2005 article in the American Journal of Public Health, Dr. Isabelle Horon of the Department reported that only 62% of Maryland maternal deaths in the years 1993-2000 were identified by cause-of-death information alone. One would expect even fewer pregnancy-associated deaths to be identified in this manner. The second method of determining

cases 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 by examining death certificates alone. All deaths occurring within 365 days of pregnancy conclusion were subsequently designated as pregnancy-associated and further investigated. Using these two methods, 33 pregnancy-associated deaths were identified in 2006. The purpose of this report is to summarize the reviews of these 33 deaths.

Case Review

Pregnancy-associated deaths for 2006 underwent several stages of review under the auspices of the MedChi MCH Committee. Once cases were identified, medical records were obtained from the hospitals of death and delivery when applicable. A physician consultant reviewed death certificates, hospital records and OCME (Office of the Chief Medical Examiner) records for all cases. A small group reviewed the data on all deaths from 2006.

The MedChi Maternal Mortality Workgroup is a subcommittee of the MCH Committee. The Workgroup conducted an in-depth discussion of selected cases to determine pregnancy-relatedness and to identify opportunities for prevention. The MedChi Maternal Mortality Workgroup includes individuals from general obstetric, perinatology, family practice, pediatric and nurse-midwifery specialties. The Workgroup's discussion followed the CDC framework for case review outlined in "Strategies to Reduce Pregnancy-Related Deaths: From Identification to Action." This approach took into account medical and non-medical factors contributing to maternal death, and examined quality and content of medical care.

Non-medical or social causes underlying the death include factors such as:

- Intendedness of pregnancy
- Woman's and her family's knowledge about pregnancy
- Timeliness on the part of the woman in recognizing a problem
- Accessibility and acceptability of health care
- Cultural competence and communication skills of health care providers
- Woman's adherence or non-adherence to medical advice and health interventions

Quality and content of medical care includes factors such as:

- 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
- Treatment and management
- Diagnostic procedures
- Medical interventions
- Patient education and follow-up

Cases discussed by the Maternal Mortality Workgroup are de-identified and members sign confidentiality statements. The Maternal Mortality Policy Subcommittee meets to review system issues identified through case reviews and to develop recommendations. This Subcommittee includes representation from managed care, nursing, and social work in addition to the Maternal Mortality Workgroup members. All those involved in any phase of the case review process were included in a final review of systems issues and recommendations under the auspices of the MCH Committee.

IV. Case Findings in Maryland

The data for this report are from 2006. There were 33 pregnancy-associated deaths identified for 2006. In 2005, case reviews were conducted on the 35 pregnancy-associated deaths that occurred that year.

Cause of Death Classification

Of the 33 pregnancy-associated deaths, approximately 46% were due to medical causes, 36% were due to non-medical causes, and 18% were undetermined. Among the 2006 pregnancy-associated deaths, the leading causes identified were homicide, cardiovascular disease, and substance abuse. Figure 3 shows the percentage distribution by manner of death, and Figure 4 shows the leading causes of death for both medical and non-medical causes among pregnancy-associated deaths occurring in 2006.

Figure 3. Percentage Distribution by Manner of Death for Pregnancy-Associated Deaths, Maryland, 2006 (n=33)

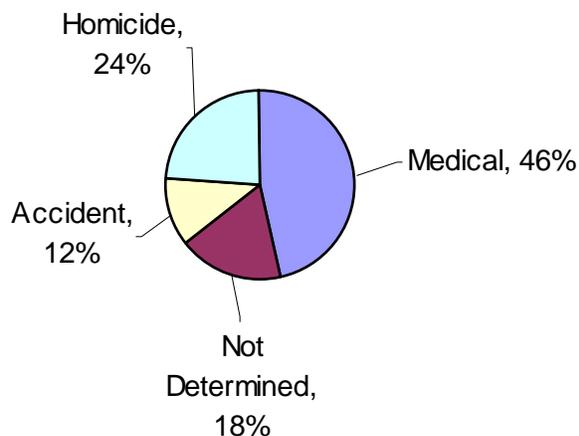
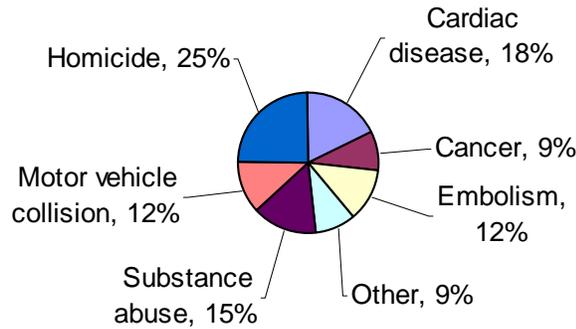


