

# Pregnancy-Related MORTALITY

*in Alabama*

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# ADPH

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Very few writings are found in ancient civilization on the delivery of babies. Some Hindu texts refer to childbed fever dating back to 1500 BC. Also, the Ebers Papyrus (1550 BC) contains prescriptions for causing abortion, for promoting labor, and for curing displacements in the uterus. Hippocrates wrote of the puerperal diseases and the different types of presentation of the infants. In the medical school of Alexandria, Herophilus provided a truer picture of female anatomy than had existed previously. In the second century Soranus (AD 98-138) wrote a treatise as a guide to midwives. The last mention of midwifery before the dark ages was in the 8th century.

With the Renaissance and Reformation, obstetrical writings began to again surface. During the middle of the 17th century, lying-in hospitals were established in many European cities. During this same period, members of the medical profession began to publish records of their experiences. In England in 1671, Jane Sharp wrote *The Midwives Book*.<sup>1</sup>

While other women have attended women as a rule, in the 1700s physicians and surgeons began to take up midwifery as a specialty rather than a secondary part of their practice. Lying-in hospitals were considered modern (partially because of the availability of forceps), but the crowding of patients, frequent examinations, and use of contaminated instruments, dressings and bed linen spread infection from patient to patient.

The Vienna physician Semmelweiss discovered the contagious nature of puerperal fever by noting the high death rate in the wards attended by the medical students and the low death rate in the clinic attended by the midwives. The medical students did autopsies each morning on women who had died the previous day, while the midwives were not required to do autopsies. After teaching his students to scrub their hands before having patient contact, the death rate fell from 11.4 percent in 1846, to 3.8 percent in 1847, to 1.3 percent in 1848.

In the US, Dr. Oliver Wendell Holmes studied the deaths of a physician and medical student who both died of septicemia after performing an autopsy on a woman who died of puerperal fever. Holmes wrote his classic essay "The Contagiousness of Puerperal Fever" in 1843, containing eight hygiene rules for the obstetrician, but his conclusions were ridiculed.

In 1879 Pasteur and his colleagues demonstrated that streptococcus caused most cases of puerperal fever. By 1900, it was known that in maternity hospitals where antiseptic techniques were rigorously followed, deaths of mothers from puerperal fever were low.<sup>2</sup>

## INTRODUCTION

**P**regnancy and childbirth carry a risk of illness and death to women completely different than for men. Deaths from pregnancy related causes had a serious effect on the life expectancy of women in the past in the United States, and these deaths continue to be a major problem in developing nations today. While pregnancy related deaths no longer greatly affect the overall life expectancy of Alabama women, these particular deaths and all other deaths to women who are pregnant or have recently been pregnant need to be studied carefully. Deaths from accidents and homicide during and shortly after pregnancy are especially troubling.

To examine the problem, this report focuses on mortality in Alabama for:

- 1) women who died from a maternal cause (**maternal deaths**) and
- 2) women who died while pregnant or within one year after delivery (**pregnancy-associated deaths**).

[See box for definitions.] Analyses by age, race, prenatal care, educational level, and cause of death reveal important patterns in the data for deaths to these women.

### DEFINITION OF MORTALITY DUE TO PREGNANCY

According to the International Classification of Diseases, 10th revision, “a **maternal death** is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, *from any cause related to or aggravated by the pregnancy or its management*, but not from accidental or incidental causes.” In addition, a late maternal death is the death of a woman from direct or indirect obstetric causes more than 42 days but less than one year after the termination of pregnancy.<sup>3</sup>

A **pregnancy-associated death** is the death of a woman while pregnant or within one year following the end of pregnancy *from any cause of death including injury*.<sup>4</sup> Thus, a maternal death as defined above is included in this broader grouping.

In this report pregnancy-associated deaths are divided into two time periods:

An **early-postpartum pregnancy-associated death** is the death of a woman while pregnant or within 42 days of termination of pregnancy, from any cause of death.

A **late-postpartum pregnancy-associated death** is a death of a woman more than 42 days but less than one year after the termination of pregnancy from any cause of death.

## PART ONE: MATERNAL DEATHS

The most phenomenal fact about maternal death in the US today is its rarity. In past centuries, childbirth and pregnancy were among the leading causes of death for women in the US. Parents expected that children would die in infancy, and death in childbirth was a likely tragedy.<sup>5</sup> In 1920 the US Bureau of Census reported that 800 women died for every 100,000 births. Likewise in Alabama in 1920, 780 women died for every 100,000 births.<sup>6</sup> Today in industrialized nations, childbirth and pregnancy cause very few deaths. In the US in 2003, there were 515 maternal deaths (provisional)<sup>7</sup> out of 4,089,950 births<sup>8</sup> for a rate of 12.6 per 100,000 births. Eight of those

deaths occurred in Alabama.

Today the picture is still very different in other parts of our world. For instance, a recent study by UNICEF and the US Centers for Disease Control and Prevention (CDC) found in Afghanistan, with a female population of nearly 14,000,000,<sup>9</sup> an estimated 1,600 out of every 100,000 mothers died from complications of childbirth and pregnancy for a total of 20,000 deaths in 2000. In some parts of Afghanistan, maternal death rates are as high as 6,000 per 100,000 women.<sup>10,11</sup> Complications of pregnancy and childbirth cause 48 percent of the deaths to women of childbearing age in Afghanistan.<sup>12</sup> Another study in Bangladesh found that a mother's death sharply

increased the probability that her children, up to age 10, will die within two years. This was especially true for her daughters.<sup>13</sup>

The World Health Organization (WHO) estimated 529,000 maternal deaths occurred worldwide in 2000, with 13 developing countries accounting for 67 percent of all maternal deaths. WHO estimated the lifetime risk of maternal death for a woman in Afghanistan as 1 in 6 while a woman in the US has a risk of 1 in 2,500. Worldwide, the risk is 1 in 74, a figure that demonstrates the severe effect caused by the high risk of maternal death in developing countries.<sup>11</sup> These are shocking figures to Americans who routinely encounter pregnancy without fear of loss of life.

### EARLY PRACTICES IN ALABAMA

Some historical information is available about maternal deaths in Alabama from the 1850s forward. It is a wonder any woman survived in Alabama after being assisted by doctors and untrained midwives. In the antebellum era, the use of clean instruments or the washing of hands was nonexistent. In rural areas in the 1850s, draining large quantities of blood from the body after a long difficult labor was believed to relax the uterus and birth canal, making delivery easier.

