

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

Maternal Mortality Review Program

2007 ANNUAL REPORT

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I. Introduction

During the 2000 Maryland General Assembly, 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 (the Department) conducts maternal mortality review in consultation with MedChi, the Maryland State Medical Society. Funding has been made available to MedChi from the Department's Center for Maternal and Child Health since June 2001 to investigate pregnancy-associated deaths in Maryland and identify opportunities for reduced maternal mortality. MedChi's Maternal and Child Health Committee provides consultation regarding maternal mortality review activities, conducts case reviews, and develops recommendations for the Department.

II. National and State Data

Defining 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.

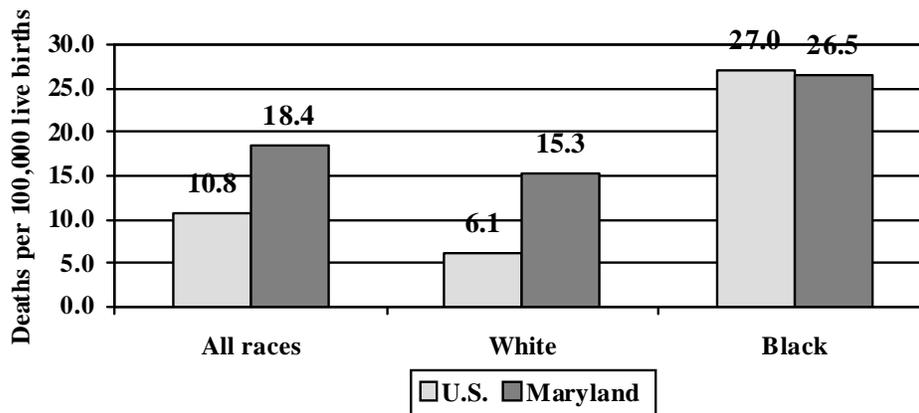
In 1986, the Centers for Disease Control and Prevention (CDC) and the American College of Obstetricians and Gynecologists (ACOG) collaborated to issue a statement recommending the use of an enhanced surveillance definition and approach to more accurately identify deaths among women in which pregnancy was a contributing factor. This group also defined a pregnancy-associated death as 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 National Center for Health Statistics 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 2000-2004 was 10.8 maternal deaths per 100,000 live births. At least part of the increase is attributed to increased ascertainment of maternal deaths. The most recent year for which national maternal death data is currently available is 2004. A five-year average ratio is used because these relatively infrequent events may vary considerably year-to-year, particularly in a small state like Maryland.

