A REPORT FROM THE

VIRGINIA MATERNAL MORTALITY REVIEW TEAM

Pregnancy-Associated Deaths from Heart Disorders and Related Conditions in Virginia, 1999-2004

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Virginia Department of Health, Office of the Chief Medical Examiner

VIRGINIA MATERNAL MORTALITY REVIEW TEAM

2012 REPORT

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Mission Statement

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

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EXECUTIVE SUMMARY

Virginia's Maternal Mortality Review Team (MMRT) reviews all cases of death of a Virginia resident occurring during pregnancy or within one year of pregnancy. The purpose of these reviews by this multidisciplinary team is to improve our understanding of these deaths and to develop prevention and intervention strategies to reduce preventable deaths. Through its review, the MMRT determined that heart disease was a major risk factor for pregnancy-associated deaths, contributing to 43.5% of all pregnancy-associated deaths from natural causes in Virginia. This report sheds light on the circumstances surrounding these deaths and provides recommendations to address gaps in services and improve opportunities for prevention. Major findings from this review are presented below.

- Approximately 10 women died pregnancy-associated deaths from heart disorders or related conditions for each 100,000 live births during the time period from 1999-2004.
- The rate of death for Black women was 3.7 times higher than the rate for White women.
- Demographically, higher proportions of women who died had less education and lived in areas with lower median household incomes than women in the general population with a live birth.
- Higher proportions of women who died were uninsured than women in the general population.
- Only 58.3% of the women who died initiated prenatal care during the first trimester of pregnancy.
- Many women who died had chronic medical conditions such as hypertension, thyroid disorders, and diabetes.
- One third of the women who died smoked cigarettes and the majority of women were overweight or obese.

Through review of these cases, the Maternal Mortality Review Team developed recommendations to improve systems of care for women in similar circumstances. These recommendations can be found on page 25 of this report.

INTRODUCTION

Heart disease accounts for 26% of all deaths in Virginia.[1] In 2000, the age-adjusted cardiovascular mortality rate for people aged 25-34 was 8.3 per 100,000 and 30.4 per 100,000 for Virginians aged 35-44. One in five female residents of Virginia has some form of cardiovascular disease. Women under age 50 who have a heart attack are twice as likely to die as men in the same age group. In Virginia, the rate of cardiovascular disease declined between 1995 and 2002. However, the number of cardiovascular deaths decreased 6% for men but only 1% among women.[2] Rates of heart disease deaths are higher for Virginia's African-American population (229.7/100,000) than White Virginians (176.6/100,000).[3] Black males and females have the highest mortality rates from cardiovascular disease at all ages, except among those ages 85 and older.[4]

Risk factors for cardiovascular disease include obesity, high blood pressure, smoking, and high cholesterol. Recently, research has shown that low income and poverty as well as having less than a high school education are independent risk factors for the development of cardiovascular disease.[5] The 2008 Virginia Health Equity Report, entitled *Unequal Health Across the Commonwealth,* documented inequities in health status among different socioeconomic and racial groups and regions of Virginia. Low socioeconomic populations had poorer health and higher levels of mortality than populations with higher socioeconomic status. In addition, this report on Virginians stated, "African Americans experience higher rates of individual level poverty, neighborhood level poverty, lower levels

[1] Virginia Department of Health; Division of Chronic Disease Prevention. (June 2005). *Cardiovascular Disease in Virginia. A Report from the Virginia Cardiovascular Health Project.*
[2] Virginia Department of Health; Division of Chronic Disease Prevention. (June 2005). *Cardiovascular Disease in Virginia. A Report from the Virginia Cardiovascular Health Project.*
[3] Kaiser Foundation. Statehealthstats.org. http://www.statehealthfacts.org/comparebar.jsp?cat=2&ind=79, accessed January 26, 2012.
[4] VDH Office of Minority Health, Quick Facts about Minorities in Virginia, accessed January 26, 2012 at http://www.vdh.state.va.us/healthpolicy/healthequity/quickfacts.htm.
[5] Franks P, Winters PC, Tancredi DJ, Fiscella KA. Do changes in traditional coronary heart disease risk factors over time explain the association between socioeconomic status and coronary heart disease? BMC Cardiovascular Disorders, 2011, 11:28.

of educational attainment and higher rates of mortality for the three major causes of death (heart disease, cancer, and stroke), as well as diabetes, kidney disease, septicemia, homicide, and HIV" (p. 41).

Diabetes and hypertension are the most frequently reported health conditions among pregnant women[6] and heart disease is the leading cause of pregnancy-related mortality in the United States. National reports show cardiovascular conditions and hypertensive disorders in pregnancy each account for 12% of all pregnancy-related deaths and cardiomyopathy accounts for an additional 11%.[7] Comparisons of three time periods (1987-1990, 1991-1997, and 1998-2005) indicate a decrease in hypertensive disorders of pregnancy but increasing rates of cardiovascular diseases and cardiomyopathy.[6]

From 1999 through 2004 in Virginia, approximately 880 women aged 15 to 44 died from diseases of the heart (ICD 10 Codes 49-59).[8] During that time period, 60 women were identified by the Virginia Maternal Mortality Review Team to have died from heart diseases and disorders, hypertensive disorders of pregnancy, and other causes associated with chronic hypertension. These 60 deaths represent 43.5% of all pregnancy-associated deaths from natural causes in Virginia during the time period. This report presents an in-depth review of those deaths and provides recommendations for prevention and intervention from the Virginia Maternal Mortality Review Team based on those findings.

