

A REPORT FROM THE  
VIRGINIA

MATERNAL MORTALITY REVIEW TEAM

**OBESITY AND MATERNAL  
DEATH IN VIRGINIA  
1999-2002**

March • 2009

**VIRGINIA DEPARTMENT OF HEALTH  
OFFICE OF THE CHIEF MEDICAL EXAMINER**



# VIRGINIA MATERNAL MORTALITY REVIEW TEAM

VICTORIA M. KAVANAUGH, RN, PhD  
COORDINATOR, MATERNAL MORTALITY REVIEW

## Mission Statement

Virginia's Maternal Mortality Review Team is dedicated to the identification of all maternal deaths in the Commonwealth and the development of interventions that reduce preventable deaths.

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# MATERNAL MORTALITY REVIEW TEAM MEMBERS, 2008

**Leah L. E. Bush, MD, Co-chair**  
Office of the Chief Medical Examiner  
Virginia Department of Health

**David E. Suttle, MD, Co-chair**  
Office of Family Health Services  
Virginia Department of Health

**Marcella F. Fierro, MD, Retired**  
Office of the Chief Medical Examiner  
Virginia Department of Health

**Ashley Barton, LCSW**  
Virginia Department of Medical Assistance Services

**Mary Beth Kavinsky, RN, MNsc**  
Regional Perinatal Councils

**Stephen H. Bendheim, MD**  
Medical Society of Virginia

**Elizabeth L. Kinnison, MD**  
Virginia Department of Health

**Cheryl N. Bodamer, RN, MPH, PhD**  
Virginia Perinatal Association

**Martha Kurgans, LCSW**  
Virginia Department of Mental Health,  
Mental Retardation and Substance Abuse Services

**Barbara S. Brown, PhD**  
Virginia Hospital and Healthcare Association

**Rochelle L. Lightner, RD**  
Virginia Dietetic Association

**Pamela Fitzgerald Cooper, MPA**  
Virginia Department of Social Services

**Alison M. Lynch, MD**  
Virginia Commonwealth University,  
Medical College of Virginia, Psychiatry

**Joan Corder-Mabe, RNC, MS, WHNP**  
Virginia Department of Health

**Ruth Micklem**  
Virginia Sexual and Domestic Violence  
Action Alliance

**Betty W. Essex**  
Virginia Department of Health

**Ellen Fink-Samnack, LCSW, CCM**  
National Association of Social Workers,  
Virginia Chapter

**Faith Miller, RNC, MSN, WHNP**  
Association of Women's Health,  
Obstetric and Neonatal Nurses, Virginia Chapter

**Peter S. Heyl, MD**  
American College of Obstetricians and Gynecologists,  
Virginia Section

**Katherine C. Smith, DO**  
Virginia Commonwealth University,  
Medical College of Virginia, Psychiatry

**Jessica Jordan, CNM, MSN**  
American College of Nurse-Midwives,  
Virginia Chapter

**Mary Elizabeth White, RN, BSN**  
Local Health Departments

Support Staff to Team  
Victoria M. Kavanaugh, RN, PhD

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# INTRODUCTION BY VIRGINIA'S COMMISSIONER OF HEALTH

It is my pleasure to present this report which highlights findings and recommendations from Virginia's Maternal Mortality Review Team. Dedicated to the prevention of deaths associated with pregnancy and childbirth, this Team has discovered significant health consequences associated with obesity during pregnancy.

This report shows how obesity impacts young women and their families in their childbearing years, transforming a unique and wonderful experience into tragedy. Some critical findings include:

- ◆ Overweight and obese women are overrepresented among women who die during or within one year of a pregnancy.
- ◆ Nearly one-third of overweight and obese women who died had cardiac disorders or gestational hypertension/eclampsia.
- ◆ In four cases, infants died with their mother.
- ◆ Race disparities found with other health and illness indicators are also present in maternal deaths. The maternal mortality ratio for overweight and obese Black women was 2.2 times higher than for overweight or obese White women.
- ◆ With regard to their health care, fewer than half of obese women had obesity noted as a risk factor in their prenatal record. Nutrition assessments were rarely documented in their medical records.

Looking more broadly, slightly more than one-quarter of Virginia adults are obese. Childhood obesity continues to rise at an alarming rate. A recent report from the Trust for America's Health and the Robert Wood Johnson Foundation ranked Virginia 27th most obese state in America.

