

**State of Maryland  
Maternal Mortality Review Program**

**2005**

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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 (the 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 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. Background**

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 maternal mortality ratio (MMR) in the United States. The MMR is defined as the number of maternal deaths (as above) per 100,000 live-births in the same time period. This ratio is utilized for national and international comparisons.

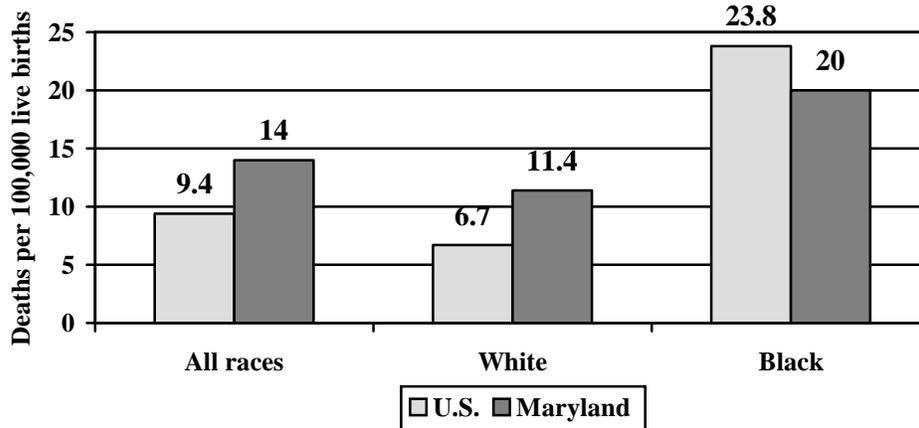
In 1986, the Centers for Disease Control and Prevention (CDC) and the American College of Obstetricians and Gynecologists (ACOG) collaborated to issue a statement recommending the use of an enhanced surveillance definition and approach to identify more accurately deaths among women in which pregnancy was a contributing factor. This group also defined a pregnancy-associated death as the death of a woman while pregnant or within 1 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 1 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 and including case review will identify additional cases at the state level, which

are believed to meet the WHO definition. It is expected that as Maryland and other states enhance surveillance the MMR will be influenced by this improved review 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 1998-2002 was 9.4 maternal deaths per 100,000 live births. At least part of the increase is attributed to increased ascertainment of maternal deaths. The most current year for which national maternal death data is currently available is 2002. 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.

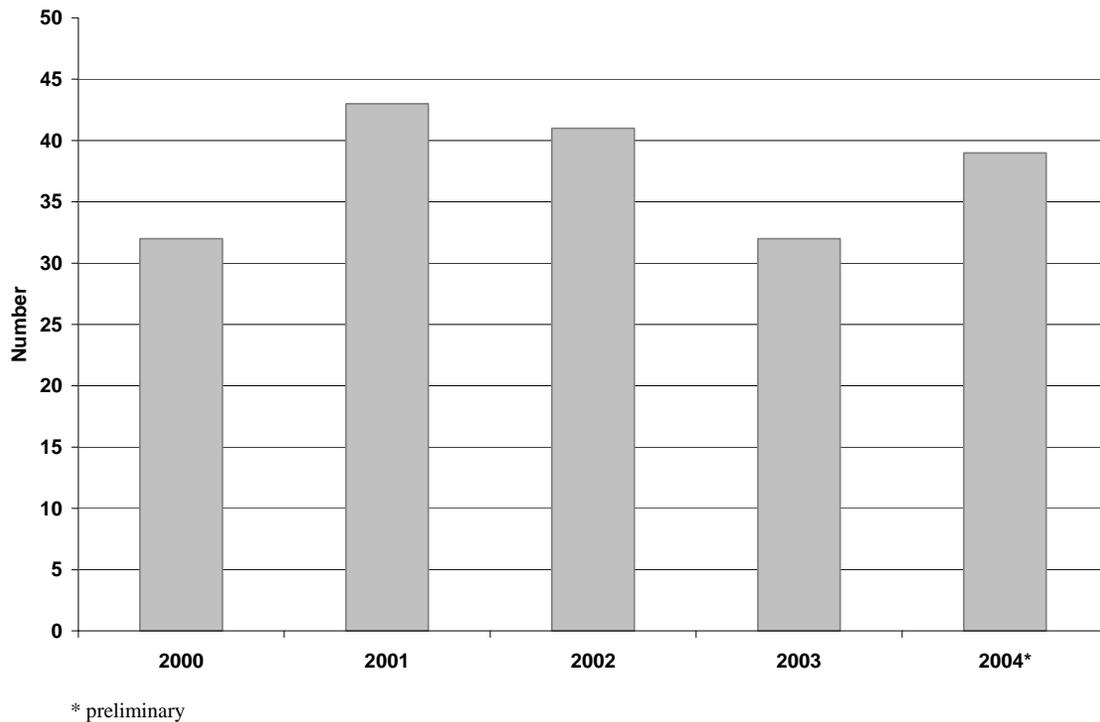
**Figure 1. Maternal Mortality Ratio by Race  
U.S. and Maryland 1998-2002**