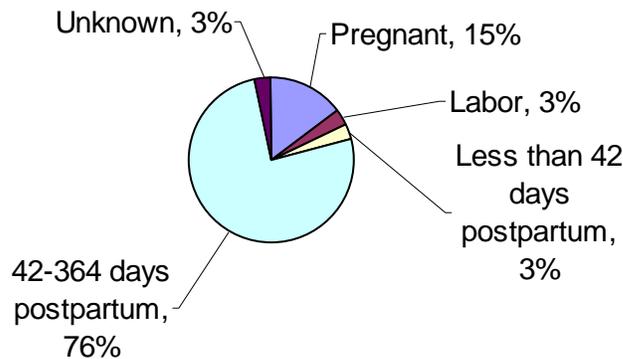
Figure 4. Percentage Distribution by Category of Death for Pregnancy-Associated Deaths, Maryland, 2006 (n=33)



Cases by Timing of Death

Of the 33 pregnancy associated deaths, 75 percent occurred after 42 or more days (six weeks) postpartum and 15 percent were among women who died while pregnant. The remaining nine percent of deaths were equally distributed (one death in each category) during the intrapartum period, within 6 weeks postpartum, and unknown. Figure 5 shows the distribution by timing of death.

Figure 5. Percentage Distribution by Timing of Death for Pregnancy-Associated Deaths, Maryland, 2006 (n=33)



Cases by Maternal Race and Ethnicity

Racial disparity in mortality is a persistent concern. Among the 33 pregnancy-associated deaths, 51.5 percent occurred among non-Hispanic black women (including one foreign-born), 39.4 percent among non-Hispanic white women, and 9.0 percent among Hispanic and Latina women. As an approximate comparison, the 2006 births in Maryland were distributed as follows: 32.9 percent among non-Hispanic black women, 47.6 percent among non-Hispanic white women, 13.0 percent among Hispanic women, and 6.3 percent among Asian and Native American women.

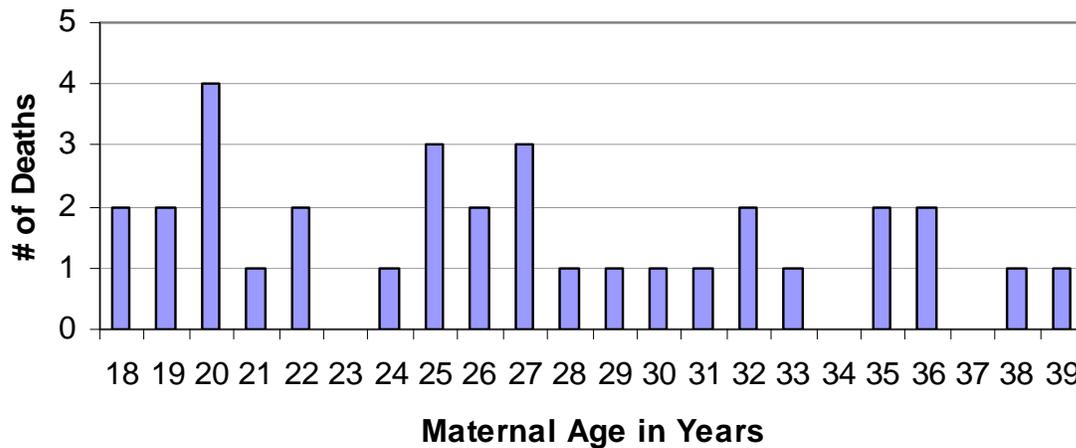
Table 1. Racial and Ethnic Distributions of Pregnancy-Associated Deaths and Live Births, Maryland 2006

Racial/ Ethnic Category	Percentage of Total Pregnancy-Associated Deaths	Percentage of Total 2006 Births
White	39.4	47.6
Black	51.5	32.9
Hispanic/Latina	9.0	13.0
Other	0.0	6.3

Cases by Maternal Age

The ages of the decedents ranged from 18 to 39 years as shown in the figure below.