As Virginia's Public Health Commissioner, I have placed obesity among my highest priorities. We must direct our efforts at children and emphasize primary prevention through improved nutrition and well-being. Our Champion Program is designed to address obesity through improved food choices, physical fitness and health for all of our citizens. Please join us in our efforts to reduce the serious health consequences associated with obesity.

Karen Remley, MD, MBA, FAAP  
Virginia Department of Health

# INTRODUCTION

Obesity is one of the fastest growing public health problems in the United States. Rates of obesity have grown dramatically over the past 20 years. By 2007, 25.6% of Americans were obese.<sup>1</sup> Obesity is a multifaceted problem associated with increased medical care costs, reduced quality of life, and premature death. According to a 2007 report from the Office of the Surgeon General,<sup>2</sup> moderate excess weight of 10 to 20 pounds increases the risk of premature death. The risk for many diseases and health conditions is increased among obese individuals including hypertension (high blood pressure), Type 2 diabetes, heart disease, stroke, and some cancers. Rates of these diseases are on the rise.

The prevalence of obesity among women entering pregnancy has likewise increased dramatically since the mid-1990s.<sup>3</sup> The incidence of pre-pregnancy obesity increased 64.9%, from 13.4% in 1993-1994 to 22.1% by 2003. Women who are obese prior to pregnancy are at greater risk for complications during pregnancy, including hypertensive disorders which have been found to be associated with cardiovascular diseases later in life.<sup>4</sup>

Following 20 years of stable rates, the national rate of maternal deaths has risen over the past several years. This increase has occurred during the period of increasing rates of obesity, leading to speculation that obesity may be related to maternal death. This speculation, as well as observations by Virginia's Maternal Mortality Review Team (MMRT) that obesity was a common occurrence in deaths they reviewed, prompted this closer examination of obesity as a factor contributing to Virginia's maternal deaths. Rates of obesity overall have risen significantly in Virginia over the past ten years.<sup>5</sup> Fourteen percent of Virginians were obese in 1993. By 2003, the percentage of obese Virginians had increased to 21.7%, an increase of slightly less than 50% in ten years.

Virginia's MMRT<sup>6</sup> reviews all maternal deaths in the Commonwealth. It works to develop recommendations to reduce such deaths. The review is conducted to develop a comprehensive understanding of the causes of maternal death within the context of women's lives and the circumstances surrounding injury and disease patterns. Team findings are used to educate colleagues and policymakers about these deaths, to propose ameliorations, changes in law and/or practice, and to recommend interventions to improve the care of women during the perinatal period. Maternal deaths are considered the "tip-of-the-iceberg" for complications of pregnancy. As such, in-depth review of the circumstances of these deaths provides a critical focus for reducing suffering among the thousands of others in similar circumstances who do not die.

The Team reviews every death of women during a pregnancy or within one year of a pregnancy regardless of the cause of death (termed pregnancy-associated death). Cases of pregnancy-associated death are identified through one or more of the following: (1) through the International Classification of Diseases, Tenth Revision (ICD), a designation of the cause of maternal death as occurring during "pregnancy, childbirth and the puerperium;" (2) by matching birth or fetal death certificates with maternal death certificate information; and/or (3) by selecting cases where a Commonwealth of Virginia death certificate indicates the decedent was pregnant within three months of her death.

<sup>1</sup> Centers for Disease Control and Prevention, MMWR Weekly, July 18, 2008/57(28); 765-768. State-Specific Prevalence of Obesity Among Adults --- United States, 2007. Accessed at [www.cdc.gov/mmwr/preview/mmwrhtml/mm5728a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5728a1.htm)

<sup>2</sup> US Department of Health and Human Services, Office of the Surgeon General. Overweight and Obesity: Health consequences. January 11, 2007. Accessed at: [www.surgeongeneral.gov/topics/obesity/calltoaction/fact\\_consequences.htm](http://www.surgeongeneral.gov/topics/obesity/calltoaction/fact_consequences.htm)

<sup>3</sup> Kim S.Y., Dietz P.M., England L., Morrow B., Callaghan WM (2007) Trends in pre-pregnancy obesity in nine states, 1993-2003. *Obesity*. 15:986-993.

<sup>4</sup> Samuels-Kalow, M.E., Phil, M., Funai, F., Buhimschi, C., Norwitz, E., Perrin, M., Calderon-Margalit, R., Deutsch, L., Paltiel, O., Friedlander, Y., Manor, O., Harlap, S. (2007) Prepregnancy body mass index, hypertensive disorders of pregnancy, and long-term maternal mortality. *American Journal of Obstetrics and Gynecology*. November; 197(5): 490.