[6] Women's Health USA 2011. Maternal morbidity and mortality. Accessed January 26, 2012 at: http://mchb.hrsa.gov/whusa11/hstat/hsrmh/pages/230mmm.html

[7] Berg, C. J., Callaghan, W. M., Syverson, C., & Henderson, Z. (December 2010). Pregnancy-Related Mortality in the United States, 1998-2005. *Obstetrics & Gynecology* , 1302-1309.

[8] Virginia Department of Health; Division of Health Statistics. Data Tables: Resident Deaths by Cause of Death, 1999, 2000, 2001, 2002, 2003, 2004. Accessed 5/2/2012 at: http://www.vdh.virginia.gov/HealthStats/stats.htm.

METHOD

Virginia's Maternal Mortality Review Team (MMRT) is a multidisciplinary team that reviews all deaths of Virginia residents that occur during pregnancy or within one year of pregnancy, termed *pregnancy-associated death*.[9] Cases of pregnancy-associated death are identified yearly 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.

The Team's Coordinator collects records relevant to understanding the decedent's health, medical and social history leading up to and including the fatal illness or disease event. Records requested include prenatal care and delivery, primary care and medical specialists, emergency department and hospitalizations, mental health, and death investigation records including autopsies. Where relevant, other public records such as court records and newspaper articles may also be collected. Once all records have been collected, the Coordinator prepares de-identified case summaries for Team review.

The Team collaboratively completes a *Contributors to Mortality* form as each case is reviewed. This discussion includes the Team's decision about the following dimensions of maternal deaths:

- The preventability of the maternal death;
- The degree to which the death was pregnancy related;
- Factors that contributed to the death;
- Ideas for prevention and intervention; and
- Agreement with cause and manner of death as described on the death certificate.

Cases selected for the focus of this report included women who died from diseases or disorders of the heart and cases in which chronic hypertension was determined to be a contributing factor in the death.

[9] A full description of the Team's protocol is available at: http://www.vdh.virginia.gov/medExam/MaternalMortality.htm

RESULTS

Sixty women were identified by the Virginia Maternal Mortality Review Team to have died from heart diseases and disorders such as atherosclerotic heart disease, myocardial infarction, infections of the heart, and arrhythmias (n=32); cardiomyopathies (n=13), hypertensive disorders of pregnancy (n=6), and other causes associated with chronic hypertension (n=9). Most of these deaths (70.0%) were determined to be at least possibly related to the pregnancy (See Table 1).

Table 1. Relationship of Pregnancy to Death Due to Heart Disorders and Related Conditions in Virginia, 1999-2004 (N=60)

	Number	Percent
Not Related to Pregnancy	18	30.0
Possibly Related to Pregnancy	7	11.7
Related to Pregnancy	35	58.3

In addition to determining if the death was related to the pregnancy based on review of the circumstances of each death, the MMRT determined if the death may have been averted through changes in community, patient, healthcare facility or healthcare professional factors; i.e. was the death preventable. This determination relates specifically to whether systems changes may lead to better outcomes in the future when circumstances are similar to those found in the cases reviewed. These decisions are made based on retrospective review and with the benefit of current knowledge and clinical guidelines. If a death was found to be preventable, the Team must identify specific strategies to address those factors determined to have contributed to the death. If a death was not preventable, the Team must agree that all that could have been done was done. Table 2 displays the Team's determination of preventability for those deaths that were deemed to be pregnancy-related and those that were not considered to be directly related to the pregnancy.

Table 2. Preventability of All Deaths by Pregnancy-Related and Not Pregnancy-Related Deaths Due to Heart Disorders and Related Conditions in Virginia, 1999-2004 (N=60)						
	All Pregnancy-Associated Heart Disorder Deaths (N=60)		Pregnancy-Related Heart Disorder Deaths (n=42)		Not Pregnancy-Related Heart Disorder Deaths (n=18)	
	Number	Percent	Number	Percent	Number	Percent
Probably Not or Not Preventable	28	46.6	17	40.5	11	61.1
Probably or Definitely Preventable	22	36.6	16	38.1	6	33.3
Unsure or Unable to Agree	10	16.6	9	21.4	1	5.6

POPULATIONS AT RISK IN VIRGINIA

Table 3 provides demographic information for women who died from heart disorders within one year of pregnancy. The largest group of women was 33 years old. Black women accounted for the highest percentage of deaths. More women were unmarried than married when they died.