Figure 6. Age Distribution of Pregnancy-Associated Deaths, Maryland, 2006 (n=33)



V. Recommendations

Problem: Approximately 15% of the 33 pregnancy-associated mortality were directly related to substance abuse.

Recommendation #1: The MCH Committee found that there is a need for increased stakeholder awareness about substance abuse as a risk factor for pregnancy-associated deaths in Maryland. Significant issues among these cases include lack of prenatal care, lack of programs/services to manage substance abuse in pregnancy, co-morbid conditions, poly-substance use, fear of Child Protective Services action if identified as a substance user, and delayed care due to fears and lack of access to care. All of the women who died as a result of substance abuse were more than 42 days postpartum and the types of substances abused and causes of death included methadone intoxication, narcotic intoxication and cerebrovascular accident (following endocarditis and severe thromboembolic disease).

These findings should be disseminated to stakeholders, including providers, hospitals, managed care organizations (MCOs), medical specialty and related societies, and the Maryland Hospital Association. There should be the development and implementation of programs in which addiction specialists are key partners in prenatal and postnatal care (both for outpatient and inpatient care) with medical providers. These programs should consider inclusion of the following: (1) readily available on-site addiction specialists; (2) coordination of prenatal care and addiction care; (3) assistance with transportation, housing and child care for individuals in need of such services; and (4) availability of addiction specialists and coordinated care for all women of reproductive age. Furthermore, policies and funding allocations throughout the State should support the needs for pregnant and postpartum women to receive obstetric care that includes addiction-related services. An example would be funding allocated to outpatient facilities that are staffed and equipped for obstetric and postpartum patients with substance abuse problems.

Problem: Among the 33 total pregnancy-associated deaths for 2006, homicide made up 24.2% of all cases.

Recommendation #2: Because of the lack of pregnancy information for the majority of the homicide victims, it is critical that procedures be developed to gather information on homicide victims. For the 2006 pregnancy-associated deaths, eight were homicides. Of these eight, five occurred during the postpartum period and three during pregnancy. Seven of the eight deaths occurred as a result of gunshot wounds. Only two of these deaths were found to have documentation of the hospital of delivery and/or prenatal records available for review, making it difficult to identify and report on any potential areas for prevention in these deaths.

The MCH Committee also recommends that representatives of the criminal justice system and social services should be engaged in the discussion of pregnancy-associated homicide cases in order to identify ways in which these deaths may have been prevented. In addition, dissemination of the findings and recommendations of this report to key stakeholders will facilitate a more comprehensive approach in addressing this problem.

Problem: Cardiac causes made up 18% of the pregnancy-associated deaths in 2006, an increase from 2004 and 2005.

Recommendation #3: Because of the heterogeneous nature of these deaths, the MCH Committee could not agree to a consensus recommendation. While the absolute number of cases was six, this was an increase from the 2004 and 2005 reports. Although the Committee determined that it was unlikely that any of the cardiac-related deaths were preventable, these deaths did represent the second largest number of deaths in terms of category. As such, the Committee did agree that it is critical that key stakeholders (e.g., hospitals, medical societies, MCOs) are aware of this finding for 2006. Furthermore, it is important to identify ways to share these findings with obstetric, cardiology and primary care providers and implement communication between these providers in the care of these higher-risk patients. Patients with cardiac conditions need to be linked back to pre-pregnant care as soon as possible.

Problem: Obesity and overweight may be major contributors to pregnancy-associated deaths.

In 2006, 21% of the 33 pregnancy-associated deaths were obese and 39% were overweight. The understanding of this issue is limited by poor documentation of height and weight on both prenatal and inpatient charts, and lack of abstraction of these data for deaths in past years. Most of the height and weight measurements were obtained from OCME records as many charts did not contain these data. Once more complete height, weight, and BMI data are available, the impact of this problem may be better understood.

Recommendation #4: Improvements in the documentation of height and weight during both pre-pregnancy and at the time of admission is needed. Improvements in documentation should be achieved through communication with obstetric providers and making it a requirement to include this information for all inpatient admissions and in the records for deceased women.