Alabama physicians were concerned about the use of untrained midwives. By the middle of the 19th century, Alabama's public health officials had noted a direct relationship between a high rate of infant and maternal deaths and the use of untrained midwives. However, the growing population and lax or nonexistent licensing laws contributed to the expanded use of untrained midwives in Alabama. Even among educated people, practices such as purging and blood letting continued. Prior to the 20th century, antiseptic use in routine deliveries was condemned, even by Jerome Cochran, known as the "Father of the Alabama Public Health System" and a founding member of the American Public Health Association.<sup>14</sup>

In 1921 the US Congress passed the Maternity and Infancy Act for the investigation of maternal and infant mortality. This act was the first federally funded social

welfare measure in the US. Designating the Alabama State Board of Health as the responsible state agency, Alabama received \$20,800 in early 1922 and matched these federal funds with an additional \$25,000 to fund, for five years, nutrition and hygiene activities, midwife training and visiting nurses for pregnant women and new mothers in the state. The first to receive the funds was an experimental program in Talladega County. By the end of 1922, 14 counties had programs.<sup>15,16</sup>

A statistical study was prepared in 1924 of maternal and infant deaths in Alabama compared to the US and to the state of New York. According to the Director of Child Hygiene and Public Health Nursing of the Alabama State Board of Health, Alabama had an unusually high rate of maternal deaths. Midwives attended twenty-eight percent of all births in Alabama in 1924. In the study, most of the stillbirths, maternal deaths and tetanus deaths led back to a group of about 25 percent of the names on the register of Alabama midwives.<sup>17</sup>

Eventually, the advent of anesthesia, the rising level of medical education and the improving socioeconomic status of the people of Alabama brought a sharp reduction in maternal and infant mortality. It was finally with antibiotics that maternal deaths decreased significantly.

## MEASURING MATERNAL DEATHS

A common measure of the risk of death once a woman has become pregnant is the maternal mortality ratio (MMR) which is calculated as the number of maternal deaths in a given time period per 100,000 live births during the same time period. The MMR for the world in 2000 was 400 ( $\pm$  220), and for the US the MMR was 17 ( $\pm$  5) per 100,000 live births. Worldwide, the US does not have the lowest ratio of maternal mortality. Of the 182 nations tracked by WHO, 28 had an MMR lower than the US in 2000 including Canada with an MMR of 6 ( $\pm$  2).<sup>11</sup>

### INTERESTING FACTS IN ALABAMA:

- In 1924, there were 58,840 births and 519 maternal deaths (MMR=882).<sup>18</sup>
- In 2002, there were 58,867 births and 6 maternal deaths (MMR=10).

For Alabama, the 3-year MMR for 2001 - 2003 was 9.5. However, the MMR for white Alabamians was 6.6 while the MMR for Alabamians of black and other races was 15.6. The racial disparity in the MMR reflects a phenomenon seen nationwide. CDC reports that since 1940 MMRs have been at least three to four times higher for blacks than whites. This four fold increase in risk of maternal death for a black woman compared to a white woman is one of the largest racial disparities among important public health indicators.<sup>19,20</sup>

Nationally the risk of death from complications of pregnancy and childbirth has decreased

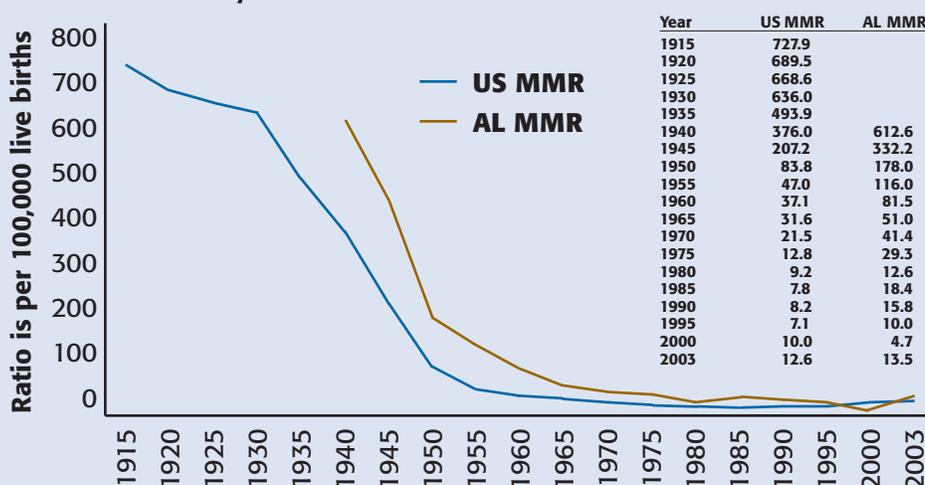
approximately 99 percent in the 20th century.<sup>21</sup> Figure 1 shows the tremendous decrease in the MMR in the US and Alabama since 1915. Two revolutionary medicines drastically reduced maternal deaths from infection during the 1940s. Sulfanilamide used to treat infectious diseases was available by 1937.<sup>14</sup> The antibiotic penicillin became available through mass production in 1946 at \$0.55 per dose.<sup>22</sup> In the US, no further decrease in maternal mortality has occurred since 1982.<sup>21</sup>

In Alabama, maternal deaths also decreased greatly in the 20th century. In 1936 just prior to the advent of sulfanilamide, 16.3 percent of deaths to women 20 to 29 years of age were due to pregnancy and childbirth.<sup>23</sup> Pregnancy and childbirth was the second leading cause of death, exceeded only by deaths from tuberculosis. In 2003, pregnancy and childbirth caused 3 deaths to women 20 to 29 and 8 deaths overall. Table 1 shows that pregnancy and childbirth tied diabetes as the tenth leading cause of death for women aged 20 to 29 years in 2003.

Looking back more than 100 years ago in Alabama, sixty-one percent of maternal deaths recorded in 1885 were puerperal-hemorrhage, septicemia, or convulsions.

**PUERPERAL FEVER/SEPSIS:** Fever that lasts for more than 24 hours within the first 10 days after a woman has had a baby, miscarriage, or abortion. The fever is from an infection due to the exposure of pathogenic bacteria, most often of the placental site within the uterus. If the infection involves the bloodstream, it constitutes puerperal sepsis. "Puerperal fever is as old as medicine."<sup>5</sup>

**FIGURE 1**  
Maternal Mortality Ratios, Alabama and US 1915 to 2003



**TABLE 1**  
Leading Causes of Death  
Women Aged 20 to 29  
years, Alabama 2003

Accidents .....	70
Cancer .....	19
Homicide .....	16
Heart Disease.....	11
Suicide .....	9
Congenital Malformations.....	7
Cerebrovascular Disease .....	5
HIV .....	4
Influenza & Pneumonia...4	
Pregnancy & childbirth ....	3
Diabetes .....	3
Other.....	63

The causes of the remaining 39 percent were vague such as “other” or “following childbirth”.<sup>24</sup> In 1920, 78 percent of the Alabama maternal deaths recorded were puerperal causes.<sup>6</sup> Today in the US, the leading causes of maternal deaths are hemorrhage, blood clot, high blood pressure, infection, stroke, amniotic fluid in the blood stream, and heart muscle disease.<sup>25</sup>

**Puerperium:** the period of time following childbirth when a woman’s body returns to its state before pregnancy.

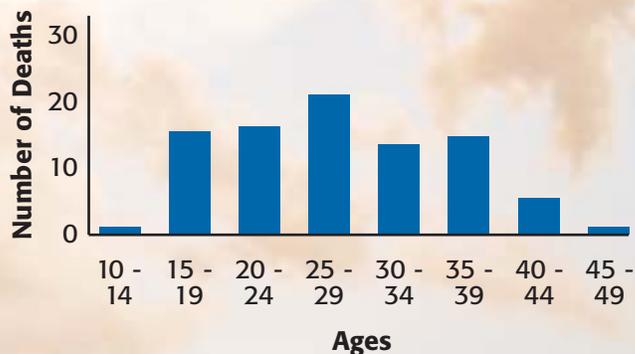
### MATERNAL DEATHS IN ALABAMA TODAY

To study maternal deaths in Alabama today, all deaths to women in the childbearing ages from 1991 to 2003 were examined to determine if death occurred during or within one year of pregnancy. Those deaths were then linked to a birth or fetal death if one could be found. [See Methodology.] Ninety-one\* women in Alabama officially died from a cause directly related to the pregnancy and are considered maternal deaths [See box with definitions.]