Table 3. Age, Race, and Marital Status of Women Dying Pregnancy-Associated Deaths Due to Heart Disorders and Related Conditions in Virginia, 1999-2004 (N=60)		
	Number	Percent
Age (Range: 17-43; Mode: 33)		
19 and <	1	1.7
20-24	14	23.3
25-29	12	20.0
30-34	19	31.7
35-39	8	13.3
40-44	6	10.0
Race		
White	27	45.0
Black	32	53.3
Other	1	1.7
Marital Status		
Never Married	28	46.7
Married	26	43.3
Divorced	6	10.0

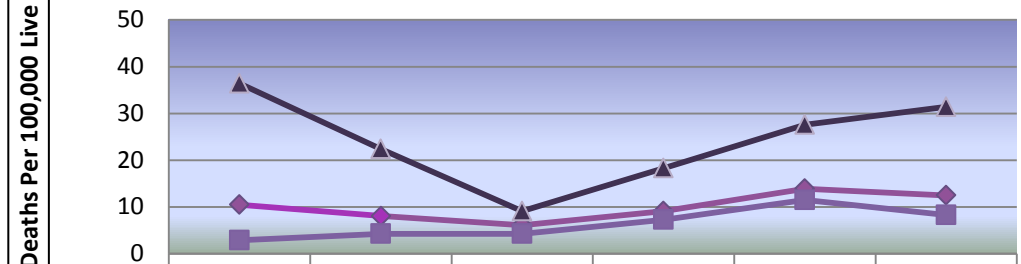
Rates and ratios provide information on how likely a death is to occur within a given population. Maternal mortality ratios are reported as the number of deaths for every 100,000 live births for the same time period. Overall in Virginia, approximately 10 women died pregnancy-associated deaths from heart disorders or related conditions for each 100,000 live births. As shown in Table 4, the maternal mortality ratio was 3.7 times higher for Black women than for White women.

Table 4. Pregnancy-Associated Deaths Due to Heart Disorders and Related Conditions per 100,000 Live Births in Virginia, 1999-2004 (N=60)

Overall	10.1
White Women	6.5
Black Women	24.2

Examination of trends over time in Table 5 reveals the highest ratio of deaths due to heart disorders occurred in 2003 and 2004. Black women experienced higher ratios of mortality due to heart disorders than White women each year. The highest levels of heart disorder deaths among Black women occurred in 1999 and 2004 (36.4 and 31.4 respectively).

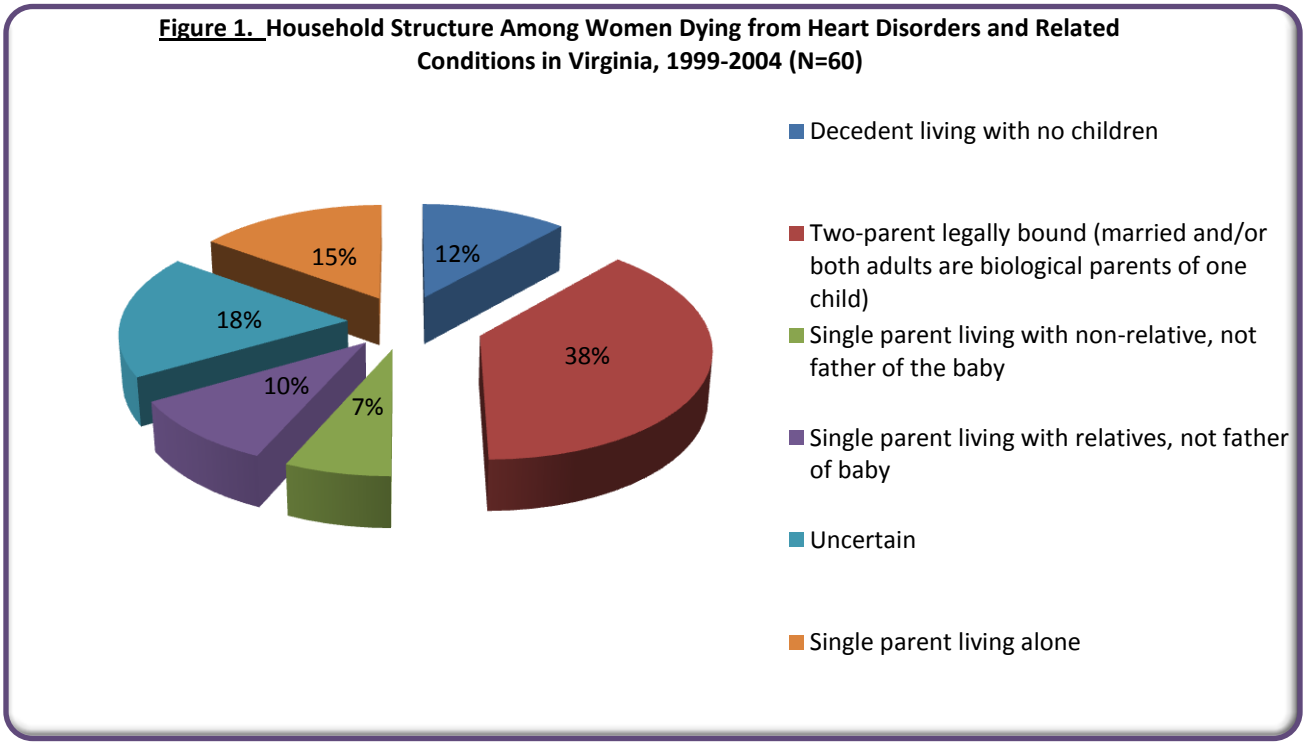
Table 5. Mortality Risk Among Women Dying Pregnancy-Associated Deaths Due to Heart Disorders and Related Conditions by Year and by Race in Virginia, 1999-2004 (N=60)



