

Pregnancy-Related Mortality

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PUBLIC HEALTH IMPORTANCE

Each year, 300–500 pregnancy-related deaths* are reported in the United States. This number represents outcomes of only the most severe of pregnancy-related complications. For every pregnancy-related death, >3,600 admissions to hospitals are for pregnancy-related complications not associated with delivery. Understanding the characteristics of women who die as a result of pregnancy complications and the risk factors for pregnancy-related death is essential if we are to develop strategies to prevent both mortality and severe morbidity associated with pregnancy complications.

In 1990, the U.S. Department of Health and Human Services identified pregnancy-related mortality as a high-priority public health area in which further improvement is needed to achieve the national year 2000 health goals. The *Healthy People 2000* objective for pregnancy-related mortality is to “reduce the maternal mortality ratio to no more than 3.3 [pregnancy-related deaths] per 100,000 live births” (1). Alternatively, because these ratios differ depending on the source of data used, the objective further states that “if other sources of maternal mortality data (besides vital statistics) are used, a 50% reduction in maternal mortality is the intended target.” We must overcome two main obstacles to achieve further reductions in pregnancy-related mortality: the slow decline in pregnancy mortality ratios since 1980 and the continuing gap between rates for various racial and ethnic groups.

* Except in quotations and titles, this report uses the term **pregnancy-related death** rather than **maternal death** because it is more accurate (see definitions in the CDC Surveillance Activities section of this chapter). See discussion later in this chapter on mortality rates and ratios.

The reported pregnancy mortality ratio dropped 56% from 1970 to 1980. Since 1981, however, the reported pregnancy mortality ratio has remained relatively stable, declining by only 3.5% between 1981 and 1990 (2). Moreover, black women continue to have a greater risk of pregnancy-related death than do white women. In 1960, black women had a pregnancy mortality ratio 4.1 times that of white women; in 1970, this relative risk increased to 4.4; in 1980, it dropped to 3.5; and in 1990, it increased again to 4.2 (2,3) (for additional information about related topics and surveillance activities, see the Legal Induced Abortion, Prenatal Care, and Pregnancy-Related Morbidity chapters).

HISTORY OF DATA COLLECTION

National vital statistics have served as our only national source of information on numbers, ratios, and causes of pregnancy-related deaths in the United States. State and local pregnancy mortality information has been obtained from state vital statistics reports and from publications based on vital records linkage, review of death certificates,

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medical records, or autopsy reports or from reports by state-based Maternal Mortality Review Committees. In fact, pregnancy death investigation was one of the first areas of regular death investigation, with widespread participation by practitioners and the public health community. In recent years, however, the number of Maternal Mortality Review Committees has declined dramatically (4). Today, national estimates and most state estimates of pregnancy mortality ratios are based on published vital statistics reports.

For more than 20 years, CDC has conducted nationwide surveillance and investigation of abortion-related deaths. CDC's abortion mortality surveillance has relied on multiple reporting sources for case identification and on multiple data sources for case classification and ascertainment. Most abortion deaths have been identified through four main sources: state health departments, national vital statistics, Maternal Mortality Review Committees, and reports by individuals (5,6). Multiple sources have improved the completeness of the reporting. For example, CDC investigated 538 possible abortion-related deaths in 1972–1982. If we had relied solely on state health departments, only 63% of these deaths would have been included. Nineteen percent were first reported by individuals, 6% were identified from national vital statistics, and 13% were reported by other sources (5,6).

The sources of information on abortion mortality surveillance include death certificates, autopsy reports, hospital records, case summaries, personal contacts, and reports from Maternal Mortality Review Committees. The availability of information from multiple sources made possible a more accurate classification of the deaths. Of the 538 possible abortion-related deaths reported to CDC in 1972–1982, 402 (75%) were found to be abortion-related (186 related to legal induced abortions, 84 related to illegal induced abortions, and 132 related to spontaneous abortions). Twenty percent of the 337 cases reported to CDC from state health departments and 37% of the additional 30 cases identified from national vital statistics were classified as not being abortion-related on the basis of information collected from multiple sources (5,6).

In 1987, CDC collaborated with the Maternal Mortality Special Interest Group of the Ameri-

can College of Obstetricians and Gynecologists (ACOG), the Association of Vital Records and Health Statistics (AVRHS), and state and local health departments to initiate the National Pregnancy Mortality Surveillance System. This surveillance was designed to be similar to the abortion mortality surveillance, established in 1972. A CDC/ACOG Maternal Mortality Study Group was established to provide continuing advice to CDC on the implementation of the National Pregnancy Mortality Surveillance System. This study group includes representatives from CDC and other federal agencies, ACOG, state health departments, and other provider organizations with a broad interest and expertise in maternal health. The group meets annually during the clinical meeting of ACOG.