<sup>5</sup> CDC Behavioral Risk Factor Surveillance System, Accessed on June 8, 2008 at: <http://apps.nccd.cdc.gov/BRFSS/sex.asp?cat=OB&yr=2001&qkey=4409&state=VA>

<sup>6</sup> A full description of the Team's protocol is available at: <http://www.vdh.virginia.gov/medExam/MaternalMortality.htm>

# INTRODUCTION

This report includes all pregnancy-associated deaths due to natural causes which occurred between 1999 and 2002. Cases of violent death, those due to homicide, suicide, unintentional injury, and those that were undetermined in manner, were excluded from this report.<sup>7</sup>

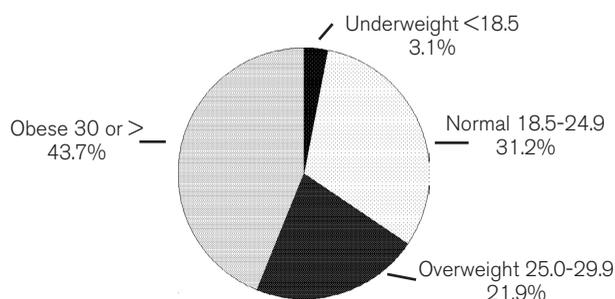
## MEASURING OBESITY

The National Institutes of Health define obesity using the Body Mass Index (BMI).<sup>8</sup> BMI is calculated using a person's height and weight. While BMI cannot accurately predict when weight could lead to health problems, it is a simple and inexpensive method for screening for weight categories that may relate to health problems using information that is readily available. BMI is a widely used diagnostic tool to help identify obesity in the population. Underweight is defined as BMI less than 18.5, normal weight is defined as BMI of 18.5 to 24.9; overweight as a BMI of 25-29.9, and obese as BMI over 30 with morbid obesity defined as BMI over 40.

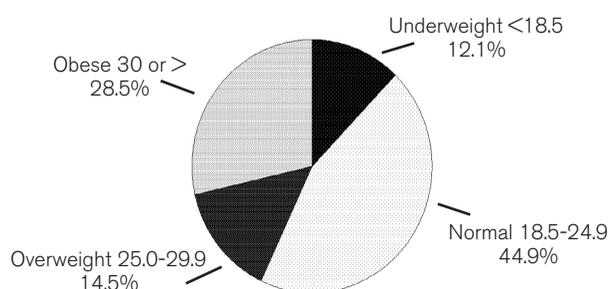
## OBESITY IN VIRGINIA AND THE UNITED STATES

A total of 86 women in Virginia died from natural causes within one year of a pregnancy during the years 1999 through 2002. A prenatal BMI was calculated in 64 of these deaths. Prepregnancy BMIs ranged from 17.2 to 58.5 with an average BMI of 30.7 (obese). Higher percentages of Virginia women dying of natural, pregnancy-associated deaths were overweight and obese prior to pregnancy when compared to a national sample of prepregnant women. Two deaths (3.1%) were to underweight women, 20 deaths (31.2%) were to normal weight women, 14 deaths (21.9%) were to women in the overweight BMI category, and 28 deaths (43.7%) were to women classified as obese (see Figure 1). To serve as a comparison, prepregnancy BMI data for a sample of women from throughout the United States in 2003 as reported by the Pregnancy Nutrition Surveillance<sup>9</sup> program is shown in Figure 2 below.<sup>9</sup> In the national sample, 12.1% of women were categorized as underweight, 44.9% normal weight, 14.5% overweight, and 28.5% were categorized as obese.

**Figure 1: Natural Pregnancy-Associated Maternal Death by Prepregnancy BMI in Virginia, 1999-2002 (N=64)**



**Figure 2: Prepregnancy BMI in the United States, 2003**



## BACKGROUND CHARACTERISTICS

Younger women are generally considered to be at lower risk for complications of pregnancy. Examination of the BMI categories for younger women who died and older women who died revealed that over half of the women in the younger age groups were overweight or obese while

<sup>7</sup> A full report of all cases reviewed for 1999-2001 can be found on the Team's website at: <http://www.vdh.virginia.gov/medExam/MaternalMortality.htm>

<sup>8</sup> National Institutes of Health Weight Control Information Network available at <http://win.niddk.nih.gov/statistics/#what> accessed August, 2008. Body Mass Index (BMI) is defined as the individual's body weight divided by the square of their height.