	1999	2000	2001	2002	2003	2004
Overall	10.5	8.1	6.1	9.1	13.9	12.5
White	2.9	4.3	4.3	7.3	11.5	8.3
Black	36.4	22.4	9.1	18.3	27.6	31.4

Household structure refers to the combination of relatives and nonrelatives living together as a family and considered to be the family support system. Female headed households and households maintained by single mothers are vulnerable to less secure employment and lower family income.[10] Studies show single women experience more stress as new mothers than married new mothers.[11] The distress single mothers experience is entirely due to being exposed to more stress and strain than married mothers and is not due to any differences in vulnerability to stress between married and single mothers.[12] Examination of household structure among the women who died indicates that thirty-eight percent lived with their child and the father of at least one biological child. Overall, 15% of the women who died were single parents living alone. One quarter of all Black women were single parents living alone with their children compared to 3.7% of White women.

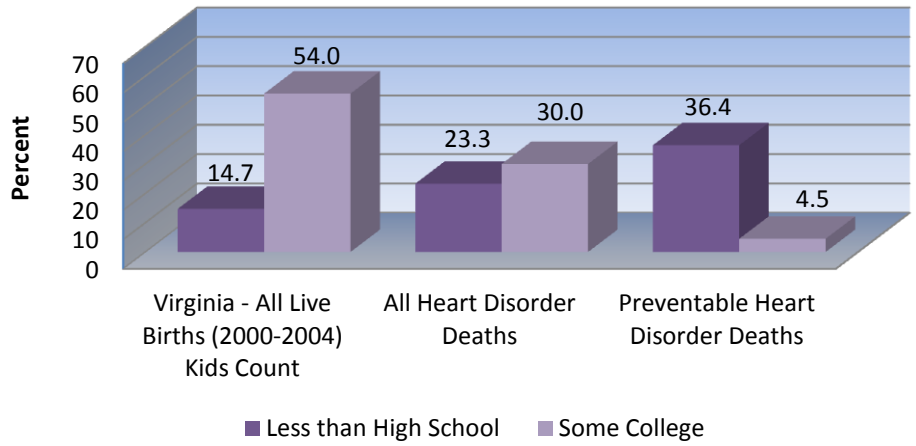
Figure 1. Household Structure Among Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004 (N=60)



[10] America's Children: Key national indicators of well-being, 2011. ChildStats.Gov, http://www.childstats.gov/americaschildren/eco1.asp accessed February 23, 2012.
[11] Copeland D. and Harbaugh BL. Differences in parenting stress between married and single first time mothers at six to eight weeks after birth. Issues Compr Pediatr Nurs. 2005 Jul-Sep;28(3):139-52.
[12] Avison WR, Ali J, Walters D. Family structure, stress, and psychological distress: A demonstration of the impact of differential exposure. Journal of Health and Social Behavior, 48(3):301-317.

According to the 2008 Virginia Health Equity Report, age-adjusted heart disease death rates per 100,000 population for Virginians 18 and over decreased by years of education attained: less than high school – 372.8; high school graduate – 298.8; more than high school – 159.3 As shown in Figure 2,[13] higher percentages of women who died from heart disorders within one year of pregnancy had less than a high school education compared to women in the general population who gave birth during the same time period. Women whose deaths were preventable had the highest percentage of non-high school graduates. Similarly, a smaller proportion of women who died completed at least one year of college than women in the general population (Figure 2). Women whose deaths were preventable were the least likely to complete at least one year of college.

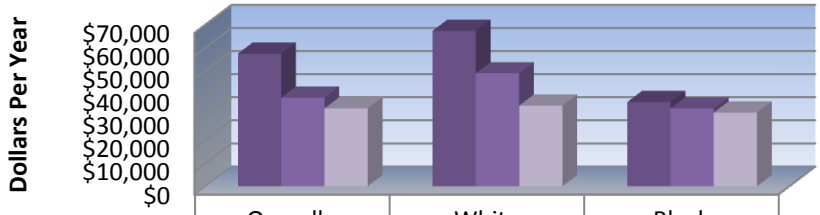
Figure 2. Educational Attainment Among All Women and Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004



[13] Data Center Kids Count - Virginia: A project of the Annie E. Casey Foundation: accessed January 26, 2012 at: http://datacenter.kidscount.org/data/bystate/Trend.aspx?Trend.aspx?state-VA

Women who died lived in areas with lower median household incomes than women in the general population in Virginia with Black women in each category living in areas with lower income (Figure 3).[14] Women who died preventable deaths lived in areas with the lowest median household incomes.

