

Pregnancy-Related Mortality in the United States, 1998 to 2005

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OBJECTIVE: To estimate the risk of women dying from pregnancy complications in the United States and to examine the risk factors for and changes in the medical causes of these deaths.

METHODS: De-identified copies of death certificates for women who died during or within 1 year of pregnancy and matching birth or fetal death certificates for 1998 through 2005 were received by the Pregnancy Mortality Surveillance System from the 50 states, New York City, and Washington, DC. Causes of death and factors associated with them were identified, and pregnancy-related mortality ratios (pregnancy-related deaths per 100,000 live births) were calculated.

RESULTS: The aggregate pregnancy-related mortality ratio for the 8-year period was 14.5 per 100,000 live births, which is higher than any period in the previous 20 years of the Pregnancy Mortality Surveillance System. African-American women continued to have a three- to four-fold higher risk of pregnancy-related death. The proportion of deaths attributable to hemorrhage and hypertensive disorders declined from previous years, whereas the proportion from medical conditions, particularly cardiovascular, increased. Seven causes of death—hemorrhage, thrombotic pulmonary embolism, infection, hypertensive disorders of pregnancy, cardiomyopathy, cardiovascular

conditions, and noncardiovascular medical conditions—each contributed 10% to 13% of deaths.

CONCLUSION: The reasons for the reported increase in pregnancy-related mortality are unclear; possible factors include an increase in the risk of women dying, changed coding with the *International Classification of Diseases, 10th Revision*, and the addition by states of pregnancy checkboxes to the death certificate. State-based maternal death reviews and maternal quality collaboratives have the potential to identify deaths, review the factors associated with them, and take action on the findings.

(*Obstet Gynecol* 2010;116:1302–9)

LEVEL OF EVIDENCE: III

In September 2000, 183 nations, including the United States, met at the United Nations Millennium Summit and signed the Millennium Declaration, setting eight Millennium Development Goals to improve social and economic development and eliminate poverty around the world.¹ As an indication of the importance of women's health to the well-being of countries and the world, Goal 5 is to decrease maternal mortality by 75% by 2015. Even in developed countries where pregnancy mortality is many-fold lower than in resource-poor areas, many maternal deaths are considered to be avoidable,^{2–4} and deaths of women from complications of pregnancy are considered sentinel events, a sentiment reiterated by the U.S. Joint Commission on Accreditation of Health Care Organizations in 2010.⁵ As such, maternal deaths indicate the need for review and assessment of the interaction of care, patient action, and the system in which they occur to better-understand how to reduce their number.

Although the National Center for Health Statistics at the Centers for Disease Control and Prevention (CDC) calculates the official maternal mortality ratio for the United States, since 1986 the CDC's Division of Reproductive Health has conducted a complementary activity, the Pregnancy Mortality Surveillance

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A poster presentation of a portion of the data was made at the Society for Pediatric and Perinatal Epidemiologic Research Annual Meeting, June 23–24, 2008, Chicago, Illinois.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Financial Disclosure

The authors did not report any potential conflicts of interest.

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ISSN: 0029-7844/10



System.⁶ In the past decade, two national system changes have had an effect on the number of cases reported to both systems. In 1999, cause of death coding in the United States changed from using *International Classification of Diseases, Ninth Revision (ICD-9)* to using the *International Classification of Diseases, Tenth Revision (ICD-10)*; this latter system allows more deaths to be classified as maternal because of a causal relationship to pregnancy. Then, in 2003, the U.S. Revised Standard Death Certificate was issued, which includes a question asking if the decedent had been pregnant at the time of death or within a defined preceding time period. This change increased the identification of deaths with a temporal relationship to pregnancy.

The Pregnancy Mortality Surveillance System contains data on pregnancy-related deaths beginning in 1979; in-depth analyses of the data from 1979 to 1987 have been previously reported.⁷⁻⁹ For this report, we used Pregnancy Mortality Surveillance System data from 1998 through 2005, the most recent years for which complete data are available, to calculate the risk of a woman dying from pregnancy complications in the United States, although selected comparison with previous years' data are also made. Furthermore, we examined risk factors for and changes in the medical causes of these deaths.