<sup>9</sup> CDC Pediatric and Pregnancy Nutrition Surveillance System, 2003 Pregnancy Nutrition Surveillance, Nation. Accessed at: [http://www.cdc.gov/pednss/pnss\\_tables/index.htm](http://www.cdc.gov/pednss/pnss_tables/index.htm), June 5, 2008.

# BACKGROUND CHARACTERISTICS

even higher percentages of older women were overweight or obese. Of the 17 deceased women who were between 20 and 29 years old, 10 (58.8%) were overweight or obese. Of the 40 women who died and were 30 to 39 years old, 28 (70.0%) were overweight or obese (see Table 1). For both groups, higher percentages of deceased women in Virginia were overweight or obese prior to pregnancy when compared to women of the same age groups in the general population (44.5% and 54.2% overweight/obese, respectively).

Higher percentages of both White women and Black women who died in Virginia were overweight and obese when compared to Asian women and to the national sample. In the national sample, 41.2% of White women, 49.6% of Black women, and 20.9% of Asian women were overweight or obese. Table 2 displays the data by BMI categories and by race of the women who died in Virginia.

Examination of the data by BMI categories among women from each of Virginia's five Health Planning Regions (see Table 3) revealed that 77.3% of the women in the Eastern region, 71.4% of the women in the Southwest region, and 70.0% of the women in the Central region who died were overweight or obese. The Northern region had the lowest percentage (38.5%) of overweight or obese women among those who died.

**Table 1: Natural Pregnancy-Associated Maternal Death by Age Group (20-29 and 30-39) and BMI Category in Virginia, 1999-2002 (N=57)**

	20-29 Years Old		30-39 Years Old	
	No.	%	No.	%
Underweight	0	0.0	2	5.0
Normal Weight	7	41.2	10	25.0
Overweight / Obese	10	58.8	28	70.0
<b>TOTAL</b>	<b>17</b>	<b>100.0</b>	<b>40</b>	<b>100.0</b>

**Table 2: Natural Pregnancy-Associated Maternal Death by Race and BMI Category in Virginia, 1999-2002 (N=64)**

	White		Black		Asian		Other	
	No.	%	No.	%	No.	%	No.	%
Underweight	0	0.0	1	3.3	1	25.0	0	0.0
Normal Weight	6	22.2	11	36.7	2	50.0	1	33.3
Overweight / Obese	21	77.8	18	60.0	1	25.0	2	66.7
<b>TOTAL</b>	<b>27</b>	<b>100.0</b>	<b>30</b>	<b>100.0</b>	<b>4</b>	<b>100.0</b>	<b>3</b>	<b>100.0</b>

**Table 3: Natural Pregnancy-Associated Maternal Death by Health Planning Region and BMI Category in Virginia, 1999-2002 (N=64)**

	Northwest		Northern		Southwest		Central		Eastern	
	No.	%								
Underweight	0	0.0	1	7.7	0	0.0	1	10.0	0	0.0
Normal Weight	2	40.0	7	53.8	4	28.6	2	20.0	5	22.7
Overweight / Obese	3	60.0	5	38.5	10	71.4	7	70.0	17	77.3
<b>TOTAL</b>	<b>5</b>	<b>100.0</b>	<b>13</b>	<b>100.0</b>	<b>14</b>	<b>100.0</b>	<b>10</b>	<b>100.0</b>	<b>22</b>	<b>100.0</b>

# BACKGROUND CHARACTERISTICS

The maternal mortality ratio permits population-specific comparisons between various groups. This ratio reflects the number of maternal deaths for every 100,000 live births. For women in Virginia, the maternal mortality ratios were higher for overweight and obese women than for normal and underweight women (see Table 4). Estimates of maternal mortality ratios for each BMI category were calculated using percentages of women in each BMI category in the national sample of prepregnancy BMI categories.<sup>10</sup> The greatest mortality risk for Black women and for White women was among the overweight and obese. Overweight/obese Black women had a mortality ratio that was 2.2 times higher than overweight/obese White women. This represents a significant racial disparity as has been found in other reports on maternal mortality.