Like the national MMR, the Maryland MMR has also shown no improvement in recent years. For 1998-2002, the average Maryland MMR was 14.0 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.

In the United States, black women have an MMR three to four times greater than that for white women, a disparity that has persisted since the 1940s. The US MMR for black women was 23.8 maternal deaths per 100,000 live births while the MMR for white women was 6.7 per 100,000 live births over the period 1998-2002. In the same period, Maryland's MMR averaged 20.0 per 100,000 live births for black women compared to 11.4 among white women. The difference between black and white women is smaller in Maryland because black women have a lower mortality than the US average and white women have a higher rate of death than in the United States overall.

Figure 2. Pregnancy-Associated Deaths, Maryland



In Maryland, the larger category of pregnancy-associated deaths, tracked by the Maternal Mortality Review Program, demonstrates an average of 37 deaths per year.

### III. Maternal Mortality Review Process in Maryland

#### Case Identification

Cases for review were 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.

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 jurisdictions 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. 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. Using these three methods, 32 pregnancy-associated deaths were identified in 2003. The purpose of this report is to review these 32 deaths.

### Case Review

Pregnancy-associated deaths for 2003 underwent several stages of review under the auspices of the MedChi Maternal and Child Health 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 records for all cases. The Maternal Mortality Workgroup selected 13 cases determined to be preventable or potentially preventable for detailed review. Pregnancy-relatedness and opportunities for prevention of cases were determined through discussion. The Workgroup includes general obstetric, perinatology, family practice, pediatric and nurse-midwifery specialties. The Workgroup met four times to discuss these cases and identified a range of health systems issues. 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 takes into account medical and non-medical factors contributing to maternal death and examines 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.

The Maternal Mortality Workgroup is a subcommittee of the MedChi Maternal and Child Health (MCH) Committee. Cases discussed by the Workgroup are de-identified and members signed confidentiality statements. A Maternal Mortality Policy Subcommittee met to review system issues identified through case review. This Subcommittee included representation from managed care, nursing and social work in addition to the Maternal Mortality Workgroup members. The Subcommittee met once to discuss health systems issues and develop recommendations. 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 Maternal and Child Health Committee.

## **IV. Case Findings in Maryland**

### Case Identification

There were 32 pregnancy-associated cases identified for 2003. Pregnancy-related deaths are a subset of pregnancy-associated deaths. Following a review of available information on all the deaths, 17 cases (53%) were pregnancy-related, 11 cases (34%) were not related to pregnancy, and in four cases (13%) pregnancy-relatedness could not be determined. The enhanced surveillance approach identified 13 percent of the deaths included in the review, of which none were determined to be pregnancy-related. A similar number of deaths have been identified for 2004. Case abstraction and review is under way for those deaths.

### Cause of Death Classification

Among the 32 pregnancy-associated deaths in 2003, cardiac disease was the leading cause of death (19%), followed by homicide (13%), then hemorrhage, embolism and substance abuse (9% each). The remainder of the deaths was due to multiple other causes. Among the 17 pregnancy-related deaths, the leading causes were cardiac disease (24%), followed by embolism and hemorrhage (18% each). The “cardiac disease” category includes cases of cardiomyopathy, hypertensive cardiac disease, coronary artery disease, coronary artery dissection and aortic aneurysm rupture and cardiac arrhythmia.

