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# Vital and Health Statistics

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From the CENTERS FOR DISEASE CONTROL AND PREVENTION / National Center for Health Statistics

## 1988 National Maternal and Infant Health Survey: Methods and Response Characteristics

May 1998



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Centers for Disease Control and Prevention  
National Center for Health Statistics



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Data Evaluation and Methods  
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No. 125

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Centers for Disease Control and Prevention  
National Center for Health Statistics

Hyattsville, Maryland  
May 1998  
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# Preface

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This report presents a detailed description of the sample design, imputation procedures, weighting procedures, variance estimation, and response characteristics for the 1988 National Maternal and Infant Health Survey (NMIHS). The survey was designed by staff of the former Followback Survey Branch in the Division of Vital Statistics at the National Center for Health Statistics (NCHS). The NCHS contracted with the Demographic Surveys Division of the U.S. Bureau of the Census to conduct the survey. The Survey Design Staff of the Office of Research and Methodology (ORM) at NCHS were responsible for the sample design. The Statistical Methods Staff in ORM were responsible for developing estimation procedures for the NMIHS.

Van L. Parsons of the Statistical Methods Staff in ORM served as a peer reviewer of this report.

At NCHS, the authors would like to acknowledge James Weed, Paul Placek, Gloria Simpson, Michael Kogan, Michelle Davis, and Steven Botman. At the U.S. Bureau of the Census, we would like to acknowledge Robert Mangold, Robert Wilson, Debbie Usitalo, Nan Sukla, and David Hackbarth.

The NMIHS was supported in part by a number of Federal agencies, most of whom participated in the design of the questionnaires and the survey.

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**Objectives**

The 1988 National Maternal and Infant Health Survey (NMIHS) was conducted by the National Center for Health Statistics to study factors related to poor pregnancy outcome, such as adequacy of prenatal care; inadequate and excessive weight gain during pregnancy; maternal smoking, drinking, and drug use; and pregnancy and delivery complications.

**Methods**

The NMIHS is a nationally representative sample of 11,000 women who had live births, 4,000 who had late fetal deaths, and 6,000 who had infant deaths in 1988. Questionnaires were mailed to mothers based on information from certificates of live birth, reports of fetal death, and certificates of infant death. Information supplied by the mother, prenatal care providers, and hospitals of delivery was linked with the vital records to expand knowledge of maternal and infant health in the United States.

**Results**

The response rates in all three components of the NMIHS differed according to the mothers' characteristics. Mothers were more likely to respond if they were 20–39 years of age, were white, were married, had fewer than four children, entered prenatal care early, had more prenatal visits, had more years of education, or resided in the Midwest Region. The percent of respondents was lower for teenage mothers, mothers of races other than white, and mothers with four or more children, little prenatal care, or fewer years of education. Mothers whose infants weighed less than 2,500 grams were less likely to respond in the live-birth and infant-death components than mothers whose infants weighed 2,500 grams or more.

**Conclusions**

The NMIHS will provide an invaluable tool for researchers and practitioners seeking solutions to perinatal and obstetric problems.

**Keywords:** *mother's characteristics • infant characteristics • prenatal care • infant birthweight*

# 1988 National Maternal and Infant Health Survey: Methods and Response Characteristics

*Maureen Sanderson, Ph.D., University of South Carolina; Chester Scott, Division of Vital Statistics, National Center for Health Statistics; and Joe Fred Gonzalez, M.S., Office of Research and Methodology, National Center for Health Statistics*

## Introduction

The purpose of this report is to present detailed methods and response characteristics for the 1988 National Maternal and Infant Health Survey (NMIHS). Areas that are emphasized in this report are survey design specifications, sample design, data collection instruments used in the survey, imputation of missing data, weighting to produce national estimates, approximation of sampling errors, and response rates for mothers, their hospitals of delivery, and their primary prenatal care providers.

## Background

The National Center for Health Statistics (NCHS) conducts “followback” surveys to gain additional information from vital records. The term “followback” is used to indicate that sources named on vital records are contacted to provide supplemental information. Previous followback surveys include the National Natality Surveys (NNS's) in 1963, 1964–66, 1967–69, 1972, and 1980; a National Infant Mortality Survey (NIMS) in 1964–66; and a National Fetal Mortality Survey (NFMS) in 1980. The National Maternal and Infant Health Survey is the equivalent of a combined NNS, NFMS, and NIMS. By comparing previous surveys with the National Maternal and Infant Health Survey and controlling for the use of different

samples, trends over time can be studied among subgroups of women for factors such as prenatal care, weight gain during pregnancy, maternal smoking and drinking, and pregnancy and delivery complications as they relate to birth outcome.

## The 1988 National Maternal and Infant Health Survey

The 1988 NMIHS was conducted by NCHS to assist researchers in studying factors related to poor pregnancy outcome. The survey is a nationally representative sample of 9,953 women who had live births, 3,309 who had late fetal deaths, and 5,332 who had infant deaths in 1988. The infants of approximately 88 mothers appear in both the live-birth and infant-death components. In addition, the mothers of 310 infants in the live-birth cohort reported that these children had died before the mothers completed the questionnaire. Mothers were mailed questionnaires using names and addresses from certificates of live birth, reports of fetal death, and death certificates for infants. The mother's questionnaire included information on prenatal care and health habits, previous and subsequent pregnancies, characteristics of the parents, and the baby's health through 6 months of age.



Each mother was asked to provide names and addresses of the hospital of delivery, all hospitals to which she or the baby was admitted before or after delivery, and up to seven prenatal care providers. Mothers were asked to sign a request statement allowing her hospitals and prenatal care providers to release medical information to the NCHS. Followup attempts for nonresponse to the mother's questionnaire included a second mailing of the questionnaire, a postcard reminder, and a telephone or personal interview. Data were collected by the U.S. Bureau of the Census under a contract with NCHS.

If the mother signed a request statement, questionnaires were mailed to all of the medical sources she identified. Signed request statements from mothers were included with the questionnaires sent to medical sources in an attempt to increase response rates from medical sources. The hospital and prenatal care provider questionnaires asked for information on timing and number of prenatal care visits, health characteristics of the mothers and infants, and delivery diagnoses and procedures using the *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)*(1). NCHS contracted with the American Health Information Management Association, formerly the American Medical Records Association, to transcribe medical records onto questionnaires and to verify ICD-9-CM codes. Nonresponse followup included a second mailing and up to three telephone reminders.

The 1988 NMIHS incorporated several design features that were not present in its immediate predecessor, the 1980 NNS/NFMS. First, the 1988 NMIHS included an infant-mortality component. Second, the NMIHS included unmarried mothers, whereas only married mothers were mailed questionnaires in the NNS/NFMS. With 25.7 percent of 1988 births being to unmarried mothers in the United States, it was essential that this group be included in the NMIHS (2). Third, because black infants have rates of low birthweight and infant mortality about twice that of white infants (3), black infants were oversampled in the live-birth, fetal-death, and infant-death

components of the NMIHS to increase the reliability of the data. Very low-birthweight (less than 1,500 grams) and moderately low-birthweight (1,500–2,499 grams) infants were oversampled in the live-birth component to obtain a sufficient number of high-risk births for special studies. A full description of the 1980 NNS/NFMS methods is published elsewhere (4).

The 1988 NMIHS provides an invaluable tool for researchers and practitioners seeking solutions to perinatal and obstetric problems. It also can be used to monitor progress in achieving maternal and infant health objectives set by the U.S. Department of Health and Human Services for the year 2000 (5).

## Conduct of the Survey

Many Federal agencies collaborated with NCHS in planning and funding the NMIHS, including:

- Agency for Toxic Substances and Disease Registry
- Center for Prevention Services of the Centers for Disease Control and Prevention
- Division of Diabetes Translation of the Centers for Disease Control (CDC)
- Office of Minority Health of the CDC
- Center for Devices and Radiological Health of the Food and Drug Administration
- Center for Food Safety and Applied Nutrition of the Food and Drug Administration
- Health Care Financing Administration
- Maternal and Child Health Bureau of the Health Resources and Services Administration
- Indian Health Service
- Office of Minority Health of the Public Health Service
- National Institute on Alcoholism and Alcohol Abuse
- National Institute of Child Health and Human Development
- National Institute on Drug Abuse
- National Institute of Mental Health
- Food and Nutrition Service of the U.S. Department of Agriculture

- Texas Department of Health

## Availability of Data and Findings

A public-use data tape of the 1988 NMIHS, containing information from the mothers' questionnaires and vital records, may be purchased from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650. Previous NNS data tapes are also available for purchase (6). Data from all components of the survey are available on CD-ROM from NCHS.

## Design Specifications

### Survey Objectives

The primary purpose of the NMIHS was to collect data needed by Federal, State, and private researchers to study factors related to low birthweight, fetal loss, and infant death. Additional objectives were to produce national estimates of unique information not available on vital records; facilitate surveillance, analytic, and epidemiologic research using the extensive information provided by hundreds of new survey items; compare the characteristics of live births, fetal deaths, and infant deaths, and assess demands on maternal and infant health delivery systems; generate new direct and standardized estimates for States and local areas; and evaluate the quality and completeness of information on State vital records.

### Domain and Precision Specifications

The target population of the NMIHS was registered births, late fetal deaths (defined as 28 weeks gestation or more), and infant deaths to mothers who were residents of the United States in 1988. The live-birth and fetal-death components were restricted to women 15 years of age or over, and the infant-death component included women under 15 years of age. States were asked

**Table A. Analytical subdomains classified by race and birth outcome in the 1988 National Maternal and Infant Health Survey**

| Black                           | Other than black      |
|---------------------------------|-----------------------|
| Live birth . . . . .            | Live birth            |
| Less than 1,500 grams . . . . . | Less than 1,500 grams |
| 1,500–2,499 grams . . . . .     | 1,500–2,499 grams     |
| 2,500 grams or more . . . . .   | 2,500 grams or more   |
| Fetal death . . . . .           | Fetal death           |
| Infant death . . . . .          | Infant death          |

to provide the sampled birth certificates, reports of fetal death, and death certificates for infants, along with the corresponding birth certificates, to NCHS.

Groups at risk for adverse pregnancy outcomes were oversampled in the NMIHS to increase the reliability of the estimates for these subdomains.

Table A presents the subdomains based on child or fetus race and birthweight, for which separate analyses can be conducted. The NMIHS sample was designed to have approximately equal precision for each of the analytical subdomains.

Sample sizes for the NMIHS were based on precision requirements, response rates from the 1980 NNS/NFMS, and budgetary resources. NMIHS precision requirements were to detect (a) with 80-percent confidence, a 15-percent difference ( $\alpha = 0.05$ ) in the proportion of subdomains of live births defined by infant's birthweight and mother's race (and marital status for black women) with a characteristic of interest; (b) with 80-percent confidence, a 15-percent difference ( $\alpha = 0.05$ ) in the proportion of other subdomains of approximately 160,000 live births or larger with a characteristic of interest; and (c) with 80-percent confidence, a

15-percent difference ( $\alpha = 0.05$ ) in the proportion of subdomains of fetal deaths and infant deaths of approximate size 1,500 grams or larger with a characteristic of interest. The expected and actual sample sizes in each subdomain of the NMIHS are shown in table B. The expected sample size was 10,000 in the live-birth component, 4,000 in the fetal-death component, and 6,000 in the infant-death component. Black infants were oversampled in all three components, and very low-birthweight and moderately low-birthweight infants were oversampled in the live-birth component. The actual sample sizes were inflated to compensate for projected nonresponse.

## Operational Requirements

Mail questionnaires were to be sent to mothers using names and addresses from the vital record. Mothers not responding to the mail questionnaire could complete a telephone or personal interview. Proxy interviews were not accepted. Respondent burden was to be held to a minimum.

Mothers were asked to provide contact information for the hospital of delivery, all hospitals where the mother

or baby were admitted before and after delivery, and up to seven prenatal care providers. Questionnaires were not to be sent to medical sources unless the mother signed a request statement allowing hospitals and providers to release medical information to NCHS.

It was expected that 77 percent of mothers in the live-birth component and 75 percent of mothers in the fetal-death and infant-death components would respond to the questionnaire. The expected response rate for hospitals was 87 percent for all three components. Eighty percent of prenatal care providers in the live-birth component and 75 percent of prenatal care providers in the fetal-death and infant-death components were expected to respond to the questionnaire.

