# Fetal Deaths

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## PUBLIC HEALTH IMPORTANCE

In 1989, fetal deaths* represented a substantial portion of pregnancy losses in the United States, accounting for 54.8% of perinatal deaths. For every 1,000 live births, 7.5 fetal deaths occurred, compared with 6.2 neonatal deaths. Whether measured by numbers or by the anguish of affected families, fetal deaths are an important public health concern. Historically, however, the factors contributing to fetal mortality have been less researched than those contributing to infant mortality, and fewer prevention efforts have been initiated because of our limited understanding of the etiology of many fetal diseases, problems of measuring fetal well-being in utero, and the poorer quality of fetal mortality data relative to infant mortality data. Consequently, the public and public health professionals have a limited awareness of fetal mortality as a public health problem and are less likely to use fetal mortality surveillance in prevention efforts.

We have observed numerous changes in fetal death trends since 1950, when the United States adopted the World Health Organization's (WHO) definition of fetal death (*1*):

> Death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation, the fetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.

This definition emphasizes the absence of signs of life at delivery regardless of gestational age. Since the WHO definition was adopted, we have made improvements in diagnosis and intervention that have resulted in decreases in the risks for fetal death. For example, some investigators have reported a decline in the proportion of fetal deaths occurring during labor to those occurring before labor (*2*). With these clinical advances, the leading etiologies of infant mortality have changed as well. To address such shifts in the epidemiology of perinatal outcomes, we need to better understand the predisposing factors, such as type I diabetes and birth defects. Prevention efforts that address these factors may differ greatly from interventions involving improved obstetrical procedures. Therefore, we need to shift our emphasis in perinatal mortality research from intervention to

* The term **fetal death** as used here refers to death at ≥20 weeks of gestation. This description is a portion of the definition used in current U.S. reporting requirements. **Perinatal death** as used here refers to death occurring from ≥20 weeks of gestation through the first 28 days of life. **Neonatal death** refers to death occurring from birth through the first 28 days of life. **Infant mortality** refers to death within the first year of life.

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**prevention** and from infancy to **pregnancy**, focusing on the prevention of poor pregnancy outcomes such as preterm delivery, very low birth weight, and birth defects (*3,4*).

One major goal, then, of the surveillance of fetal deaths is to monitor our progress toward preventing these pregnancy losses. Another goal for surveillance is to collect fetal mortality data that, in combination with data on births and neonatal deaths, will provide a more complete picture of pregnancy outcomes and their risks. Because some etiologies cause both fetal and neonatal deaths, the evaluation of interventions targeted at these etiologies must be based on the surveillance of all perinatal deaths. A final goal is to collect data that will provide a sensitive enough pregnancy health indicator to allow more timely assessments of prevention efforts.

Despite these goals, our current data collection systems have major limitations. For example, fetal mortality statistics understate the magnitude of total fetal loss because most states require the reporting of only fetal deaths at ≥20 weeks, even though fetal deaths at <20 weeks of gestation are much more frequent (*5*). Moreover, not all of these reportable fetal deaths are reported (*6*).

To gain a better perspective on the magnitude of and the potential for prevention of these pregnancy losses, international comparisons can be useful. However, U.S. fetal mortality rates cannot be compared meaningfully with those of many other countries because of differences in fetal death reporting requirements and reporting completeness. Instead, the perinatal mortality rate is more informative for these comparisons, because it takes into account inconsistencies in international classifications of fetal and infant deaths. In 1989, the United States was ranked 18th internationally in perinatal mortality (fetal deaths at ≥28 weeks of gestation plus infant deaths occurring <7 days after birth) (*NCHS, unpublished data, 1993*) (for additional information about related topics and surveillance activities, see the Behavioral Risk Factors Before and During Pregnancy, Prenatal Care, Prevalence of Birth Defects, Infant Mortality, and Neonatal and Postneonatal Mortality chapters).

## HISTORY OF DATA COLLECTION

Vital statistics on stillbirths were first collected by the Bureau of the Census in 1918. Beginning in 1922, the bureau began annually collecting and tabulating these statistics from the states in the birth-registration area. At that time, states had variations in their legal definitions of stillbirth and how stillbirths were reported (*7*). By 1933, all states were admitted into the birth-registration area, and this allowed the national compilation of state-specific statistics. Although the first standard fetal death certificate was developed in 1930 (*8*), until 1939, the nationally recommended procedure for fetal death registration required the filing of both a live birth and a death certificate. Since 1939, the filing of a separate fetal death certificate has been recommended (*9*). In 1946, the responsibility for maintaining vital statistics for the entire nation moved to the Public Health Service (*10*); this responsibility now rests with CDC's National Center for Health Statistics (NCHS).

Since 1950, the term **fetal death** has been used in preference to other terms to reflect the adoption of the WHO's recommended definition and to end confusion between the terms **stillbirth**, **abortion**, and **miscarriage**. Most states individually have adopted the WHO or comparable definitions over time. After the legalization of induced abortions, separate reporting for spontaneous fetal deaths and induced terminations was begun in 1970 (*9*).

## CDC SURVEILLANCE ACTIVITIES

U.S. fetal death registration is based on state law, and reports are filed and maintained in state vital statistics offices. Fetal mortality data from the National Vital Statistics System are cooperatively produced by NCHS and state vital statistics offices under a joint agreement known as the Vital Statistics Cooperative Program.

### Key Variables Available

About every 10 years, NCHS works with states to develop a recommended U.S. Standard

Report of Fetal Death to serve as the model for state reports (for the most recent revision in 1989, see Figure 1). Although conforming closely with the standard report, state reports continue to differ from or lack certain items included in the U.S. standard report, often because of unique state needs or state vital statistics laws (*8*).

The 1978 revision of the standard fetal death report recommended that state reports include data on the delivering hospital; parents' names and basic demographic data; maternal pregnancy history; basic clinical information about the fetus; and fill-in lines for causes of death, congenital malformations, significant conditions, maternal conditions, and complications of pregnancy, labor, and delivery (*11*). The 1989 revision added these new items: parental occupations, parental Hispanic origin, maternal smoking and alcohol use history, and maternal weight gain. Also, check-box items replaced most fill-in lines, offering the potential to improve reporting (*12*).