### Cases by Timing of Death

In 2003, among the pregnancy-associated deaths, 35 percent occurred while pregnant, six percent occurred during labor and 50 percent occurred postpartum. Among the pregnancy-related deaths, 41 percent occurred postpartum and 47 percent occurred while pregnant. Two deaths occurred during the intrapartum period, which includes the time from the onset of labor through the delivery of the placenta.

### Cases by Maternal Race and Ethnicity

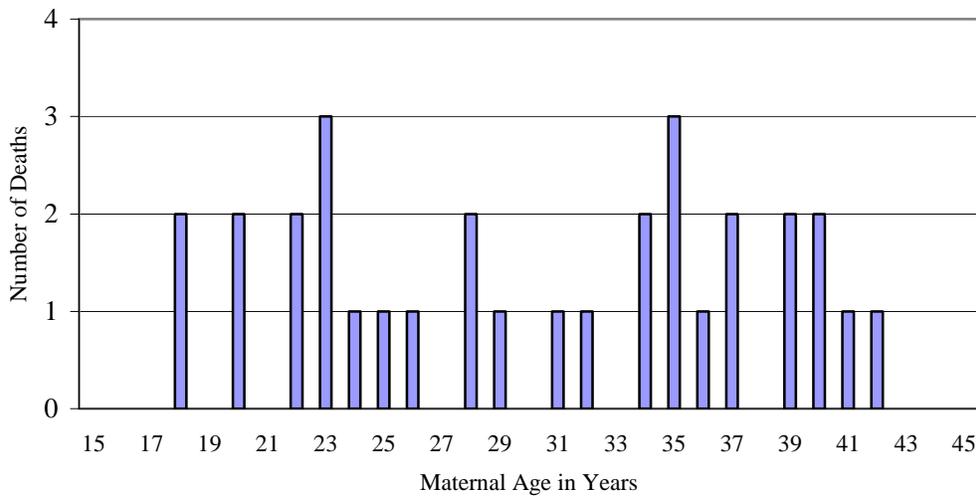
Racial disparity in mortality is a persistent concern. Among the 32 pregnancy-associated deaths, 59 percent occurred among African American women, 31 percent among non-Hispanic white women, and 6 percent among Hispanic women. Among the 17 pregnancy-related deaths, 53 percent occurred among African American women, 41 percent among non-Hispanic white women, and 6 percent among Hispanic women. As an approximate comparison, the 2003 births

in Maryland were distributed as follows: 32.4 percent among black women, 52.3 percent among non-Hispanic white women, and 9.3 percent among Hispanic women.

Cases by Maternal Age

The ages of the decedents ranged from 18 to 42 years as shown below. Thirty-five percent of pregnancy-associated deaths were among women aged 35 years and older, and 6 percent were among women less than 20 years of age. Among women who gave birth in 2003, 18.7 percent were 35 years of age and older, and 8.5 percent were less than less than 20 years old. Older mothers exhibit increased risk of death during and in the year after pregnancy.

**Figure 3. Age Distribution of Pregnancy Associated Deaths, Maryland, 2003**



Preventability

A case was classified as preventable if the death might have been avoided by a change in either patient behavior, provider practice, or institutional systems. Thirteen cases (38%) were considered to have opportunities for prevention and were selected for in-depth discussion by the Maternal Mortality Workgroup. Injury and drug-related deaths were included if missed opportunities for intervention were identified during interactions with the health care system. Of these 13 cases, three cases were determined to be preventable, six potentially preventable, and four undetermined by the Maternal Mortality Workgroup. It is recognized that the determination of preventability does not follow rigid criteria and that this determination is open to interpretation. These considerations make comparisons in different venues impossible.

All cases thought to be preventable or potentially preventable were discussed in detail during the Maternal Mortality Workgroup meetings in order to identify the various factors that contributed to that death. Interactions between several factors may contribute to a death, particularly among the most vulnerable women with an underlying medical condition or mental illness. Factors examined included: individual, health care provider(s), health care system, and policy. Many of

the issues and recommendations from previous years were also common in this year's review. Key findings were grouped as either process or health systems issues.

## **V. Findings and Recommendations**

### **A. Process Issues**

- Access to and completeness of medical records, both hospital and prenatal care, limit the case review effectiveness.

Recommendations:

Official request for hospital medical records should come from the Department.