Figure 3. Median Household Income Among All Women and Women Dying From Heart Disorders and Related Conditions in Virginia, 1999-2004

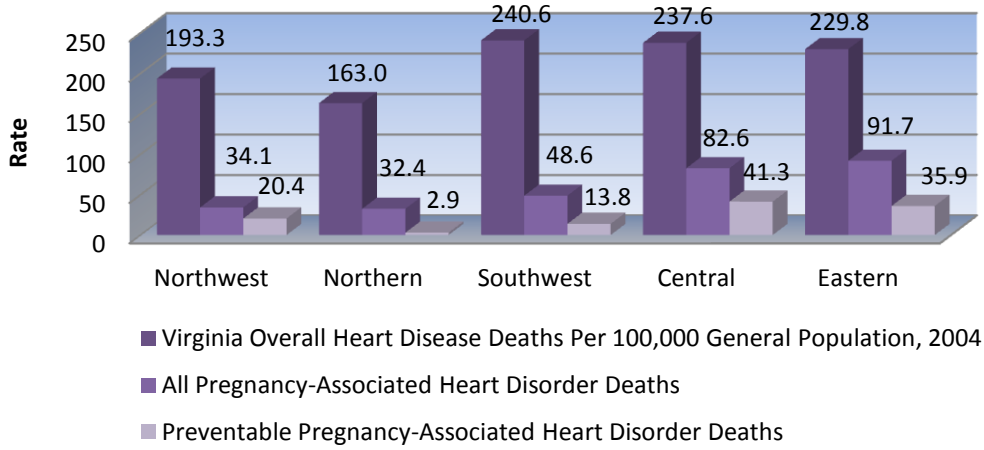


	Overall - Women	White Women	Black Women
Virginia -2006 (Kaiser State Health Facts)	$57,354	$67,240	$36,400
All Heart Disorder Deaths	$38,295	$48,841	$33,643
Preventable Heart Disorder Deaths	$33,653	$34,844	$31,849

Figure 4 shows trends in regions of the State in which pregnancy-associated deaths due to heart disorders and related conditions occurred along with patterns of heart disease deaths in the general population. Similar to heart disease deaths overall, pregnancy-associated deaths due to heart problems (both preventable and not preventable deaths) were lowest in the Northwestern and Northern Regions which have the lowest rates of heart disease deaths in the general population.

[14]Kaiser State Health Facts, accessed January 26, 2012 at: http://statehealthfacts.org/comparecat.jsp?cat=1&rgn=48&rgn=1

Figure 4. Mortality Rates for Heart Disease Overall and for Pregnancy-Associated Deaths Due to Heart Disorders and Related Conditions in Virginia, 1999-2004



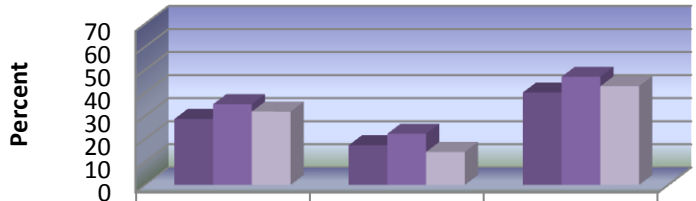
Overall, the Maternal Mortality Review Team characterized the women who died as having multiple risk factors and life stressors. Many were single mothers living alone with their children. The Team was concerned about the number of women who had not completed high school. They also noted that women who died tended to live in areas with income levels below the average income level of all women who delivered a live infant. The Team believed these factors represent potential barriers to obtaining healthcare and noted the need for care coordination, case management and/or home visiting services to assist these families.

OBSTETRICAL HISTORY AND PRENATAL CARE DURING THE RECENT PREGNANCY

There were no notable differences in the proportion of women who died and women in the general population in terms of Medicaid payment for care (Figure 5). The Team frequently noted that women who were covered under Medicaid during pregnancy lacked health insurance before and after pregnancy, which rendered them unlikely to have continuing healthcare. The Team identified the need for health insurance coverage for working women, care coordination for management of chronic and

complex medical conditions, as well as paid time off for care as factors to be considered to improve health outcomes among women in similar circumstances.

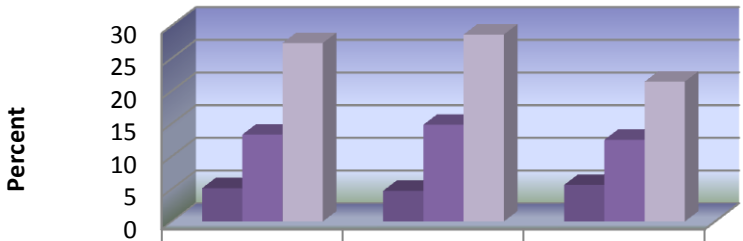
Figure 5. Medicaid Payment for Care for all Live Births and for Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004



	Overall	White	Black
Virginia - All Live Births (1999-2004)*	28.6	17.2	40.1
All Heart Disorder Deaths	35.0	22.2	46.9
Preventable Heart Disorder Deaths	31.8	14.3	42.8

Higher percentages of women who died were "self pay" (implying no public or private insurance coverage) for care than women in the general population who gave birth (Figure 6). The highest percentage of women classified as self pay was among women whose deaths were preventable. The Team expressed dismay at the numbers of women who were eligible for coverage by Medicaid due to their pregnancies who remained uninsured at the time of delivery. The Team was adamant that all barriers to timely enrollment in health insurance programs must be identified and removed so that all women receive the care they need for a healthy pregnancy and safe delivery.