CDC SURVEILLANCE ACTIVITIES

At its inception, the National Pregnancy Mortality Surveillance System had two major components: 1) a retrospective component based on linked vital records (death certificates of all identified pregnancy-related deaths that occurred in the United States during 1979–1986 were linked to records of their associated pregnancy outcomes); and 2) a prospective component based on ongoing investigation of all pregnancy-related deaths identified through the individual state systems and other sources of reporting, starting with deaths in 1987. Both components attempt to identify all pregnancy-related deaths in the United States, starting with pregnancy-related deaths reported through the vital statistics systems, and to more appropriately classify causes of death into meaningful clinical categories. In addition, the CDC/ACOG Maternal Mortality Study Group introduced new definitions and coding procedures for use in conducting pregnancy mortality surveillance.

The most commonly used definition of a pregnancy-related (maternal) death is that developed by the World Health Organization (WHO) (7):

A maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from

any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Maternal deaths should be subdivided into two groups:

- **Direct obstetric deaths:** those resulting from obstetric complications of the pregnant state (pregnancy, labor, and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.
- **Indirect obstetric deaths:** those resulting from previous existing disease that developed during pregnancy and which was not due to direct causes, but which was aggravated by physiologic effects of pregnancy.

The WHO's definition is used for estimating pregnancy mortality ratios at the national level; however, many states have modified the interval between pregnancy termination and death and used intervals ranging from 42 days to a year or more (Table 1) (3,8–18).

The CDC/ACOG Maternal Mortality Study Group introduced two new terms that are being used by CDC and increasingly by some states and researchers. The study group differentiates between pregnancy-associated and pregnancy-related deaths, defining them as follows (6):

A **pregnancy-associated death** is the death of any woman, from any cause, while pregnant or within 1 calendar year of termination of pregnancy, regardless of the duration and the site of pregnancy.

A **pregnancy-related death** is a pregnancy-associated death resulting from 1) complications of the pregnancy itself, 2) the chain of events initiated by the pregnancy that led to death, or 3) aggravation of an unrelated condition by the physiologic or pharmacologic effects of the pregnancy that subsequently caused death.

The term **pregnancy-associated death** is preferred to **maternal death** because some of

these deaths may not be **related** to pregnancy. Moreover, some pregnancies result in abortions, ectopic pregnancies, and gestational trophoblastic neoplasias. Because maternal means **pertaining to the mother** (19), its use is semantically inaccurate in describing these pregnancy outcomes. In comparison, the term **pregnancy-associated** is nonspecific and includes all pregnancy outcomes. In addition to introducing these new terms, the CDC/ACOG definitions also extend the interval between termination of pregnancy and death from 42 days to 1 year.

With the advent of intensive care units and advanced life-support systems, a limitation of 42 days or even 90 days does not include all pregnancy-associated deaths. For instance, in Georgia during the period 1974–1975, 22 of 78 (29%) deaths related to pregnancy occurred after 42 days of the termination of pregnancy (20). In the same study, 6% of deaths due to causes clearly related to the pregnancy occurred >90 days postpartum.

Case Finding and Data Collection

The National Pregnancy Mortality Surveillance System is designed to rely on multiple reporting sources for case identification and on multiple information sources for data collection. As in the case of abortion mortality surveillance, multiple sources are expected to improve the completeness of the reporting, improve the accuracy of case ascertainment, and result in more accurate classification of these deaths. The system is designed to collect information from death certificates, matching birth or fetal death records, autopsy reports, hospital records of women, case summaries, personal contacts, Maternal Mortality Review Committee reports, and hospital records of newborns.

To allow for more accurate classification and better understanding of the risk factors associated with pregnancy-related deaths, the National Pregnancy Mortality Surveillance System, in classifying deaths, takes into account the interaction of five main factors (6):

- The outcome of pregnancy (e.g., abortion, ectopic pregnancy, live birth).

TABLE 1. Overview of selected maternal mortality studies, United States and Puerto Rico*