MATERIALS AND METHODS

Initiated in 1986, the Pregnancy Mortality Surveillance System has as its goal the identification of all deaths in the United States caused by pregnancy and its complications. Since 1991, 52 reporting areas (the 50 states, New York City, and Washington, DC) have been asked to voluntarily provide de-identified copies of death certificates for all deaths occurring during or within 1 year of pregnancy, regardless of the cause of death or duration of pregnancy. For deaths occurring after a live birth or stillbirth, a copy of the matching birth or fetal death certificate is also requested. Identification of a small number of deaths and additional information about them are also obtained through computerized searches of the media, individual case reports, and state maternal mortality review committee reports.

All available information for each death is reviewed. Using a system developed in 1986 by the American College of Obstetricians and Gynecologists/CDC Maternal Mortality Study Group, clinically experienced epidemiologists review and code information on the outcome of pregnancy, cause of death, and associated conditions. For deaths since 2000, the causes of death and associated medical

conditions have been independently re-reviewed to increase consistency in coding for these variables.

A pregnancy-related death is defined as a death during or within 1 year of pregnancy that was caused by a complication of pregnancy, a chain of events initiated by pregnancy, or aggravation of an unrelated condition or event by the physiologic effects of pregnancy. The temporal relationship between the death and pregnancy is determined by an indication of pregnancy on the death certificate (either by a pregnancy checkbox or words or codes indicating pregnancy), written indication of the duration of the complications that caused the death, or the presence of a matched birth or fetal death certificate within 1 year of the date of death. A causal relationship between pregnancy and death is based on the clinical cause of death, the time interval between pregnancy and death, and knowledge of the pathophysiology of complications in pregnancy.

Not all reporting areas provide matched birth or fetal death certificates, and not all pregnancy-related deaths are associated with a pregnancy for which such a certificate is required. However, between 1998 and 2005, the number of reporting areas with a checkbox or question concerning the presence or absence of recent pregnancy in the decedent on their death certificate increased. In 1998, 19 reporting areas had a pregnancy checkbox or a prompt encouraging certifiers to report recent pregnancies on their death certificate. In 2003, the year in which the recommended revised standard death certificate was introduced, this number increased to 24; by 2005, 35 reporting areas had some way of indicating that the death was temporally related to a pregnancy.^{10,11}

The newly introduced standardized checkbox asks if the decedent had been pregnant at the time of death, within 42 days of death, or within 43 to 365 days of death. However, some states have no pregnancy checkbox or questions, whereas others have introduced or continued to use questions with different time frames, such as "pregnant within 90 days of death" or "pregnant within 365 days of death."

Thus, in cases that rely on the checkbox to determine the temporal relationship between a pregnancy and death, the precision of the estimate of the pregnancy-to-death-interval will vary depending on which pregnancy question was used. In the Pregnancy Mortality Surveillance System, deaths attributable to a medical condition exacerbated by but not unique to pregnancy are not classified as pregnancy-related if the only data on the temporal relationship between the pregnancy and death comprise a checkbox stating "pregnant within 1 year." However, depending on the



condition, if the checkbox states either “pregnant within 42 days” or “pregnant within 90 days,” then death is considered pregnancy-related.

The pregnancy-related mortality ratio is defined as the number of pregnancy-related deaths per 100,000 live births. Data on the number of pregnancy-related deaths in the 52 reporting areas, the numerator, are from the Pregnancy Mortality Surveillance System. Data on the number of live births, the denominator, are from the public-use natality files from the National Center for Health Statistics.¹² Because pregnancy-related deaths are relatively rare and year-to-year reporting by states can vary unpredictably, pregnancy-related mortality ratios are reported for each year from 1998 to 2005, but the remainder of the analysis uses aggregate data for the time period. Cause-specific proportionate mortality is defined as the percentage of all pregnancy-related deaths attributable to a specific cause of death.