## Sample Design

### Summary

The NMIHS sample represents women who had a live birth, fetal death, or infant death in 1988. The live-birth and fetal-death components were restricted to women 15 years of age or over, and the infant-death component included women under 15 years of age. The NMIHS drew stratified systematic samples from live births and infant deaths that were registered in 48 States, the District of Columbia, and New York City in 1988; and from fetal deaths that were registered in 46 States, the District of Columbia, and New York City in 1988. Black infants were oversampled in the

**Table B. Expected and actual sample sizes, by race and birth outcome in the 1988 National Maternal and Infant Health Survey**

| Birth outcome                 | Black                          |                    |                              | Other than black               |                    |                              |
|-------------------------------|--------------------------------|--------------------|------------------------------|--------------------------------|--------------------|------------------------------|
|                               | Number of expected respondents | Actual sample size | Number of actual respondents | Number of expected respondents | Actual sample size | Number of actual respondents |
| Live birth                    |                                |                    |                              |                                |                    |                              |
| Less than 1,500 . . . . .     | 750                            | 1,296              | 841                          | 750                            | 951                | 710                          |
| 1,500–2,499 grams . . . . .   | 750                            | 1,194              | 803                          | 750                            | 938                | 714                          |
| 2,500 grams or more . . . . . | 3,500                          | 4,948              | 3,582                        | 3,500                          | 4,090              | 3,303                        |
| Fetal death . . . . .         | 2,000                          | 2,624              | 1,297                        | 2,000                          | 2,149              | 2,012                        |
| Infant death . . . . .        | 3,000                          | 4,532              | 2,770                        | 3,000                          | 3,634              | 2,562                        |

live-birth, fetal-death, and infant-death components of the NMIHS, and very low-birthweight (less than 1,500 grams) and moderately low-birthweight (1,500–2,499 grams) infants were oversampled in the live-birth component.

Although race of mother and father are reported on the birth certificate, tabulations are by race of child. Because race of child is not reported directly on the birth certificate, it was determined for statistical purposes by an algorithm, used at the time for the United States, based on the information reported for the mother and father. In cases of mixed parentage, where one parent was white, the child was assigned the race of the other parent. When neither parent was white, the child was assigned the race of the father, with one exception: If either parent was Hawaiian, the child was assigned to Hawaiian.

Certain records of vital events selected for the NMIHS were excluded for a number of reasons. Vital events to unmarried mothers in Arizona, Kansas, and North Dakota were excluded. In addition, registration areas had the option of excluding births because of privacy and confidentiality concerns. Colorado, Oregon, and Washington sought mothers' permission to include the vital records of their infants in the NMIHS. Records were excluded if the mother refused permission.

## Survey Procedures

### Sampling of Certificates of Vital Events

The sampling frames for the live-birth and infant-death components of the NMIHS consisted of the files of birth certificates and certificates of infant death for all registration areas except Montana and South Dakota. Montana did not participate in the survey because State clearance was not received in time to sample certificates. After providing a limited number of certificates for inclusion in the survey, South Dakota withdrew clearance because of a State law that required the attending physician's approval for release of the medical record. The

sampling frame for the fetal-death component of the NMIHS consisted of the file of reports of late fetal death for all registration areas except Montana, Michigan, New York State, and South Dakota. State laws in Michigan and New York State prohibit the provision of reports of fetal death for followback surveys; therefore, those States were eliminated from the sampling frame for the fetal-death component of the NMIHS. The three sampling frames included no records from Puerto Rico, the Virgin Islands, or Guam.

Certificates of live birth, reports of late fetal death, and certificates of infant death to nonresidents of the United States were excluded from their respective sampling frames. Attempts were made to exclude mothers under 15 years of age from the sampling frames; however, maternal age is not reported on certificates of infant death, and corresponding birth certificates were not available until after the sample was drawn. A small percent of the infant-death (0.5 percent) sampling frame included women under 15 years of age. To decrease the possibility of overlap of the NMIHS with CDC's Pregnancy Risk Assessment Monitoring System (PRAMS), approximately one-half of the certificates of live birth and infant death were excluded from the sampling frames for Maine, Michigan, and West Virginia, which participated in PRAMS. The District of Columbia, Indiana, and Oklahoma sent all sample certificates to NCHS rather than one-half of the certificates as instructed; weights were adjusted to account for this sampling inconsistency. In the case of Missouri, the live-birth and infant-death sampling frames were restricted to January 1 through June 30, 1988.

It is estimated that more than 99 percent of all live births and deaths to infants that occurred in the United States in 1988 were registered (7,8). The number of fetal deaths that are not registered is unknown (8), however, underregistration is thought to increase as gestational age decreases. The NMIHS was designed to restrict fetal deaths to 28 weeks gestation or more to minimize the effect of underregistration.

The reporting of fetal deaths varies by State or registration area, with some reporting at all periods of gestation, some 20 weeks gestation or more, and some a combination of gestational age and/or birthweight (8). Prior to selecting the sample, approximately three in five reports of fetal death with particular file numbers assigned by the State or registration area were requested by NCHS for screening. A total of 23,483 records were screened for gestations of 28 completed weeks or more, based on last menstrual period or physician's estimate of gestation. There were instances where information on the final fetal-death certificate differed from the preliminary fetal-death certificate used in screening. Of the 4,773 fetal deaths sampled, 92 had gestational ages less than 28 completed weeks, and 601 were missing gestational age. These fetal deaths should have been ineligible for the NMIHS but were included in the study. Gestational age was missing from a total of 5,679 (19.3 percent) reports of all fetal deaths in 1988 (8).

Within registration areas, sampling strata were formed on the basis of child's or fetus's race (black or other than black), and in the live-birth component, birthweight (less than 1,500 grams, 1,500–2,499 grams, 2,500 grams or more). [Table A](#) presents the six sampling subdomains in the live-birth component and the two sampling subdomains in the fetal-death and infant-death components of the NMIHS. Implicit stratification was employed to ensure that samples were representative with respect to maternal and infant characteristics. Within each sampling stratum in the live-birth and fetal-death components, records were sorted by mother's marital status and age before being selected for the sample. In the infant-death component, records were sorted by child's sex and age at death within each sampling stratum.

According to the vital registration system for 1988, 4,234 certificates of live birth lacked a response for birthweight (7). In addition, data items used to form poststratification cells may have been missing because vital records used to draw the NMIHS sample were not imputed. The following conventions were used when a data item used to

**Table C. Total number of resident live births to women 15 years of age or over in the United States in 1988, number of fetal deaths included in the sample for the 1988 National Maternal and Infant Health Survey, inverse of probability of selection, and average weights by race and birthweight**

| Race and birthweight  | Resident live births <sup>1</sup> | Sample size | Inverse of probability of selection | Average weight <sup>2</sup> |
|-----------------------|-----------------------------------|-------------|-------------------------------------|-----------------------------|
| Total                 | 3,898,922                         | 13,417      | ...                                 | ...                         |
| Black                 |                                   |             |                                     |                             |
| Less than 1,500 grams | 18,403                            | 1,296       | 14                                  | 21.8822611                  |
| 1,500–2,499 grams     | 67,651                            | 194         | 55                                  | 84.24777                    |
| 2,500 grams or more   | 579,740                           | 4,948       | 113                                 | 161.8481219                 |
| Other than black      |                                   |             |                                     |                             |
| Less than 1,500 grams | 29,815                            | 951         | 29                                  | 41.9928622                  |
| 1,500–2,499 grams     | 153,379                           | 938         | 160                                 | 214.8166309                 |
| 2,500 grams or more   | 3,049,934                         | 4,090       | 720                                 | 923.3830125                 |

... Category not applicable.

<sup>1</sup>The total number of resident live births to women 15 years or over in the United States in 1988 includes births occurring in Montana and South Dakota, which were excluded from the sampling frame.

<sup>2</sup>The average weight is the weight after adjustment for selection probabilities, nonresponse, and poststratification for each sampling subdomain.

sample the records was unknown: child's or fetus's race was assigned to other than black, birthweight was assigned to 2,500 grams or more, and marital status was assigned to married. Values for mother's age, child's sex, and infant age at death were randomly assigned.

Sampling of certificates and reports was without replacement, meaning that each certificate or report was subjected to sampling only once. However, the infants of approximately 88 mothers were sampled and appear in both the live-birth and infant-death components. Sequential file numbers are assigned to each vital event within each State and registration area. The registration areas sent computer tapes of live births and infant deaths to NCHS, which used terminal digits of file numbers to select the samples for those components. Using information supplied by NCHS following screening, State registrars selected the sample of fetal deaths based on the terminal digits of file numbers. On average, 34 of every 10,000 birth

certificates, 3 of every 10 eligible reports of fetal death, and 2 of every 10 death certificates for infants were selected. In the case of fetal deaths, all reports for black fetuses and 40 percent of reports for fetuses other than black were selected for the sample. The registration areas sent copies of sample records to NCHS for processing; in the infant-death component, the corresponding birth certificate was also sent. The deadline for receipt of records was October 30, 1989.

Table C presents the total number of registered live births in the United States in 1988 to women who were 15 years of age or over, the sample selected for the NMIHS, the inverse of the probability of selection, and average weights in each sampling stratum. The live-birth component of the NMIHS consisted of 13,417 certificates of live birth from a resident population of 3,898,922 live births (representing approximately 1 in 291 live births). A total of 10,588 births were excluded from the 3,909,510 live births in 1988

because they were to mothers under 15 years of age (7). The resident population of 3,898,922 live births includes births occurring in Montana and South Dakota, which were excluded from the sampling frame. The lower inverse of the probability of selection in categories of black persons and in very low- and moderately low-birthweight categories reflects the oversampling by race and birthweight in the live-birth component.

Table D presents the total number of registered late fetal deaths in the United States in 1988 to women who were 15 years of age or over, the sample selected for the NMIHS, the inverse of the probability of selection, and average weights in each sampling stratum. The fetal-death component of the NMIHS consisted of 4,773 reports of fetal death of 28 weeks gestation or more from a resident population of 15,259 reports of fetal death (representing approximately 1 in 3 late fetal deaths). The resident population of 15,259 late fetal deaths includes those occurring in Montana, South Dakota,

**Table D. Total number of resident fetal deaths to women 15 years of age or over in the United States in 1988, number of fetal deaths included in the sample for the 1988 National Maternal and Infant Health Survey, inverse of probability of selection, and average weights by race**

| Race             | Resident fetal deaths <sup>1</sup> | Sample size | Inverse of probability of selection | Average weight <sup>2</sup> |
|------------------|------------------------------------|-------------|-------------------------------------|-----------------------------|
| Total            | 15,259                             | 4,773       | 88                                  | 88                          |
| Black            | 3,850                              | 1,230       | 1.67                                | 2.9894527                   |
| Other than black | 11,409                             | 2,079       | 3.7                                 | 5.5709367                   |

<sup>1</sup>The total number of resident fetal deaths to women 15 years or over in the United States in 1988 includes fetal deaths occurring in Michigan, Montana, New York City, and South Dakota, which were excluded from the sampling frame.

<sup>2</sup>The average weight is the weight after adjustment for selection probabilities, nonresponse, and poststratification for each sampling subdomain.

**Table E. Total number of resident infant deaths to women 15 years of age or over in the United States in 1988, number of fetal deaths included in the sample for the 1988 National Maternal and Infant Health Survey, inverse of probability of selection, and average weights by race**

| Race                       | Resident fetal deaths <sup>1</sup> | Sample size | Inverse of probability of selection | Average weight <sup>2</sup> |
|----------------------------|------------------------------------|-------------|-------------------------------------|-----------------------------|
| Total . . . . .            | 38,917                             | 8,166       | ...                                 | ...                         |
| Black . . . . .            | 11,840                             | 4,532       | 2.56                                | 4.2743695                   |
| Other than black . . . . . | 27,077                             | 3,634       | 7.36                                | 10.5687115                  |

... Category not applicable.

<sup>1</sup>The total number of resident infant deaths in the United States in 1988 includes infant deaths occurring in Montana and South Dakota, which were excluded from the sampling frame.

<sup>2</sup>The average weight is the weight after adjustment for selection probabilities, nonresponse, and poststratification for each sampling subdomain.

Michigan, and New York City, which were excluded from the sampling frame. Black births were oversampled in the fetal-death component of the NMIHS, reflected in the lower inverse of the probability of selection.

Table E presents the total number of registered infant deaths in the United States in 1988, the sample selected for the NMIHS, the inverse of the probability of selection, and average weights in each sampling stratum. The infant-death component of the NMIHS consisted of 8,166 death certificates for infants from a resident population of 38,917 infant death certificates (representing approximately 1 in 5 infant deaths). The actual population of 1988 infant deaths was 38,910 (8), slightly less than the 38,917 in table E. The resident population in table E was based on the projected number of infant deaths, which accounts for this discrepancy. The resident population of 38,917 infant deaths includes those occurring in Montana and South Dakota, which were excluded from the sampling frame. Again, the lower inverse of the probability of selection in black categories reflects the oversampling in this group in the infant-death component.

Certain records of vital events selected for the NMIHS were excluded. Arizona, Kansas, and North Dakota excluded the vital events to unmarried mothers selected for the NMIHS. Colorado, Oregon, and Washington excluded the vital events of mothers who refused to have their infants included in the NMIHS.