**Figure 1. Maternal Mortality Ratio by Race
U.S. and Maryland 2000-2004**

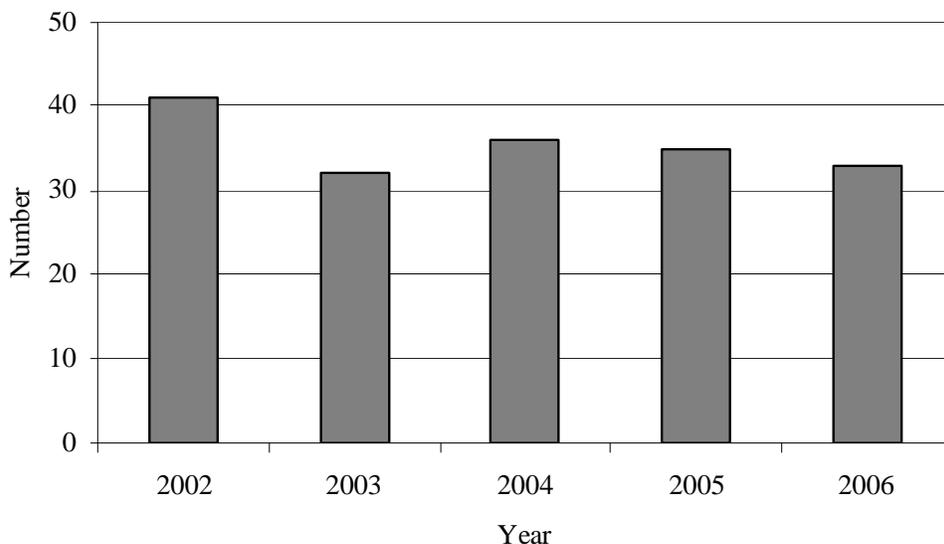


Like the national MMR, the Maryland MMR has also shown no improvement in recent years. For 2000-2004, the average Maryland MMR was 18.4 per 100,000 live births, higher than the MMR for the United States, and substantially higher than the Healthy People 2010 goal of 3.3 per 100,000 live births. For 2004, the U.S. maternal mortality rate was 13 deaths per 100,000 live births. The national rate was 12 deaths per 100,000 live births 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. The U.S. MMR for black women was 27 maternal deaths per 100,000 live births while the MMR for white women was 6.1 per 100,000 live births over the period 2000-2004. In the same period, Maryland's MMR averaged 26.5 per 100,000 live births for black women compared to 15.3 among white women. The difference between black and white women is much smaller in Maryland because black women have a lower mortality rate

than the U.S. average and white women have nearly double the rate of death than the U.S. population overall.

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



In Maryland, the number of pregnancy-associated deaths, tracked by the Maternal Mortality Review Program, demonstrates an average of 35 deaths per year over the last five years.

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 percent of the total pregnancy-associated deaths. This is similar to previous years.

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 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 includes 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 2005, Dr. Isabelle Horon of the Department's Vital Statistics

Administration published an article in the American Journal of Public Health, which reported that only 62 percent of maternal deaths in the years 1993-2000 were identified by cause-of-death information alone. The second method of determining cases comes from linking death certificates for women aged 10-50 years to birth certificates and fetal death certificates to identify additional cases that were not found by examining death certificates alone. Thirdly, cases were identified through a manual review of files from deaths reported to the Office of the Chief Medical Examiner (OCME), also looking for evidence of pregnancy in deceased women. All deaths occurring within 365 days of pregnancy conclusion were subsequently designated as pregnancy-associated and further investigated. By the use of these three methods, 35 pregnancy-associated deaths were identified in 2005 for Maryland. The purpose of this report is to summarize the reviews of these 35 deaths.

Case Review

Pregnancy-associated deaths for 2005 underwent several stages of review by the MedChi Maternal and Child Health Committee (MCH Committee). Once cases were identified, medical records were obtained from the hospitals of death and delivery, as well as prenatal care sites and other known sites of medical care when applicable. A physician consultant specializing in obstetrics and gynecology reviewed death certificates, medical records and OCME records for all deaths.

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 level of 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 Workgroup were de-identified and members signed confidentiality statements. A special meeting of the MCH Committee was convened to review key findings and to develop recommendations. Participants included representation from managed care, nursing, and social work in addition to the MedChi Maternal Mortality Workgroup and MCH Committee members. All those involved in any phase of the case review process were included in a final review of systems issues and recommendations.

IV. Case Findings in Maryland

The most recent data are for 2005 deaths. There were 35 pregnancy-associated cases identified for 2005. This is similar to 2004 for which 36 pregnancy-associated deaths were identified.

Cause of Death Classifications

Approximately two-thirds of the pregnancy-associated deaths were due to medical or natural causes and one-third were due to non-medical causes. The leading causes of 2005 pregnancy-associated deaths were due to vehicle or motorcycle collision or injury, cardiovascular disease, substance abuse, and infection. Figure 3 shows the distribution by manner of death, and Figure 4 shows the leading causes of death for both medical (natural) and non-medical causes among the pregnancy-associated deaths occurring in 2005. In Figure 4, “other medical” diagnosis were as follows: asthma; pneumonia; endocarditis; cardiovascular; diabetes; sickle cell; sarcoidosis; acute obstructive hydrocephalus; congenital Chiari malformation; Bowel ischemia with necrotic bowel; and subdural hemorrhage with complications (listed as natural because there was no injury workup).

Figure 3. Percentage Distribution of Pregnancy-associated Deaths by Manner of Death, Maryland, 2005