For both deaths and live births, race was defined as the race of the mother and categorized as white, African American, and other (non-white, non-African American). Over the 8 years covered in this analysis, for 22 of the pregnancy-related deaths, the race of the woman was unknown. As is frequently performed with vital statistics in cases with missing data, the race was imputed, that is, the decedent was assigned a race according to the distribution of race among pregnancy-related deaths in her state for the period 1998 to 2005. In the case of live births, the National Center for Health Statistics assigns to the child the race of the mother; if race of the mother is missing, then race of the father is used. If father’s race is also missing, then National Center for Health Statistics assigns race of the mother in the next live birth record in the file. Less than 1% of births have imputed race.¹² Live birth order, a variable available on the natality file, was used as a proxy for parity and categorized as 1, 2, 3, 4, and 5 or more. Onset of prenatal care was categorized as first trimester, second trimester, third trimester, any care, and no care. Because information on live birth order and onset of prenatal care come from the birth certificate, analysis of these variables was limited to pregnancy-related deaths occurring after a live birth for which we had a linked birth certificate that included information on live birth order or onset of prenatal care. Birth certificates were available for 96% of deaths after a live birth and 90% of deaths associated with a stillbirth. Marital status was categorized as currently married or unmarried, and pregnancy-related deaths were categorized according to marital status only among women for whom the death or birth certificate had information concerning their status.

In this current analysis, to more precisely convey the relative contribution of different causes of death, we subdivided two former Pregnancy Mortality Surveillance system cause of death categories. First, embolism was divided into thrombotic pulmonary embolism and amniotic fluid embolism. Second, the category “complications of other medical conditions” was divided into complications of cardiovascular conditions and complications of noncardiovascular conditions. For this analysis, the numerator data file (deaths) contains no identifiers and only has information about deceased individuals; the denominator data file (births) is de-identified and available for public use. Hence, this analysis did not require review by an Institutional Review Board.

RESULTS

In the 8-year period 1998 to 2005, data for 9,988 potential pregnancy-related deaths were received by the Division of Reproductive Health. Of these, 4,693 were found to be pregnancy-related (occurring during or within 1 year of pregnancy and caused by pregnancy complications); 5,151 were pregnancy-associated but not pregnancy-related (occurring during or within 1 year of pregnancy but not causally related to pregnancy); and 130 were not pregnancy-associated (occurring more than 1 year after the end of pregnancy). For 14 cases, either the temporal or causal relationship between the death and pregnancy could not be determined. The remainder of this analysis will be limited to the 4,693 reported pregnancy-related deaths.

For 85% of the deaths, the outcome of pregnancy was known. Of these, 15% occurred before delivery, 71% occurred after a live birth, 6% occurred after a stillbirth, 4% occurred after an ectopic pregnancy, and 3% occurred after a spontaneous or induced abortion. Less than 0.1% of reported deaths were associated with gestational trophoblastic disease. In the majority of cases in which the outcome of the pregnancy was unknown, the information on the death certificate was suggestive of a death in the latter half of pregnancy. However, because we did not have the matching birth or fetal death certificate or information on the death certificate indicating the outcome of pregnancy, we were unable to determine if the pregnancy had ended in a live birth or stillbirth.

The pregnancy-related mortality ratio for the 8-year period 1998 to 2005 was 14.5 pregnancy-related deaths per 100,000 live births (Table 1). The annual pregnancy-related mortality ratio ranged from a low of 12.0 in 1998 to a high of 16.8 in 2003. For the 8-year period, the pregnancy-related mortality ratio



Table 1. Pregnancy-Related Mortality Ratios* by Year, Race, Maternal Age, Marital Status, Live Birth Order, and Onset of Prenatal Care in the United States From 1998 to 2005

	No. of Deaths	All Races	White	African American	Other
Year					
1998	474	12.0	8.3	30.5	13.6
1999	524	13.2	9.5	32.2	14.5
2000	589	14.5	10.5	36.8	9.9
2001	592	14.7	10.2	38.1	15.7
2002	566	14.1	9.8	38.9	9.1
2003	689	16.8	11.7	43.5	18.9
2004	623	15.2	10.6	41.4	9.5
2005	636	15.4	10.7	38.7	15.9
1998–2005	4,693	14.5	10.2	37.5	13.4
Maternal age					
<15		8.0	6.1	11.1	0
15–19		8.9	6.4	16.5	6.2
20–24		11.0	7.5	24.8	10.1
25–29		12.4	8.1	38.9	11.2
30–34		14.5	10.6	48.9	10.7
35–39		24.1	16.5	80.6	25.4
>39		54.9	40.0	166.9	38.4
Marital status[†]					
Married		11.8	9.2	41.2	12.9
Unmarried		19.5	12.5	35.5	12.9
Live birth order[‡]					
1		6.9	5.2	16.2	6.2
2		6.3	4.2	18.6	6.0
3		8.8	6.1	22.0	9.9
4		11.7	9.0	20.9	18.3
5+		17.3	11.3	34.1	18.1
Onset of prenatal care[§]					
First trimester		7.4	5.3	19.8	7.1
Second trimester		8.4	5.9	16.3	9.8
Third trimester		9.1	6.7	15.6	10.8
Any prenatal care		7.6	5.4	18.9	7.6
No prenatal care		39.1	30.9	56.1	41.8