**Table 4: Maternal Mortality Ratio for Natural Pregnancy-Associated Maternal Death by BMI Category and Race in Virginia, 1999-2002 (N=64)**

	Total (Includes women of all races)		White		Black	
	No. of Deaths	Maternal Mortality Ratio	No. of Deaths	Maternal Mortality Ratio	No. of Deaths	Maternal Mortality Ratio
Underweight	2	4.3	6	3.6	12	26.8
Normal Weight	20	11.6				
Overweight	14	25.1	21	18.1	18	40.9
Obese	28	25.6				

# PRENATAL CARE AND OTHER HEALTH CONDITIONS

Early and regular prenatal care is essential for the health of both the mother and the developing fetus. Early screening for and detection of problems and/or potential complications with the pregnancy allow for prevention efforts, more effective treatment and for referrals to specialized care when necessary. The Team concluded that the majority (76.0%) of overweight and obese women received at least adequate prenatal care (based on time of entry into care and number of visits received) in the pregnancy that occurred prior to their deaths. This was also true for the underweight and normal weight women (68.1%). However, the prenatal records for only 11 of the 28 (39.3%) obese women noted obesity as a risk. Five women were referred to a specialist for dietary counseling while 11 women were counseled by the prenatal care provider. During the review process, the Team noted that nutrition assessments were not recorded in the medical records and spoke of the need for more preconception education about the risks of pregnancy for obese women.

Many of the women who were obese had other chronic health conditions, many that are caused or exacerbated by obesity. Hypertension, Type 2 diabetes, and certain types of cancers have all been linked to obesity. Seventeen of the 28 (60.7%) obese women were noted to have a chronic condition such as hypertension, heart disease, asthma, epilepsy, diabetes, or cancer. Four were described as morbidly obese. In at least one case, the Team noted that morbid obesity may have delayed the diagnosis of a life threatening condition. Nine (64.3%) of the 14 overweight women and six of the normal/underweight women had a chronic condition such as hypertension, asthma, and cancer.

<sup>10</sup> For example, total births for the four year period were 384,074. Nationally, 44.9% of women were in the Normal BMI category. Therefore the estimate of the number of live births to normal weight women was calculated as .449 X 384074 = 172449 live births to normal weight women.

# CAUSES OF DEATH

Obese women had the highest percentage (28.7%) of deaths from cardiac disorders, followed by cancer (21.4%), and pulmonary embolism (17.9%). See Table 5.

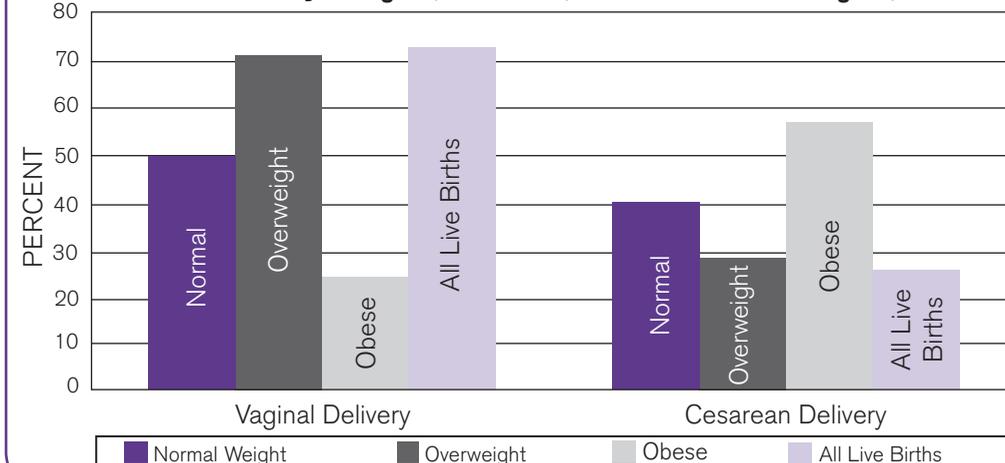
**Table 5: Natural Pregnancy-Associated Maternal Death by BMI Category and Cause of Death in Virginia, 1999-2002 (N=64)**