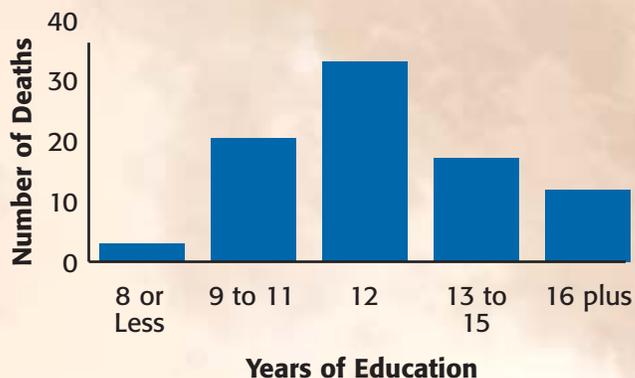
Figure 2 shows that the number of maternal deaths per year over the 13-year span ranged from a high of 13 to a low of 2. Figure 3 shows that the ages of the women who died ranged throughout the child-bearing years with the highest number occurring in the 25-29 age group. The educational levels of these women included those who had not completed high school through those who were college graduates (Figure 4).

\* One death to a woman of a race other than black or white was omitted from these analyses.

**FIGURE 3**  
Number of Maternal Deaths by Age Group, Alabama 1991 to 2003



**FIGURE 4**  
Number of Maternal Deaths by Years of Education, Alabama 1991 to 2003



**FIGURE 2**  
Number of Maternal Deaths, Alabama Residents 1991 to 2003

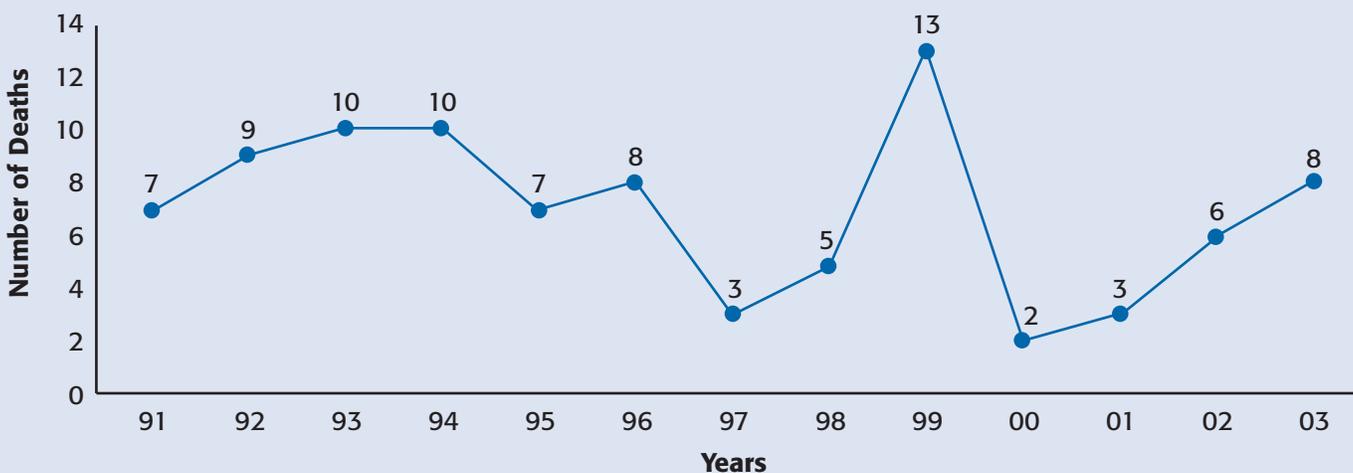
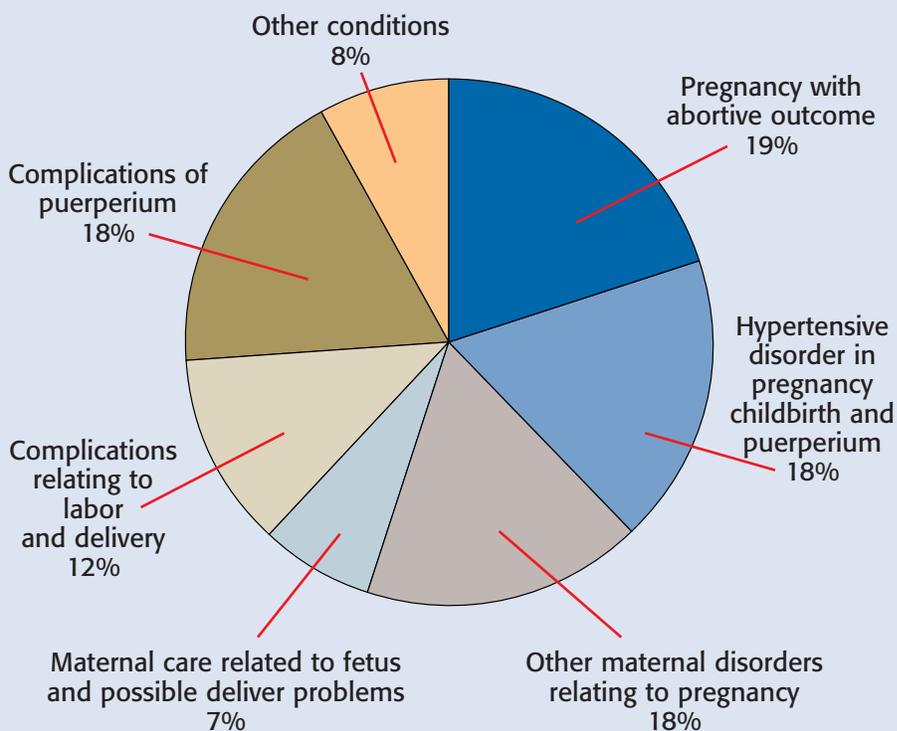


Figure 5 shows the distribution of causes of these maternal deaths. Examples of deaths from pregnancy with an abortive outcome include ectopic (located outside the uterus) pregnancies and miscarriages. The category of hypertension disorders includes pre-existing hypertension, pregnancy-induced hypertension, and eclampsia. The category of maternal disorders relating to pregnancy includes such conditions as infections, asthma, and cardiovascular disease. The category of maternal care related to fetus and possible delivery problems includes multiple gestation, premature rupture of membranes, placenta previa, and antepartum hemorrhage. Complications of labor and delivery include obstructed labor, trauma, and postpartum hemorrhage. Complications of puerperium includes sepsis and other infections, obstetric embolisms, and complications of anesthesia.