Send letters from the Department to Obstetric Department Chairs and the Maryland Ob/Gyn Society regarding the maternal mortality review process and the importance of having complete records, including having the complete prenatal care records as part of the delivery record.

Send the Maternal Mortality Report from the Department to the Maryland Hospital Association and hospital chairs.

- There is no current mechanism for obtaining medical records for undelivered cases identified through a review of autopsy records at the Office of the Chief Medical Examiner.

Recommendation:

Investigate the feasibility of OCME investigators requesting information regarding encounters with the health and social services systems.

- Birth certificate and fetal death records were not available to the case reviewers.

Recommendation:

MCH should work with the Vital Statistics Administration to assure availability of necessary information.

- Providers lack knowledge of maternal mortality issues.

Recommendations:

Summarize cases from the four years of review for topic focused provider education.

Develop a speakers' bureau for topics related to maternal mortality.

### **B. Health Systems Issues:**

- Need for improved communication and teamwork among multi-disciplinary members of the patient care team.

Recommendations:

Utilize the patient safety approach to address process improvement not disciplinary outcome.

Identify approaches to improve communication and teamwork.

Prepare a cumulative summary of findings and present them with recommendations for best practice.

Review hospital policies on communication and teamwork.

- Non-obstetric providers may not be knowledgeable about the management of the pregnant patient. For example, patients who present to the Emergency Department may face delays in having their medical issue addressed when they are pregnant.

Recommendations:

Institutions should examine their own cases and establish protocols so that appropriate patient triage occurs through the Emergency Department or Labor and Delivery Ward and not the automatic admission to one or the other.

Hospitals should ensure that immediate consultation by an obstetrician is available for all pregnant women seen in the hospital.

### **C. Special Focus Issues: Thromboembolic Conditions**

- Lack of clear guidance for OB providers on prevention of thromboembolic events during prenatal and immediate postpartum period.

Recommendations:

Review and summarize cases for 2000-2003.

Develop practice guidelines from professional societies for hospitals to use, e.g., grand rounds, staff meetings. MedChi MCH obstetric committee members to report back on guidelines to be distributed by Committee.

## **VI. Activities of Maternal Mortality Review Program, 2005**

The maternal mortality review process for the State has been established and continues to evolve. This has been achieved through collaboration between the Department and MedChi and its Maternal and Child Health Committee and community partners. A format for case review has been created including a guide for data abstraction and case summarization as well as a process for development of recommendations for improvement based on case evaluation.

Dr. Isabelle Horon addressed the importance of multiple sources for identifying maternal deaths in “Underreporting of Maternal Deaths on Death Certificates and the Magnitude of the Problem of Maternal Mortality,” published in the American Journal of Public Health, March 2005. Staff

from the Center for Maternal and Child Health are working with the Maryland Hospital Association and the OCME to identify areas where case review may be enhanced through the availability of improved completion of records and linkage of information. The Center for Maternal and Child Health is developing a relationship with patient safety activities, the Office of Health Care Quality, DHMH, the Maryland Health Care Commission and the Maryland Hospital Association.

DHMH, MedChi and other partners have utilized the findings and recommendations of the Maternal Mortality Review Program to guide their work as well as to enhance the Program. Drs. Harold Fox and Hanan Aboumatar presented the results of review at the State Medical Convention in October 2005. Dr. Aboumatar and Ms. Meena Abraham also provided a poster presentation on the Maryland review process at the American Public Health Association meeting in Philadelphia in December 2005. Dr. Diana Cheng has presented Grand Rounds on maternal mortality at Dorchester General Hospital and Anne Arundel Medical Center under the auspices of the Domestic Violence Advisory Board.

Maternal depression continues to be a focus of MCH programs. Suicide is the final disastrous outcome of this condition. Diana Cheng, MD, Director of Women's Health, MCH, is working with the Mental Health Association of Maryland on a maternal depression grant and has lectured on depression in women and perinatal depression locally as well as at the national CityMatCH and SIDS and Infant Mortality meetings. In addition, MCH published "Women and Depression Across the Lifespan" in collaboration with the Depression and Related Affective Disorders Association (DRADA). This publication has also been translated into Spanish. A postpartum depression brochure has been translated into Spanish, Chinese, Vietnamese, Korean, Russian, and French, and is available on the MCH Website. Hospitals and others may request the brochures for their patients. Several thousand of the depression brochures are distributed each month. The brochures can be viewed at [www.fha.state.md.us/mch/html/women.html#ppb](http://www.fha.state.md.us/mch/html/women.html#ppb).