## Reporting Requirement Differences

Reporting requirements for fetal deaths vary according to state laws (*13*). While continuing to promote standard reporting, the 1977 revision of the *Model State Vital Statistics Act and Regulations* recommended reporting of all spontaneous losses occurring at ≥20 weeks or weighing ≥350 g (*14*) rather than continuing to recommend the reporting of deaths at all gestations (*15*). Currently, nine states have adopted this reporting requirement. An additional 27 states have adopted the very similar requirement of reporting deaths ≥20 weeks of gestation. Three states require the reporting of deaths of fetuses weighing ≥500 g, whereas four states use different gestational age or birthweight requirements or a combination of both. Over time, some states have modified their requirements to accommodate state needs in light of NCHS recommendations (see the Technical Appendix in NCHS, 1991 [11]). In addition, although eight states and several territories require reports for all spontaneous losses regardless of gestation (*13*), as of 1989, only five states were sending these reports to NCHS. Specific reporting differences are described elsewhere (see the Technical Appendix in NCHS, 1991 [11]).

## Data Collection and Processing

Medical information on the fetal death report, including the cause of death, is generally provided by the attending physician, medical examiner, or coroner. Generally, the funeral director completes the report's demographic portion, using information from the family, and files the report with the state. However, when a funeral director is not involved, physicians or medical records personnel complete and file the entire report. Although the cooperation of medical personnel in filling out the fetal death report is required, the extent of their input varies by state, and this may affect the quality of the data. Currently, medical personnel complete about half of all state reports.

NCHS promotes uniformity in the collection and processing of fetal death data in a number of ways, such as by issuing periodic updates to the standard report. NCHS also periodically updates the *Model State Vital Statistics Act and Regulations* to assist states in developing and revising state vital statistics laws, provides training and technical assistance to state vital statistics offices, and provides states with annually updated instruction manuals that contain information on standard coding and data processing procedures.

Beginning in 1989, NCHS initiated a special project to code data on the underlying cause of fetal death. Although cause-of-death information using ICD coding standards was available before 1989, it was not coded by NCHS. Data on the underlying cause of fetal death will be available on the fetal death data tape in the future. In the meantime, state-specific information on the underlying causes of fetal deaths can be obtained from some state vital statistics offices (see discussion on cause-of-death coding in the Infant Mortality chapter).

Once fetal death reports are filed and processed in state vital statistics offices, states send NCHS

**FIGURE 1.**

**U.S. STANDARD**

## REPORT OF FETAL DEATH

**STATE FILE NUMBER**

DEPARTMENT OF HEALTH AND HUMAN SERVICES – PUBLIC HEALTH SERVICE – NATIONAL CENTER FOR HEALTH STATISTICS – 1989 REVISION

**TYPE/PRINT IN PERMANENT BLACK INK FOR INSTRUCTIONS SEE HANDBOOK**

**1.** FACILITY NAME (*If not institution, give street and number*)

**2.** CITY, TOWN, OR LOCATION OF DELIVERY | **3.** COUNTY OF DELIVERY | **4.** DATE OF DELIVERY (*Month, Day, Year*) | **5.** SEX OF FETUS

**PARENTS**

**6a.** MOTHER'S NAME (*First, Middle, Last*) | **6b.** MAIDEN SURNAME | **7.** DATE OF BIRTH (*Month, Day, Year*)

**8a.** RESIDENCE STATE | **8b.** COUNTY | **8c.** CITY, TOWN, OR LOCATION | **8d.** STREET AND NUMBER

**8e.** INSIDE CITY LIMITS? (*Yes or no*) | **8f.** ZIP CODE | **9.** FATHER'S NAME (*First, Middle, Last*) | **10.** DATE OF BIRTH (*Month, Day, Year*)

| | **11.** OF HISPANIC ORIGIN? (Specify No or Yes—If yes, specify Cuban, Mexican, Puerto Rican, etc.) | **12.** RACE—American Indian, Black, White, etc. (*Specify below*) | **13.** EDUCATION (*Specify only highest grade completed*) | | **14.** OCCUPATION AND BUSINESS/INDUSTRY (*Worked during last year*) | |
|---|---|---|---|---|---|---|
| | | | Elementary/Secondary (0-12) | College (1-4 or 5+) | Occupation | Business/Industry |
| **MOTHER** | **11a.** ☐ No ☐ Yes Specify: | **12a.** | **13a.** | | **14a.** | **14b.** |
| **FATHER** | **11b.** ☐ No ☐ Yes Specify: | **12b** | **13b.** | | **14c.** | **14d.** |

MULTIPLE BIRTHS Enter State File Number for Mate(s) LIVE BIRTH(S)

FETAL DEATH(s)

**15.** PREGNANCY HISTORY (*Complete each section*)

| LIVE BIRTHS | | OTHER TERMINATIONS (*Spontaneous and induced at any time after conception*) |
|---|---|---|
| **15a.** Now Living Number ____ ☐ None | **15b.** Now Dead Number ____ ☐ None | **15d.** (*Do not include this fetus*) Number ____ ☐ None |
| **15c.** DATE OF LAST LIVE BIRTH (*Month, Year*) | | **15e.** DATE OF LAST OTHER TERMINATION (*Month, Year*) |