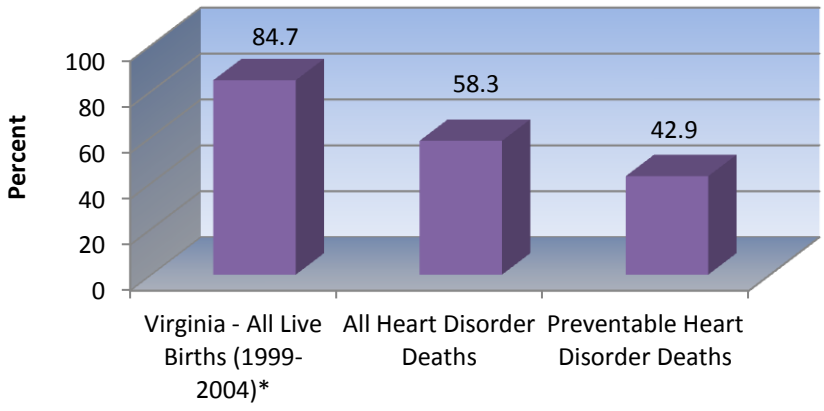
Figure 6. Self Pay for Care for all Live Births and for Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004



	Overall	White	Black
Virginia - All Live Births (1999-2004)*	5.1	4.7	5.6
All Heart Disorder Deaths	13.3	14.8	12.5
Preventable Heart Disorder Deaths	27.3	28.6	21.4

Figure 7 shows percentages of women entering prenatal care in the first trimester. Smaller proportions of women dying from conditions of the heart and related disorders, and especially among women whose deaths were preventable, received care in the first 13 weeks of pregnancy. Overall, Black women who died received fewer prenatal care visits than White women who died (7.9 and 11.9 respectively). Black women also initiated care later than White women (12.5 weeks compared to 10.6 weeks).

Figure 7. Prenatal Care Initiated in First Trimester by All Women and Women Dying Due to Heart Disorders and Related Conditions in Virginia, 1999-2004

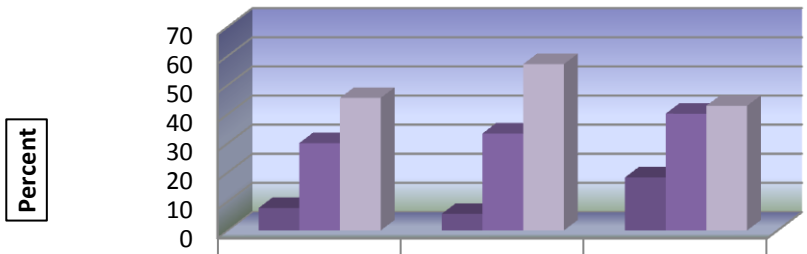


More than one-third (36.7%) of the women who died had been pregnant four or more times and 38.3% of the women had experienced a previous pregnancy loss. Hypertension in a previous pregnancy was reported by 13.3%. Fourteen of the 60 women (23.3%) did not intend to become pregnant with the index child.

Pre-existing conditions were common among the women who died. Records indicated the presence of illnesses such as thyroid disorders, polycystic kidney disease, chronic hypertension, and diabetes. Three women had been advised against becoming pregnant by a healthcare provider prior to the index pregnancy. All three had severe heart conditions and reported that the pregnancy was not intended.

Thirty percent of all women who died from heart disease related conditions had chronic hypertension. Close to half of the women with preventable deaths had chronic hypertension. Figure 8[15] compares percentages of women in the general population having chronic hypertension to those who died. Higher percentages of women who died, and especially women who died preventable deaths, had chronic hypertension than that found in the general population.

Figure 8. Chronic Hypertension Among US Women Aged 20-44 and Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004

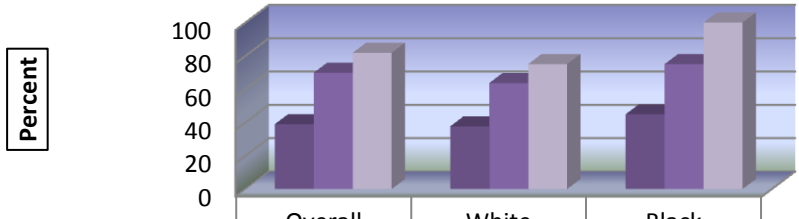


	Overall	White	Black
US Women 20-44, 2001-2004 CDC health data interactive	7.7	5.7	18.2
All Heart Disorder Deaths	30.0	33.3	40.1
Preventable Heart Disorder Deaths	45.5	57.1	42.8

[15] CDC Health Data Interactive. Hypertension, ages 20+, US, 1988-2008 (NHANES).

Twenty (33.3%) of the women who died had a history of smoking, twelve of whom were known to smoke during the most recent pregnancy. Obesity was a major risk factor with nearly 70.0% of the women who died being overweight or obese. Figure 9[16] illustrates the percentages of women who died who were in the Overweight and Obese BMI categories to women in the general population in Virginia with a live birth.