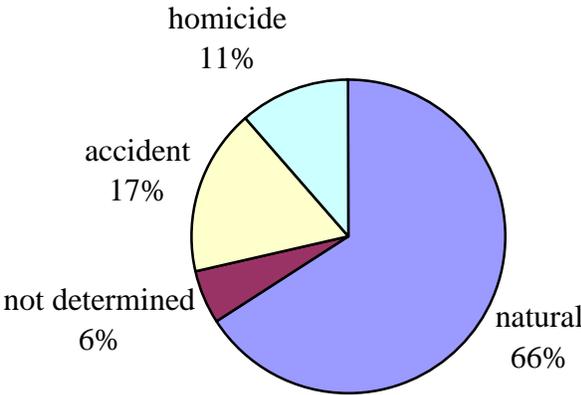
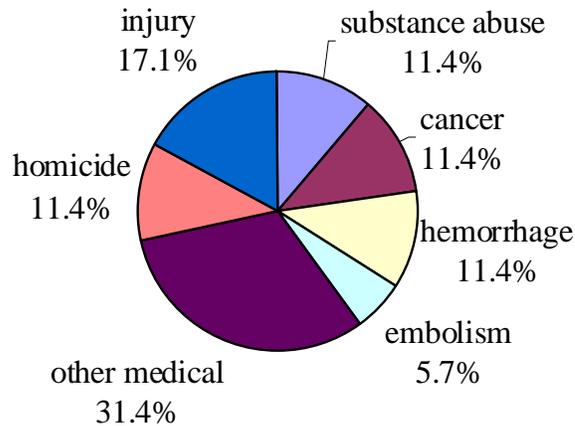


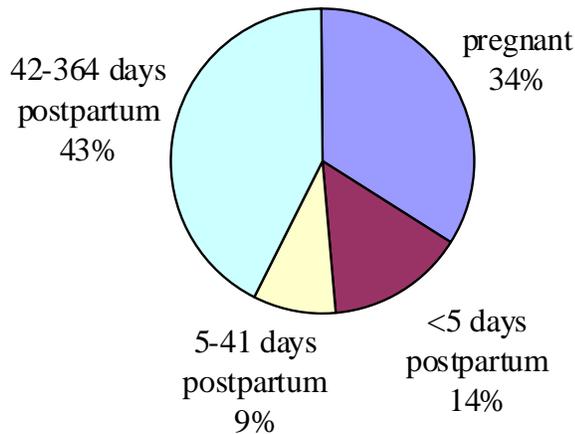
Figure 4. Percentage Distribution by Category of Death, 2005
Pregnancy-associated Deaths, Maryland



Cases by Timing of Death

The majority of the pregnancy-associated deaths occurred 42 or more days (six weeks) postpartum. Approximately 20 percent occurred within the first six weeks postpartum, and 34 percent were among women who died while pregnant.

Figure 5. Percentage Distribution by Timing of Death,
2005 Pregnancy-associated Deaths, Maryland



Cases by Maternal Race and Ethnicity

Racial disparity in mortality is a persistent concern. Among the 35 pregnancy-associated deaths, 60 percent occurred among black women (43 percent American-born and 17 percent foreign-born), 34 percent among white women, and six percent among other foreign-born women. As an approximate comparison, the 2005 births in Maryland were distributed as follows: 49 percent among non-Hispanic white women, 33 percent among black women, and 18 percent among Hispanic and Asian women.

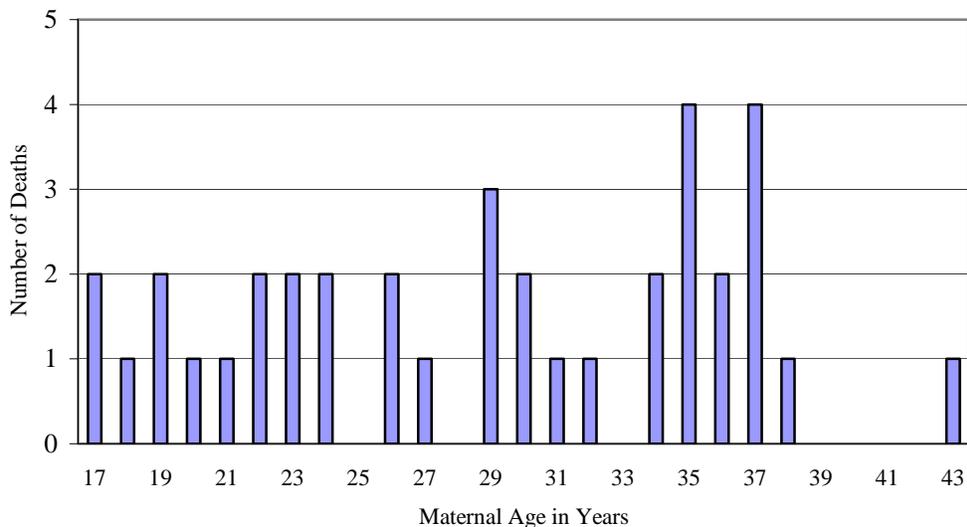
Table 1. Racial and ethnic distributions of pregnancy-associated deaths and births, Maryland 2005