* PRM R=Pregnancy related mortality ratio (pregnancy related deaths per live births).

[†] Limited to deaths of women with known marital status (n=4,688).

[‡] Limited to deaths associated with live birth and known live birth order (n=2,503).

[§] Limited to deaths associated with live birth and known onset of prenatal care (n=2,494).

was 10.2 for white women, 37.5 for African-American women, and 13.4 for women of non-white, non-African-American races. The ratio of the pregnancy-related mortality ratio for African-American compared with white women ranged from 3.4 to 4.0.

Pregnancy-related mortality increased with maternal age for women of all races, and at each age interval, African-American women were more likely to have a pregnancy-related death than were women of white or other races (Table 1). The excess risk of

death for African-American women compared with white women was lowest for teenagers; for African-American women aged 25 years or older, the excess risk compared with white women was more than four-fold. Among white women, the mortality ratio was 40% higher for unmarried compared with married women, whereas for African-American women and women of other races, there was little or no effect of marital status on pregnancy-related mortality.

With the analysis limited to pregnancy-related deaths after a live birth for which the birth certificate included data on previous pregnancies, we found pregnancy-related mortality to be lowest with the first and second deliveries and two to three times greater by the fifth or higher delivery (Table 1). The increased risk of death for African-American women compared with white women varied between 2.3-fold and 4.4-fold at each live birth order. Among pregnancy-related deaths of women who died after delivering a liveborn infant and for whom the trimester when prenatal care began was known, we found a small and inconsistent relationship between trimester of prenatal care onset and the pregnancy-related mortality ratio. However, for women who had no prenatal care, approximately 1% of the population, the risk of a pregnancy-related death was five times greater than for women with any prenatal care.

Using the new grouping for cause of death, seven causes were each responsible for between 10% and 13% of the pregnancy-related deaths: noncardiovascular medical conditions (13%); hemorrhage, hypertensive disorders of pregnancy, and cardiovascular conditions (12% each); cardiomyopathy and infection (11% each); and thrombotic pulmonary embolism (10%) (Table 2). The causes of death that were most common varied by the outcome of pregnancy. Among deaths after a live birth, hypertensive disorders of pregnancy, cardiomyopathy, noncardiovascular medical conditions, and cardiovascular conditions were the most common causes of death, whereas hemorrhage, infection, and noncardiovascular medical conditions were most commonly found with deaths after a stillbirth. More than 90% of deaths from ectopic pregnancy were attributable to hemorrhage. Hemorrhage, infection, and complications of anesthesia were most common in deaths associated with abortive outcomes.

For 82% of the pregnancy-related deaths, data were available to calculate the interval between the end of pregnancy and the death. A delivery-to-death interval was available for 99.4% of deaths after a live birth, 97.1% after a stillbirth, 62.9% after an abortion, 21.5% after an ectopic pregnancy, and 12.6% for



Table 2. Causes of Pregnancy-Related Death by Outcome of Pregnancy in the United States, 1998 to 2005