### Age and Race

Table 2 shows the MMR for each category of maternal death for total deaths and by race. Overall, the MMR for black Alabamians (23.9) is 334.5 percent higher than for white Alabamians (5.5) for this 13-year period. The greatest difference in the MMR between white Alabamians and black Alabamians is for hypertensive disorders in pregnancy. Thirteen black Alabamians compared to three white Alabamians died from a hypertension-related maternal death.

**FIGURE 5**  
**Causes of Maternal Death, Alabama 1991 to 2003**



**TABLE 2**  
**Deaths and Maternal Mortality Ratios by Race and Cause of Death, Alabama 1991 to 2003**

Cause	Total		White		Black	
	Deaths	Ratio	Deaths	Ratio	Deaths	Ratio
Pregnancy with abortive outcome	18	2.3	6	1.1	12	4.6
Hypertensive disorder in pregnancy childbirth and puerperium	16	2.0	3	0.6	13	5.0
Other maternal disorders relating to pregnancy	16	2.0	5	0.9	11	4.2
Maternal care related to fetus and possible delivery problems	6	0.8	1	0.2	5	1.9
Complications relating to labor and delivery	11	1.4	3	0.6	8	3.1
Complications of puerperium	17	2.1	7	1.3	10	3.9
Other conditions	7	0.9	4	0.8	3	1.2
<b>Total</b>	<b>91</b>	<b>11.5</b>	<b>29</b>	<b>5.5</b>	<b>62</b>	<b>23.9</b>

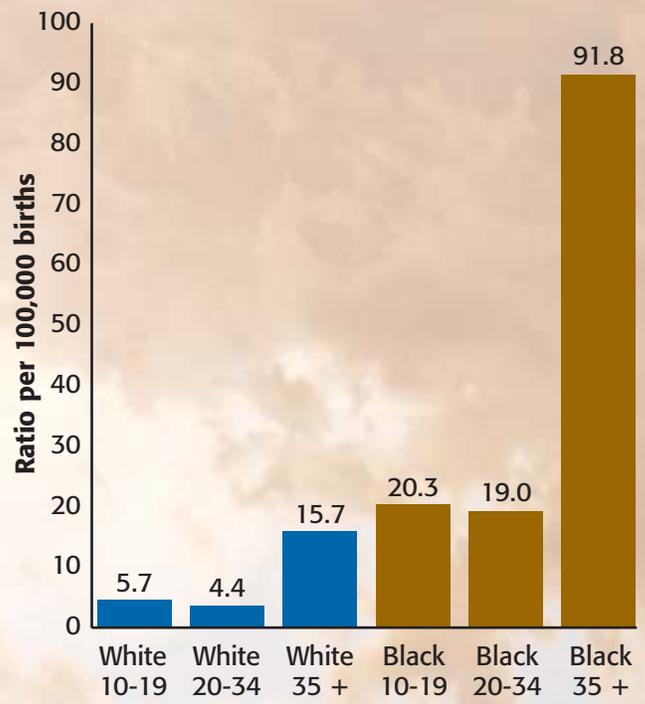
Ratios per 100,000 are based on Alabama births from 1991 to 2003: total births, 794,756; white births, 526,489; black births, 259,307

### Age of Mother

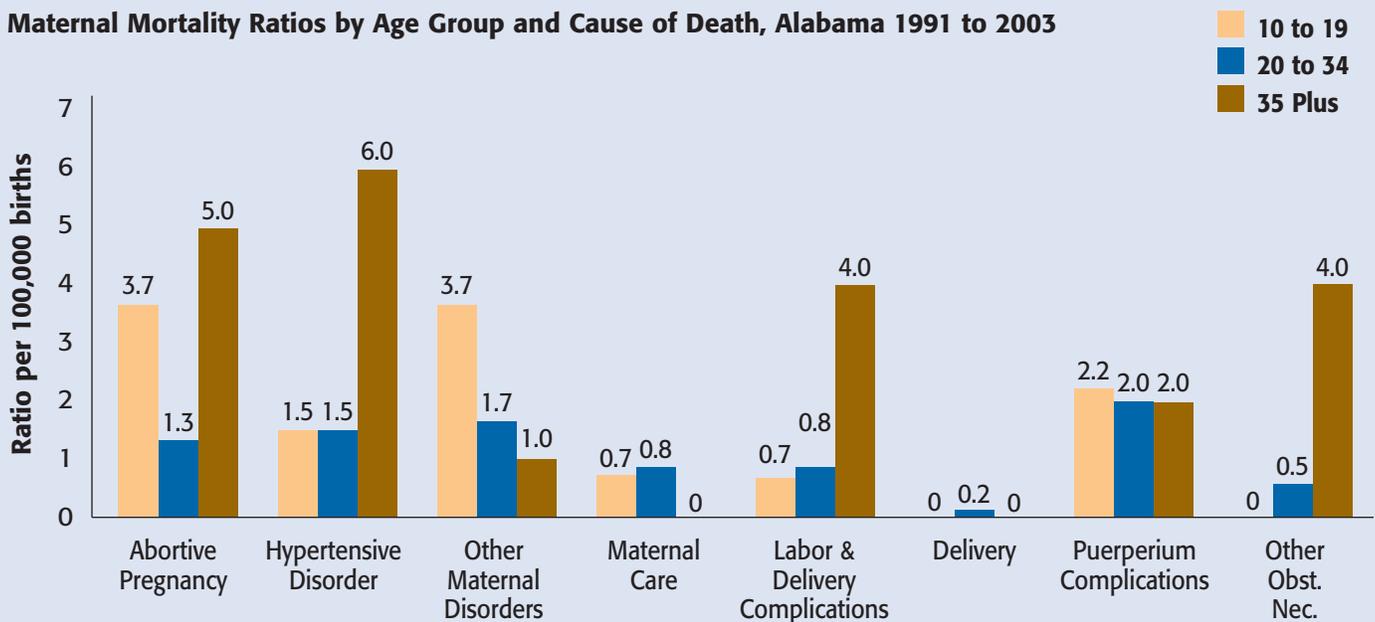
Nationally, the age of the mother is related to maternal deaths. Age-specific maternal mortality ratios are presented for white compared to black Alabamians in Figure 6. For both racial groups, the MMR is lowest for women aged 20 to 34 and much higher for women aged 35 and older. For black women aged 35 and older, the MMR is 383.2 percent higher than for black women aged 20 to 34. For white women aged 35 and older, the MMR is 256.8 percent higher than for white women aged 20 to 34. Even more striking, for women aged 35 and older, the age-specific black MMR is 484.7 percent higher than the white MMR.

Figure 7 shows the differences in MMRs for three age groups by cause of maternal death. Even though the number of cases is small, a striking contrast is seen in MMRs for women aged 35 and older compared to younger aged women for hypertensive disorders (N=16), for labor and delivery complications (N=11) and for pregnancy with abortive outcome (N=18). Compared with women aged 20 to 34, younger women aged 10 to 19 have noticeably higher MMRs for pregnancy with abortive outcome and maternal disorders other than hypertension. Interestingly, deaths from puerperium complications are distributed evenly across the three age groups.