**16.** MOTHER MARRIED? (At delivery, conception, or any time between) (*Yes or no*)

**17.** DATE LAST NORMAL MENSES BEGAN (*Month, Day, Year*)

**18.** MONTH OF PREGNANCY PRENATAL CARE BEGAN—First, Second, Third, etc. (*Specify*)

**19.** PRENATAL VISITS—Total Number (*If none, so state*)

**20.** WEIGHT OF FETUS (*Specify Unit*)

**21.** CLINICAL ESTIMATE OF GESTATION (*Weeks*)

**22a.** PLURALITY—Single, Twin, Triplet, etc. (*Specify*)

**22b.** IF NOT SINGLE BIRTH—Born First, Second, Third, etc. (*Specify*)

**MEDICAL AND HEALTH INFORMATION**

**23a.** MEDICAL RISK FACTORS FOR THIS PREGNANCY (*Check all that apply*)

Anemia (Hct. < 30/Hgb. < 10) . . . .01 ☐
Cardiac disease . . . .02 ☐
Acute or chronic lung disease . . . .03 ☐
Diabetes . . . .04 ☐
Genital herpes . . . .05 ☐
Hydramnios/Oligohydramnios . . . .06 ☐
Hemoglobinopathy . . . .07 ☐
Hypertension, chronic . . . .08 ☐
Hypertension, pregnancy-associated . . . .09 ☐
Eclampsia . . . .10 ☐
Incompetent cervix . . . .11 ☐
Previous infant 4000+ grams . . . .12 ☐
Previous preterm or small-for-gestational-age infant . . . .13 ☐
Renal disease . . . .14 ☐
Rh sensitization . . . .15 ☐
Uterine bleeding . . . .16 ☐
None . . . .00 ☐
Other _____ .17 ☐
(*Specify*)

**23b.** OTHER RISK FACTORS FOR THIS PREGNANCY (*Complete all items*)

Tobacco use during pregnancy . . . . . Yes ☐ No ☐
Average number cigarettes per day _____
Alcohol use during pregnancy . . . . . Yes ☐ No ☐
Average number drinks per week _____
Weight gained during pregnancy _____ lbs.

**24.** OBSTETRIC PROCEDURES (*Check all that apply*)

Amniocentesis . . . .01 ☐
Electronic fetal monitoring . . . .02 ☐
Induction of labor . . . .03 ☐
Stimulation of labor . . . .04 ☐
Tocolysis . . . .05 ☐
Ultrasound . . . .06 ☐
None . . . .00 ☐
Other _____ .07 ☐
(*Specify*)

**25.** COMPLICATIONS OF LABOR AND/OR DELIVERY (*Check all that apply*)

Febrile (> 100°F or 38°C.) . . . .01 ☐
Meconium, moderate/heavy . . . .02 ☐
Premature rupture of membrane (> 12 hours) . . . .03 ☐
Abruptio placenta . . . .04 ☐
Placenta previa . . . .05 ☐
Other excessive bleeding . . . .06 ☐
Seizures during labor . . . .07 ☐
Precipitous labor (< 3 hours) . . . .08 ☐
Prolonged labor (> 20 hours) . . . .09 ☐
Dysfunctional labor . . . .10 ☐
Breech/Malpresentation . . . .11 ☐
Cephalopelvic disproportion . . . .12 ☐
Cord prolapse . . . .13 ☐
Anesthetic complications . . . .14 ☐
Fetal distress . . . .15 ☐
None . . . .00 ☐
Other _____ .16 ☐
(*Specify*)

**26.** METHOD OF DELIVERY (*Check all that apply*)

Vaginal . . . .01 ☐
Vaginal birth after previous C-section . . . .02 ☐
Primary C-Section . . . .03 ☐
Repeat C-Section . . . .04 ☐
Forceps . . . .05 ☐
Vacuum . . . .06 ☐
Hysterotomy/Hysterectomy . . . .07 ☐

**27.** CONGENITAL ANOMALIES OF FETUS (*Check all that apply*)

Anencephalus . . . .01 ☐
Spina bifida/Meningocele . . . .02 ☐
Hydrocephalus . . . .03 ☐
Microcephalus . . . .04 ☐
Other central nervous system anomalies (*Specify*)_____ 05 ☐
Heart malformations . . . .06 ☐
Other circulatory/respiratory anomalies (*Specify*)_____ 07 ☐
Rectal stresia/stenosis . . . .08 ☐
Tracheo esophageal fistula/Esophageal atresia . . .09 ☐
Omphalocele/Gastroschisis . . . .10 ☐
Other gastrointestinal anomalies (*Specify*)_____ 11 ☐
Malformed genitalia . . . .12 ☐
Renal agenesis . . . .13 ☐
Other urogenital anomalies (*Specify*)_____ 14 ☐
Cleft lip/palate . . . .15 ☐
Polydactyly/Syndactyly/Adactyly . . . .16 ☐
Club foot . . . .17 ☐
Diaphragmatic hernia . . . .18 ☐
Other musculoskeletal/integumental anomalies (*Specify*)_____ 19 ☐
Down's syndrome . . . .20 ☐
Other chromostomal anomalies (*Specify*)_____ 21 ☐
None . . . .00 ☐
Other_____ 22 ☐
(*Specify*)

**CAUSE OF FETAL DEATH**

**28.** Enter only one cause per line for a, b, and c.

PART I. Fetal or maternal condition directly causing fetal death.

IMMEDIATE CAUSE
a _____ Specify Fetal or Maternal
DUE TO (OR AS A CONSEQUENCE OF):
b _____ Specify Fetal or Maternal
DUE TO (OR AS A CONSEQUENCE OF):
c _____ Specify Fetal or Maternal

Fetal and/or maternal conditions, if any, giving rise to the immediate cause(s), stating the underlying cause last.

PART II. Other significant conditions of fetus or mother contributing to fetal death but not resulting in the underlying cause given in Part I.

**29.** FETUS DIED BEFORE LABOR, DURING LABOR OR DELIVERY, UNKNOWN (*Specify*)

**30.** ATTENDANT'S NAME AND TITLE (*Type/Print*)
Name_____
☐ M.D. ☐ D.O. ☐ C.N.M. ☐ Other Midwife
☐ Other (*Specify*)_____

31. NAME AND TITLE OF PERSON COMPLETING REPORT (*Type/Print*)
Name_____
Title_____

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state-coded computer tapes and microfilm copies of the original fetal death reports, which are then coded by NCHS. Beginning with data from 1992, NCHS will use state-coded data in the national fetal death file for selected states while continuing to use data coded from the microfilm copies for the remaining states and registration areas. NCHS develops special rules to handle state variations in data collection and processing. Personal identifiers are not included in the fetal death data file.