## Sources of Information

### Vital Records

The content of birth certificates varies somewhat by registration area but generally conforms to the U.S. Standard Certificate of Live Birth. Table F shows the data items that vary among the registration areas. Information on demographic characteristics of the parents, pregnancy history, characteristics of the newborn, and other items was coded from the birth certificate as part of the data record for each NMIHS live birth. Information concerning complications of pregnancy, labor, and delivery was not coded because the format for reporting these items differed among registration areas.

The content of reports of fetal death also varies somewhat by registration area but generally conforms to the U.S. Standard Report of Fetal Death. Table G shows the data items that vary among registration areas. Information on demographic characteristics of the parents and pregnancy history was coded in the same format as the birth certificate as part of the data record for each NMIHS fetal death. Information concerning when the fetus died, cause of fetal death, and whether an autopsy was performed was not coded.

The content of death certificates for infants also varies somewhat by registration area but generally conforms to the U.S. Standard Certificate of Death. Table H shows the data items that vary among registration areas. Information on demographic characteristics of the decedent, underlying cause of death, and multiple cause-of-death conditions was coded

from the death certificate as part of the data record for each NMIHS infant death.

### Mothers

Names and address from the vital record were used to mail questionnaires to mothers. The mother's questionnaire supplemented the vital record with information on social and demographic characteristics of the parents and timing and content of prenatal care. Each mother was asked to provide names and addresses for her hospital of delivery, all hospitals where she or the baby was admitted before and after delivery, and up to seven prenatal care providers. In addition, mothers were asked to sign a request statement authorizing her hospitals and prenatal care providers to release medical information to NCHS. Medical-source questionnaires were not mailed if mothers refused to release their medical records to NCHS.

### Hospitals and Prenatal Care Providers

Using names and addresses supplied by the mother, questionnaires were mailed to hospitals and prenatal care providers to obtain additional information concerning labor and delivery, the health of the mother and infant, and prenatal care. Separate prenatal care questionnaires were not mailed for mothers who indicated they received their prenatal care from a hospital because this information would be available from the hospital questionnaire. If prenatal care providers sent the prenatal record to the hospital prior to delivery, information on prenatal

Table F. Areas reporting selected items on the certificate of live birth for each State, 1988

| Area                           | Marital status of mother | Educational attainment of parents | Ethnic origin | Hispanic origin | Dates of last live birth and other terminations | "Other" terminations less than 20 weeks and 20 weeks or more | Date last normal menstrual period began | Number of prenatal visits | 1-minute Apgar score | 5-minute Apgar score | Complications of pregnancy | Complications of labor | Congenital anomalies |
|--------------------------------|--------------------------|-----------------------------------|---------------|-----------------|---|--|---|---------------------------|----------------------|----------------------|----------------------------|------------------------|----------------------|
| Alabama . . . . .              | X                        | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Alaska . . . . .               | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Arizona . . . . .              | X                        | X                                 |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Arkansas . . . . .             | X                        | X                                 |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| California . . . . .           |                          |                                   |               | X               | X   | X  | X                                       |                           |                      |                      | X                          | X                      | X                    |
| Colorado . . . . .             | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Connecticut . . . . .          |                          | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Delaware . . . . .             | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| District of Columbia . . . . . | X                        | X                                 |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Florida . . . . .              | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Georgia . . . . .              | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Hawaii . . . . .               | X                        | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Idaho . . . . .                | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Illinois . . . . .             | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Indiana . . . . .              | X                        | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Iowa . . . . .                 | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Kansas . . . . .               | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Kentucky . . . . .             | X                        | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Louisiana . . . . .            | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Maine . . . . .                | X                        | X                                 | X             |                 | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Maryland . . . . .             |                          | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Massachusetts . . . . .        | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Michigan . . . . .             |                          | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Minnesota . . . . .            | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Mississippi . . . . .          | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Missouri . . . . .             | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Montana . . . . .              | X                        | X                                 |               |                 | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| Nebraska . . . . .             | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Nevada . . . . .               |                          | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| New Hampshire . . . . .        | X                        | X                                 |               |                 | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| New Jersey . . . . .           | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| New Mexico . . . . .           | X                        | X                                 |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| New York City . . . . .        |                          | X                                 | X             |                 | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   |                      |
| New York State . . . . .       |                          |                                   |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   |                      |
| North Carolina . . . . .       | X                        | X                                 |               | X               | X   | X*   | X                                       | X                         | X                    | X                    | X**/***                    | X***                   | X***                 |
| North Dakota . . . . .         | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Ohio . . . . .                 |                          | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Oklahoma . . . . .             | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Oregon . . . . .               | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Pennsylvania . . . . .         | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Rhode Island . . . . .         | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| South Carolina . . . . .       | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| South Dakota . . . . .         | X                        | X                                 |               |                 | X   | X  |   | X                         | X                    | X                    | X                          | X                      | X                    |
| Tennessee . . . . .            | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Texas . . . . .                |                          |                                   |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Utah . . . . .                 | X                        | X                                 |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Vermont . . . . .              | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Virginia . . . . .             | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Washington . . . . .           | X                        |                                   |               | X               | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| West Virginia . . . . .        | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Wisconsin . . . . .            | X                        | X                                 |               |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |
| Wyoming . . . . .              | X                        | X                                 | X             |                 | X   | X  | X                                       | X                         | X                    | X                    | X                          | X                      | X                    |

\*Reported "other terminations" as spontaneous and induced at any time after conception.

\*\*Reported complications of pregnancy as medical risk factors for this pregnancy.

\*\*\* Used checkbox format.

care was available from both sources. Data from these and other prenatal care sources were unduplicated and combined to form a single prenatal care record.

### Number of Sources in the NMIHS

Information from 13,417 certificates of live birth, 4,773 reports of fetal death, and 8,166 death certificates for

infants was used to mail questionnaires to mothers (table J). Of the potential 13,417 mothers who had live births, 4,773 mothers who had late fetal deaths, and 8,166 mothers who had infant deaths, a total of 9,953 mothers

**Table G. Areas reporting selected items on the report of fetal death for each State, 1988**

| Area                           | Marital status of mother | Education of father | Education of mother | Date last normal menstrual period began | Month prenatal care began | Number of prenatal visits | "Other" terminations less than 20 weeks and 20 weeks or more | Complications of pregnancy | Complications of labor | Physician's estimate of gestation | Congenital anomalies |
|--------------------------------|--------------------------|---------------------|---------------------|---|---------------------------|---------------------------|--|----------------------------|------------------------|-----------------------------------|----------------------|
| Alabama . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| Alaska . . . . .               | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Arizona . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Arkansas . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| California . . . . .           |                          | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Colorado . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Connecticut . . . . .          |                          | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| Delaware . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| District of Columbia . . . . . | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Florida . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Georgia . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Hawaii . . . . .               | X                        | X                   | X                   | X                                       | X                         | X                         | X*   |                            |                        | X                                 |                      |
| Idaho . . . . .                | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Illinois . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Indiana . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| Iowa . . . . .                 | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Kansas . . . . .               | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Kentucky . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| Louisiana . . . . .            | X                        | X                   | X                   | X                                       | X                         | X                         | X  |                            |                        |                                   |                      |
| Maine . . . . .                | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| Maryland . . . . .             |                          | X                   | X                   | X                                       | X                         |                           | X  |                            | X                      | X                                 |                      |
| Massachusetts . . . . .        | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          |                        |                                   |                      |
| Michigan . . . . .             |                          | X                   | X                   | X                                       | X                         | X                         | X  |                            |                        | X                                 | X                    |
| Minnesota . . . . .            | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Mississippi . . . . .          | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Missouri . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Montana . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| Nebraska . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Nevada . . . . .               |                          | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| New Hampshire . . . . .        | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| New Jersey . . . . .           | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| New Mexico . . . . .           | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 |                      |
| New York City . . . . .        |                          | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 |                      |
| New York State . . . . .       |                          | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 |                      |
| North Carolina . . . . .       | X                        | X                   | X                   | X                                       | X                         | X                         | X*   | X**/***                    | X***                   | X                                 | X                    |
| North Dakota . . . . .         | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Ohio . . . . .                 |                          | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Oklahoma . . . . .             | X                        | X                   | X                   | X                                       | X                         | X                         | X  |                            |                        |                                   |                      |
| Oregon . . . . .               | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Pennsylvania . . . . .         | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Rhode Island . . . . .         | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 |                      |
| South Carolina . . . . .       | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| South Dakota . . . . .         | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Tennessee . . . . .            | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Texas . . . . .                |                          | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Utah . . . . .                 | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Vermont . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Virginia . . . . .             | X                        |                     | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Washington . . . . .           | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| West Virginia . . . . .        | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Wisconsin . . . . .            | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |
| Wyoming . . . . .              | X                        | X                   | X                   | X                                       | X                         | X                         | X  | X                          | X                      | X                                 | X                    |

\*Reported "other terminations" as spontaneous and induced at any time after conception.  
 \*\*Reported as medical risk factors for this pregnancy.  
 \*\*\*Used checkbox format.

(74.2 percent) who had live births, 3,309 mothers (69.3 percent) who had late fetal deaths, and 5,332 mothers (65.3 percent) who had infant deaths responded to the questionnaire. Also,

9,296 responding mothers (93.4 percent) who had live births, 3,092 responding mothers (93.4 percent) who had late fetal deaths, and 4,954 responding mothers (92.9 percent) who had infant

deaths signed the request statement permitting contact with their hospitals and providers.

Not all mothers who signed the request statement provided names and

**Table H. Areas reporting selected items on the certificate of infant death: Each State, 1988**

| Area                           | Hispanic origin | State of birth | Underlying cause of death | Was autopsy performed |
|--------------------------------|-----------------|----------------|---------------------------|-----------------------|
| Alabama . . . . .              | X               | X              | X                         |                       |
| Alaska . . . . .               | X               | X              | X                         |                       |
| Arizona . . . . .              | X               | X              | X                         | X                     |
| Arkansas . . . . .             | X               | X              | X                         | X                     |
| California . . . . .           | X               | X              | X                         | X                     |
| Colorado . . . . .             | X               | X              | X                         | X                     |
| Connecticut . . . . .          | X               | X              | X                         |                       |
| Delaware . . . . .             | X               | X              | X                         |                       |
| District of Columbia . . . . . | X               | X              | X                         | X                     |
| Florida . . . . .              | X               | X              | X                         |                       |
| Georgia . . . . .              | X               | X              | X                         | X                     |
| Hawaii . . . . .               | X               | X              | X                         | X                     |
| Idaho . . . . .                | X               | X              | X                         |                       |
| Illinois . . . . .             | X               | X              | X                         | X                     |
| Indiana . . . . .              | X               | X              | X                         | X                     |
| Iowa . . . . .                 | X               | X              | X                         |                       |
| Kansas . . . . .               | X               | X              | X                         | X                     |
| Kentucky . . . . .             | X               | X              | X                         |                       |
| Louisiana . . . . .            | X               | X              | X                         |                       |
| Maine . . . . .                | X               | X              | X                         | X                     |
| Maryland . . . . .             | X               | X              | X                         |                       |
| Massachusetts . . . . .        | X               | X              | X                         |                       |
| Michigan . . . . .             | X               | X              | X                         |                       |
| Minnesota . . . . .            | X               | X              | X                         |                       |
| Mississippi . . . . .          | X               | X              | X                         | X                     |
| Missouri . . . . .             | X               | X              | X                         |                       |
| Montana . . . . .              | X               | X              | X                         |                       |
| Nebraska . . . . .             | X               | X              | X                         | X                     |
| Nevada . . . . .               | X               | X              | X                         | X                     |
| New Hampshire . . . . .        | X               | X              | X                         |                       |
| New Jersey . . . . .           | X               | X              | X                         | X                     |
| New Mexico . . . . .           | X               | X              | X                         | X                     |
| New York City . . . . .        | X               | X              | X                         | X                     |
| New York State . . . . .       | X               | X              | X                         | X                     |
| North Carolina . . . . .       | X               | X              | X                         |                       |
| North Dakota . . . . .         | X               | X              | X                         | X                     |
| Ohio . . . . .                 | X               | X              | X                         | X                     |
| Oklahoma . . . . .             | X               | X              | X                         |                       |
| Oregon . . . . .               | X               | X              | X                         |                       |
| Pennsylvania . . . . .         | X               | X              | X                         |                       |
| Rhode Island . . . . .         | X               | X              | X                         |                       |
| South Carolina . . . . .       | X               | X              | X                         |                       |
| South Dakota . . . . .         | X               | X              | X                         |                       |
| Tennessee . . . . .            | X               | X              | X                         | X                     |
| Texas . . . . .                | X               | X              | X                         | X                     |
| Utah . . . . .                 | X               | X              | X                         | X                     |
| Vermont . . . . .              | X               | X              | X                         |                       |
| Virginia . . . . .             | X               | X              | X                         |                       |
| Washington . . . . .           | X               | X              | X                         |                       |
| West Virginia . . . . .        | X               | X              | X                         |                       |
| Wisconsin . . . . .            | X               | X              | X                         |                       |
| Wyoming . . . . .              | X               | X              | X                         | X                     |

addresses for their hospital of delivery: 8,916 responding mothers (89.6 percent) who had live births, 2,928 responding mothers (88.5 percent) who had late fetal deaths, and 4,704 responding mothers (88.2 percent) who had infant deaths. Less than one-fourth of mothers identified a hospital where they were admitted prior to delivery, ranging from

15.1 percent (500 responding mothers) in the fetal-death component to 22.5 percent in the infant-death component (1,198 responding mothers). The percentage of mothers who reported a postnatal or infant hospitalization was very low.