Cause of Death	Outcome of Pregnancy							Total
	Live Birth	Stillbirth	Ectopic	Abortion	Molar	Undelivered	Unknown	
Hemorrhage	278 (9.7)	49 (20.2)	160 (93.0)	28 (21.2)	0	20 (3.4)	52 (7.4)	587 (12.5)
Ruptured ectopic	0	0	159	0	0	0	0	159
Uterine rupture or laceration	27	9	0	12	0	6	7	61
Abruptio placenta	40	18	0	1	0	5	11	75
Placenta previa	16	1	0	0	0	2	7	26
Placenta accreta	37	3	0	1	0	2	5	48
Retained products of conception	9	3	0	3	0	0	1	16
Coagulopathies	14	8	0	7	0	1	6	36
Atony or uterine bleeding	75	4	0	3	0	0	12	94
Other or unspecified	60	3	1	1	0	4	3	72
Thrombotic pulmonary embolism	276 (9.7)	11 (4.5)	4 (2.3)	11 (8.3)	2 (67)	103 (17.5)	71 (10.2)	478 (10.2)
Amniotic fluid embolism	258 (9.0)	20 (8.2)	0	1 (0.8)	0	18 (3.1)	57 (8.2)	354 (7.5)
Hypertensive disorders	428 (15.0)	33 (13.6)	0	2 (1.5)	0	49 (8.3)	67 (9.6)	579 (12.3)
Preeclampsia	245	16	0	1	0	18	36	316
Cerebrovascular or CNS	62	5	0	0	0	2	7	76
Other or unspecified	183	11	0	1	0	16	29	240
Eclampsia	160	16	0	1	0	24	22	223
Cerebrovascular or CNS	62	6	0	0	0	4	8	80
Other or unspecified	98	10	0	1	0	20	14	143
Other or unspecified hypertension	23	1	0	0	0	7	9	40
Cerebrovascular or CNS	12	0	0	0	0	2	6	20
Other or unspecified	11	1	0	0	0	5	3	20
Infection	263 (9.2)	43 (17.7)	4 (2.3)	49 (37.1)	0	68 (11.5)	75 (10.7)	502 (10.7)
Chorioamnionitis	8	11	0	2	0	9	6	36
Genital tract	39	2	1	10	0	2	11	65
Sepsis	92	18	3	31	0	20	30	194
Other	124	12	0	6	0	37	28	207
Anesthesia complications	33 (1.2)	2 (0.8)	1 (0.6)	17 (12.9)	0	0	1 (0.1)	54 (1.2)
Cardiomyopathy	379 (13.3)	15 (6.2)	0	3 (2.3)	0	42 (7.1)	103 (1.5)	542 (11.5)
Cerebrovascular accident	199 (7.0)	4 (1.6)	0	3 (2.3)	0	35 (5.9)	54 (7.7)	295 (6.3)
Cardiovascular conditions	357 (12.5)	19 (7.8)	1 (0.6)	3 (2.3)	0	109 (18.5)	94 (13.5)	583 (12.4)
Noncardiovascular conditions	323 (11.3)	41 (16.9)	1 (0.6)	15 (11.4)	1 (33.3)	128 (21.7)	112 (16.0)	621 (13.2)
Unknown cause of death	62 (2.2)	6 (2.5)	1 (0.6)	0	0	17 (2.9)	12 (1.7)	98 (2.1)
Total deaths	2856	243	172	132	3	589	698	4693

CNS, central nervous system.
Data are n (%).

which the outcome of the pregnancy was unknown. Among pregnancies with a known interval, 15% died before delivery, 29% died within 24 hours of delivery, 16% died between 24 hours and 7 days after delivery, and 25% died between 8 days and 6 weeks after delivery. The remaining 14% of deaths occurred more than 42 days but fewer than 365 days after delivery.

Because 42 days is the cutoff for the definition of a maternal death, as opposed to a pregnancy-related death, we examined which causes of deaths would be more likely to be undercounted using the former definition. Almost all pregnancy-related deaths from

hemorrhage, amniotic fluid embolism, hypertensive disorders of pregnancy, and complications of anesthesia occurred within 42 days of delivery (97.1%, 99.7%, 95.4%, and 98.0%, respectively). However, a significant proportion of deaths attributable to the remaining cause groups occur after 42 days: 10.1% of infection deaths, 10.2% of deaths attributable to thrombotic pulmonary embolism, 11.8% of deaths attributable to cerebrovascular accidents, 16.7% of deaths attributable to noncardiovascular medical conditions, 16.8% of deaths attributable to cardiovascular conditions, and 47.7% of cardiomyopathy deaths.