Quality control of fetal death data takes place in a number of ways. Some states have their own procedures and regularly query reports with problem data back to the original data source. NCHS encourages these state efforts and provides guidelines for such queries (*16*). Fetal death data are subject to NCHS quality control procedures at several processing stages to check for the completeness, coding validity, and consistency of data items. First, problems or inconsistencies are checked against the original source and are corrected if possible. A list of coding inconsistencies is returned to the states for information and corrective action. Second, a quality control sample of records is dual-coded, and both microfilm copies and state-coded files are compared. Third, for each state, the percentages of nonresponses for each item are compared with the state's previous year percentages and the U.S. average percentages. States are contacted when very high percentage or large changes in nonresponses are noted. Counts and percentages of records with impossible or out-of-range codes are also reviewed and compared with the previous year's performance. Finally, according to written procedures, invalid or inconsistent values may be modified or assigned as **unknowns**. Selected missing items may be imputed, either by using data from a previous record or other report items, or by assigning a standard value (e.g., the modal value 1 for missing plurality). Imputed values are flagged. Also, numeric values such as gestational age are computed.

Fetal mortality data are generally available about 2 years after the close of a data year. Tables of these data are published annually in *Vital Statistics of the United States, Volume II, Mortality, Part A* (*17*), as well as in periodic NCHS reports. Also, a number of unpublished tables are produced annually and are available from NCHS on request. NCHS also produces public-use data tapes containing individual record information on all registered fetal deaths; data for 1982–1988 are currently available. The tape contents, file characteristics, and cost are described in NCHS's *Catalog of Electronic Data Products* (*18*).

Additional sources of fetal death data include the National Fetal Mortality Survey of 1980 and the National Maternal and Infant Health Survey of 1988, which are nationally sampled surveys produced periodically with a wider range of variables than the annual vital statistics data files (*19*). Birth defects surveillance programs may also report data on fetal deaths (see the Prevalence of Birth Defects chapter).

## GENERAL FINDINGS

In this section, we present important findings from U.S. national surveillance activities and other studies that help highlight important issues for the prevention of fetal deaths.

Global measurements of the numbers of and risks for the approximately 60,000 fetal deaths reported in U.S. fetal death statistics are available from NCHS (see the CDC Surveillance Activities section) and are highlighted here. Most of the data reported by NCHS focus primarily on the estimated 30,000 U.S. deaths occurring at ≥20 weeks of gestation and include frequency counts according to several characteristics. Also, fetal death ratios (defined in the Interpretation Issues section) were formerly provided by gestation, maternal characteristics, race, sex, birth weight, residence, and other items. However, more recently, fetal death rates are provided instead of ratios (see discussion later in this chapter concerning rates and ratios). In 1989, new tables on Hispanic origin and prenatal care were included in NCHS's fetal death reports.

Nationally, overall fetal mortality rates have declined by more than half since 1960, from 15.8 in 1960 to 7.5 in 1989, continuing to drop even after the 1977 change in reporting requirements (Figure 2)(also see Table 3-2 in NCHS, 1994 [*17*]). The fetal mortality rate did not decline

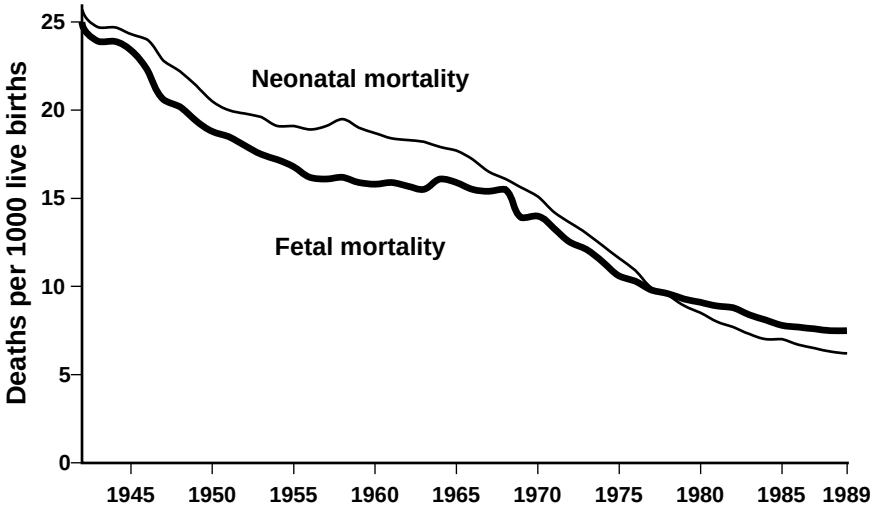
between 1960 and 1965. From 1965 to 1970, however, the rate declined by an average of 2.5% per year. From 1970 to 1980 the rate declined more rapidly, averaging 4.2% per year. From 1980 to 1989, the velocity of the decline in the fetal mortality rate again slowed to an average of 2.1% per year. Various factors may have contributed to these declines, including the better management of maternal complications, such as hypertension, pregnancy-associated diabetes, and Rh isoimmunization, which may have reduced the incidence of antepartum fetal deaths, and improvements in obstetrical management of labor, such as electronic fetal monitoring, which may have reduced the incidence of intrapartum fetal deaths (*20–24*).

Although fetal mortality rates have declined for all race groups, the gap between black and white fetal mortality rates has widened since 1970. In 1970, the fetal mortality rate for blacks was 23.2—1.90 times the rate of 12.3 for whites. By 1989, the fetal mortality rate for blacks was 13.1—2.05 times the rate of 6.4 for whites. These rates, which are not adjusted for other factors such as maternal age and medical risks, may indicate differences in socioeconomic resources and access to care between comparison groups (see discussion of this topic in the Infant Mortality chapter). For example, NCHS data on the month in which prenatal care began indicate that 63% of white mothers compared with 45% of African-American mothers who experienced a fetal death had begun prenatal care in the first 3 months of the pregnancy (see Table 3-18 in NCHS, 1994 [*17*]). In addition, 7% of white mothers compared with 18% of black mothers experiencing fetal deaths received no prenatal care. Other populations with apparently higher fetal death rates than whites include Native Americans and Hawaiians, each of whom have a rate of 7.6. In contrast, rates were substantially lower for Asian subgroups—3.2 for Chinese, 3.1 for Japanese, 5.6 for Filipinos, and 5.6 for other Asian and Pacific Islanders.