Figure 9. Prepregnancy BMI Overweight and Obese Categories for Women with a Live Birth in 2007 and those Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004



	Overall	White	Black
Virginia - PRAMS, 2007	38.9	37.6	44.9
All Heart Disorder Deaths	69.8	63.6	75.0
Preventable Heart Disorder Deaths	81.8	75.0	100.0

While Team members noted the importance of primary prevention of these preexisting conditions, they also identified the need for providers to screen aggressively and to refer for appropriate management when risk factors are present. The Team was also concerned about the need for education about family planning and contraception as well as improving access to contraception for those who desire it.

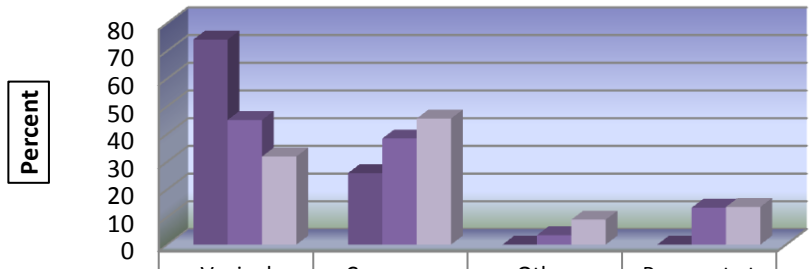
DELIVERY, OUTCOME OF THE PREGNANCY, AND TIMING OF DEATH

Proportionately more women who died delivered by Cesarean section than women in the general population with a live birth (Figure 10). Overall, 14 of the 23 (60.9%) Cesarean Section deliveries were unscheduled, emergency deliveries performed to save the mother's life. Of the 10 preventable

[16] Self-reported pre-pregnancy body mass index (BMI) by selected maternal characteristics, 2007. Virginia Department of Health, Office of Family Health Services, Pregnancy Risk Assessment Monitoring System, 2007.

deaths delivered by Cesarean Section, 7 (70.0%) were unscheduled, emergency deliveries. There were a total of 11 fetal or infant deaths, 5 of which resulted from the mother's preventable death.

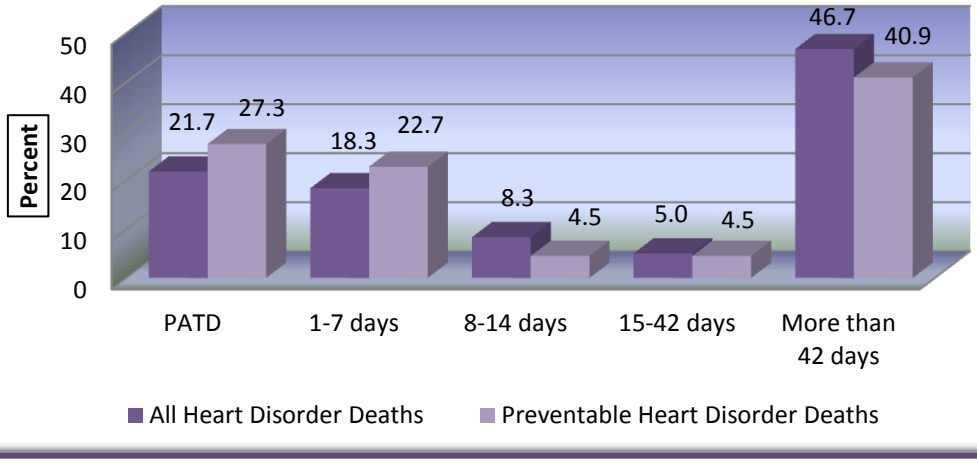
Figure 10. Method of Delivery for all Live Births and for Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004



	Vaginal	Cesarean Section	Other	Pregnant at Time of Death
Virginia - All Live Births (1999-2004)*	74.0	25.8	0.0	0.0
All Heart Disorder Deaths	45.0	38.3	3.4	13.3
Preventable Heart Disorder Deaths	31.8	45.5	9.0	13.6

As shown in Figure 11, one in five women were pregnant at the time of death (PATD) or died on the day of delivery. Forty percent had died within one week of delivery. Over one-half (53.3%) died before the end of the postpartum period, 42 days after delivery. This traditionally marks the return of the woman to her prepregnant state and ends her need for obstetric care.

Figure 11. Interval Between End of Pregnancy and Death Among Women Dying from Heart Disorders and Related Conditions in Virginia, 1999-2004 (N=60)



CONCLUSION

Heart disorders and hypertension-related conditions are major causes of death within one year of pregnancy in Virginia and across the United States. Many times, death from these conditions is related to the pregnancy itself and review of patterns and trends indicates several opportunities for prevention and intervention. Virginia's Maternal Mortality Review Team found higher proportions of women who died had no insurance coverage for care and/or delivery than women in the general population giving birth during the same time period. Also, women who died were less likely to enter care in the first trimester or to receive care that is considered adequate in terms of numbers of visits and time of entry into care when compared with women in general. Higher percentages of women who died had chronic hypertension than found among all US women of the same age during the same time period. In addition, women who died were more likely to be overweight or obese than women who gave birth in Virginia. One in five of the women who died were known to smoke cigarettes.

As Virginia's Maternal Mortality Review Team discovered by examining the circumstances surrounding these deaths, certain characteristics emerged that were strikingly similar to those which describe deaths due to similar causes in the general population across the Commonwealth. Geographically, patterns of pregnancy-associated deaths due to heart disorders mirrored mortality rates for deaths due to heart disease in the general population. Lower rates of heart disease deaths are reported in the Northern and Northwestern Health Planning Region than in the Southwest, Central and Eastern Regions.