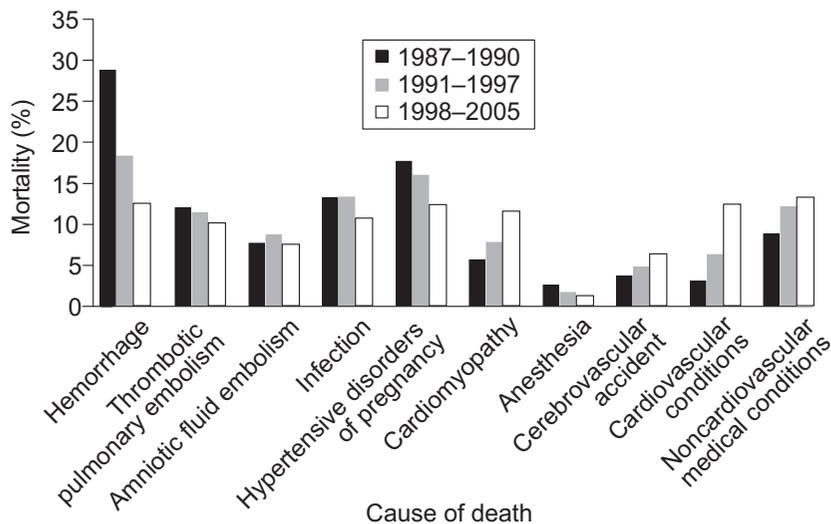


Fig. 1. Cause-specific proportionate pregnancy-related mortality for 1987 to 1990, 1991 to 1997, and 1998 to 2005 in the United States.

Berg. Increase in Pregnancy-Related Deaths. Obstet Gynecol 2010.

We compared the percentage of pregnancy-related deaths by cause of death for three time periods, 1987 to 1990, 1991 to 1997, and 1998 to 2005, in keeping with previously published reports (Fig. 1). The contribution of those causes of death previously responsible for the most deaths—hemorrhage and hypertensive disorders of pregnancy—continue to decrease, whereas the percent of deaths attributable to medical conditions, particularly cardiovascular, and cardiomyopathy continue to increase.

DISCUSSION

From 1998 through 2005, the pregnancy-related mortality ratio for the United States ranged from 12.0 to 16.8 pregnancy-related deaths per 100,000 live births, higher than the ratio in previous decades,⁷⁻⁹ with African-American women continuing to experience a rate of pregnancy-related death up to four-times greater than for white women. Shifts in the causes of pregnancy-related death also occurred between the current study period and previous reports covering the years 1979 to 1997. The percentage of deaths attributable to hemorrhage and hypertensive disorders of pregnancy continued to decrease; deaths from medical conditions, particularly cardiovascular, as well as from cardiomyopathy, increased. Seven causes of death—hemorrhage, thrombotic pulmonary embolism, infection, hypertensive disorders of pregnancy, cardiomyopathy, cardiovascular conditions, and noncardiovascular medical conditions—make approximately equivalent contributions to the total pregnancy-related mortality ratio.

The pregnancy-related mortality ratio based on deaths reported to the Pregnancy Mortality Surveillance System initially declined from 10.9 in 1979 to

7.4 in 1986, and then increased steadily to 9.1 for the years 1987 through 1990 and 11.5 for 1991 through 1997, to a high of 16.8 in 2003.⁷⁻⁹ Although this increase in reported mortality from pregnancy is concerning, its causes and the underlying change in the actual magnitude of pregnancy-related deaths remain unclear. The methods used to ascertain pregnancy-related death affect the number of cases identified and, in the period covered by this report, two significant national-level system changes were made in the registration and classification of deaths, ie, in 1999 the change from ICD-9 to ICD-10 coding and the addition of a pregnancy checkbox to death certificates in 16 reporting areas between 2003 and 2005.