Besides varying by race and ethnic origin, fetal mortality rates also differ with respect to numerous other demographic factors. Similar to infant mortality rates, fetal mortality rates in the 43 areas where marital status is adequately reported are also substantially higher for unmarried than for married mothers, although the magnitude of the difference is reduced when maternal race is controlled (Table 1). The risk of fetal death also varies by the age of the mother, with the youngest and oldest mothers experiencing the greatest risk (Table 1). Data on the differences in fetal mortality rates by state are available from NCHS but should be interpreted with caution (see the Interpretation Issues section).

Fetal deaths are etiologically heterogeneous with respect to the timing and causes of death, and we must carefully distinguish between **intrapartum** fetal deaths, occurring **during labor**, and **antepartum** fetal deaths (occurring **before** labor). Despite the lack of national cause-of-death data, major causes of fetal deaths identified in the literature include maternal conditions, preterm labor, asphyxia, abruptio placentae, infection, proteinuric hypertension, and birth defects (*20,25,26*). However, because of limitations with cause-of-death information and variations in study design (see Interpretation Issues section), studies have reported different distributions of the causes of fetal deaths. For example, the proportion of deaths caused by birth defects has ranged from 10%–15% (*20,27,28*) to as high as 30% (*29*). Although the distribution of gestations for the fetal deaths may differ, most of the studies cited above include gestational ages of ≥20 weeks in their case definitions. One of the few consistencies is the large percentage (ranging from 23% to 52%) of reports with an unknown cause of death (*20,25*). In a recent Canadian study, Fretts et al. demonstrated temporal changes in cause-specific fetal death rates from the 1960s to 1980s (*24*). They found that fetal deaths caused by intrapartum asphyxia and Rh isoimmunization had almost disappeared, with significant declines occurring in unexplained antepartum deaths and in those caused by fetal growth retardation. However, they observed no significant changes in deaths due to intrauterine infection or abruptio placentae. In contrast to the 1960s—when the risk was elevated for women with hypertension, diabetes, or a history of stillbirth—during the 1980s, only women with a history of insulin-dependent diabetes were at detectable risk. After 28 weeks of gestation, fetal deaths were most often attributed to fetal growth retardation or abruptio placentae, although many were still unexplained.

**FIGURE 2. Fetal and neonatal mortality rates* — United States, 1942–1989**




* Fetal mortality rates are per 1,000 live birth and fetal deaths. Neonatal mortality rates are per 1,000 live births.

Source: NCHS, 1994 *(17)*.

**TABLE 1. Fetal mortality rates,* by race, marital status, and age of mother — United States, 1989**

| | Race | | |
|---|---|---|---|
| | All races† | White | Black |
| **Marital status§** | | | |
| Total | 7.6 | 6.4 | 13.3 |
| Married | 6.3 | 5.9 | 11.6 |
| Unmarried | 11.1 | 8.7 | 14.2 |
| **Age (years)¶** | | | |
| Total | 7.5 | 6.4 | 13.1 |
| <15 | 14.4 | 12.4 | 16.3 |
| 15–19 | 8.6 | 7.4 | 11.6 |
| 20–24 | 7.4 | 6.2 | 12.0 |
| 25–29 | 6.6 | 5.7 | 13.1 |
| 30–34 | 7.1 | 6.1 | 15.5 |
| 35–39 | 9.4 | 8.4 | 17.7 |
| 40–44 | 13.5 | 12.0 | 25.0 |
| 45–49 | 23.8 | 24.8 | ** |

* Per 1,000 live births and fetal deaths.
† Includes races other than white and black.
§ Rates by marital status are for 42 states and the District of Columbia.
¶ Rates by age are for all states and the District of Columbia.
** Rate does not meet standards of reliability or precision (<20 fetal deaths).

Source: NCHS, 1994 (*17*).

In the United States, as in other developed countries, most fetal deaths occur during the antepartum period, before the onset of labor (*25*). In comparing antepartum fetal deaths (between 24 weeks of gestation and before labor), intrapartum fetal deaths, and neonatal deaths among all single births that occurred in New York City in 1976–1978, Kiely, Paneth, and Susser found that 12.8% of deaths occurred during labor, 72.6% occurred before labor, but for 14.6% of deaths, the time of death was unknown (*30*).

Unlike the risk factors for antepartum deaths, most risk factors for intrapartum stillbirths are related to labor and delivery problems (*2,21,22,25*). The most striking finding in the New York City studies is the clear association between less available perinatal technology (as measured by the level of the hospital or facility) and an increased risk for intrapartum fetal death—an association that does not occur in late antepartum fetal deaths (*2,22,29*). In contrast, after controlling for prior fetal loss, type of service (public vs. private), race, marital status, and mother's educational attainment, the investigators found that increasing maternal age was strongly associated with antepartum fetal deaths but not with intrapartum fetal deaths and that high parity was strongly associated with intrapartum deaths but not to antepartum deaths. More recently, Little and Weinberg found similar results for maternal age, but they also discovered that overweight women had differentially higher risks for intrapartum vs. antepartum fetal deaths at ≥28 weeks of gestation (*31*).

In addition, health-care professionals and researchers recognize that the risk of fetal death declines as gestation advances. Also, several studies have shown that the risk increases with younger and older maternal age, high parity, prior fetal loss, morbidity conditions, inadequate prenatal care, smoking, lower socioeconomic status, and reproductive tract infections (*20,22,26,32–38*). A few studies have displayed an increased risk among older smokers than among younger smokers (*32,33*). In contrast, for intrapartum deaths, no increased risks have been found for social, demographic, or antenatal care variables such as maternal age, parity, adverse obstetric history, and the level of the delivery hospital (*25*). Although risks for fetal death associated with illegal drug use have been less frequently studied, some researchers have identified an increased risk due either to direct toxicity or an indirect effect on other high risk conditions such as abruptio placentae (*39*).