Fewer mothers supplied contact information for primary prenatal care

providers: 86.4 percent (8,603 responding mothers) in the live-birth component, 84.9 percent (2,809 responding mothers) in the fetal-death component, and 82.0 percent (4,373 responding mothers) in the infant-death component. Almost one-fourth of mothers identified a secondary prenatal care provider, ranging from 24.1 percent (2,396 responding mothers) in the live-birth component to 27.0 percent (1,439 responding mothers) in the infant-death component. Very few mothers identified more than two prenatal care providers.

## Questionnaires

The same mother's questionnaire was used for all three components in the NMIHS; similarly, the medical-source questionnaires did not differ among outcomes. Similar cover letters were used for medical sources in the NMIHS. Two approaches for contacting mother's were used, but the cover letter for mothers differed, depending on the approach used. In the direct approach, the infant's name and date of delivery were stamped on the questionnaire (form NMIHS-1). In the indirect approach, the mother was asked to provide the infant's name and date of delivery if she had a live birth, stillbirth, or infant who died before 1 year of age in 1988 (form NMIHS-2).

A pretest of the NMIHS was conducted in 1987 and was based on 247 live births, 127 fetal deaths, and 201 infant deaths that occurred in Arkansas, Michigan, Tennessee, and Wisconsin. It was designed to test data collection instruments and methods, particularly the direct and indirect approaches for contacting mothers (9).

The States were given the decision to use the direct or indirect approach for contacting mothers, and in the main survey, the majority of States used the direct approach. Delaware and New Mexico used the indirect approach for all mothers; Maine, New Hampshire, Pennsylvania, and Rhode Island used the indirect approach for unmarried mothers; and Washington and Texas used the indirect approach for unmarried mothers under 18 years of age.



**Table J. Number of potential sources of information in the 1988 National Maternal and Infant Health Survey, by type of source and birth outcome**

| Source  | Birth outcome |             |              |
|---|---------------|-------------|--------------|
|   | Live birth    | Fetal death | Infant death |
| Vital records . . . . .                         | 13,417        | 4,773       | 8,166        |
| Respondent mothers . . . . .                    | 9,953         | 3,309       | 5,332        |
| Signed request statement . . . . .              | 9,296         | 3,092       | 4,954        |
| <b>Provided hospital(s) contact information</b> |               |             |              |
| Delivery . . . . .                              | 8,916         | 2,928       | 4,704        |
| Prenatal . . . . .                              | 1,742         | 500         | 1,198        |
| Postnatal . . . . .                             | 491           | 248         | 412          |
| First infant . . . . .                          | 397           | N/A         | 269          |
| Second infant . . . . .                         | 895           | N/A         | 447          |
| Third infant . . . . .                          | 256           | N/A         | 206          |
| <b>Provided prenatal care provider(s)</b>       |               |             |              |
| <b>Contact information</b>                      |               |             |              |
| Primary . . . . .                               | 8,603         | 2,809       | 4,373        |
| Second . . . . .                                | 2,396         | 937         | 1,439        |
| Third . . . . .                                 | 463           | 198         | 319          |
| Fourth . . . . .                                | 27            | 15          | 26           |
| Fifth . . . . .                                 | 7             | 5           | 3            |
| Sixth . . . . .                                 | 3             | 0           | 1            |
| Seventh . . . . .                               | 1             | 0           | 0            |

**Mother’s Questionnaire**

The mother’s questionnaire included questions about prenatal care and health habits, delivery of the baby, hospitalizations before and after delivery, previous and subsequent pregnancies, socioeconomic characteristics of the parents, and the baby’s health through 6 months of age. Women who had a fetal death were instructed to skip the section on baby’s health. The wording of questions for mothers who had suffered a fetal or infant loss was given special attention in the NCHS National Laboratory for Cognition and Survey Methodology Measurement. Participants in the U.S. Department of Agriculture’s Women, Infants, and Children (WIC) program were recruited to test the questionnaire. A support group of mothers who had a miscarriage, stillbirth, or infant death provided insight on the sensitivity of the questionnaires and accompanying brochure. Interviewers received sensitivity training from a social worker who specialized in grief therapy.

Mothers were mailed an NMIHS-1 (direct approach) or NMIHS-2 (indirect approach) questionnaire. Followup attempts for nonresponse included a postcard reminder, a second mailing of the questionnaire, and then contact by

an interviewer for a telephone or personal interview (form NMIHS-3). The only difference between form NMIHS-3 and forms NMIHS-1/2 was the prompts for use by interviewers.

In the 1980 NNS/NFMS, request statements were routinely included in questionnaires sent to medical sources and were effective in increasing response rates (4). Similarly, in the NMIHS, mothers completing the questionnaire were asked to sign the following request statement:

I request my hospitals, doctors, and other medical care providers to release information about me and my baby, including costs of care, from the time my pregnancy began through today’s date. I understand that the National Center for Health Statistics will use this information only for statistical purposes in health research, and no information which identifies me, my baby, my hospitals, my doctors or other medical care providers will ever be released or published. This request expires one year from date of signature, unless I tell you otherwise.

Mothers who completed telephone interviews were read the request statement, along with this question: “Do you agree with the request statement which I just read?” Interviewers signed

and dated “proxy request statements” for mothers who agreed. In the 1980 NNS/NFMS, medical sources were less likely to provide medical information when proxy request statements were provided (4). Therefore, mothers were sent a copy of the request statement to obtain an original signature.

**Hospital Questionnaire**

The hospital questionnaire (form NMIHS-4) provided information on prenatal care; hospitalizations before, during, and after the delivery; health status and care of the infant; and infant rehospitalizations after the delivery. Questions about gestational age, birth length and weight, Apgar scores, and congenital anomalies were included. The prenatal care section of the hospital questionnaire was identical to the prenatal care provider questionnaire described later. Medical records administrators assisted in the reorganization of the hospital questionnaire to make it easier for medical records personnel to complete.

**Prenatal Care Provider Questionnaire**

The prenatal care provider questionnaire (form NMIHS-5) sought information on the care mothers received during their pregnancy, including chorionic villus sampling, amniocentesis, sonograms, and other x rays. Providers were asked to record values for weight, blood pressure, hematocrit/hemoglobin, and urine glucose/protein at each prenatal and postnatal visit. Obstetricians reviewed the prenatal care questionnaire.

**Collection of Survey Data**

**Contacting Mothers**

NCHS contracted with the U.S. Bureau of the Census to collect NMIHS data from mothers between January 1989 and August 1990. Mothers were sent a questionnaire with its accompanying cover letter (NMIHS-1/2), a brochure, and a prepaid return envelope. The brochure emphasized the importance of the survey, described its voluntary and confidential nature, and stressed that the mother’s participation could provide information that might help other

women. Mothers were offered informational pamphlets on a variety of topics, ranging from prenatal care to breastfeeding to dealing with grief. The brochure included a toll-free telephone number, in English and Spanish, to allow mothers to call NCHS and complete the questionnaire by telephone. An NCHS interviewer conducted Spanish interviews over the telephone.

To minimize problems of recall, questionnaires were mailed as soon as possible after the vital event. The mean interval between delivery and interview was 17 months for the live-birth component, 16 months for the fetal-death component, and 19 months for the infant-death component. The mean interval between death and interview was 17 months for the infant-death component.

When questionnaires were returned by the post office as undeliverable, an attempt was made to obtain an address from the hospital to remail the questionnaire. Followup attempts for nonresponse to the first mailing included a reminder postcard after 7 days and a second mailing of the questionnaire after 4 weeks. Mothers who did not respond within 2 months of the initial mailing were contacted to schedule a telephone or personal interview. When telephone numbers were available, telephone interviews were attempted; otherwise, interviewers tried to locate mothers to conduct personal interviews. Proxy interviews were not accepted.

No further attempts were made to contact mothers who refused to participate in the survey. Completed questionnaires were manually edited and mothers were recontacted by telephone to obtain missing information. Copies were made of original and proxy request

statements for inclusion in the questionnaires mailed to medical sources.

The response rates for mothers in the live-birth, fetal-death, and infant-death components are presented in table K. Mothers were considered respondents if they provided at least some of the information requested. Seventy-four percent of mothers in the live-birth component, 69.3 percent of mothers in the fetal-death component, and 65.3 percent of mothers in the infant-death component were classified as respondents. Mothers in the fetal-death component were more likely to respond to a first or second mailing (34.9 percent) than were other mothers, and mothers in the live-birth component were more likely to complete a telephone or personal interview (41.0 percent).

The percent of nonrespondents ranged from 25.8 percent of mothers in the live-birth component to 34.7 percent of mothers in the infant-death component. Reasons for nonresponse differed among the three components. Interviewers were unable to locate or could not contact 16.1 percent of mothers in the live-birth component, 17.8 percent of mothers in the fetal-death component, and 18.7 percent of mothers in the infant-death component. The largest percentage of women who refused to participate were mothers in the fetal-death component (8.3 percent), followed by mothers in the infant-death component (6.9 percent), and by mothers in the live-birth component (3.9 percent). Additional reasons for nonresponse in order of frequency included certificate excluded by State, other noninterview, nonresident, mother claims no

pregnancy, mother deceased, mother gave baby up for adoption, multiple birth duplicate, and not biological mother.

### Contacting Hospitals and Prenatal Care Providers

Using names and addresses supplied by the mother, U.S. Bureau of the Census staff mailed questionnaires to hospitals and prenatal care providers between June 1989 and May 1991. Hospital addresses were verified using American Hospital Association identification numbers, and medical directories were used to check prenatal care provider addresses. Medical sources were sent a hospital or prenatal care provider questionnaire with its cover letter, a brochure, a prepaid return envelope, and a copy of the mother's original or proxy request statement in batches. A cover letter and brochure were sent to hospital administrators, in addition to medical records directors, with the first batch of questionnaires. The brochure emphasized the survey's importance, its confidentiality, and its endorsement by professional associations. Hospitals and providers were offered publications from the 1980 NNS/NFMS.

Interviewers attempted to locate new addresses and remail questionnaires that were returned by the post office as undeliverable. Hospitals and prenatal care providers who did not respond within 6 weeks were mailed a second questionnaire. Nonrespondents to the second mailing received telephone reminders at 9 and 11 weeks after the initial mailing. Hospitals that did not respond to the telephone reminders were called a third time by the American Health Information Management

**Table K. Number and percent distribution of mothers in the 1988 National Maternal and Infant Health Survey, according to response status**

| Birth outcome          | Respondents |       |                      |               |                |          |           |                 | Non-respondents |
|------------------------|-------------|-------|----------------------|---------------|----------------|----------|-----------|-----------------|-----------------|
|                        | Number      | Total | Response status      |               |                |          |           | Non-respondents |                 |
|                        |             |       | All responses        | First mailing | Second mailing | Personal | Telephone |                 |                 |
|                        |             |       | Percent distribution |               |                |          |           |                 |                 |
| Live birth . . . . .   | 13,417.0    | 100.0 | 74.2                 | 22.7          | 7.8            | 21.1     | 19.9      | 25.8            |                 |
| Fetal death . . . . .  | 4,773.0     | 100.0 | 69.3                 | 25.5          | 9.4            | 16.8     | 15.8      | 30.7            |                 |
| Infant death . . . . . | 8,166.0     | 100.0 | 65.3                 | 20.4          | 7.1            | 19.5     | 16.0      | 34.7            |                 |

Association (AHIMA) and were remailed a questionnaire if necessary. AHIMA reminders increased the NMIHS pretest hospital response rate from 75.2 percent to 93.0 percent (10).

Hospitals and prenatal care providers had the option of completing the questionnaire themselves or partially completing the questionnaire and returning it with photocopies of the medical records for the mother and infant. Medical sources were remunerated for completing the questionnaire or photocopying the medical record. NCHS contracted with AHIMA to transcribe photocopied medical records onto the questionnaires and to verify the ICD-9-CM coding on questionnaires completed by hospitals (1). The prenatal care provider questionnaire requested information on prenatal procedures. AHIMA did not verify coding on this questionnaire. Between October 1989 and July 1991, AHIMA transcribed 56.0 percent of all hospital questionnaires and 26.9 percent of all provider questionnaires. The remaining 44.0 percent of hospital questionnaires were verified for ICD-9-CM coding; the ICD-9-CM coding on prenatal care provider questionnaires completed by the providers was not verified. AHIMA developed a procedure manual and quality control system to ensure the accuracy of these data.