**FIGURE 6**  
Maternal Mortality Ratios by Age Group and Race, Alabama 1991 to 2003



**FIGURE 7**  
Maternal Mortality Ratios by Age Group and Cause of Death, Alabama 1991 to 2003



### Prenatal Care

Of the women who died from a maternal death, 42 died without an accompanying delivery of either a live birth or a fetal death. For the remaining 49 women for whom a matched certificate was available, 33 (67 percent) had prenatal care that began in the first three months of the pregnancy.

For the remaining 16 of that same subgroup of 49 women, half received some prenatal care and half did not (Table 3). Late care was defined as either no prenatal care or care that began in the fourth month or later. Mothers with late care were more likely than early care mothers to die from a cause related to the mother’s condition (for example hypertension, cardiovascular disease, or infections). While numbers are small, 56.3 percent of late care mothers compared with 36.6 percent of early care mothers died from a cause related to the mother’s condition.

The race of the deceased mother was correlated with late prenatal care. For women who died of a maternal death whose pregnancies resulted in a live birth or fetal death, 41.9 percent of black mothers compared with 17.6 percent of white mothers received late maternal care.

**TABLE 3**  
**Number of Maternal Deaths by Month Prenatal Care Began, Alabama Women\* 1991 to 2003**

Month Prenatal Care Began	Deaths
1	9
2	14
3	10
4	3
5	1
6	2
7	2
No Prenatal Care	8
Total	49

\* Included only deaths with a matching birth certificate or fetal death report.

## PART TWO: EARLY AND LATE POSTPARTUM PREGNANCY-ASSOCIATED DEATHS

In Part One, the discussion focused on maternal deaths from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. This section focuses on pregnancy-associated deaths or deaths to women while pregnant or within one year of termination of pregnancy, irrespective of the cause of death. The deaths from maternal causes discussed in Part One are also included in this section.

### Pregnancy-Associated Deaths

The CDC definition of pregnancy-associated deaths used for the National Pregnancy Mortality Surveillance System is the death of a woman who died while pregnant or within one year following the end of pregnancy, from any cause including injury. The checkbox on the Alabama

death certificate asking if the decedent had been pregnant in the past 42 days identified 190 of the women in Alabama included as pregnancy-associated deaths. The remaining cases were found by matching birth and death certificates (see Methodology).

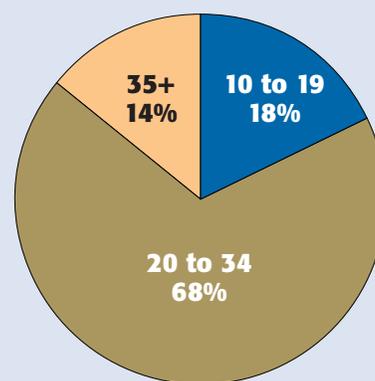
Using the CDC National Pregnancy Mortality Surveillance System definition, in Alabama from 1991 to 2003, 590\*\* women died from a pregnancy-associated death. Ages ranged from 14 to 46. The majority (68 percent) of this group was aged 20 to 34 as seen in Figure 8.

### Cause of Death

The cause of pregnancy-associated death is determined partly through the information provided by a checkbox on the death certificate asking if the decedent had been pregnant within the last 42 days. For some causes of death

such as accidents or homicide, pregnancy information is irrelevant to the assigned cause of death. For other causes of death, particularly heart disease and

**FIGURE 8**  
Percent of Pregnancy-Associated Deaths by Age Group, Alabama 1991 to 2003



\*\* One death to a woman of a race other than black or white was omitted from these analyses.

**TABLE 4**

**Deaths and Cause-Specific Pregnancy-Associated Mortality Ratios by Race, Total and Percent that Black is Higher or Lower than White, Alabama 1991 to 2003**

Leading Causes	Total		White		Black		Percent Higher/Lower
	Deaths	Ratio	Deaths	Ratio	Deaths	Ratio	
Accidents	175	22.0	127	24.1	48	18.5	-23.2
Pregnancy	91	11.5	29	5.5	62	23.9	334.5
Heart Disease	68	8.6	30	5.7	38	14.7	157.9
Homicide	67	8.4	30	5.7	37	14.3	150.9
Cancer	35	4.4	18	3.4	17	6.6	94.1
Cerebrovascular Diseases	14	1.8	7	1.3	7	2.7	107.7
Suicide	11	1.4	10	1.9	1	0.4	-78.9
Influenza & Pneumonia	10	1.3	1	0.2	9	3.5	1,650.0
Septicemia	6	0.8	2	0.4	4	1.5	275.0
Aortic Aneurysm	5	0.6	3	0.6	2	0.8	33.3
All Other	108	13.6	45	8.5	63	24.3	-
Total	590	74.2	302	57.4	288	111.1	93.6

cerebrovascular diseases, the pregnancy state of the decedent may affect the final death code assigned because the disease may have been caused or exacerbated by the pregnancy. If so, pregnancy becomes the underlying cause of death.

Table 4 presents causes of death and cause-specific Pregnancy-Associated Mortality Ratios (PAMR) by race. The last column of Table 4 shows the percent that the black ratio is higher or lower than the white ratio. As with maternal mortality, for all causes, the PAMR was higher for black (111.1) compared to white (57.4) females.

The ratio differences by race are displayed in Figure 9. Frequent causes of death where black women had a PAMR noticeably higher than white women were for pregnancy (334.5 percent higher), diseases of the heart (157.9 percent higher), and homicide (150.9 percent higher). Nine black women compared to one white woman died from

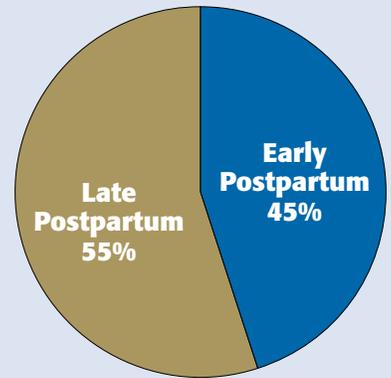
influenza and pneumonia\*\*\* for a black rate 1,650 percent higher than the white rate, a very striking finding. Accidents and suicide were the two leading causes of death where the black ratio was lower than the white ratio.

The order of the leading causes differs by race (Table 4). For white women the four leading causes were (1) accidents, (2) heart disease and homicide (tied), and (4) pregnancy. For black women the leading causes were (1) pregnancy, (2) accidents, (3) heart disease, and (4) homicide.

### Time Frame

Pregnancy-associated deaths can be broken into two time frames. Early postpartum deaths are those that occurred to women who were pregnant at the time of their death, died from a maternal cause or died within 42 days of termination of pregnancy. From 1991 to 2003, 268 women met the definition of early postpartum deaths.