## INTERPRETATION ISSUES

### Registration Completeness

#### DIFFERENCES IN THE INTERPRETATION OF STANDARD DEFINITIONS

Fetal deaths, especially those involving preterm fetuses, can be misclassified as live births because of either individual difficulties with or differences in the clinical interpretation of the WHO fetal death definition. To help practitioners distinguish between fetal deaths and live births, the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists have clarified the WHO's fetal death definition as follows (*13,40*): "Heartbeats are to be distinguished from transient cardiac contractions, respirations are to be distinguished from fleeting respiratory efforts or gasps."

Despite these guidelines, which are endorsed by NCHS, distinguishing between fetal deaths and live births in practice depends on such factors as the skill and experience of the hospital's clinical and registrars staff, differences between individual physicians and hospitals in the application of definitions, and changes in medical practice over time. For example, Kleinman attributed some of the notable changes in both the incidence of live births and the proportion of deaths among infants weighing <500 g from 1981–1985 to changes that had occurred in reporting classifications of pregnancy outcomes (*41*). In addition, trend analyses for fetal deaths may be difficult to interpret because of the increased reporting of deliveries of infants weighing <500 g at birth. Kleinman attributed these increases to practice and reporting changes (*41*). He found that in 1970–1985, not only were these increases notable, but they differentially increased by 39% for whites and by 78% for blacks.

Other possible factors that might bias the classification of outcomes include financial incentives to classify outcomes as live births in ambivalent

cases or legal disincentives to classify early neonatal demises as fetal deaths (e.g., deaths related to intrapartum fetal distress).

These classification problems occur for fetal and infant death statistics worldwide. These problems are the reason for the development of perinatal mortality measures that bypass inconsistencies in classifying deaths that occur very near the time of delivery by incorporating various combinations of later fetal deaths and neonatal infant deaths (*11,40,42*). Analyses using such measures have an advantage because late fetal deaths and neonatal deaths often share the same etiologies and, to examine the full impact of these risks with respect to outcomes, combining such losses makes good sense.

Early fetal deaths at <20 weeks of gestation, however, may have substantially different etiologies than late fetal or neonatal deaths, and they should be assessed separately. Although NCHS has procedures to adjust these perinatal measures for unknown gestations, perinatal mortality measurements cannot help us assess these earlier fetal death risks, deal with the underreporting of fetal deaths (especially earlier deaths), or fully account for fetal deaths with unknown gestations (6.7% in 1989).

## REPORTING REQUIREMENTS

State differences in reporting requirements, as described previously, pose difficulties in the interpretation of both national trends and state comparisons (*13*). Because most states require reports for fetal deaths at ≥20 weeks of gestation, NCHS addresses the comparability problem by presenting most fetal death tables in the annual publication, *Vital Statistics of the United States*, based on reports of deaths at ≥20 weeks of gestation (see the Technical Appendix in NCHS, 1991 [*11*]). However, this approach does not address the problem of age-dependent underreporting resulting from the different reporting requirements used.

## UNDERREPORTING

Substantial evidence indicates that not all fetal death reports for which reporting is required are filed (*6,43,44*). Greb and colleagues compared Wisconsin reports to hospital referrals to the Wisconsin Stillbirth Service Project and found that 17.8% of fetal deaths evaluated at the project were never reported to the state (*6*). Furthermore, Goldhaber found that the completeness of reporting from Northern California Kaiser Foundation hospitals depended on how close the estimated gestational age of the deceased fetus at delivery was to the state reporting minimum of age of ≥20 weeks, with approximately 10% of deaths at 20–27 weeks being reported compared with 79% of deaths at ≥28 weeks (*43*). Reporting also depended on whether hospitalization was required for delivery or whether physicians classified the event as a fetal death. Thus, underreporting of fetal deaths is most likely to occur in the earlier part of the required reporting period for each state (*43,44*).

National evidence of underreporting was found in a recent NCHS comparison of 1989 fetal mortality rates, similar to work previously reported by Kleinman (*45*). The overall fetal death rate (≥20 weeks) of 9.9 for the five states reporting fetal deaths at all gestations was 39% higher than the rate of 7.1 for all other states combined. In contrast, the neonatal mortality rate for these five states was 18% higher than the rate for all other states combined. The magnitude of these percentage differences strongly suggests that higher underreporting occurs in states reporting fetal deaths at ≥20 weeks than in states reporting deaths at all gestations.

Completeness of reports for deaths at the shortest gestations in states reporting all gestational ages has also been questioned. Complete reporting at these ages could depend on the mothers' experience with and knowledge of the possibility of pregnancy, access to pregnancy testing before a loss, and health beliefs and attitudes about when to seek care as well as providers' attitudes about the significance of the loss and need for reporting.

Although we have no better solutions to underreporting other than improved reporting, some researchers have limited their analyses to late fetal deaths at ≥28 weeks to avoid underreporting. However, this solution still ignores the problem of earlier losses, because at least one

third of deaths at ≥20 weeks fall in the 20–27 week category, and losses at <20 weeks account for 80% of all losses in states that report them (*45*). The apparent dependency of reporting completeness on the earliest gestational age for registration suggests that if we are to adequately measure fetal losses at ≥20 weeks, we might be able to determine minimum reporting ages to maximize completeness and address concerns about adequate ascertainment and burdensome costs of very early loss reports.

## Data Quality

### ITEM-SPECIFIC NONRESPONSE

In comparison with other vital statistics records, fetal death records generally have more not-stated responses to individual items. Item nonresponse in fetal death records reflects both difficulty in ascertaining early death data, such as cause of death, sex, or birth defects, and limitations in access to necessary information, such as funeral directors' lack of access to medical charts. Even the physician or medical records staff may have difficulty obtaining information, for example, if the death occurs before the onset of clinical prenatal assessment or if important clinical data are only in another provider's records. In addition, important information such as birth weight may be missed if the delivery occurred out of the hospital or was attended by emergency room providers not aware of requirements or not accustomed to collecting this information. This latter reason was given by a number of hospitals that missed gestational ages and birth weights in a recent study of fetal deaths at ≥20 weeks in Georgia (*46*). In contrast to data on live births, missing birth weights were a larger problem than missing gestational ages. Among the 40% of the selected problem records that were missing data, most were missing data on birth weights. As the result of active hospital follow-up of these problem records, 48% of the missing weights were obtained, and important corrections were made to data on gestational age and birth weight. Additional factors contributing to item nonresponse may include the lower priority given to the fetal death system than to other vital statistics systems and fewer resources available for follow-up.