Problem: Lack of rapid access to prenatal charts or incomplete charts for inpatient care may result in inadequate knowledge about patients' histories, potentially leading to suboptimal labor and delivery care.

Recommendation #5: A recurring theme in many of the 2006 deaths was that charts were incomplete or had poor documentation. Further, prenatal charts missing from inpatient records make chart review for the Maternal Mortality Review or other quality assurance programs a challenge. An immediate action item is to investigate the feasibility of instituting centralized laboratory reporting and electronic medical record systems. This may require advocacy and legislation but should be a priority for the State.

VI. Maternal Mortality Review Related Activities

The Maryland Patient Safety Center Perinatal Collaborative

The Maryland Patient Safety Center Perinatal Collaborative began in February 2007. The MPSC is a collaboration between the Delmarva Foundation and the Maryland Hospital Association. The

Perinatal Collaborative brought together 26 of the 33 hospitals that provide obstetrical services to Maryland residents. Teams from each hospital's labor and delivery units participated in learning sessions to facilitate communication, patient care and treatment protocols, the use of simulated patient emergencies, and electronic fetal monitoring. Team members were able to share experiences and practice methods via a Web-based electronic portal. The Perinatal Collaborative efforts are viewed through the lens of improving communication with the goal of reducing preventable adverse outcomes to zero in these hospitals and thus improving patient safety throughout the State. Approximately 75 percent of all Maryland births occur in the 25 participating hospitals. Participating hospitals are as follows:

1. Anne Arundel Medical Center
2. Calvert Memorial Hospital
3. Carroll Hospital Center
4. Civista Medical Center
5. Franklin Square Hospital
6. Frederick Memorial Hospital
7. Georgetown University Hospital
8. Harbor Hospital Center
9. Holy Cross Hospital of Silver Spring
10. Howard County General Hospital
11. Laurel Regional Hospital
12. Maryland General Hospital
13. Mercy Medical Center
14. Montgomery General Hospital
15. Peninsula Regional Medical Center
16. Prince George's Hospital Center
17. Shady Grove Adventist Hospital
18. Sinai Hospital of Baltimore
19. Southern Maryland Hospital Center
20. St. Agnes Hospital
21. St Mary's Hospital
22. Upper Chesapeake Medical Center
23. Washington Adventist Hospital
24. Washington County Hospital
25. Western MD Health Systems Cumberland Memorial

The University of Maryland Maryland Advanced Systems and Services (MAPSS).

The University of Maryland School of Medicine, in collaboration with Johns Hopkins, have established the Maryland Advanced Perinatal Systems Services (MAPSS) Program. The program is lead by Hugh E. Mighty, MD, FACOG, Chairman Department of Obstetrics, Gynecology & Reproductive Sciences at the University of Maryland. MAPSS provides high-risk perinatal consultation to community physicians for the management of complications associated with poor pregnancy outcomes including maternal death. The MAPSS uses telemedicine to provide high-risk perinatal consultation to local health care providers in under-served communities, while Johns Hopkins perinatal consultation is offered on-site upon request from local physicians. These high-risk obstetrics services help to address the shortage of obstetrical providers throughout the State as well increase the capacity of providers to manage complications of pregnancy at the community level. This enables women to have access to

specialized consultative services while remaining in their local communities. Both University of Maryland and Johns Hopkins University have served in an advisory capacity to the Maryland Patient Safety Center Perinatal Collaborative.

Local Domestic Violence Fatality Review Teams (DVFRT)

As of 2008, Baltimore City and 15 other Maryland counties have organized domestic violence fatality review teams. Each multi-disciplinary team may consist of representatives from various organizations in a county, including domestic violence agencies, the State's attorney's office, law enforcement, hospitals, the local health department, parole and probation, the district court, as well as other knowledgeable individuals, which may include a survivor of domestic violence. Diana Cheng, M.D., Medical Director of Women's Health for the Department, is a member of the Baltimore City DVFRT, where the majority of cases occur. Due to the relatively high prevalence of homicide as a cause of death during the perinatal period, she has reviewed past obstetrical medical records of female cases that are presented before the MCH Committee. The inclusion of perinatal health history has become a vital part of case reviews.