Author	Place/dates	Number of Deaths	Definition of interval [†]	MMR [§]		Sources of data and method of review
				Study	Vital stats	
Hansen (9)	New Jersey, 1988	40	NR ^{††}	34	NR	Review of maternal deaths by the maternal mortality subcommittee
May (10)	North Carolina, 1988–1989	48	1 year	24	9.5	Enhancement of vital records by computer-matching of birth and fetal death records with death certificates
Comas (11)	Puerto Rico, 1989	22	1 year	33	19.5	Use of question on death certificate that asked whether a decedent was pregnant within the past year
Comas (12)	Puerto Rico, 1982	28	90 days	40.4	11.5	Review of medical records of women whose cause of death was likely to be related to pregnancy
Kirshon (13)	Jefferson Davis Hospital, Houston, TX, 1981–1987	21	90 days	21.9	NR	Review of medical records of all women of reproductive age who died at the hospital
Rumbolz (14)	Nebraska, 1987–1989	30	90 days	11.1	NR	Review of maternal deaths by the maternal child health committee
Allen (15)	New York City, 1983–1984	58 37	6 months 6 months	51.6 32.6	40.8 24.1	Enhanced ongoing surveillance activity by manual examination of death certificates; linkage of birth and fetal death files with death files; review of autopsy reports of death to women whose cause of death was likely to be related to pregnancy
Dorfman (16)	New York City, 1981–1983	120	6 months	36.1	NR	Ongoing surveillance; review of all death certificates
Syverson (17)	New York City, 1981–1984	224	1 year	40.2	NR	Ongoing surveillance
Koonin (18)	United States, 1979–1986	2644	1 year	9.1	NR	Review of vital records
NCHS** (3)	United States, 1988	330	42 days	NA ^{††}	8.4	Routine reporting of deaths

* Abstracted from Atrash HK, Rowley D, Hogue CJR (8).

[†] Interval from pregnancy termination to death.

[§] Maternal mortality ratio; maternal deaths per 100,000 live births.

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^{††} Not applicable.

- The method of pregnancy termination (e.g., normal vaginal delivery, cesarean section, suction curettage)
- The time of death in relation to pregnancy termination (e.g., during pregnancy, during labor and delivery, or postpartum).
- The cause of death (e.g., hemorrhage, sepsis, embolism).

- The underlying obstetric or medical condition that precipitated the cause of death (e.g., placenta previa, chorioamnionitis, diabetes).

The CDC/ACOG Maternal Mortality Study Group has also designed a new system of classifying pregnancy-related deaths. This system differentiates between the immediate and underlying causes of death as stated on the death certificate,

associated obstetrical and medical conditions or complications, and the outcome of pregnancy. For example, if a woman died of a hemorrhage that resulted from a ruptured ectopic pregnancy, the immediate cause of death would be classified as hemorrhage, the associated obstetrical condition would be classified as ruptured fallopian tube, and the outcome of pregnancy would be ectopic pregnancy. This classification scheme allows us to analyze the chain of events that led to death.

The study group also designed an abstract form and coding manual for data collection, coding, and entry (Table 2) (21). The coding manual is available from CDC on request. The abstract form and coding manual were used as the basis for developing menu-driven, Epi Info-based personal computer software for data entry and analysis of pregnancy mortality data (22). The software is being pilot-tested and will soon be available for distribution to state and local health departments, Maternal Mortality Review Committees, and individual researchers.

Data Analysis and Interpretation

To facilitate comparisons and identify groups at special risk, CDC analyzes information from the National Pregnancy Mortality Surveillance System using three statistical measures of pregnancy-related mortality: pregnancy mortality ratio, pregnancy mortality rate, and outcome-specific pregnancy mortality rate.

The **pregnancy mortality ratio** (equivalent to the term **maternal mortality rate**) is defined as the number of pregnancy-related deaths per 100,000 live births. The word **ratio** is used instead of **rate** because the numerator is not a portion of the denominator. **Pregnancy mortality rate** is defined as the number of pregnancy-related deaths per 100,000 pregnancies (pregnancies include all live births, stillbirths, induced and spontaneous abortions, ectopic pregnancies, and molar pregnancies). **Outcome-specific pregnancy mortality rate** is defined as the number of deaths due to a pregnancy outcome per 100,000 pregnancies with the same outcome (e.g., ectopic pregnancy, induced abortion, live birth). This rate is used to determine the risk of death associated with specific pregnancy outcomes.

Each death is reviewed to confirm whether it is pregnancy-related. Classification by immediate cause of death, associated conditions, and outcome of pregnancy is made after the review of each death. After each death has been investigated, data are abstracted and input into computerized files. To ensure confidentiality, individual identifiers are removed from all records, and access to the surveillance data is restricted to CDC staff members responsible for analyzing the data. All data and results of analysis are disseminated in a manner that preserves the anonymity of each individual.

GENERAL FINDINGS

Analysis of data on all pregnancy-related deaths for 1979–1986 has been completed; analysis methods are described elsewhere (18,23). When reviewing these findings, keep in mind that the National Pregnancy Mortality Surveillance System has not been fully implemented, and data for 1979–1986 are based on reports from state health departments. Most states have identified their pregnancy-related deaths from vital statistics; some have identified additional deaths through linkages of birth and death records or through other sources. As a result, the numbers and ratios reported here are not substantially different than numbers and ratios reported through national vital statistics. However, this chapter includes more information about the characteristics of the women who died because we had, in addition to death certificates, matching birth and fetal death records for most women who died following a live birth or stillbirth (18,23).