Nationally, in records on fetal deaths at ≥20 weeks, the percentage of not-stated responses for items varies widely (Table 2). Reporting is virtually complete for some items, such as the place of delivery (0.1% stated in 1989). Reporting for other items, particularly new items such as maternal weight gain, reflects a high nonresponse percentage (46.9% not stated in 1989). Yet the overall quality of fetal death records has been improving. Further improvements are expected in the national data file after NCHS shifts to using selected state-coded data tapes rather than microfilm copies of reports. These state-coded files will contain the results of queries received after the microfilm copies are sent to NCHS.

### GESTATIONAL AGE MEASUREMENTS

Because risks for poor pregnancy outcomes of fetuses differ across gestational periods, the accuracy of gestational age estimates is important to the interpretation and further analysis of these data. At NCHS, the gestational age of the fetus is computed by subtracting the date of delivery from the date of last menstrual period (LMP). The physician's estimate of gestation is used if the calculated estimate is missing, is outside of an acceptable range, or is inconsistent with reported birth weight but the physician's estimate meets these criteria. Some inaccuracies have been reported in the use of both the physician's estimate and LMP measures of gestational age. Problems with the use of the physician's estimate include clustering of responses on even-numbered weeks of gestation and a pronounced clustering at 40 weeks of gestation (*47*). Problems with gestational age estimates computed from LMP include substantial reporting inaccuracies for postterm pregnancies (*47*). The physician's estimate of gestational age can be made by using methods, such as ultrasound, clinical assessments, calculation of dates, or a combination of these approaches; biases may be introduced by the lack of uniform measurement methods. For LMP gestation, calculated estimates may also be misleading when a fetal death has occurred days or weeks before the fetus is delivered. Therefore, without better standardized measurements, the problem of gestational age ascertainment will remain an issue, especially among at-risk

**TABLE 2. Percentage of nonresponses for selected items on records of fetal deaths at ≥20 weeks of gestation — United States, 1989**

| | Percentage of fetal death records |
|---|---|
| Place of delivery | 0.1 |
| Hispanic origin* | 3.6 |
| Marital status† | 5.8 |
| Total-birth order | 6.6 |
| Birth weight | 11.5 |
| Month prenatal care began | 13.4 |
| Method of delivery§ | 13.4 |
| Maternal education¶ | 19.2 |
| Weight gain** | 46.9 |

* Total of 31 states.
† Total of 42 states and the District of Columbia.
§ Total of 39 states and New York City.
¶ Total of 48 states and New York City.
** Total of 38 states and New York City.

Source: NCHS, 1994 (*17*).

pregnancies in which minimal or no prenatal ascertainments were made.

## CAUSE AND TIMING OF DEATH

Because fetal deaths are heterogeneous events with respect to causes, cause-of-death analyses are important for examining preventable risks (see the General Findings section). However, both the uniformity and plausibility of these data have been and will continue to be important issues, especially in the new national data on underlying cause of fetal death that will be available in the future. Despite the lack of national data, four specific points addressing these issues have been raised in reviews of state-specific data:

- A major drawback to uniformity is that many fetuses who die are not autopsied or otherwise evaluated. For example, in a recent review of fetal deaths in Kansas, Cowles et al. found that only 37% of the 243 reports indicated an autopsy was obtained (*23*). Factors that may affect whether such evaluations occur are the wishes of the family during this sensitive time, the costs of evaluations, who will pay these costs, the perception that finding the cause of a fetal death is less important than finding the cause of an infant death, and the availability of skilled pathologists and technicians. Cost may be less of an issue because an increasing number of third-party payers will pay for placental examinations—a necessary component of the pathologic review of fetal deaths (*48*).

- Cause-of-death determinations also depend on the adequacy and completeness of the postmortem workup and the condition of the fetus. Highlighting one of the most distressing facts about fetal death cause-specific analyses, Pitkin showed that all known and suspected causes and associated conditions combined accounted for no more than 50% of observed fetal deaths, leaving half or more undiagnosed (*49*). Moreover, this incomplete determination of causes limits the assessment of risks. For example, Yudkin et al. found that death rates for unexplained postterm deaths were four times higher than rates for postterm deaths with known causes, indicating that risk factors may be differentially distributed by cause category and

could be missed in cause-specific analyses not accounting for undetermined causes (*50*). However, Pitkin points out the need for further examinations with careful pathologic assessments that could provide additional information on more than half of the deaths with no apparent cause (*49*).

- Implausible or misclassified causes of death have also been identified as a problem. Although various factors may increase the risk of death, some factors may not be important in the cascade of events that caused the death, yet they can be presumed and reported to be the cause without careful assessments by knowledgeable reviewers such as clinicians and certifiers. In a recent review of cause-of-fetal-death reporting by five states, Kirby questioned the plausibility of reported causes of deaths (*51*). Both Kirby's review and an accompanying editorial by Atkinson agreed that improvements in these data are needed (*51,52*). Consistent with other studies mentioned above, he found that 24.2%–33.7% of these deaths had unspecified causes. Comparing causes on 112 state reports with causes derived by using an extensive protocol, Greb et al. found marked discrepancies. For example, 23 of the 35 placenta- or cord-related deaths were reclassified with an unknown cause because of the lack of confirmation of a placenta- or cord-related injury (*6*). Also, they found that many of the "appropriately" categorized reported diagnoses were wrong.

- As we mentioned in the General Findings section, the distinction between intrapartum fetal deaths and late antepartum fetal deaths should be made. Because the causes of these two groups of fetal deaths are clearly different, public health implications and methods of prevention are different for them.