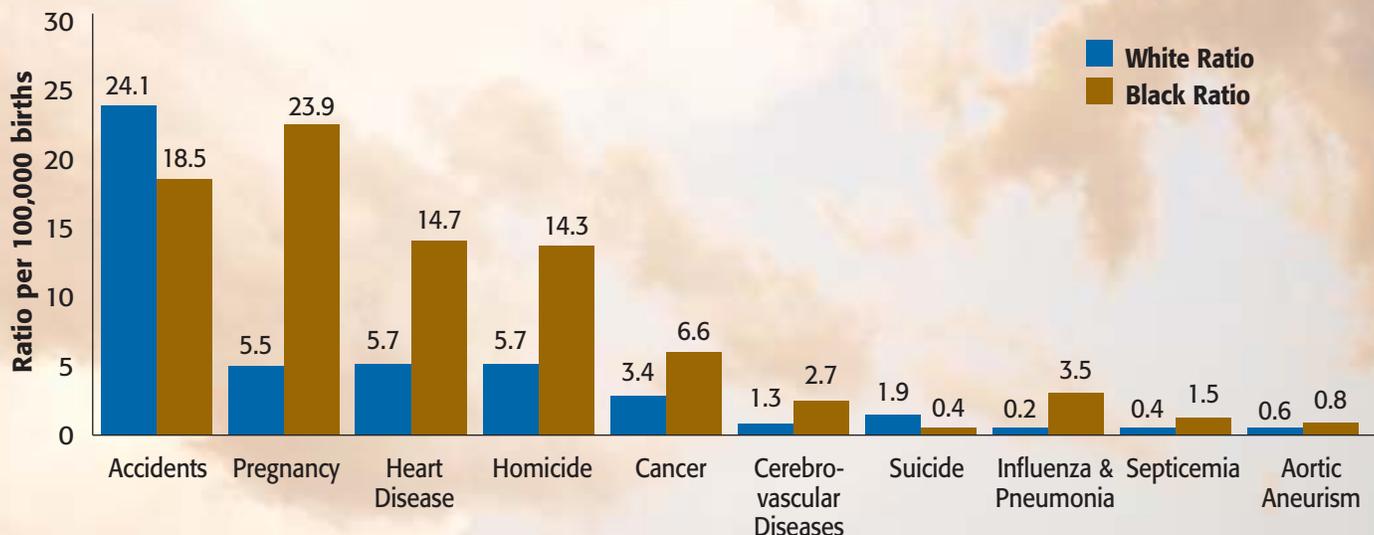
**FIGURE 10**  
**Pregnancy-Associated Deaths by Time Frame, Alabama 1991 to 2003**



Late postpartum deaths are those occurring to women more than 42 days but less than 366 days postpartum. From 1991 to 2003, 322 women died in the time period of 43 through 365 days postpartum. Slightly more women died in the late postpartum period compared to the early postpartum time frame (Figure 10).

\*\*\* Only one death was from influenza, the remaining nine deaths were from pneumonia.

**FIGURE 9**  
**Pregnancy-Associated Mortality Ratios by Cause of Death and Race, Alabama 1991 to 2003**



Differences are seen in the causes when comparing early and late postpartum deaths. Only two women died from a pregnancy related cause during the late postpartum period. Additionally, a larger proportion of the deaths from accidents, heart disease, homicide, cancer, and suicide occurred during the late postpartum period. Figure 11 shows the different causes of death for late postpartum compared to early postpartum periods.

### External Causes of Death

Accidents, homicide, and suicide (considered external causes of death unrelated to the acute or chronic medical condition of the mother) are troubling.

**Ninety-one percent of all accidental deaths to women who died from early postpartum causes were from motor vehicle fatalities.**

Of the 46 women who died from early postpartum accidental deaths of all types, 32 women died before the delivery of a live birth. Nearly all of these deaths were from motor vehicle crashes. The remaining early postpartum accidental deaths (n=14) occurred to women within 42 days of the

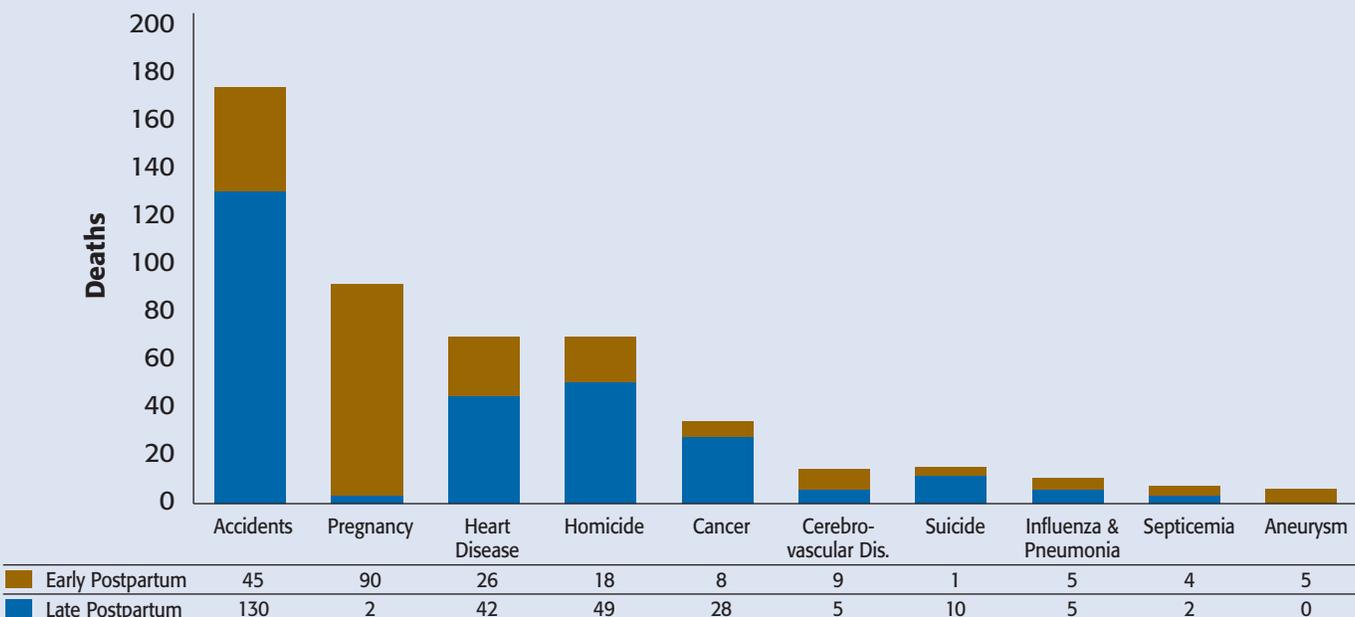
birth of their baby. Of the women who died from late postpartum accidents, 75.4 percent of those deaths were from motor vehicle fatalities.

Sixty-seven women died from homicide within one year of the termination of their pregnancy. The majority (73 percent) were killed in the late postpartum period. Of the 18 homicide deaths to women who died in early postpartum pregnancy-associated period, 12 were killed while pregnant. Two additional women delivered live born infants before they died from gunshot wounds. The remaining four women were killed approximately one month after their baby was born. Homicide was the cause of death for 49 women in the late postpartum period leaving their children without a mother before the first birthday.

Eleven women died from suicide following the birth of their babies. One woman died from suicide 28 days after the birth of her baby. The remaining suicides were in the late postpartum period. The majority of the deaths were at approximately six months postpartum as shown in Figure 12.