Overall, 2,726 deaths during 1979–1986 were reported to CDC. After reviewing available records, we determined that 2,644 were pregnancy-related deaths. Of these deaths, 1,363 (51.6%) occurred after live births, 343 (13.0%) were associated with ectopic pregnancies, 263 (9.9%) occurred after stillbirths, 146 (5.5%) deaths occurred before delivery, 124 (4.7%) were related to abortions (induced legal, induced illegal, and spontaneous), and 14 (0.5%) were associated with molar pregnancies. The outcome of pregnancy was unknown for 391 (14.8%) deaths. Matching records were available for 95% of pregnancies that resulted in live births and 86% of pregnancies that resulted in stillbirths.

TABLE 2. National pregnancy mortality surveillance code sheet, developed by the CDC/ACOG Maternal Mortality Study Group

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1. Case number (1-8) _____
 2. Death certificate number (9-16) _____
 3. Date of death (17-22) __ __/ __ __/ __ __
 4. Initial date case reported (23-26) __ __/ __ __/ __ __
 5. Initial source of notification (27) __
 6. Death certificate in case file (28) __
 7. Matching live birth or fetal death certificate in case file (29) __
 8. Pregnancy status indicated on death certificate (30) __
 - 9a. State of death (31-32) __ __
 - 9b. County of death (33-35) __ __ __
 - 10a. State of residence (36-37) __ __
 - 10b. County of residence (38-40) __ __ __
 11. SMSA county of residence (41) __
 12. Age (42-43) __ __
 13. Date of birth (44-49) __ __/ __ __/ __ __
 - 14a. Race/ethnicity (50) __
 - 14b. Hispanic origin (51) __
 15. Marital status (52) __
 16. Occupation (53) __
 17. Educational level (54-55) __ __
 18. Place of death (56) __
 19. Month prenatal care began (57-58) __ __
 20. Number of prenatal visits (59-60) __ __
 21. Birth weight (61-64) __ __ __ __ gms.
 22. Sex of infant (65) __
 23. Autopsy report in case file (66) __
 24. Hospital record in case file (67) __
 25. Report of personal contact with attending M.D. in case file (68) __
 26. Maternal Mortality Study Committee report in case file (69) __
 27. Newborn hospital record in case file (70) __

TABLE 2. National pregnancy mortality surveillance code sheet, developed by the CDC/ACOG Maternal Mortality Study Group — continued

-
28. Place of initial event/acute illness (71) __
29. Woman's height (72-73) __ __ inches
- 30a. Prepregnancy weight (74-76) __ __ __ pounds
- 30b. Weight at time of death (77-79) __ __ __ pounds
- 31a. Total number of pregnancies (gravity) (80-81) __ __
- 31b. Outcome of previous pregnancies (if twins, count each separately)
 Live births (82-83) __ __
 Stillbirths (84) __
 Induced abortion (85) __
 Spontaneous abortion (86) __
 Abortion, type unknown (87) __
 Ectopic pregnancy (88) __
 Molar pregnancy (89) __
32. Outcome of pregnancy (90-91) __ __
33. Procedure for termination of pregnancy (92-93) __ __
34. Gestational age in weeks at termination of pregnancy (94-95) __ __
35. Date of termination of pregnancy (96-101) __ __ / __ __ / __ __
36. Type of obstetrical anesthesia/analgesia (102-103) __ __
37. Other operative procedure (104) __
38. Type of anesthesia/analgesia for other operative procedure (105) __
39. Days between termination of pregnancy and other operative procedure (106-108) __ __ __
40. CDC immediate (precipitating) cause of death (110-111) __ __
41. #1 Associated condition leading to death (112-114) __ __ __
 #2 Associated condition leading to death (115-117) __ __ __
 #3 Associated condition leading to death (118-120) __ __ __
42. Concurrent medications (yes=1, no=2, unknown=9)
 Anticonvulsants (125) __
 Anticoagulants (126) __
 Antibiotics (127) __
 Antineoplastics (128) __
 Antihypertensives (129) __
 Corticosteroids (130) __
 Hormones (OCPs, estrogens) (131) __
 Insulin (132) __
 Narcotics (Rx only) (133) __
 Sedatives/hypnotics/anxiolytics (134) __
 Tocolytics (135) __
 Thyroid/antithyroid medications (136) __
43. If death due to injury, list type of injury (140-141) __ __