Many fatal events occur in women with pre-existing health problems. Promoting health in the pre-conception and inter-conception periods can have important beneficial outcomes for both mother and baby. It has been observed that obese women have greater pregnancy complications and may be at increased risk of fatal complications peripartum. Dr. Diana Cheng has applied for an MCH/HRSA grant, "Innovative Approaches to Promoting a Healthy Weight in Women." This grant will build on the WELL (Women Enjoying Life Longer) Initiative, a program to increase preventive health services to uninsured women. The Maternal Mortality Review process has also identified that some women refuse or discontinue medications necessary for the management of chronic conditions because they are breastfeeding infants. This information has been shared with the Maryland Breastfeeding Promotion Task Force, resulting in presentations regarding the safe management of medication and breastfeeding.

In 2005, the state released the Maryland Pregnancy risk Assessment Monitoring System (PRAMS) Report, 2001-2003 Births. This summary report of the state's first three years experience in the PRAMS, under the Centers for Disease Control and Prevention, supplies data on many issues facing pregnant and postpartum women in the state and allows comparisons with national and other states' data. Dr. Diana Cheng, PRAMS Project Director, has presented

information from this experience at multiple professional meetings. PRAMS reports may be found at [www.fha.state.md.us/mch/html/prams\\_fs.html](http://www.fha.state.md.us/mch/html/prams_fs.html).

Significant racial disparity exists in maternal mortality as well as other adverse outcomes of pregnancy. African American women die twice as frequently as white women in pregnancy-associated events. The Maryland Perinatal Disparities project has focused on these differences and inequities in order to assist in the implementation of programs or policies to effectively address the problem. In 2005, Dr. Maureen Edwards presented this data at the March of Dimes Prematurity Summit, the Advocates for Children and Youth convention, and the state Fetal and Infant Mortality training.

The “Perinatal Network” newsletter became a statewide, professional education tool in 2005, sponsored by MCH. The newsletter is delivered electronically to more than 500 private and public health providers in Maryland. It addresses a variety of issues related to maternal and infant health and identifies resources for dealing with these concerns. Topics have included the management of asthma in pregnancy, alcohol use in pregnancy, and others directed at maximizing the health of mothers and babies. “Perinatal Network” can be found on the DHMH Website at [www.fha.state.md.us/mch/html/perinatalnetwork.html](http://www.fha.state.md.us/mch/html/perinatalnetwork.html).

In the fall of 2004, the Department’s Family Health Administration completed a revision of the Maryland Perinatal System Standards for hospitals providing maternal and infant services. The Standards are used by the Maryland Health Care Commission in its State Plan and the Maryland Institute of Emergency Medical Services System for the designation of perinatal referral centers. Staff from DHMH joined the Maryland Institute for Emergency Medical Systems (MIEMSS) staff in application review and site visits to the Level 3c perinatal units in 2005. A process for quality assurance including the review of all cases of maternal death is one of the Perinatal Standards. Documentation of appropriate identification and review of maternal deaths is included in the site review process.

## **VII. Summary**

Maryland continues to experience high maternal mortality compared to the US 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-four pregnancy-associated deaths were reviewed for 2003. A series of modifiable factors contributing to maternal mortality in Maryland have been identified and recommendations have been made for developing solutions.

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 DHMH Vital Statistics Administration and the Office of the Chief Medical Examiner. The Program is grateful for their input and support. The Maternal Mortality Review Program would like to offer special thanks to the volunteer members of MedChi's Maternal and Child Health Committee and those who joined in the Maternal Mortality Policy Subcommittee for the many hours and serious attention given to this important public health project. Dr. Harold Fox, Director of Gynecology and Obstetrics at Johns Hopkins University provided exemplary leadership to the Workgroup. The Program is also grateful for the diligent work of Dr. Hanan Aboumatar, physician consultant, for her careful and thorough abstraction of the cases, and Dr. Cecilia Penn for review of OCME records.