**Accidents and homicide account for 54.4 percent of late postpartum deaths.**

**FIGURE 11**  
**Number of Pregnancy-Associated Deaths by Leading Cause and Time of Death, Alabama 1991 to 2003**

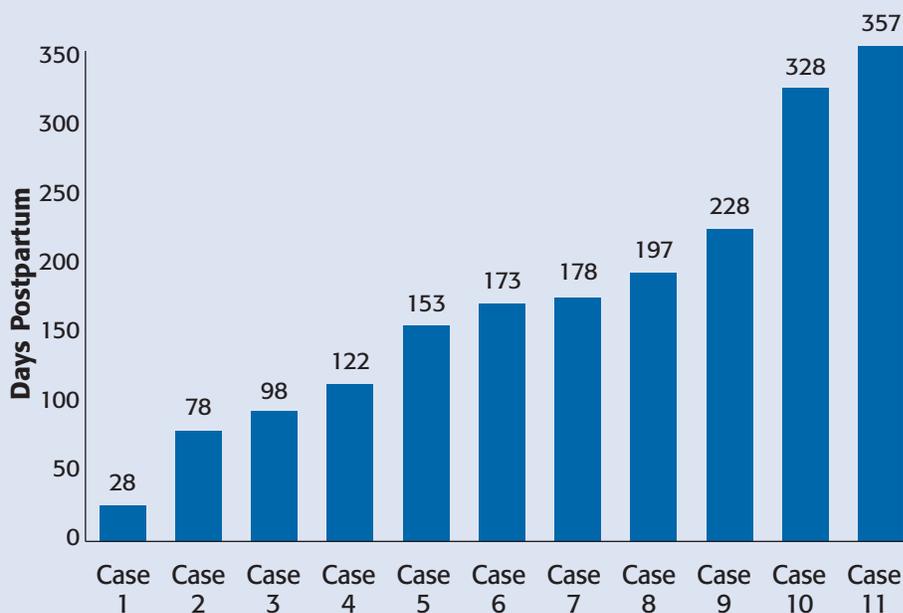


## Stress During Pregnancy

The physical demands of pregnancy are often exacerbated by very stressful events occurring in the lives of the women during their pregnancy. The Pregnancy Risk Assessment Monitoring System (PRAMS) is a statewide random sample survey of new mothers developed for health planners so that they can target and evaluate programs to improve the well being of mothers and their babies [See Methodology/ Sources of data for more information]. For 2000 to 2002, 6.2 percent (with a 95% confidence interval (CI) of 5.4 percent to 7.1 percent) of Alabama mothers experienced physical abuse by their husband, partner, or someone else during their pregnancy. Prenatal care providers discussed physical abuse with only 34.9 percent (CI of 33.3 percent to 36.6 percent) of all surveyed Alabama mothers in this time frame. Figure 13 shows the leading sources of stress experienced by mothers within twelve months of the birth of their baby. Other stressors experienced by at least 10 percent of the women were (a) someone close had a drinking or drug problem, 16.2 percent; (b) husband or partner lost job, 13.8 percent; (c) separated or divorced from husband or partner, 12.6 percent; (d) lost their job, 11.9 percent; and (e) husband or partner didn't want the pregnancy, 10.7 percent. Six or more stress factors were experienced by 9.1 percent of the women. Only 21.0 percent (CI of 19.6 to 22.5) of the women experienced none of the survey stressors during their pregnancy. These data powerfully demonstrate that pregnancy is not an easy time of life for many women.

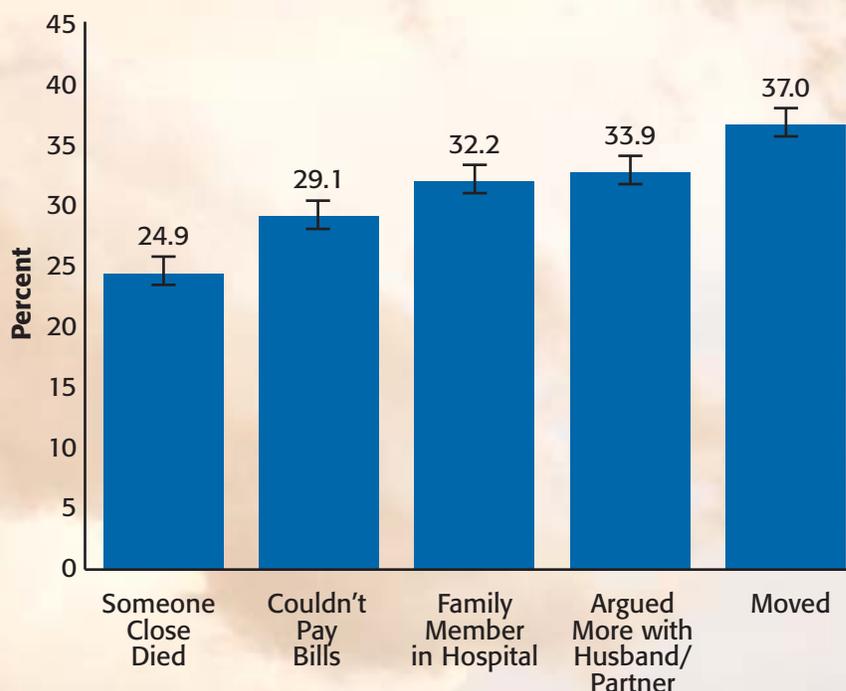
**FIGURE 12**

**Pregnancy-Associated Suicide Deaths by Number of Days Postpartum, Alabama 1991 to 2003**



**FIGURE 13**

**Five Leading Sources of Stress Twelve Months Before Delivery, Alabama PRAMS 2000 to 2002**



## CONCLUSION

**P**regnancy related mortality is a sentinel indicator of public health; yet in the US, over 500 women die of pregnancy complications each year. In Alabama about 7 women die each year from pregnancy related causes, and an additional 38 women die from any cause within the first year after their delivery.

In Alabama, like the rest of the nation, risk of maternal death is greater for older women, and women with late or no prenatal care. As women postpone childbearing, practitioners and potential mothers alike must be aware of all the risks to ensure healthy outcomes. Overall, for those who died of a maternal cause, women aged 35 and older had much higher death rates for pregnancy with abortive outcome, hypertensive disorders, and labor and delivery complications. Black women over 35 had a particularly high risk from hypertensive disorders.

Thirty-three percent of the women who died from a pregnancy related cause following a live birth had prenatal care that began after the first trimester. Mothers whose prenatal care began in the fourth month or later were more likely to die from a cause related to the mother's condition, such as hypertension, cardiovascular disease or infections, than mothers beginning care earlier. Early prenatal care must be a reality for all mothers, regardless of circumstances.

Unfortunately, black women continue to have three to four times higher maternal mortality ratios (MMR) both nationally and in Alabama. The MMR in Alabama for black women was 334.5 percent higher than for white women. For women aged 35 and older, the black MMR of 91.8 was 484.7 percent higher than the white MMR of 15.7. The black MMR exceeds the white ratio by the largest margin for the category hypertensive in pregnancy, childbirth and puerperium.

Racial differences also exist in prenatal care patterns. For women who died from a pregnancy related cause and delivered either a live birth or fetal death, 41.9 percent of black mothers, compared with 17.6 percent of white mothers, entered prenatal care late or not at all. This finding is consistent with birth data that show a higher percentage of

black and other race mothers receive less than adequate prenatal care compared to white mothers.