TABLE 2. National pregnancy mortality surveillance code sheet, developed by the CDC/ACOG Maternal Mortality Study Group — continued

-
44. Selected risk factors present:
 Alcohol abuse (142) ___
 Drug abuse
 Heroin, intravenous (IV) (143) ___
 Cocaine, IV (144) ___
 Crack cocaine (145) ___
 Cocaine, not IV/not specified (146) ___
 Narcotics, other/not specified, IV (147) ___
 Narcotics, not IV (148) ___
 Amphetamines (149) ___
 Barbiturates, sedatives, or anxiolytics (150) ___
 Marijuana (151) ___
 Other drug abuse/not specified (152) ___
 Obesity (153) ___
 Smoking (154) ___
 Refused medical therapy or treatment (155) ___
 Other (156) ___
45. Date case file closed (158-161) ___/___/___
46. Final classification of death (162) ___
47. Coder initials (163-164) ___
48. State ICD code (165-168) ___
49. Conditions of special interest (169-170) ___
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The interval between the time of birth or pregnancy termination and death of the mother was known in 66% of the deaths. About 69% of these deaths occurred during pregnancy or within the first week after delivery or pregnancy termination; 25% occurred 8–42 days after delivery; and 6% occurred between 43 days and 1 year after the pregnancy (Figure 1).

The overall pregnancy mortality ratio for the 8-year study period was 9.1 deaths per 100,000 live births; the ratio dropped steadily from 10.9 in 1979 to 7.4 in 1986 (Figure 2). The ratio decreased from 7.1 in 1979 to 5.1 in 1986 for white women and from 27.2 in 1979 to 16.6 in 1986 for black women and women of other minority races (Figure 2). For each of the 8 years, the pregnancy mortality ratio for black women and women of other minority races was higher than that for white women, with risk ratios ranging from 2.5 to 3.8. Age-specific mortality ratios were also higher for black women and women of other minority races than for white women in each age-group (Figure 3). For all ra-

cial groups, the pregnancy mortality ratio increased with age and was highest for women aged ≥ 40 years (Figure 3).

The age-adjusted pregnancy mortality ratio was 7.1 per 100,000 live births for married women and 20.7 for unmarried women. Unmarried white women had an age-adjusted ratio 2.7 times that for married white women (15.6 vs. 5.8), whereas unmarried black women had an age-adjusted pregnancy mortality ratio only 1.2 times that for married black women (24.7 vs. 20.5).

For deaths associated with live births, the age-adjusted pregnancy mortality ratio by live birth order was 5.8 per 100,000 live births for women following their first live birth. The risk decreased to 4.1 for women following their second live birth and then increased with increasing live birth order.

Under CDC's new classification system—which differentiates between causes of death, associated (obstetric and medical) conditions, and outcomes of pregnancy—each pregnancy outcome

FIGURE 1. Percentage of pregnancy deaths, by number of days from time of termination of pregnancy to death — United States, 1979–1986