As was found in the 2008 Health Equity Report, Black women were more likely to die from heart disorders than White women. Black women had much higher pregnancy-associated mortality rates than White women. Also as reported in the Health Equity Report, deaths were higher among those with less education and lower incomes. Compared to women in the general population who had a live birth during the same time period, women who died were less likely to have a high school education, less

likely to have at least one year of college education, and likely to live in households in areas with lower median household incomes. According to the World Health Organization, educational attainment and levels of income are among the social determinants of health which are defined as "the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics."[17]

The strongest and most consistent predictor of health for women and children is education.[17] Low levels of education limit access to jobs and resources which in turn reduce the capacity to integrate within society and increases the risk of poverty. Being less educated is also associated with unhealthy behaviors and exposure to stress.[18] The significance of socioeconomic status as a social determinant of health is described in the 11 Domains of Core Preconception Health and Health Care Indicators as "a complex construct generally used to define social inequality." This report recommends that providers of care to all women of childbearing age ask about economic status as part of preconception health promotion. This should be followed by referral to agencies that can determine eligibility for financial assistance and provide all necessary assistance needed to acquire access to primary and preventive health services.

The Maternal Mortality Review Team identified several factors that contributed to the deaths reported here. Among the most frequently identified factors were those related to failure of the individual to seek care and/or noncompliance with prescribed treatment. Of particular concern was the number of women who were uninsured. Though many of the women had Medicaid coverage

[17] World Health Organization. Social Determinants of Health, Key Concepts. Accessed January 26, 2012. http://www.who.int/social_determinants/thecommission/finalreport/key_concepts/en/index.html

[18] Council of State and Territorial Epidemiologists. 11 Domains of Core Preconception Health and Health Care Indicators. Accessed January 26, 2012 at: http://www.cste.org/dnn/ProgramsandActivities/ChronicDiseaseMCHandOralHealth/MCHIndicators/tabid/337/Default.aspx

throughout the pregnancy, they had chronic conditions that would have required routine follow-up and care before and after the pregnancy to ensure good health. In addition, proportionately more women who died were self pay for obstetric care and/or delivery than women in the general population, even though they would have qualified for Medicaid during pregnancy. Overall, uninsured individuals are less likely to receive medical care due to cost, less likely to have a usual source of medical care, and are at increased risk for serious health conditions.[19] Continuous disease management was seen as a critical factor in the care of women with heart diseases and disorders as well as those with chronic hypertension.

Similarly, healthcare professionals often were delayed in providing appropriate diagnosis, treatment, and follow-up. The Team also noted that providers did not seek consultations or refer for specialty care in a timely way or in a way that reduced barriers for the individual to follow-up. Lack of communication and planning between providers was found to be an important contributing factor. Ideas for improving follow-up included ensuring follow-up appointments were made prior to hospital discharge, notifying referral providers to expect and accept the patient for timely follow-up appointments, and providing sufficient quantities of medications to maintain the patient until they could be seen in follow-up.

Overall, the women who died lived lives complicated by low levels of education, few financial resources, chronic health conditions, and responsibilities of single parenthood. Virginia's Maternal Mortality Review Team identified systems changes including improved access to funding for services, case management and home visitation, along with improved disease management protocols as necessary factors to improve and protect the health of these citizens. The Team further identified the need to develop innovative ways to make prenatal care more accessible, affordable, and available to all

[19] US Department of Health and Human Services. Agency for Healthcare Research and Quality, National Healthcare Disparities Report, 2010, Chapter 9: Access to healthcare. Accessed on February 23, 2012 at: http://www.ahrq.gov/qual/nhdr10/nhdr10ch9.pdf

women. The Team encourages providers to explore new models of care provision to improve prenatal care utilization as well as birth outcomes.

Based on these findings, the Maternal Mortality Review Team offers the following recommendations for reducing the numbers of pregnancy-associated deaths due to heart diseases and disorders and related conditions among the citizens of the Commonwealth of Virginia. These recommendations are offered in the spirit of public health to the Governor, Members of the General Assembly, healthcare professionals, community service providers, and the citizens of the Commonwealth.

VIRGINIA MATERNAL MORTALITY REVIEW TEAM RECOMMENDATIONS TO ADDRESS PREGNANCY-ASSOCIATED DEATHS FROM HEART DISORDERS AND RELATED CONDITIONS IN VIRGINIA

1. **Support and enhance the CommonHelp portal to improve, simplify, and expedite access to services. The portal should be practical, accessible, and available for consumers to use.**
2. **Establish comprehensive cardiovascular disease care with disease specific pathways that extend beyond delivery.**
3. **Maximize use of information technology such as electronic medical records, telemedicine and other innovative means to improve communication among providers.**
4. **Ensure that all pregnant Medicaid members with chronic health problems receive face to face case management beginning at enrollment.**
5. **Expand alternatives to the traditional office based model of prenatal care to make care more accessible, affordable, and available.**

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This report is available at: http://www.vdh.virginia.gov/medExam/MaternalMortality.htm

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