No further attempt was made to contact medical sources who refused to participate in the survey or who indicated that they had no record of the patient. Completed questionnaires were manually edited, and hospitals or prenatal care providers were recontacted by mail to obtain missing information. In addition to the hospital of delivery, each mother was asked to identify the hospitals where she was admitted prenatally and/or postnatally, and up to three hospitals where the infant was admitted prior to 6 months of age. Along with the primary prenatal care provider, mothers could identify an additional six prenatal care providers. Data from all these sources were unduplicated and combined to form a single medical-source record.

The response rates for hospitals and primary prenatal care providers are

**Table L. Number of mothers who signed request statements and percent of mothers for whom data were available from hospitals and prenatal care providers in the 1988 National Maternal and Infant Health Survey**

| Birth outcome                             | Number | Percent of mothers |
|---|--------|--------------------|
| Live birth                                |        |                    |
| Hospitals . . . . .                       | 9,296  | 75.5               |
| Primary prenatal care providers . . . . . | 9,296  | 56.9               |
| Fetal death                               |        |                    |
| Hospitals . . . . .                       | 3,092  | 74.2               |
| Primary prenatal care providers . . . . . | 3,092  | 55.4               |
| Infant death                              |        |                    |
| Hospitals . . . . .                       | 4,954  | 73.2               |
| Primary prenatal care providers . . . . . | 4,954  | 49.8               |

NOTE: Percent of mothers with data available was calculated by combining information from multiple medical sources for each mother and dividing that number by the total number of mothers who signed request statements.

shown in table L. In calculating medical-source response rates for the 1980 NNS/NFMS, the numerator was the total number of questionnaires received, and the denominator was the total number of questionnaires mailed (4). The 1988 NMIHS medical-source response rates were calculated differently, by combining information from multiple sources for each mother and dividing that number by the total number of mothers who signed request statements. This calculation focuses on the percent of mothers about whom some information from the providers was available as opposed to the rate at which all contacted providers returned records.

The response rates for hospitals of delivery were similar in all three components, ranging from 75.5 percent for mothers in the live-birth component to 73.2 percent for mothers in the infant-death component. Multiplying these response rates by the percentage of mothers signing request statements gives us the percentage of mothers for whom hospital of delivery information is available: 70.5 percent for mothers in the live-birth component, 69.3 percent for mothers in the fetal-death component, and 65.6 percent for mothers in the infant-death component. The largest percentage of primary prenatal care respondents was in the live-birth component (56.9 percent), followed by mothers in the fetal-death component (55.4 percent), and by mothers in the infant-death component (49.8 percent). Multiplying these response rates by the percent of mothers signing request statements gives us the percent of

mothers for whom prenatal care information is available: 53.1 percent for mothers in the live-birth component, 51.7 percent for mothers in the fetal-death component, and 44.6 percent for mothers in the infant-death component.

Reasons for nonresponse among hospitals were similar for all three components and included refusal (8.0 percent), no response (9.3 percent), and no hospital reported (2.6 percent). Reasons for nonresponse in primary prenatal care providers were similar among components, including no response (19.1 percent), refusal (5.5 percent), and no provider reported (5.5 percent). Additional reasons for hospital and primary prenatal care provider nonresponse included no record of patient, not included in hospital/provider phase-address or request problem, unable to locate, no records of patients or records not available, duplicate record with different identification number, not a hospital or provider, responded for wrong pregnancy, and untranscribed medical record.

## Data Processing and Imputation

The units of observation in the NMIHS are individual live births, fetal deaths, and infant deaths. Each record includes information from a certificate of live birth, report of fetal death, or death certificate for infants with the accompanying birth certificate; and information from the mother, hospital,

and prenatal care provider questionnaires.

## Processing of Vital Records

The “Vital Statistics Classification and Coding Instructions for Live Birth Records, 1988,” *NCHS Instruction Manual, Part 3a*, was used to classify and code information from certificates of live birth. Similarly, the “Vital Statistics Classification and Coding Instructions for Fetal Death Records, 1988; *NCHS Instruction Manual, Part 3b*, was used to classify and code information from reports of fetal death, and the “Vital Statistics Classification and Coding Instructions for Death Records, 1988, *NCHS Instruction Manual, Part 2a*, was used to classify and code information from death certificates for infants. Vital record data were keyed by NCHS with 100-percent verification.

Vital record data were missing when the information was not provided or when the data item was not included on the vital record used by the registration area (see [tables F, G, and H](#)). Invalid values were outside the range of acceptable values for each data item. Missing and invalid data, termed “item nonresponses,” are normally imputed on the vital record. Imputation is the replacement of an item nonresponse with actual data from a similar respondent. Vital record data included in the NMIHS were not imputed prior to sampling. If data items used to obtain the samples were missing, values were randomly assigned. Other vital record data items that were missing or invalid were assigned missing value codes.

Two certificates of live birth, 42 reports of fetal death, and 1,356 corresponding birth certificates for infants in the infant-death component were missing because the States did not send certificates or reports to NCHS. Future releases of the NMIHS public use data will be matched to the 1988 birth cohort of NCHS’s Linked Birth/Infant Death File to locate the missing birth certificates for infants in the infant-death component.

The infant-death certificate and mother’s questionnaire were used to build 1,356 substitute birth certificates consisting of the following variables: child’s sex, father’s race, mother’s race, child’s race, mother’s age, father’s age, birthweight, plurality, mother’s education, father’s education, marital status, month prenatal care began, and total number of prenatal visits. There was no question on the mother’s questionnaire concerning infant birthweight; therefore, the infant’s gestational age as reported by the mother was used to infer birthweight; preterm was defined as less than 2,500 grams, and term/postterm was defined as 2,500 grams or more. Schoendorf et al. (11) reported greater than 80-percent agreement between the birth certificate and mother’s questionnaire for all of these variables except father’s age, month prenatal care began, and total number of prenatal visits. Similar procedures were used to build reports of fetal death for the 42 missing vital records. A flag (location 5692) indicates whether the vital record was built.

Date of last menstrual period, often used to determine gestational age, was missing or incomplete on 19.9 percent of vital records. When last-menstrual-period date was missing on the vital record, four different methods were used to assign a date for those mothers who had signed a request statement. Data from the hospital or provider do not appear on this version of the NMIHS public use file but were available in-house for calculating the date.

Preference was given to last-menstrual-period date available from the hospital or provider. The next three methods used gestational age to compute date of last menstrual period: gestational age available from the hospital or provider, physician’s estimate of gestation available from the report of fetal death, or an estimate of gestation from the mother’s questionnaire. This procedure reduced the percent of vital records missing date of last menstrual period to 3.9 percent. The percents of missing-last-menstrual-period dates assigned using each method were date available from hospital or provider (74.5 percent), gestational age

available from hospital or provider (21.4 percent), physician’s estimate of gestation available from report of fetal death (0.5 percent), and estimate of gestation from the mother’s questionnaire (3.6 percent). It should be noted that this method of assigning last-menstrual-period date differs from the method used to impute gestational age on NCHS’s Natality Files and Linked Birth/Infant Death Files, which require valid month and year of last-menstrual-period date and birth, and infant’s race and birthweight. A flag (location 4269) indicates which method was used to assign date of last menstrual period.

## Processing of Mother’s Questionnaire

Completed mothers’ questionnaires were keyed on magnetic tape with 100-percent verification. Duplicate questionnaires were rejected, and range and consistency checks were done. Range checks identified responses that were outside an acceptable range of values. Consistency checks were designed to ensure that responses to related questions were internally consistent. For example, a mother’s response about the content of her prenatal visits was compared with her response on whether she received prenatal care. Inconsistent responses were either recoded with appropriate values or treated as item nonresponses. Data from the mother’s questionnaire were merged with the corresponding vital record(s).

Item nonresponses on the mother’s questionnaire were replaced, using a “hot-deck imputation” procedure. This type of imputation procedure replaces an item nonresponse with an appropriate value from a previous record in the file. Predictor items were selected to ensure that the characteristics of the donor were similar to those of the respondent with the item nonresponse: marital status, mother’s age, race, and (in the live-birth component) birthweight. Imputations were done separately in the three components. The data files for live births, fetal deaths, and infant deaths were randomly sorted within strata, and

information from the previous record in the file with similar predictor values was assigned to the current record.

A total of 461 variables was imputed in the NMIHS. Of these, 299 were imputed in less than 1 percent of cases, 68 were imputed in 1–2 percent of cases, 71 were imputed in 2–5 percent of cases, 14 were imputed in 5–10 percent of cases, and 9 were imputed in more than 10 percent of cases. The nine variables that were imputed in more than 10 percent of cases are listed in [table M](#). Data items that were imputed were flagged.

In the NMIHS, the live-birth and infant-death samples were not independent, and a small number of records appeared in both components. Mothers who were sampled in both the live-birth and infant-death components were mailed a questionnaire for either, but not both, occurrences. Following imputation, her completed questionnaire was copied from the live-birth component into the infant-death component or vice versa. Researchers should use caution when combining the live-birth and infant-death components for analysis.

## Processing of Hospital and Prenatal Care Provider Questionnaires

Hospital and prenatal care provider questionnaires were keyed on magnetic tape with 100-percent verification, and duplicate records were deleted. The consistency between prenatal visit dates, date of admission, and date of delivery was checked to ensure that the hospital provided the medical record for the correct pregnancy. Records were deleted if a prenatal visit date preceded the date of delivery by more than 10 months, or the hospital delivery date differed from the vital record delivery date by more than 5 days, or the date of admission for delivery differed from the vital record delivery date by more than 35 days. The questionnaires underwent range, consistency, and blanking edits similar to those used for the mother’s questionnaire. Item nonresponses were not imputed on medical-source questionnaires.

Questionnaires returned by hospitals of delivery, hospitals where the mother or infant was admitted, and prenatal care providers were combined to produce a single data record for each respondent mother. If prenatal care providers sent the prenatal record to the hospital prior to delivery, prenatal care information was available from both sources. Mothers could identify up to six prenatal providers, in addition to the primary prenatal care provider. Therefore, prenatal care data may have been provided by a maximum of eight different sources (hospital of delivery and up to seven prenatal care providers).

Prenatal care information from all prenatal sources was merged sequentially by date of visit to form a single “amalgamated” prenatal care record. If there was only one source for a particular data item, the value was copied “as is” on the amalgamated prenatal record. When more than one source provided a response for a particular item, data items were compared to determine the most appropriate entry for the amalgamated record. For example, if multiple sources reported the same date for a prenatal visit, information from one of these sources was retained. Preference for ordering multiple sources was given to the primary prenatal care provider, followed by the hospital of delivery and, lastly, subsequent prenatal care providers. A reporting flag identifies those medical sources that provided each prenatal care data item.

Medical-source information was then merged with the vital record and mother’s questionnaire. If no medical sources provided information for a respondent mother, her record consisted of the vital record and mother’s questionnaire only. Similarly, a respondent mother’s record may have included the hospital-of-delivery questionnaire and the amalgamated prenatal care record, merged with the vital record and mother questionnaire.

## Consistency Between Responses

Many data items were available from more than one source. Mother’s education was present on the vital record and the mother’s questionnaire.

Mothers may have completed an additional year of school between the time they delivered and completed the questionnaire. Mother’s prepregnant weight was available from the mother’s questionnaire and the prenatal care questionnaire. Self-reported prepregnant weight may have differed significantly from the prepregnant weight reported by her provider. Inconsistencies between different sources were inevitable and were not adjusted.

## Estimation

The NMIHS was designed to make inferences about registered births and late fetal deaths to mothers who were residents of the United States and were 15 years of age or over in 1988, and about infant deaths to mothers who were residents of the United States in 1988. The NMIHS was based on probability samples of vital events that occurred in the United States in 1988; therefore, data can be weighted to produce national estimates. Each mother who responded to the questionnaire received a final weight that permits estimation of population totals. Nonrespondents to the mother’s questionnaire were assigned a final weight of zero. Weights were calculated including live births and infant deaths occurring in Montana and South Dakota, and fetal deaths occurring in Michigan, Montana, New York City, and South Dakota, which were excluded from the sampling frame.

There were six sampling subdomains in the live-birth component and two sampling subdomains in the fetal-death and infant-death components of the NMIHS ([table A](#)). [Tables N–P](#) present the poststratification cells or weighting strata in the live-birth, fetal-death, and infant-death components of the NMIHS. Poststratification cells were defined by the sampling subdomains and implicit stratification on mother’s marital status and age in the live-birth and fetal-death components, and child’s sex and age at death in the infant-death component of the NMIHS.