In addition, changes by states in the use of linkage of deaths of women of reproductive age to birth and fetal death certificates may have occurred. In the initial years of the Pregnancy Mortality Surveillance System, the percentage of death certificates sent to CDC from the states that were found not to be pregnancy-related was less than 10%; in 1991 to 1997, 40% of reported potential deaths were not causally related to pregnancy and in 1998 to 2005, the percent had increased to 53%, reflecting an increasing pool of potentially pregnancy-related deaths being identified and reported by the states. However, the actual number of states that use a matching process in any year to identify these deaths is unknown. With national changes and possible state changes in ascertainment, we cannot definitively determine the relative contributions of any increase in pregnancy-related mortality compared with improved ascertainment at this time. However, studies in states with sufficient numbers of pregnancy-related deaths performed over a period of years using uniform methods of case



identification could help partition changes in pregnancy-related mortality ratios into changes in ascertainment and changes in risk of mortality. A study using this methodology between areas, although not over time, has been performed comparing pregnancy-related mortality in two states and two countries in Europe.¹³

Between 1987 and 2005, the traditional “direct” causes of pregnancy-related death—hemorrhage, hypertensive disorders of pregnancy, and infection—made a smaller contribution to the pregnancy-related mortality ratio, whereas other mainly “indirect” causes, including cardiovascular and noncardiovascular medical conditions, cardiomyopathy, and cerebrovascular accidents, made a greater contribution. The most dramatic decrease has been in deaths attributable to hemorrhage. Interestingly, this decrease has occurred despite evidence indicating an increase in cases of obstetric hemorrhage. Studies in the United States and other developed countries have found increases in the frequency of obstetric hemorrhage, particularly postpartum hemorrhage attributable to uterine atony, over the past one to two decades.^{14–17} However, the number of deaths attributable to hemorrhage have decreased, with the number of deaths attributable to uterine atony declining by almost one-third.

On the other hand, deaths associated with medical conditions, especially cardiovascular conditions, account for an increasing percentage of pregnancy-related deaths; if cardiomyopathy deaths are included in this category, then cardiovascular disease becomes the leading cause. Our data are not detailed enough to further analyze possible contributing factors such as obesity and other comorbidities. However, this finding is mirrored in the more in-depth maternal mortality reviews of several developed countries, such as the United Kingdom, where cardiac disease is now the leading cause of overall maternal death.^{3,4,18,19} Addressing the emerging problems of cardiovascular disease and other chronic conditions will require early identification of disease when possible, ideally before pregnancy. Women so identified have the opportunity to benefit from a thorough multidisciplinary assessment, stabilization of disease, appropriate referrals to high-risk centers, and counseling regarding the risks associated with pregnancy. From a public health perspective, efforts to optimize the health of populations have afforded the opportunity to decrease the risks of cardiovascular disease in this young group of women.

The Pregnancy Mortality Surveillance System is able to provide a more detailed picture of deaths caused by pregnancy than our vital statistics alone. The fact that many states provide the Pregnancy Mortality Surveillance System with linked birth and

death certificates allows it to identify more deaths. In addition, the data on these matched certificates allow an accurate calculation of the interval between pregnancy and death and also frequently will provide clinical information not available on the death certificate. The Pregnancy Mortality Surveillance System coding system, designed specifically to capture clinical data on the cause of death, is more granular than ICD-9 or ICD-10 pregnancy chapter codes, providing causes of death more reflective of the woman’s clinical course. However, The Pregnancy Mortality Surveillance System’s reliance on the voluntary cooperation of the reporting areas is an increasing limitation. The increased legal requirements by states for data sharing and limitations on variables available have led to a decrease in the timeliness of our ability to collect and report the data. Finally, even with the improved clinical cause of death, Pregnancy Mortality Surveillance System data cannot approach the level of information that can be collected by state review committees. Detailed data at the state level or other population-based level will be needed to understand not only the medical but also the nonmedical reasons for the ongoing racial disparity between African-American and white women in the risk of dying from pregnancy complications.

A pregnancy-related death is a sentinel event that demands investigation of the factors that lead to the tragic outcome. As health care quality improvement and patient safety efforts intensify, understanding the social and health care contexts surrounding women who die as a result of pregnancy is critical to instituting the systemic changes needed to decrease pregnancy-related mortality. The challenges are great, especially as we confront an increasing burden of chronic diseases, such as diabetes mellitus, obesity, and cardiovascular conditions, among young women. However, women continue to die as a result of pregnancy, and these deaths are not random events. State-based maternal death reviews and maternal quality collaboratives have the potential to identify deaths, review the factors associated with them, and take action with the findings.

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