Racial/ Ethnic Category	Percentage of Total 2005 Pregnancy-associated Deaths	Percentage of Total 2005 Births
Non-Hispanic white	34.3	49.3
Black	42.9	32.6
Black foreign-born	17.1	-----
Other (includes Hispanic and Asian)	5.7	17.9

Cases by Maternal Age

The ages of the decedents ranged from 17 to 43 years as shown in the figure below.

Figure 6. Age Distribution of Pregnancy-associated Deaths, Maryland, 2005



V. Recommendations

Problem: Over 10 percent of maternal mortality was directly related to substance abuse.

Recommendation #1: An effort should be made to increase the identification of these patients through a multidisciplinary, multiagency approach. Significant issues facing these patients include lack of prenatal care, lack of programs and services to manage substance abuse in pregnancy, co-morbid conditions, polysubstance use, and fear of Child Protective Services agency action if identified as a substance user while pregnant. Early identification pregnancy testing should be required in all hospital emergency departments and drug treatment facilities for women of reproductive years. This should also include a mechanism for follow-up requiring documentation of prenatal care. For all pregnant women in substance abuse programs, a referral should be made and case management services initiated if it is determined that the woman is not receiving prenatal care. A mechanism for Healthy Start and Healthcare for the Homeless to provide referrals for patients who admit to substance abuse should be established. Follow-up is more likely to occur if broad-based strategies are implemented. Examples of such strategies include the development of Statewide “Substance Abuse Teams” modeled after rape crisis teams, in partnership with Child Protective Services, since they already have addiction specialists on staff, and the development of in-house hospital teams, including addiction specialists, for follow-up of pregnant women. For these recommendations to be actualized, the findings of this report need to be shared with providers, administrators, substance abuse programs, and Child Protective Services.

Problem: Lack of recognition and delayed management of intra- and postpartum hemorrhage.

Recommendation #2: Training in the area of maternal hemorrhage is needed to prevent complications such as profound blood loss that can possibly lead to diffuse intravascular coagulation (DIC) and death of the patient and/or infant. Health care facilities should provide ongoing and updated education for providers focusing on recognition and management of intra- and postpartum hemorrhage, and reinforce such education with mandatory team training for hospital credentialing and re-credentialing. Given the resources already available in the State, existing continuing medical education programs can be utilized to provide scenarios and simulations to Maryland providers. A means of increasing participation in these trainings would be to provide the training through medial insurers or similar organizations. Accordingly, the findings and recommendations of this report should be shared with hospitals and managed care organizations as well as specialty societies, the Maryland Hospital Association, and other such organizations.

Problem: Lack of rapid access to prenatal charts or incomplete charts for inpatient care for patients with pre-existing medical conditions.

Recommendation #3: Lack of access to other medical records results in inadequate knowledge about a patient's history and any evaluation for medical conditions, potentially leading to suboptimal care. Furthermore, subsequent chart review for maternal and mortality review or other quality assurance procedures is made more difficult without access to all of the patient's charts.

Two possible solutions to this problem could be the development of a unified (centralized) laboratory reporting system throughout Maryland, and a universal electronic medical record system for all Maryland hospitals. The former is something that potentially could be implemented in the near future; the latter would likely take time but should be a goal for Maryland. An immediate action item is to investigate the feasibility of instituting centralized, unified laboratory reporting and electronic medical record systems. The MCH Committee recognizes that achieving both of these goals would be feasible only if all hospitals participated, all had hospital compatible electronic record systems, or at minimum had compatible electronic laboratory ordering and reporting systems. This would require advocacy and legislation but should be a priority item for the State.

Problem: Obesity and overweight may be major contributors to maternal mortality.