Maryland Maternal Depression

The Department collaborated with University of Texas on the prevalence of perinatal depression in the Hispanic community. This resulted in an article, currently in press, for the Maternal and Child Health Journal entitled "Acculturation and Depressive Symptoms among Pregnant and Postpartum Latinas" by Marivel Davila, Stephanie McFall and Dr. Diana Cheng.

The Department also conducted an analysis of Maryland PRAMS data looking at the impact of depression on maternal and child health. This resulted in publication of an abstract entitled "Association of Postpartum Depression with Maternal Behaviors and Parenting Routines" by Diana Cheng, M.D. and Isabelle Horon, Dr.P.H. in the April 2008 issue of *Obstetrics and Gynecology* and a poster presentation at the annual 2008 Clinical Meeting of ACOG.

Prenatal Counseling

Inadequate documentation of counseling provided to prenatal patients was noted in the last MMR report. This was confirmed in the Maryland PRAMS analysis, "Focus on Quality of Prenatal Care" (October 2007). Although new mothers reported adequate prenatal counseling on medical factors such as birth defects, use of medications, and preterm labor, 30-40% of women reported that they did not receive counseling about alcohol use, cigarette smoking, or illegal drugs, and over 50% did not receive counseling about seatbelt use or partner violence.

The Maryland PRAMS "Focus on HIV Counseling and Testing during Pregnancy" (June 2008) revealed good counseling rates (83%) for HIV testing; however, approximately 25% of mothers who were White, married, privately insured and college graduates did not receive counseling about HIV.

Preconception Health

The goal of a pilot women's health integration project in the Baltimore County Title X Family Planning Program (funded by the Health Resources and Services Administration's Maternal and Child Health Bureau in 2001-2005) was to improve women's health, particularly preconception health, for those who have difficult access to health care. Despite the conclusion of the grant and resultant loss of funding, many women's health services continue. Dr. Cheng was invited to speak about this project at the University of North Carolina School of Public Health in May 2008. She also spoke at the Annual CityMatch Conference in Albuquerque in September 2008 about the smoking cessation component of this program.

Women's Health Report

The Department issued the Women's Health Report in September 2008. This report includes current data on women's health factor in Maryland. There is a separate section on perinatal health, and perinatal data are included for comparison in all women's general health data.

Substance Abuse

The Department's Pregnancy Risk Assessment Monitoring System (PRAMS) released several data briefs related to alcohol and cigarette smoking. The reports are as follows:

- 1) "Alcohol Use During Pregnancy: Prevalence and Provider Counseling" by Dr. Diana Cheng, Kelechi Uduhiri, and Dr. Isabelle Horon. This abstract was published in April 2008 *Obstetrics and Gynecology* and was part of poster presentation for the annual ACOG meeting, May 2008.
- 2) "Light and Heavy Smoking During Pregnancy: Prevalence and Associations with Perinatal Risk Factors and Birth Outcomes, Maryland, 2001-2006" by Lee Hurt and Dr. Diana Cheng. This abstract was selected for poster presentation at the annual American Public Health Association meeting in San Diego, September 2008.
- 3) "Cigarette Smoking and its Association with Postpartum Depression" by Dr. Diana Cheng and Lee Hurt. This abstract was selected for poster presentation at the annual PRAMS meeting in Atlanta, December 2008.

VII. Summary

Maryland continues to experience high maternal mortality compared to the U.S. average and the Healthy People 2010 goal of 3.3 deaths per 100,000 live births. The use of multiple sources for identifying pregnancy-associated deaths has resulted in a more complete detection of cases. Thirty-three pregnancy-associated deaths were reviewed for 2006. Information identified in the maternal mortality review process will continue to be incorporated into activities throughout the State by members of the Department, MedChi, and their perinatal partners in an effort to eliminate preventable maternal deaths.

VIII. Acknowledgements

The review of deaths would not be possible without the data, cooperation, and expertise of the Department's Vital Statistics Administration and the OCME. The Maternal Mortality Review Program would like to offer special thanks to the volunteer members of MedChi's MCH Committee and those who join in the Maternal Mortality Policy Subcommittee for the many hours and serious attention given to this important public health project. The Program is also grateful for the diligent work of Catherine Witkop, MD, MPH, physician consultant, for her careful and thorough abstraction and presentation of the cases.