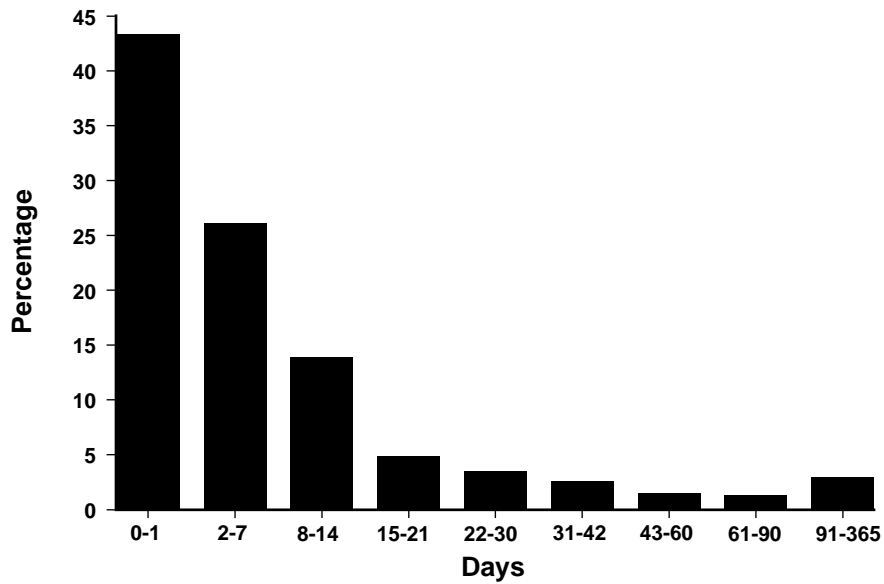


FIGURE 2. Pregnancy mortality ratios, by race — United States, 1979–1986

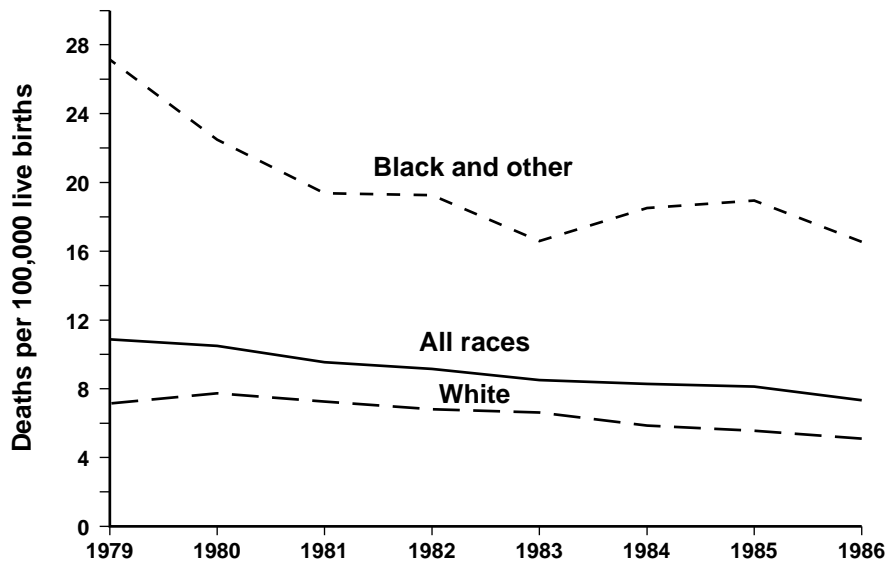
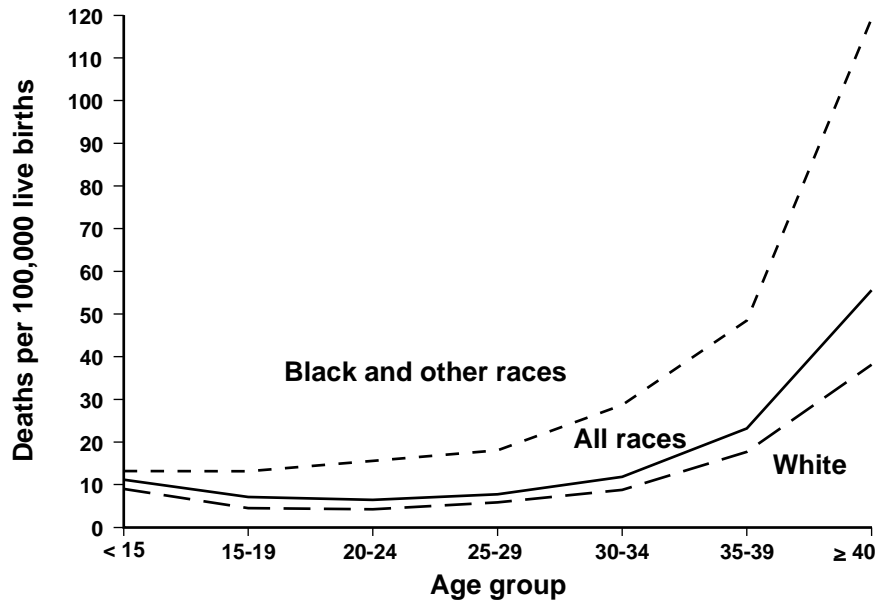


FIGURE 3. Pregnancy mortality ratios, by age and race — United States, 1979–1986

was associated with a specific leading cause of death (Table 3). The leading causes of pregnancy-related death after a live birth were thrombotic pulmonary embolism, pregnancy-induced hypertension complications, hemorrhage (primarily postpartum uterine bleeding), and infection. More than half of the deaths were attributed to these four causes. Women with preeclampsia succumbed to a variety of conditions, whereas those with eclampsia died primarily of central nervous system insults. For women whose pregnancies ended in stillbirths, the leading causes of death were hemorrhage (largely from abruptio placentae), pregnancy-induced hypertension complications, and amniotic fluid pulmonary embolism. Almost 90% of women whose deaths were associated with ectopic pregnancies died of hemorrhage from rupture of the ectopic site. The leading causes of death for women whose pregnancies ended in a spontaneous or induced abortion were hemorrhage from uterine bleeding, generalized infection, and thrombotic pulmonary embolism. Women who had a molar pregnancy died of a variety of causes and conditions, whereas most women who died before delivery died of thrombotic and amniotic fluid embolism, hemorrhage from uterine rupture or laceration, and central nervous system complications related to eclampsia.