Recommendation #4: Height, weight, and BMI will be added to MedChi's data abstraction process for maternal mortality reviews. The understanding of how obesity relates to maternal death is limited by poor documentation of height and weight on both prenatal and inpatient charts and lack of abstraction of these data for maternal mortality reviews in the past. Obstetric providers should include this information in their documentation. The pre-pregnancy height and weight on prenatal charts should be required as should the documentation of height and weight on all inpatient admissions (including deceased women). Once data are available, the true impact of this problem can be determined. The MCH Committee suggests educating obstetric providers about the need for better height, weight, and BMI documentation by training and disseminating information through MedChi, ACOG, residency training programs, and hospitals' pre-existing quality improvement programs. The MCH Committee also recommends that the MMR annual legislative report be made available to the hospitals as this would assist in the dissemination of the Committee's findings and recommendations.

Problem: Utilization of emergency departments in place of routine prenatal care through an obstetrical provider.

Recommendation #5: Emergency department (ED) visits may result in inappropriate care if there is lack of recognition of pregnancy-related conditions or inappropriate management of such conditions, or if there is delayed follow-up with obstetric providers. Women are utilizing the ED as their source of care and often do not have a follow-up visit to an obstetric provider. Documentation of pregnancy status should be required for all ED care given to women of reproductive capacity. Although this is being done in many EDs, it should be mandatory for any ED care if such care is to be reimbursed. Furthermore, ED providers should document on ED charts whether the patient is receiving prenatal care and where the care is being provided, or provide a referral for prenatal care within the same hospital system if possible, as this assures follow-up. Furthermore, it is recommended that there be a renewed focus on educating ED providers regarding conditions in which pregnancy status affects management and outcomes.

Problem: Lack of a thorough evaluation of pregnant and postpartum women for evidence of intentional injury.

Recommendation #6: A thorough injury work-up for pregnant and postpartum women presenting to the ED, including consideration of possible intimate partner or domestic violence. Health care institutions should require ongoing education of ED and obstetric providers about injury workup and management. This could be in the form of grand rounds presentations, and other Continuing Medical Education (CME) and credentialing requirements.

Problem: Lack of coordination between primary care and obstetrical providers for women with concurrent medical illnesses.

Recommendation #7: A mechanism should be developed that would facilitate the sharing of medical records with other providers caring for the same patient concurrently. The most efficient way for this to occur is with universal electronic medical record system (see Recommendation #3). In the absence of such a system, copies of relevant progress notes can be placed in the prenatal record, or at a minimum, contact information for other providers should be included on the prenatal chart.

Problem: A follow-up visit at six weeks postpartum may be too late and postpartum discharge instructions may not be adequate for ideal care of women at high risk for postpartum complications.

Recommendation #8: Effective immediately, reviews of cases for MedChi's maternal mortality review will include this issue for discussion as currently the extent of this problem is unclear. If future reviews determine that appropriate postpartum follow-up appears to be a recurrent problem, recommendations will be made in the future that are likely to include education to providers concerning factors that may put certain patients at risk for postpartum mortality.

Problem: Inadequate documentation of counseling provided to patients about pregnancy complications.

Recommendation #9: Health care institutions should mandate obstetric providers to document that they follow standard obstetric guidelines for counseling. Efforts should be made to improve documentation in prenatal and other medical charts that such counseling has been provided to the patient and that the patient understands as this is key to demonstrating that adequate counseling took place in the context of a prenatal or ED visit.

VI. 2007 Activities of Maternal Mortality Review Program

Maryland Maternal Depression

Program initiatives that address depression during pregnancy and postpartum have resulted from the review of the pregnancy-associated suicides that occurred from 1993-2003. MedChi's Center for a Healthy Maryland received a \$25,000 grant from Aetna Foundation to continue the work of the Maryland Maternal Depression Team. The funding period was for calendar year

2007. Through this funding, MedChi intends to survey physicians regarding their practice in screening and treating women with maternal depression and knowledge of available resources. Maternal depression materials as well as the provider referral list which was been updated were distributed to about 150 providers around the State. In 2007, the Department's Diana Cheng, M.D., Medical Director, Women's Health, presented obstetrics and gynecology grand rounds on perinatal depression at three hospitals in Maryland, including University of Maryland, Upper Chesapeake, and GBMC. Dr. Cheng also presented on an AMCHP Webcast on perinatal depression with Laura Miller, M.D., a psychiatrist from the University of Illinois. This was part of a women's health educational series sponsored by the CDC. Dr. Cheng also presented a plenary session on perinatal depression to the Federal/State MCH Partnership meeting in Alexandria, VA in October 2007. This session focused on a new educational booklet, "Depression During and After Pregnancy: A Resource for Women, Their Families, and Friends" that Dr. Cheng consulted on.