The five leading causes of death for women who died while pregnant or within one year following the end of pregnancy (pregnancy-associated mortality), were (1) accidents, (2) pregnancy, (3) heart disease, (4) homicide, and (5) cancer. For each of these leading causes except accidents, black women had higher pregnancy-associated mortality ratios (PAMR) than white women. The black ratio was 334.5 percent higher for pregnancy, 157.9 percent higher for heart disease, 150.9 percent higher for homicide, and 94.1 percent higher for cancer. The black ratio was 23.2 percent lower than the white ratio for accidents.

Deaths from injuries that are preventable (accidents, homicide, and suicide) accounted for 42.9 percent of the pregnancy-associated deaths in the study. A motor vehicle was the cause of the most of the 175 accidental deaths, yet PRAMS data show that health care providers (doctors, nurses or other health care workers) have discussed seat belt use during a prenatal care visit with less than half of new mothers completing the survey. Of the 67 women who died from homicide, 12 were pregnant when they died, 2 delivered live born infants before they died from gun shot wounds, and 4 were killed approximately one month after the delivery. All of the 11 suicide deaths occurred after the birth of the baby, a time that most people associate with happiness and joy, but a period where the risk of postpartum depression is great.

These data suggest that risks exist before and after the birth of a baby from depression, stress, fatigue, and other factors that cause new mothers to die from accidents, homicide, and most deplorably, suicide. Nearly 80 percent of new mothers completing PRAMS surveys indicated they had an experience during pregnancy that could cause stress. Approximately six percent of PRAMS mothers reported that their husbands or partners physically abused them during their pregnancy. PRAMS mothers also reported only about 35 percent of health care providers discussed physical abuse by a husband or partner during a prenatal care visit. These data indicate that care providers must be

careful to screen for violence, depression, and stressful life events during prenatal and postpartum visits.

The Centers for Disease Control and Prevention points out that “studies indicate that as many as half of all deaths from pregnancy complications could be prevented if women had better access to health care, received better quality of care, and made changes in their health and lifestyle habits.”<sup>25</sup> This study also supports that conclusion. With appropriate interventions during and shortly after pregnancy, a number of the deaths that occurred in Alabama might have been prevented. Emphasis must continue to be placed on getting women into prenatal care early in their pregnancies and in educating providers to look at stress factors that may be present in the lives of pregnant women.

All over the world more than half a million women a year die from childbirth. Medical texts as ancient as 1550 BC grappled with the malpresentations, labor, and puerperal infections that caused the death of scores of women. Modern medicine has conquered the majority of the obstetrical dangers for women in developed countries. The MMR in the US and Alabama has decreased at a phenomenal rate, yet certain risks still remain. Black women, older women, and women with late prenatal care are at much higher risk. Prenatal care is not reaching every mother. Pre and postpartum screenings for violence, stressful life events, and depression must occur for every woman. The death of any mother at the birth of her child is a tragedy, and every newborn Alabamian deserves to have the mother who helped create his life survive to help nurture it.

# METHODOLOGY

## Sources of Data

Mortality data for this study are from death certificates filed with the Center for Health Statistics in the Alabama Department of Public Health for residents of Alabama. Data reflect the underlying cause of death defined as the disease or injury initiating the sequence of events that leads directly to death. For this study, deaths were classified using the International Classification of Diseases (ICD), Versions 9 and 10. Data for 1991 through 1998 were coded according to the ICD-9, and data for 1999 and 2003 were classified using the ICD-10.

The main change in the coding rules under the ICD-10 is that a death can be classified as maternal when indirect maternal causes of death are listed in Part I of the death certificate and pregnancy is reported in either Part I or Part II. Previously with the ICD-9 coding rules, a death due to an indirect maternal cause was classified as maternal only if pregnancy was reported in Part I. When new coding rules were put into effect, from 1998 to 1999 the number of maternal deaths reported by the National Vital Statistics System increased by 39 percent.<sup>26</sup>

The Pregnancy Risk Assessment Monitoring System (PRAMS) is a surveillance system of new mothers and is supported by the CDC under cooperative agreement number U50/CCU407103. The PRAMS survey includes numerous questions about the mother's experiences with the health care system during pregnancy and delivery, as well as questions on postpartum care for both the mother and the infant. Data are also collected on maternal behaviors and experiences that might have influenced the outcome of the pregnancy and health of the infant. The survey questionnaire is mailed to a sample of new mothers randomly selected from the birth certificate master file two to four months after the baby is born.

## Data Limitations

Death certificates are not intended to provide information on all of the medical conditions of a decedent, but instead, to provide information relating to the cause of death. Physicians vary in the way they interpret causal sequences, and they may have difficulty selecting a single underlying cause of death for a person with multiple chronic diseases. Additionally in Alabama the medical cause of death depends on the varying judgments of coroners, physicians and medical examiners.

When using vital events data for examining specific medical or social factors, the number of events reported in a given year may be very small. Understanding the statistical limitations of small numbers is important in conducting analyses. Any time something is measured, error is almost inevitable. Error can be based on the accuracy of the reports, or alternately, on the number of the events or the size of the population. Some error is random; and when the numbers are very large, random error does not affect the usefulness of the data. However, when the number of vital events is very small or the population of the area is very low, random errors in data collection, or even randomly occurring events, can cause drastic fluctuations in rates.

One way to counteract random error is to increase the number of years or to enlarge the area being studied. Otherwise, calculations may be correct but have very limited practical value. Thirteen years of mortality data were combined to help stabilize ratios in this publication, however cell sizes were often still very small.

## **Limitations of Maternal Mortality Measurement**

Worldwide, measuring maternal mortality is difficult because information is needed about pregnancy status at or near the time of death. Autopsy findings may or may not be available. Some maternal deaths are missed or misclassified. The quality of cause of death information of the death certificate may vary tremendously. Lack of physician knowledge about the correct way to complete a death certificate is one of the difficulties in correctly measuring the number of maternal deaths. In other less developed places deaths (and births) just are never recorded.

The World Health Organization states that registered maternal deaths should be adjusted upwards by 50 percent, on average.<sup>11</sup> CDC states that the misclassification of deaths underestimates maternal death such that, in the US, the true number of maternal deaths is 1.3 to 3 times higher than reported by vital statistics records.<sup>20</sup> Additionally when maternal deaths are relatively rare, they are subject to measurement error. It has been estimated that more than half of US maternal deaths are not identified through the routine use of cause of death codes on death certificates.

## **Pregnancy Mortality Surveillance**

Alabama cooperates with CDC's National Center for Chronic Disease Prevention and Health Promotion's Pregnancy Mortality Surveillance System (PMSS) that conducts epidemiological surveillance of pregnancy-related deaths for the nation in conjunction with efforts nationally to identify pregnancy-associated mortality as part of CDC's Safe Motherhood campaign. In the absence of pregnancy information on the death certificate, the matched birth certificate or fetal death report can identify deaths for this surveillance. For women who died between the ages of 8 and 50, computer searches were made of birth and fetal death files for the preceding 12 months to locate matches. The PMSS has been able to identify about 35 percent more deaths as pregnancy-related through its closer scrutiny.<sup>26</sup>

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