Overall, 5.5% of women in the United States who had a live birth during the study period had inadequate prenatal care (defined as no care or care starting in the third trimester) (24). In comparison, 15% of women who had a live birth and subsequently died had inadequate prenatal care.

INTERPRETATION ISSUES

Pregnancy mortality surveillance based only on vital statistics reports has serious limitations as a source of numbers, ratios, and causes of pregnancy-related death (25). Vital records are not designed to be used in investigating pregnancy-related deaths, and the information available from these records is limited. Moreover, because pregnancy-related death definitions are based on causes of death, and because clinical information listed on death certificates is often inadequate, numbers of pregnancy-related deaths based on vital statistics are usually underestimates of the true number of pregnancy-related deaths (8). Furthermore, the published causes of pregnancy-related death are a mixture of outcomes of pregnancy, immediate causes of death, and underlying obstetric conditions (3). In-depth investigations of pregnancy-related deaths

TABLE 3. Cause of pregnancy-related death, by outcome of pregnancy, United States,* 1979–1986†

Cause of death	OUTCOME OF PREGNANCY															
	Live birth		Stillbirth		Ectopic		Abortion [§]		Molar		Undelivered		Unknown		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Hemorrhage	249	18.3	89	33.9	305	88.9	43	34.8	2	14.3	30	20.5	81	20.7	799	30.2
Pulmonary embolism	370	27.1	47	17.9	10	2.9	24	19.4	2	14.3	60	41.1	106	27.1	619	23.4
Pregnancy-induced hypertension	307	22.5	59	22.4	1	0.3	1	0.8	2	14.3	17	11.6	92	23.5	479	18.1
Infection	101	7.4	22	8.4	6	1.7	35	28.2	2	14.3	8	5.5	28	7.2	202	7.6
Cardiomyopathy	53	3.9	4	1.5	0	0.0	1	0.8	0	0.0	2	1.4	30	7.7	90	3.4
Anesthesia complications	65	4.8	3	1.1	4	1.2	11	8.9	0	0.0	0	0.0	3	0.8	86	3.3
Other	218	16.0	39	14.8	17	5.0	9	7.3	6	43.0	29	19.9	51	13.0	369	14.0
Total maternal deaths	1,363	100.0	263	100.0	343	100.0	124	100.0	14	100.0	146	100.0	391	100.0	2,644	100.0

* Including Puerto Rico.

† From Koonin LM, Atrash HK, Lawson HW, Smith JC (18).

§ Includes spontaneous and induced abortions.

published over the last decade have reported pregnancy mortality ratios two to six times higher than ratios in vital statistics reports (Table 1) (8). Therefore, the true national pregnancy mortality ratio is most likely higher than the reported ratio. We have a clear need for pregnancy mortality surveillance activities that identify all pregnancy-related deaths and collect adequate information to characterize these deaths. Other approaches used to better identify and classify pregnancy-related deaths include matching death records with pregnancy outcome records, reviewing medical records and autopsy reports, reviewing death certificates, and reviewing reports from Maternal Mortality Review Committees. Although each of these sources has some advantages, each has been found to have serious limitations as well (25).

The National Pregnancy Mortality Surveillance System, when fully implemented, will provide information about national numbers and ratios of pregnancy mortality and will identify clusters of pregnancy-related deaths by age, geographic location, cause, and other factors. However, because every death is unique, we must learn lessons from each death and carry out appropriate and relevant interventions at the local level

to prevent future morbidity and mortality caused by similar chains of events. Therefore, pregnancy-related death review should be an ongoing process conducted by professionals and program decision makers at the local level. Pregnancy-related death review should include not only medical contributing factors but also any other possible contributors such as quality of care, access to and use of services, socioeconomic circumstances, and behaviors during pregnancy. Active, state-based pregnancy mortality surveillance that relies on multiple sources for identifying and classifying pregnancy-related deaths historically has been conducted by Maternal Mortality Review Committees. The number of states with Maternal Mortality Review Committees has decreased dramatically over the past decade, primarily for two reasons: the decreasing number of pregnancy-related deaths and the medicolegal climate of today's practice of medicine (4). Optimally, state-based Maternal Mortality Review Committees will be reestablished in all states to investigate and learn from each pregnancy-related death.

In conjunction with the National Pregnancy Mortality Surveillance System and the legal advisors at CDC and ACOG, the CDC/ACOG Maternal

Mortality Study Group commissioned Ronald F. Wright, J.D., assistant professor of law at Wake Forest University School of Law, to study legal protection afforded medical review processes at the state level. He found that “in all but a few states, the legal risk of participating in expert review is negligible. Most states have statutes that protect information involved in the review process from disclosure or use in subsequent litigation. Laws in most states also protect participants in the review process ... from civil liability” (26). A state-by-state annotation of statutes regarding the protection of expert review committees was published by ACOG and is available on request (27).