Maryland Patient Safety Center Perinatal Collaborative

The Department's Babies Born Healthy Initiative supported the Maryland Patient Safety Center's (MPSC) Perinatal Collaborative. The Perinatal Collaborative began in February of 2007 and brings hospitals that provide obstetrical services together to establish standards of care that encourage patient safety related to issues such as cesarean section, electronic fetal monitoring, and augmentation of labor. The hospitals involved in the Collaborative have learned about existing protocols for inducing labor and conducting cesarean sections from colleagues at institutions within the State as well as across the country. The Perinatal Collaborative has informed and motivated hospitals to establish their own protocols. Additionally, many of the hospital teams participating in the Perinatal Collaborative are looking to enhance communication between the various providers interacting with patients within their labor and delivery units. Additionally, the Perinatal Collaborative is partnering with the National Perinatal Information Center (NPIC) for a pre-intervention and post-intervention data analysis with the Adverse Outcomes Index. Collecting these data will allow the hospitals to assess their own improvements, as well as compare themselves to their colleagues.

Local Domestic Violence Fatality Reviews in Maryland

The finding that homicide is one of the leading causes of pregnancy-associated deaths has helped increase interest in intimate partner violence in Maryland. The enactment of House Bill 741 (2005) enables Maryland counties to establish domestic violence fatality review teams. Dr. Cheng is a member of the Baltimore City team which was just established in 2006. Dr. Cheng's input has helped create a focus on deaths during the perinatal period. There is currently interest in the development of a tool kit in Baltimore for use by clinical personnel which will thoroughly document injuries from domestic violence.

Unintended Pregnancy

The Maryland PRAMS (Pregnancy Risk Assessment Monitoring System) Project analyzed survey data of new mothers and released a Focus Brief on Unintended Pregnancy in April 2007. Dr. Cheng presented "Unintended Pregnancy and Associated Perinatal Behaviors" at the September 2007 annual meeting of Association of Reproductive Health Professionals in Minneapolis. The abstract of this presentation was published in the August 2007 issue of *Contraception*.

Alcohol and Drug Abuse

The Department of Health and Mental Hygiene has several initiatives to reduce the burden of drug and alcohol use among pregnant women. All pregnant women are given priority for the Alcohol and Drug Abuse Administration's in-patient substance abuse treatment services, which serve approximately 1,500 women annually. Additionally, the Department supports Chrysalis House Healthy Start, a recovery home for pregnant women attempting to abstain from drugs and alcohol. Educational programs also are conducted to teach both women and health care providers about the negative effects of alcohol and other drugs on children. Specifically, the Center for Maternal and Child Health hosted the Maryland State Fetal Alcohol Spectrum Disorders (FASD) Conference in September 2007. The purpose of the conference was to provide education for the prevention of FASD, as well as increase awareness of the resources and interventions available for children and adults with FASD. A May 2007 Maryland PRAMS issue brief entitled "Focus on Alcohol Use during Pregnancy" analyzed alcohol consumption among mothers who delivered babies from 2001 to 2005. These results were presented at the FASD conference. Grand rounds also have been conducted to increase awareness of the importance of screening and referrals for drug abuse and treatment.

VII. Summary

The maternal mortality rate in Maryland continues to remain high in comparison to the U.S. average and the Healthy People 2010 goal of 3.3 deaths per 100,000 live births. The enhanced surveillance approach, which uses multiple sources for identifying pregnancy-associated deaths, has resulted in a more complete detection of cases in Maryland. There were 35 pregnancy-associated deaths reviewed for 2005. Information identified in the maternal mortality review process will continue to be incorporated into activities throughout the State by members of the Department, MedChi, hospitals, and their perinatal partners in an effort to eliminate preventable maternal deaths. Activities should focus on collaboration to improve access to prenatal care, and access or referral to substance abuse treatment and counseling services. Provider education and hospital initiatives will continue to contribute to improved patient safety (identification and management of intra- and postpartum hemorrhage, the impact of obesity and overweight on risk of maternal mortality, and the provision of health services to pregnant women). Other initiatives will include an effort to improve data sharing (laboratory test results) and access to medical records (primary care, ED, etc.) throughout a woman's pregnancy and into the postpartum period.