An estimator,  $\hat{x}$  for any population total,  $x$ , is the weighted sum over all sample elementary units

$$\hat{x} = \sum_u x(u)W_f(u) \quad (1)$$

where  $u$  represents a sample elementary unit,  $x(u)$  is the characteristic of interest for unit  $u$ , and  $W_f(u)$  is the NMIHS final weight for unit  $u$ . The estimation procedure described applies to statistics derived from the NMIHS mother's questionnaire. Similar methods can be used to define sample weights based on the NMIHS hospital and prenatal care provider questionnaires.

### Estimation Procedures for Vital Events

The NMIHS estimator of a population total as presented in equation (1) takes into account the selection procedures of the survey design to define the final weight  $W_f$  for each sample elementary unit. The final weight is the product of three weighting factors:

1. Inverse of the probability of selection
2. Nonresponse adjustment
3. Ratio adjustment (poststratification)

The first weight, the inverse of the probability of selection, reflects the unequal probabilities of selection within each weighting stratum or poststratification cell presented in tables C–E. Black infants and very low-birthweight and moderately low-birthweight infants had higher probabilities of selection because they were oversampled in the NMIHS. Failure to weight NMIHS data leads to biased population estimates, because some mothers are overrepresented and others are underrepresented.

The second weight adjusts for nonresponse to the survey and may reduce potential bias introduced by differential response to the survey. Based on response rates from previous surveys, the anticipated NMIHS response rates in the live-birth and fetal-death components were 77 percent, and in the infant-death component was 75 percent. The nonresponse adjustment was derived by dividing the number of sample vital events eligible for the NMIHS in the  $i$ th weighting stratum by the number of sample vital events responding to the NMIHS in the  $i$ th weighting stratum. The base weight,  $W_{basei}$ , is the product of the first and second weight in the  $i$ th weighting stratum

$$W_{basei} = \frac{1}{P_i} \cdot \frac{n_{si}}{n_{ri}} \quad (2)$$

where  $p_i$  is the probability of selection of each sample vital event in the  $i$ th weighting stratum,  $n_{si}$  is the number of sample vital events in the  $i$ th weighting stratum, and  $n_{ri}$  is the number of survey respondents in the  $i$ th weighting stratum.

In the infant-death component, base weights were also adjusted for sampling inconsistencies. In States that participated in PRAMS, only one-half of the certificates were eligible for the NMIHS. The District of Columbia, Indiana, and Oklahoma sent all sample certificates to NCHS rather than one-half of the certificates as instructed. The base weights of 347 infant deaths were multiplied by 0.5 to account for this sampling inconsistency.

The third weight used information from the vital registration system to perform poststratified ratio adjustment. Within each poststratification cell, the total number of U.S. resident live births to women 15 years of age or over in 1988, U.S. resident late fetal deaths to women 15 years of age or over in 1988, or U.S. resident infant deaths in 1988 was divided by the summed base weights to derive the third weight. This adjustment corrects for incomplete population coverage and may reduce the variability of estimates because the weighted number of vital events in the sample corresponds to the total number of events from the vital registration system.

The final weight in the  $i$ th poststratification cell,  $W_{fi}$  is the product of the base weight and the third weight

$$W_{fi} = w_{basei} \cdot \frac{N_i}{\sum W_{basei}} \quad (3)$$

where  $w_{basei}$  is the base weight in the  $i$ th poststratification cell,  $N_i$  is the control total number of population vital events in the  $i$ th poststratification cell, and the summation in the denominator is over all sample vital events in the  $i$ th poststratification cell.

Using cell number 1 in the live-birth component as an example (see table M), the inverse of the probability of selection (29) was multiplied by the inverse of the response rate (1.36) to derive the base weight (39.44). The base weight was multiplied by the 157 births in the NMIHS in cell number 1 (6,192.08). The total number of births to residents of the United States in 1988 who were 15 years or over (6,905) was divided by the sum of the base weights to derive the poststratification adjustment factor (1.11513). The base weight was then multiplied by the poststratification adjustment factor to derive the final weight (43.98072). In this example, each mother in cell number 1 reflects 44 mothers with similar characteristics who delivered a very low-birthweight infant in 1988.

This weighting procedure was applied in each of the 47 poststratification cells in the live-birth component (table N), the 18 poststratification cells in the fetal-death component (table O), and the 16 poststratification cells in the infant-death component (table P). Data items for these poststratification cells were available from the vital record. In situations where a data item used to weight the sample was unknown, child's

**Table M. Percent imputed for variables imputed in more than 10 percent of cases, 1988 National Maternal and Infant Health Survey**

| Variable  | Source code | Percent imputed |
|---|-------------|-----------------|
| Number of visits to primary prenatal care provider . . . . .    | SC023       | 10.3            |
| Nights in hospital during pregnancy . . . . .                   | SC155       | 43.6            |
| Nights in hospital after delivery . . . . .                     | SC160       | 52.7            |
| Hours mother worked each week . . . . .                         | SC234       | 10.9            |
| Father's weight . . . . .                                       | SC241       | 10.9            |
| Months of vocational or trade school father completed . . . . . | SC243       | 13.2            |
| Father's industry/occupation . . . . .                          | SC2484950   | 14.1            |
| Hours father worked each week . . . . .                         | SC253       | 18.6            |
| Household income . . . . .                                      | SC255       | 18.4            |

**Table N. 1988 National Maternal and Infant Health Survey poststratification cell definitions, number of live births in the survey, number of live births to residents of the United States in 1988, and sampling weights**

| Cell definitions |                      |                             |                            |                        |                            |   |                                     |                          |             |                               |              |
|------------------|----------------------|-----------------------------|----------------------------|------------------------|----------------------------|---|-------------------------------------|--------------------------|-------------|-------------------------------|--------------|
| Cell number      | Birthweight in grams | Marital status <sup>1</sup> | Race of child <sup>2</sup> | Age of mother in years | Number of births in survey | Number of births in 1988 <sup>3,4</sup> | Inverse of probability of selection | Inverse of response rate | Base weight | Poststratification adjustment | Final weight |
| Total            | ...                  | ...                         | ...                        | ...                    | 9,953                      | 3,898,922                               | ...                                 | ...                      | ...         | ...                           | ...          |
| 1                | Less than 1,500      | M                           | W,O                        | Under 25               | 157                        | 6,905                                   | 29                                  | 1.36                     | 39.44000    | 1.11513                       | 43.98072     |
| 2                | Less than 1,500      | M                           | W,O                        | 25–29                  | 179                        | 6,893                                   | 29                                  | 1.22                     | 35.38000    | 1.08842                       | 38.50829     |
| 3                | Less than 1,500      | M                           | W,O                        | 30–34                  | 136                        | 5,294                                   | 29                                  | 1.23                     | 35.67000    | 1.09129                       | 38.92631     |
| 4                | Less than 1,500      | M                           | W,O                        | 35 or over             | 64                         | 2,478                                   | 29                                  | 1.23                     | 35.67000    | 1.08547                       | 38.71871     |
| 5                | Less than 1,500      | M                           | B                          | Under 25               | 91                         | 1,675                                   | 14                                  | 1.48                     | 20.72000    | 0.88835                       | 18.40661     |
| 6                | Less than 1,500      | M                           | B                          | 25–29                  | 84                         | 1,834                                   | 14                                  | 1.44                     | 20.16000    | 1.08300                       | 21.83328     |
| 7                | Less than 1,500      | M                           | B                          | 30 or over             | 106                        | 1,980                                   | 14                                  | 1.38                     | 19.32000    | 0.96683                       | 18.67915     |
| 8                | Less than 1,500      | UN                          | W,O                        | 15–19                  | 54                         | 2,579                                   | 29                                  | 1.54                     | 44.66000    | 1.06940                       | 47.75940     |
| 9                | Less than 1,500      | UN                          | W,O                        | 20–24                  | 55                         | 2,590                                   | 29                                  | 1.60                     | 46.40000    | 1.01489                       | 47.09089     |
| 10               | Less than 1,500      | UN                          | W,O                        | 25 or over             | 65                         | 3,076                                   | 29                                  | 1.57                     | 45.53000    | 1.03938                       | 47.32297     |
| 11               | Less than 1,500      | UN                          | B                          | 15–19                  | 184                        | 3,741                                   | 14                                  | 1.45                     | 20.30000    | 1.00155                       | 20.33146     |
| 12               | Less than 1,500      | UN                          | B                          | 20–24                  | 172                        | 4,237                                   | 14                                  | 1.66                     | 23.24000    | 1.05997                       | 24.63370     |
| 13               | Less than 1,500      | UN                          | B                          | 25–29                  | 116                        | 2,862                                   | 14                                  | 1.73                     | 24.22000    | 1.01868                       | 24.67243     |
| 14               | Less than 1,500      | UN                          | B                          | 30 or over             | 88                         | 2,074                                   | 14                                  | 1.61                     | 22.54000    | 1.04562                       | 23.56827     |
| 15               | 1,500–2,499          | M                           | W,O                        | Under 25               | 185                        | 37,208                                  | 160                                 | 1.28                     | 204.80000   | 0.98205                       | 201.12383    |
| 16               | 1,500–2,499          | M                           | W,O                        | 25–29                  | 178                        | 37,591                                  | 160                                 | 1.23                     | 196.80000   | 1.07310                       | 211.18606    |
| 17               | 1,500–2,499          | M                           | W,O                        | 30–34                  | 143                        | 26,922                                  | 160                                 | 1.16                     | 185.59999   | 1.01436                       | 188.26520    |
| 18               | 1,500–2,499          | M                           | W,O                        | 35 or over             | 54                         | 11,850                                  | 160                                 | 1.20                     | 191.99998   | 1.14294                       | 219.44443    |
| 19               | 1,500–2,499          | M                           | B                          | Under 25               | 79                         | 6,311                                   | 55                                  | 1.47                     | 80.85000    | 0.98808                       | 79.88626     |
| 20               | 1,500–2,499          | M                           | B                          | 25–29                  | 87                         | 6,467                                   | 55                                  | 1.37                     | 75.35000    | 0.98651                       | 74.33353     |
| 21               | 1,500–2,499          | M                           | B                          | 30 or over             | 86                         | 6,470                                   | 55                                  | 1.29                     | 70.95000    | 1.06036                       | 75.23254     |
| 22               | 1,500–2,499          | UN                          | W,O                        | 15–19                  | 55                         | 11,861                                  | 160                                 | 1.47                     | 235.19998   | 0.91690                       | 215.65484    |
| 23               | 1,500–2,499          | UN                          | W,O                        | 20–24                  | 44                         | 13,317                                  | 160                                 | 1.89                     | 302.39999   | 1.00086                       | 302.66005    |
| 24               | 1,500–2,499          | UN                          | W,O                        | 25 or over             | 55                         | 14,630                                  | 160                                 | 1.58                     | 252.79999   | 1.05222                       | 266.00120    |
| 25               | 1,500–2,499          | UN                          | B                          | 15–19                  | 189                        | 14,119                                  | 55                                  | 1.35                     | 74.25000    | 1.00611                       | 74.70366     |
| 26               | 1,500–2,499          | UN                          | B                          | 20–24                  | 177                        | 16,130                                  | 55                                  | 1.59                     | 87.45000    | 1.04208                       | 91.12989     |
| 27               | 1,500–2,499          | UN                          | B                          | 25–29                  | 114                        | 10,591                                  | 55                                  | 1.61                     | 88.55000    | 1.04916                       | 92.90311     |
| 28               | 1,500–2,499          | UN                          | B                          | 30 or over             | 71                         | 7,563                                   | 55                                  | 1.80                     | 99.00000    | 1.07597                       | 106.52102    |
| 29               | 2,500 or more        | M                           | W,O                        | 15–19                  | 147                        | 142,410                                 | 720                                 | 1.28                     | 921.59998   | 1.05119                       | 968.77670    |
| 30               | 2,500 or more        | M                           | W,O                        | 20–24                  | 671                        | 613,998                                 | 720                                 | 1.24                     | 892.79999   | 1.02492                       | 915.04855    |
| 31               | 2,500 or more        | M                           | W,O                        | 25–29                  | 1,035                      | 913,548                                 | 720                                 | 1.18                     | 847.59998   | 1.03891                       | 882.65794    |
| 32               | 2,500 or more        | M                           | W,O                        | 30–34                  | 728                        | 621,416                                 | 720                                 | 1.15                     | 828.00000   | 1.03091                       | 853.59349    |
| 33               | 2,500 or more        | M                           | W,O                        | 35 or over             | 259                        | 231,777                                 | 720                                 | 1.20                     | 863.99994   | 1.03575                       | 894.88790    |
| 34               | 2,500 or more        | M                           | B                          | 15–19                  | 64                         | 11,513                                  | 113                                 | 1.58                     | 178.53999   | 1.00756                       | 179.88976    |
| 35               | 2,500 or more        | M                           | B                          | 20–24                  | 391                        | 62,401                                  | 113                                 | 1.36                     | 153.68001   | 1.03848                       | 159.59360    |
| 36               | 2,500 or more        | M                           | B                          | 25–29                  | 495                        | 76,558                                  | 113                                 | 1.32                     | 149.15999   | 1.03689                       | 154.66250    |
| 37               | 2,500 or more        | M                           | B                          | 30–34                  | 312                        | 49,337                                  | 113                                 | 1.33                     | 150.28999   | 1.05218                       | 158.13212    |
| 38               | 2,500 or more        | M                           | B                          | 35 or over             | 138                        | 20,694                                  | 113                                 | 1.25                     | 141.25000   | 1.06164                       | 149.95665    |
| 39               | 2,500 or more        | UN                          | W,O                        | 15–19                  | 134                        | 164,640                                 | 720                                 | 1.63                     | 1173.59998  | 1.04691                       | 100.0        |
| 40               | 2,500 or more        | UN                          | W,O                        | 20–24                  | 165                        | 183,690                                 | 720                                 | 1.52                     | 1094.40002  | 1.01724                       | 100.0        |
| 41               | 2,500 or more        | UN                          | W,O                        | 25–29                  | 90                         | 103,825                                 | 720                                 | 1.52                     | 1094.40002  | 1.05410                       | 100.0        |
| 42               | 2,500 or more        | UN                          | W,O                        | 30 or over             | 74                         | 74,630                                  | 720                                 | 1.38                     | 993.59998   | 1.01501                       | 100.0        |
| 43               | 2,500 or more        | UN                          | B                          | 15–19                  | 725                        | 115,559                                 | 113                                 | 1.37                     | 154.81000   | 1.02960                       | 159.39238    |
| 44               | 2,500 or more        | UN                          | B                          | 20–24                  | 780                        | 130,941                                 | 113                                 | 1.43                     | 161.59000   | 1.03888                       | 167.87261    |
| 45               | 2,500 or more        | UN                          | B                          | 25–29                  | 415                        | 69,372                                  | 113                                 | 1.42                     | 160.45999   | 1.04176                       | 167.16080    |
| 46               | 2,500 or more        | UN                          | B                          | 30–34                  | 190                        | 31,662                                  | 113                                 | 1.44                     | 162.71999   | 1.02410                       | 166.64153    |
| 47               | 2,500 or more        | UN                          | B                          | 35 or over             | 72                         | 11,703                                  | 113                                 | 1.47                     | 166.10999   | 0.97852                       | 162.54194    |