EXAMPLES OF USING DATA

Despite the limitations of the National Pregnancy Mortality Surveillance System mentioned above, the large numbers of deaths collected through such a system allow for analyses that are not possible to conduct using state and local data. For example, the retrospective study of pregnancy-related deaths for 1979–1986 includes 90 deaths caused by cardiomyopathies, 86 deaths caused by anesthesia complications, >350 deaths among Hispanic women, and about 300 deaths among teenagers. Furthermore, a national system is needed to provide national rates for monitoring trends, identifying clusters, allowing comparisons with state and international rates, and tracking our progress in achieving national goals such as the year 2000 health objectives (1).

Numerous reports of pregnancy-related deaths include findings from different approaches to identifying and investigating pregnancy-related deaths (3,8–18). To better describe and understand the pregnancy mortality problem, we cannot rely on vital statistics alone as a source of information and numbers (Table 1). Every state needs an active surveillance system to monitor pregnancy-related deaths, using multiple sources of information to identify and characterize such deaths.

FUTURE ISSUES

With improving technology and advanced medical skills, the causes of pregnancy-related death

have changed dramatically over the past 50 years. The triad of infection, bleeding, and toxemia—which in the past accounted for >90% of all pregnancy-related deaths—now accounts for <60% of such deaths. New causes of death are emerging; for instance, anesthesia complications, embolism, and cardiomyopathy were responsible for 30% of all pregnancy-related deaths during 1979–1986.

Another emerging cause of pregnancy-related death is AIDS. During the last decade, the incidence of AIDS among women of reproductive age has increased dramatically, with the number of deaths ranging from 92 in 1983 to 1,016 in 1987 and 2,645 in 1991 (28,29). In 1991, AIDS became the seventh leading cause of death among females aged 15–24 years and the fifth leading cause of death among women aged 25–45 years (29). With >6 million pregnancies in the United States every year, and with the increasing incidence of AIDS among women of reproductive age, we can also expect to see a concurrent increase in the number of deaths among pregnant women with AIDS. Nationally, 26 pregnancy-associated deaths due to AIDS were reported for 1981–1988 (30). This accounted for about 1% of all pregnancy-related deaths for the period. In New York City, 2 of 224 (0.9%) pregnancy-related deaths caused by AIDS were reported for 1982–1984 (17), whereas in New Jersey, 6 of 40 (15%) pregnancy-related deaths reported for 1988 were caused by AIDS (9).

At the 1991 CDC/ACOG Maternal Mortality Study Group meeting, members noted that pregnancy-related mortality and serious pregnancy-related morbidity are increasingly associated with emerging technology and practices; in particular, they noted an increasing prevalence of pregnancy-related mortality associated with adult respiratory distress syndrome (ARDS). Members reported several pregnancy-related deaths resulting from ARDS associated with preeclampsia and upper urinary tract infection (pyelonephritis). Our review of the literature revealed that 5 of 40 pregnancy-related deaths reported by Hansen and Chez (9), and 10 of 21 pregnancy-related deaths reported by Kirshon et al. (13) resulted from ARDS; most of these deaths were associated with preeclampsia (13).

These findings highlight the importance of active, ongoing surveillance of pregnancy-related deaths and the investigation of each such death to ensure an up-to-date understanding of the rapidly changing circumstances that contribute to serious pregnancy-related morbidity and mortality. Without this detailed knowledge, we will have extreme difficulty formulating strategies to achieve further reductions in pregnancy-related mortality and morbidity.

The National Pregnancy Mortality Surveillance System encourages and supports state-based intensive investigations of pregnancy-related deaths to supplement information and numbers obtained through vital statistics. However, to reduce the health risks associated with pregnancy, we should direct our attention toward reducing pregnancy morbidity. Pregnancy mortality is only the tip of the iceberg. CDC estimates that >800,000 women are discharged from hospitals every year for pregnancy complications (31). This does not include complications during labor and delivery, complications during the postpartum period, or complications treated on an ambulatory basis.

The ultimate objective of the National Pregnancy Mortality Surveillance System is to contribute to the reduction of pregnancy morbidity and mortality in the United States. Toward that end, we must develop a close partnership between CDC, ACOG, other public health agencies (local and federal), and professional organizations of clinical providers, particularly those caring for pregnant women. Any recommendations for preventing pregnancy morbidity and mortality can be effective only if health-care providers follow them. CDC and ACOG's collaboration in developing and carrying out the National Pregnancy Mortality Surveillance System is just the first step in developing this partnership.

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