As a result of these problems with the quality of cause and timing data, analysts using these data collection systems have had limited ability to classify causes in meaningful ways for public health decision making about resource allocations and interventions. Golding describes several major classification schemes for fetal and perinatal mortality (*53*). Although most schemes require more extensive clinical evaluation, one scheme proposed by Wigglesworth was designed to be simpler and reliable and, with improvements in the data, could be used to provide important general information to target areas for prevention. This scheme requires information on the presence or absence of a congenital abnormality and specific conditions described on the fetal death certificate, such as the timing of the demise. Other schemes demand even better, more specific clinical information; should such information become available, these schemes could provide even greater insight into the causes of fetal deaths, especially those related to antepartum deaths.

The lack of adequate cause-of-death information and the difficulties in developing and applying more refined classifications related to the etiologic heterogeneities among fetal deaths (e.g., antepartum vs. intrapartum) are substantial barriers in the identification of preventable risks for fetal deaths, especially when surveillance data are being used.

### RISK MEASURES AND OTHER ANALYTIC TECHNIQUES

In addition to fetal death frequency counts, a number of fetal or perinatal death risk measures are in use. For example, before 1989, fetal death ratios—the number of fetal deaths divided by the number of live births—were used in national report tables. Beginning with 1989 fetal death data, fetal mortality rates—the number of fetal deaths divided by the number of live births plus fetal deaths—were selected to replace death ratios because this denominator provides a better indication of the population at risk of fetal death (i.e., pregnancies). Also, various perinatal mortality rate formulas are available, and several are in use by NCHS (*11,40*). Additional measures and types of analyses, which may be useful, are detailed elsewhere (*35,54–56*).

## EXAMPLES OF USING DATA

The analysis of fetal death surveillance data to address prevention needs is still a relatively new concept and has not been conducted in-depth

by many states. We hope that this chapter will encourage public health departments to improve their fetal death surveillance data collection, analysis, and application to develop and monitor prevention efforts.

## FUTURE ISSUES

Two of the national health objectives for the year 2000 address fetal deaths (*57*):

- Reduce the fetal death rate (≥20 weeks of gestation) to no more than 5 per 1,000 live births plus fetal deaths. (Baseline: 7.6 per 1,000 live births plus fetal deaths in 1987.)

- Reduce the fetal death rate for blacks to 7.5 per 1,000 live births plus fetal deaths. (Baseline: 12.8 per 1,000 live birth plus fetal deaths in 1987.)

To meet the first objective for the entire U.S. population, we need to maintain the 3.2% annual decline in fetal mortality observed in 1981–1986. The objective for blacks calls for accelerating the annual decline in fetal mortality from 2.3% in 1981–1986 to 3.6% in the 1990s.

The likelihood of achieving these goals depends on the availability and use of interventions to avert fetal deaths. Given that the causes of many fetal deaths are unknown, the prospects for prevention are unclear. Although a large percentage of fetal deaths are attributed to lethal malformations (*20*), only a small proportion of these malformations may be prevented by changes in maternal behaviors (e.g., increasing periconceptional multivitamin use and decreasing periconceptional and antenatal alcohol and drug use), and prevention remains a problem because the causes of most malformations are unknown. In addition, because prior fetal death associated with certain malformations can be a risk for subsequent fetal demise—perhaps because of the increased risk for a subsequent malformation (*58*)—better medical evaluation of fetal deaths with genetic screening and counseling may also lead to prevention and enhanced surveillance (*59*).

Interventions to address other known causes of fetal death include improved prenatal diagnosis and treatments of maternal morbidities, such as hypertension and maternal-fetal infections, and efforts to reduce maternal cigarette smoking and the use of illegal drugs. Such improvements in access to and the quality of prenatal care may decrease fetal mortality.

Future needs for the improvement of fetal death surveillance include increased completeness of reporting, increased scope and accuracy of routinely reported data, and modified approaches to analysis. Whereas in the short-term, improved reporting may cause either a modest increase in fetal death rates or a leveling off of declines in these rates; in the long-term better reporting will support prevention efforts and could lead to a rate decline.

The 1989 revisions of the fetal death report and live birth certificate—which contain information on maternal smoking, drinking, and use of prenatal care—may help to assess how changes in these factors affect the rate of fetal death. In addition, wider use of early ultrasound for determination of gestational age as well as improved access to and earlier initiation of prenatal care may improve the accuracy of fetal gestational age data.

Currently, the etiologic heterogeneity and the lack of adequate cause-of-death information are substantial barriers in the identification of preventable risks. In fact, more rapid declines in fetal death rates may be possible if we promote and conduct effective research into the unknown causes and the primary prevention of malformations and low birth weight (*26*). Furthermore, the cause of death according to the timing of death (antepartum or intrapartum) must be further examined.

Therefore, we should focus on improving physicians' ascertainment of the initiating and contributing causes of fetal death. Improvements in the quality and availability of national reporting can help us to address the problems of unknown, inappropriately classified, and inconsistent cause reporting. Kirby recently raised these issues and proposed several ways to improve the data, challenging us to establish public

health priorities supporting cause reporting that will improve our ability to monitor and prevent fetal deaths (*51*). With such improvements, NCHS's plans to compile and soon make available national cause-specific data will help public health professionals and researchers better quantify the causes of and risks for fetal death and will allow better tracking of changing cause-specific trends. We also will be able to use appropriate cause-of-death classification schemes that provide meaningful information for public health decision making and better understanding of the initiating causes of such deaths. Knowing these causes will permit us to better target our intervention efforts.

From an analytic viewpoint, analyses of perinatal mortality data can overcome inconsistencies among demographic groups and across geographic areas in the classification of birth outcomes as fetal or infant deaths. Etiologically, the analysis of perinatal mortality data makes sense because late fetal and neonatal deaths share many of the same etiologies. To assess the effects of public health interventions, the analysis of perinatal mortality is preferable, because we would expect these interventions to reduce both fetal and neonatal deaths. To better understand and prevent fetal deaths that occur earlier in pregnancy, we need to conduct separate analyses of early fetal deaths to measure risks affecting fetal outcomes before the perinatal period, with better clinical risk and outcome markers.

Compared with the wide range of analyses conducted on live birth data, far fewer analyses have focused on fetal death data. The availability of more complete and accurate fetal mortality data and the combined analysis of fetal and neonatal mortality will help direct our future efforts to reduce adverse pregnancy outcomes.

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