... Category not applicable.

<sup>1</sup>M=married; UN=unmarried.<sup>2</sup>W,O=white and other; B=black.<sup>3</sup>The national vital registration system data included a small proportion of cases without information on birthweight (0.001 percent). These cases were reallocated according to the births with information.<sup>4</sup>The total number of resident live births to women 15 years or over in the United States in 1988 includes births occurring in Montana and South Dakota, which were excluded from the sampling frame.

or fetus's race was assigned to other than black, birthweight was assigned to 2,500 grams or more, and marital status was assigned to married. Values for mother's age, child's sex, and infant age at death were randomly assigned.

## Sampling Error

Because the NMIHS drew stratified systematic samples with different probabilities of selection, population estimates are subject to sampling error.

Black infants and very low-birthweight and moderately low-birthweight infants were oversampled to increase the reliability of estimates for these subdomains. However, the disproportionate probabilities of

**Table O. 1988 National Maternal and Infant Health Survey (NMIHS) poststratification cell definitions, number of fetal deaths in the NMIHS, number of fetal deaths of 28 weeks gestation or more to residents of the United States in 1988, and sampling weights**

| Cell number | Cell definitions            |                            |                        | Number of fetal deaths in the NMIHS | Number of eligible fetal deaths in 1988 | Inverse of probability of selection | Inverse of response rate | Base weight | Poststratification adjustment | Final weight |
|-------------|-----------------------------|----------------------------|------------------------|-------------------------------------|---|-------------------------------------|--------------------------|-------------|-------------------------------|--------------|
|             | Marital status <sup>1</sup> | Race of fetus <sup>2</sup> | Age of mother in years |                                     |   |                                     |                          |             |                               |              |
| Total       | ...                         | ...                        | ...                    | 3,309                               | 15,259                                  | ...                                 | ...                      | ...         | ...                           | ...          |
| 1           | M                           | W & O                      | <20                    | 112                                 | 804                                     | 3.70                                | 1.37                     | 5.06900     | 1.41617                       | 7.17857      |
| 2           | M                           | W & O                      | 20–24                  | 386                                 | 2,435                                   | 3.70                                | 1.38                     | 5.10600     | 1.23547                       | 6.30831      |
| 3           | M                           | W & O                      | 25–29                  | 576                                 | 3,114                                   | 3.70                                | 1.30                     | 4.81000     | 1.12396                       | 5.40625      |
| 4           | M                           | W & O                      | 30–34                  | 403                                 | 2,307                                   | 3.70                                | 1.28                     | 4.73600     | 1.20873                       | 5.72455      |
| 5           | M                           | W & O                      | 35+                    | 219                                 | 1,289                                   | 3.70                                | 1.35                     | 4.99500     | 1.17835                       | 5.88586      |
| 6           | M                           | B                          | <20                    | 36                                  | 284                                     | 1.67                                | 1.64                     | 2.73880     | 2.88042                       | 7.88889      |
| 7           | M                           | B                          | 20–24                  | 109                                 | 606                                     | 1.67                                | 1.65                     | 2.75550     | 2.01765                       | 5.55963      |
| 8           | M                           | B                          | 25–29                  | 142                                 | 586                                     | 1.67                                | 1.45                     | 2.42150     | 1.70422                       | 4.12677      |
| 9           | M                           | B                          | 30–34                  | 111                                 | 451                                     | 1.67                                | 1.46                     | 2.43820     | 1.66642                       | 4.06307      |
| 10          | M                           | B                          | 35+                    | 73                                  | 260                                     | 1.67                                | 1.40                     | 2.33800     | 1.52337                       | 3.56164      |
| 11          | UN                          | W & O                      | <20                    | 82                                  | 409                                     | 3.70                                | 1.70                     | 6.29000     | 0.79297                       | 4.98778      |
| 12          | UN                          | W & O                      | 20–24                  | 99                                  | 491                                     | 3.70                                | 1.75                     | 6.47600     | 0.76596                       | 4.95959      |
| 13          | UN                          | W & O                      | 25–29                  | 68                                  | 279                                     | 3.70                                | 1.69                     | 6.25300     | 0.65616                       | 4.10297      |
| 14          | UN                          | W & O                      | 30+                    | 67                                  | 281                                     | 3.70                                | 1.84                     | 6.80800     | 0.61604                       | 4.19400      |
| 15          | UN                          | B                          | <20                    | 233                                 | 468                                     | 1.67                                | 1.41                     | 2.35470     | 0.85301                       | 2.00858      |
| 16          | UN                          | B                          | 20–24                  | 299                                 | 586                                     | 1.67                                | 1.46                     | 2.43820     | 0.80382                       | 1.95987      |
| 17          | UN                          | B                          | 25–29                  | 154                                 | 348                                     | 1.67                                | 1.81                     | 3.02270     | 0.74759                       | 2.25974      |
| 18          | UN                          | B                          | 30+                    | 140                                 | 261                                     | 1.67                                | 1.61                     | 2.68870     | 0.69338                       | 1.86429      |

... Category not applicable.

**Table P. 1988 National Maternal and Infant Health Survey poststratification cell definitions, number of infant deaths in the survey, number of infant deaths to residents of the United States in 1988, and sampling weights**

| Cell number | Cell definitions           |                           |                    | Number of deaths in NMIHS | Number of deaths in 1988 <sup>3</sup> | Inverse of probability of selection | Inverse of response rate | Base weight | Poststratification adjustment | Final weight <sup>4</sup> |
|-------------|----------------------------|---------------------------|--------------------|---------------------------|---------------------------------------|-------------------------------------|--------------------------|-------------|-------------------------------|---------------------------|
|             | Race of child <sup>1</sup> | Sex of child <sup>2</sup> | Age at death       |                           |                                       |                                     |                          |             |                               |                           |
| Total       | ...                        | ...                       | ...                | 5,332                     | 38,917                                | ...                                 | ...                      | ...         | ...                           | ...                       |
| 1           | W,O                        | M                         | Less than 24 hours | 547                       | 5,292                                 | 7.36                                | 1.34                     | 9.86240     | 1.02597                       | 10.11853                  |
| 2           | W,O                        | M                         | 1–6 days           | 267                       | 2,600                                 | 7.36                                | 1.39                     | 10.23040    | 0.09870                       | 10.09740                  |
| 3           | W,O                        | M                         | 7–27 days          | 173                       | 1,759                                 | 7.36                                | 1.32                     | 9.71520     | 1.07772                       | 10.47026                  |
| 4           | W,O                        | M                         | 1–12 months        | 562                       | 5,856                                 | 7.36                                | 1.42                     | 10.45120    | 1.04342                       | 10.90499                  |
| 5           | W,O                        | F                         | Less than 24 hours | 369                       | 4,083                                 | 7.36                                | 1.47                     | 10.81920    | 1.05121                       | 11.37325                  |
| 6           | W,O                        | F                         | 1–6 days           | 156                       | 1,931                                 | 7.36                                | 1.47                     | 10.81920    | 1.19384                       | 12.91639                  |
| 7           | W,O                        | F                         | 7–27 days          | 123                       | 1,335                                 | 7.36                                | 1.34                     | 9.86240     | 1.14714                       | 11.31355                  |
| 8           | W,O                        | F                         | 1–12 months        | 365                       | 4,221                                 | 7.36                                | 1.54                     | 11.33400    | 1.05348                       | 11.94056                  |
| 9           | B                          | M                         | Less than 24 hours | 617                       | 2,684                                 | 2.56                                | 1.61                     | 4.12160     | 1.08173                       | 4.45846                   |
| 10          | B                          | M                         | 1–6 days           | 245                       | 961                                   | 2.56                                | 1.60                     | 4.09600     | 0.98995                       | 4.05483                   |
| 11          | B                          | M                         | 7–27 days          | 156                       | 618                                   | 2.56                                | 1.51                     | 3.86560     | 1.05179                       | 4.06580                   |
| 12          | B                          | M                         | 1–12 months        | 525                       | 2,240                                 | 2.56                                | 1.62                     | 4.14720     | 1.05907                       | 4.39218                   |
| 13          | B                          | F                         | Less than 24 hours | 505                       | 2,173                                 | 2.56                                | 1.67                     | 4.27520     | 1.04370                       | 4.46203                   |
| 14          | B                          | F                         | 1–6 days           | 177                       | 750                                   | 2.56                                | 1.60                     | 4.09600     | 1.05536                       | 4.32275                   |
| 15          | B                          | F                         | 7–27 days          | 122                       | 509                                   | 2.56                                | 1.56                     | 3.99360     | 1.06656                       | 4.25941                   |
| 16          | B                          | F                         | 1–12 months        | 423                       | 1,905                                 | 2.56                                | 1.76                     | 4.50560     | 1.02623                       | 4.62378                   |

... Category not applicable.

<sup>1</sup>W,O=white and other; B=black.<sup>2</sup>M=male; F=female.<sup>3</sup>The total number of resident infant deaths in the United States in 1988 includes infant deaths occurring in Montana and South Dakota, which were excluded from the sampling frame.<sup>4</sup>347 infant deaths from the District of Columbia, Indiana, and Oklahoma were inadvertently sampled and received one-half of the final weight.

selection often increase the sampling error when estimating population parameters over aggregated domains.

## Standard Error

The standard error is a measure of the sampling variability of an estimator

over all possible samples chosen from the sampling frame. When we assume that nonsampling error does not exist, the reliability of an estimator can be stated in terms of the relative standard error—the standard error divided by the expectation of the population estimator. The smaller the relative standard error,

the greater the reliability of an estimate. NCHS considers relative standard errors of 30 percent or more to be unreliable.

Estimates are considered unreliable when they are based on fewer than 30 sample cases. Using the average weight in each sampling subdomain from tables C–E, 30 sample cases in the



**Table Q. 1988 National Maternal and Infant Health Survey estimated inflation factors for racial and birthweight categories**

| Birth outcome               | Inflation factors |
|-----------------------------|-------------------|
| Live birth                  | } 2.0             |
| Black (3 strata)            |                   |
| Less than 1,500 grams       |                   |
| 1,500–2,499 grams           |                   |
| 2,500 grams or more         |                   |
| Other than black (3 strata) |                   |
| Less than 1,500 grams       | } 1.3             |
| 1,500–2,499 grams           |                   |
| 2,500 grams or more         |                   |
| Fetal death                 | } 1.1             |
| Black                       |                   |
| Other than black            |                   |
| Infant death                | } 1.2             |
| Black                       |                   |
| Other than black            |                   |

live-birth component of the NMIHS correspond to 938 very low-weight births, 4,367 low-weight births, and 15,763 normal-weight births; 30 sample cases in the fetal-death component of the NMIHS correspond to 138 fetal deaths; and 30 sample cases in the infant-death component of the NMIHS correspond to 219 infant deaths.