	Underweight		Normal		Overweight		Obese	
	No.	%	No.	%	No.	%	No.	%
AIDS Related	1	50.0	-	-	-	-	-	-
Amniotic Fluid Embolism	-	-	1	5.0	2	14.3	1	3.6
Cancer	-	-	3	15.0	4	28.6	6	21.4
Cardiac Disorder	-	-	4	20.0	2	14.3	8	28.7
Cardiomyopathy	-	-	1	5.0	-	-	2	7.1
Chronic Condition	-	-	2	10.0	2	14.3	1	3.6
Disorders of the Central Nervous System	-	-	-	-	2	14.3	-	-
Gestational Hypertension / Eclampsia	-	-	1	5.0	-	-	1	3.6
Hemorrhage	-	-	2	10.0	2	14.3	3	10.7
Infection	1	50.0	1	5.0	-	-	-	-
Other	-	-	3	15.0	-	-	1	6.2
Pulmonary Embolism	-	-	2	10.0	-	-	5	17.9
<b>TOTAL</b>	<b>2</b>	<b>100.0</b>	<b>20</b>	<b>100.0</b>	<b>14</b>	<b>100.0</b>	<b>28</b>	<b>100.0</b>

# OUTCOME OF THE PREGNANCY AND METHOD OF DELIVERY

All 14 of the women classified as overweight delivered one live infant. Among the obese women, there were three live twin births, 20 live singleton births, one ectopic pregnancy, and four fetal losses. Fetal losses resulted from the mother's death due to pulmonary embolism, cardiac arrest, or arrhythmia. Figure 3 shows the method of delivery for normal weight, overweight, and obese women who died alongside percentages of vaginal and Cesarean section deliveries for all live births in Virginia in 2002. Obese women who died had the highest percentage of Cesarean section deliveries.

**Figure 3: Natural Pregnancy-Associated Maternal Death by BMI Category and Method of Delivery in Virginia, 1999-2002, and All Live Births in Virginia, 2002**



# CONCLUSION

Obesity has a significant impact on the health of Virginia's residents. Direct medical costs include prevention, diagnosis, and treatment for obesity and its related medical conditions. Estimates of state-level total obesity-attributable expenditures for 1996 and 1997 included an estimate of over one billion dollars in direct medical costs to Virginians.<sup>11</sup> These estimates do not include indirect costs such as income lost due to decreased productivity, restricted activity, and absenteeism.

The burden of obesity-associated morbidity such as hypertension, Type 2 diabetes, and certain cancers is rising. These conditions adversely affect the health of women of all ages and races and complicate pregnancy, delivery, and the health of future generations.

This report demonstrates clearly that overweight and obese women are disproportionately represented among those who die during or within one year of a pregnancy. Women who are overweight or obese as they enter pregnancy are at increased risk for morbidity and mortality. The Maternal Mortality Review Team believes that urgent efforts are needed to address obesity among the citizens of the Commonwealth. Primary prevention efforts must begin in childhood. Members of the Team agree that the current obesity epidemic will require a multifaceted approach involving employers, health care providers, and health insurers. In an effort to prevent the significant health consequences of morbidity and mortality associated with obesity during pregnancy, the Maternal Mortality Review Team offers the following recommendations to the Governor, the General Assembly, and citizens of the Commonwealth of Virginia:

## The Maternal Mortality Review Team recommends that:

- **all** care providers educate patients regarding the adverse physical effects of being overweight and obese especially during pregnancy;
- all providers of pregnancy-related services promote the use of the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) by disseminating a description of the program and eligibility requirements to all pregnant women and new mothers;
- all Virginia employers provide a health improvement program to employees which includes these components: healthy nutrition, weight reduction and healthy weight management, and the importance of physical activity. All employers should educate employees about the availability and importance of the program and provide incentives for participation;
- the Virginia Department of Health develop a program to address the health risks for obese pregnant women to be included in its public health campaign. This should include a website listing community measures and treatment strategies;
- **all** schools in Virginia participate in the Governor's Nutrition and Physical Activity Scorecard. This program provides incentives to schools for implementing research-based best practices supporting proper nutrition and increased physical activity for K-12 students;
- the General Assembly may wish to consider legislation requiring all third-party payers to provide coverage for dietary counseling, education, and nutrition therapy for individuals with BMIs greater than 30.0.

<sup>11</sup> Department of Health and Human Services, Centers for Disease Control and Prevention, Overweight and Obesity: Economic Consequences. Available at: [http://www.cdc.gov/nccdphp/dnpa/obesity/economic\\_consequences.htm](http://www.cdc.gov/nccdphp/dnpa/obesity/economic_consequences.htm). Accessed 8/4/2008.



This report is available at the following website:  
<http://www.vdh.virginia.gov/medexam/maternalmortality.htm>

Commonwealth of Virginia  
Virginia Department of Health  
Office of the Chief Medical Examiner  
Maternal Mortality Review Team  
737 North Fifth Street, Suite 301  
Richmond, VA 23219  
(804) 205-3853