### Estimation of Standard Error

One method of estimating standard errors is by using a computer software package that takes all the NMIHS design features into account. “Software for SURvey DATA ANalysis” (SUDAAN) was developed by the Research Triangle Institute in collaboration with NCHS and other Public Health Service agencies (12). SUDAAN uses the first-order Taylor-series approximation method to estimate sampling variances. It allows analysts to incorporate the sample design in the calculation of standard errors and is designed to handle a poststratified estimator, such as that used in the NMIHS.

The standard errors for the NMIHS can be approximated by using inflation factors. Inflation factors measure the amount the variance estimator underestimates or overestimates the true variance of a statistic (13). Skinner et al. (13) referred to inflation factors as misspecification effects, which are commonly called “design effects.” Design effects are usually calculated

during the design of a survey, but misspecification effects or inflation factors are calculated during the analysis of a survey (13). Inflation factors are calculated for complex surveys such as the NMIHS, in which different probabilities of selection were applied within sampling subdomains. Black infants and very low-birthweight and moderately low-birthweight infants were oversampled. Differential probabilities of selection increase the variance of estimates across sampling subdomains.

### Standard Error Approximation

Inflation factors are defined as the ratio of the variance of an estimate from complex computer software (i.e., SUDAAN) to the variance of the estimate from traditional computer software (i.e., SAS or SPSS), which does not take the complex sample design into account. An inflation factor close to 1.0 indicates that the complex sample design had little effect on the variance of the estimates. In systematic samples, such as the NMIHS, inflation factors are usually greater than 1.0.

The inflation factors, ratios of the variance for maternal age calculated using SUDAAN to the variance calculated using SAS, are shown in table Q. The inflation factors in the black and other-than-black subdomains of the live-birth component of the NMIHS are 1.0 and 1.3. These inflation factors represent no increase and an increase of 30 percent over traditionally computed variance estimates. The overall inflation factor of 2.0 for the combined races in the live-birth component represents an increase of 100 percent in the variance of estimates. This large inflation factor for the combined races indicates that the live-birth component lends itself to separate analyses by race. In the fetal-death and infant-death components, the inflation factors are 1.1 and 1.2 for the combined races. One problem with using inflation factors to approximate standard errors is that inflation factors are limited to select subdomains. Clearly, variances for NMIHS estimates should not be calculated without taking the complex sample design into account because this would produce gross

underestimates of the variances.

### Standard Error Applications

(1) Standard error for aggregate estimates

The number of vital events in a poststratification cell or any combination of poststratification cells (tables N–P) has been adjusted to the vital registration system and has a standard error of 0.0. If the total for a characteristic of interest is defined as a subdomain consisting of poststratification cells, the approximate standard error of the estimated number of vital events with a particular characteristic  $x$  is calculated by

$$SE(\hat{x}) = \sqrt{\frac{\hat{x} (N_D - \hat{x})}{n_D}} \cdot IF_D \tag{4}$$

and its relative standard error is

$$RSE(\hat{x}) = \frac{SE(\hat{x})}{\hat{x}} \tag{5}$$

where  $n_D$  is the sample size within subdomain  $D$ ,  $N_D$  is the estimated total number of sampling units in the population within subdomain  $D$ ,  $x$  is the estimated total number of vital events with a particular characteristic  $x$ , and  $IF$  is the average inflation factor in subdomain  $D$ .

Example: In the live-birth component of the NMIHS, it is estimated that 564,973 mothers under 25 years of age smoked cigarettes during the 12 months before their 1988 delivery.

The estimated standard error is

$$\begin{aligned} SE(\hat{x}) &= \sqrt{\frac{564,973(1,545,824 - 564,973)}{4,519}} \cdot (2.0) \\ &= 15,661 \end{aligned}$$

and the relative standard error in percent is

$$RSE(\hat{x}) = \frac{15,661}{564,973} = 2.8 \text{ percent}$$

An approximate 95-percent confidence interval for the number of mothers under 25 years of age who smoked cigarettes during the 12 months

before their delivery is  $564,973 \pm (1.96)$  (15,661), or 534,277–595,669 mothers.

(2) Standard error for ratios or proportions when the denominator is formed by poststratification cells

When the denominator is formed by poststratification cells, it is not subject to sampling error. Thus, the approximate standard error and relative standard error may be calculated using the formulas

$$SE(\hat{p}) = \sqrt{\frac{\hat{p}(1-\hat{p})}{n_D} \cdot IF_D} \tag{6}$$

$$RSE(\hat{p}) = \frac{SE(\hat{p})}{\hat{p}} \tag{7}$$

where  $n_D$  is the sample size within subdomain  $D$ ,  $p$  is the estimated proportion of vital events with a particular characteristic  $x$ , and  $IF$  is the average inflation factor in subdomain  $D$ .

Example: An estimated 36.5 percent (564,973) of mothers under 25 years of age in the live-birth component of the NMIHS (1,545,824) smoked cigarettes during the 12 months before delivery. The number of mothers under 25 years of age is a combination of poststratification cells specified in table N. Therefore, the standard error for the percent is

$$SE(\hat{p}) = \sqrt{\frac{(36.5)(63.5)}{4,519} \cdot (2.0)} = 1.0 \text{ percent}$$

and its relative standard error in percent is

$$RSE(\hat{p}) = \frac{1.0}{36.5} = 2.7 \text{ percent}$$

An approximate 95-percent confidence interval for the percent of mothers under 25 years of age who smoked cigarettes during the 12 months before delivery is  $36.5 \pm (1.96)$  (1.0), or 34.5–38.5 percent.

(3) Standard error for rates where the numerator is not a subclass of the denominator

A rate is defined as

$$\hat{r} = \frac{\hat{x}}{\hat{y}} \tag{8}$$

where  $x$  is the numerator of the rate, and  $y$  is the denominator of the rate.

Assuming that  $x$  and  $y$  are not correlated, the standard error of a rate may be approximated as

$$SE(\hat{r}) = \hat{r} \sqrt{\frac{(N_x - \hat{x})}{\hat{x}n_x} \cdot IF_x + \frac{(N_y - \hat{y})}{\hat{y}n_y} \cdot IF_y} \tag{9}$$

and its relative standard error in percent is

$$RSE(\hat{r}) = \frac{SE(\hat{r})}{\hat{r}} \tag{10}$$

where  $n_x$  is the sample size within the numerator  $x$ ,  $N_x$  is the estimated total number of sampling units in the population within the numerator  $x$ ,  $IF_x$  is the inflation factor in the numerator,  $n_y$  is the sample size within the denominator  $y$ ,  $N_y$  is the estimated total number of sampling units in the population within the denominator  $y$ , and  $IF_y$  is the inflation factor within the denominator.

Example: The standard error and relative standard error (in percent) of the infant mortality rate for mothers who smoked during the 12 months before their delivery may be approximated as

$$SE(\hat{r}) = 12.2 \cdot \sqrt{\frac{38,917-14,304}{(14,304)(5,332)} (1.2) + \frac{3,898,922-1,170,761}{(1,170,761)(9,953)} (2.0)} = 0.3$$

$$RSE(\hat{r}) = \frac{0.3}{12.2} = 2.5 \text{ percent}$$

An approximate 95-percent confidence interval for the infant mortality rate for mothers who smoked before their delivery is  $12.2 \pm (1.96)$  (0.3), or 11.6–12.8 infant deaths per 1,000 live births.

### Testing Differences in NMIHS

The standard error of a difference between two statistics is approximated by

$$SE(\hat{x} - \hat{y}) = \sqrt{\hat{x}^2 RSE(\hat{x})^2 + \hat{y}^2 RSE(\hat{y})^2} \tag{11}$$

This estimate is appropriate for

uncorrelated statistics but is only a rough approximation of the standard error of the difference in correlated statistics.

The  $t$ -statistic can be used to test the difference in two estimates

$$t = \frac{\hat{x} - \hat{y}}{SE(\hat{x} - \hat{y})} \tag{12}$$

The exact number of degrees of freedom in the NMIHS sampling variances is not known. Accordingly, hypotheses about differences between estimates are tested using 150 degrees of freedom for the one- or two-tailed  $t$ -test as appropriate.

Example: 19.1 percent of the 1,115,485 live births to mothers 30 years of age and over were delivered by cesarean section, compared with 16.6 percent of the 2,783,437 live births to women under 30 years of age.

To test whether this difference is significant at the 0.05 level, compute

$$t = \frac{19.1 - 16.6}{\sqrt{(19.1)^2 (.06)^2 + (16.6)^2 (.04)^2}} = 1.89$$

Because this estimate is less than the two-tailed 0.05 critical value for a  $t$ -statistic with 150 degrees of freedom (1.976), the difference is not significant at the 0.05 level.

### Nonsampling Error

In addition to sampling error, population estimates based on the NMIHS sample are subject to nonsampling error. Sources of nonsampling error include incomplete coverage of the vital registration system, nonresponse adjustment, and misclassification of variables used to form sampling subdomains. Nonsampling error may have been introduced through unclear wording of questions, incomplete or inaccurate responses, and errors in data processing. The NMIHS was designed to minimize the effect of nonsampling error.

The sampling frames for the NMIHS did not include the following vital records: nonresidents of the United States, mothers under 15 years of age who had live births or fetal deaths, records received by the registration

areas after October 30, 1989, Montana vital records, vital records for unmarried mothers in Arizona, Kansas, and North Dakota, and some records for Colorado, Oregon, and Washington. In addition, the fetal-death sampling frame did not include vital records for Michigan and New York State. Lastly, some vital records were excluded because of privacy and confidentiality concerns.

Nonrespondents to the mother and medical-source questionnaires were an additional source of nonsampling error. The NMIHS questionnaires were pretested in Arkansas, Michigan, Tennessee, and Wisconsin in 1987 to test the data collection instruments and methods (9). Respondent memory may have been a problem because the mean interval between delivery and interview was 18 months. Many mothers had delivered another child in the interim and may have responded for the most recent pregnancy. The first 200 completed questionnaires for mothers in the live-birth, fetal-death, and infant-death components were examined to determine their understandability (14). This examination revealed differences in responses to mail questionnaires and telephone or personal interviews. A substantial number of medical sources refused to participate in the survey because the mother's request statement had expired.

The NMIHS provides an opportunity to assess the comparability of information obtained from vital records with information obtained from mothers, hospitals, and prenatal care providers. In 1989 the U.S. Standard Certificate of Live Birth was revised to include new items, such as medical and lifestyle risk factors during pregnancy, obstetric procedures, complications of labor and delivery, and abnormal conditions and congenital anomalies of the infant. Thirteen States used some form of the revised 1989 certificate, and NCHS contracted with RWK to evaluate the quality and completeness of vital records in these States (13).

An NCHS Series 2 report found fairly good agreement between the birth certificate and the mother's questionnaire for demographic variables but lower agreement for pregnancy variables (11). Unfortunately, this

analysis was unable to determine whether the vital record or mother's questionnaire provided the "true" value.

## Response Characteristics

### Response Rates From Mothers

The availability of vital record information for nonrespondent mothers to the NMIHS permits a comparison of their characteristics to those of respondent mothers. Response rates and methods according to characteristics of the mother and infant are shown in [tables 1–3](#). Maternal and infant characteristics are based on information from the vital record.

To be considered respondents, mothers had to provide at least some information on the mail questionnaire or telephone or personal interview. Nonrespondents to the mother questionnaire included mothers whom the interviewers could not locate or contact and mothers who refused to participate in the survey. The findings in this section are based on unweighted numbers of mothers.

The response rates in all three components of the NMIHS differed according to the mother's characteristics. Mothers were more likely to respond if they were 20–39 years of age, white, married, had fewer than four children, entered prenatal care early, had more prenatal visits, had more years of education, or resided in the Midwest Region. The percent of respondents was lower for teenage mothers, mothers of races other than white, and those with four or more children, little prenatal care, or fewer years of education. Mothers whose infants weighed less than 2,500 grams were less likely to respond in the live-birth and infant-death components than mothers whose infants weighed 2,500 grams or more.

The proportion of mail respondents to the NMIHS was lower than the proportion of mail respondents in the 1980 NNS/NFMS. Maternal characteristics differed in mothers who

completed a mail questionnaire compared with mothers who completed a telephone or personal interview. In all three components, around 40.0 percent of white mothers responded by mail, and 22.0 percent of black mothers in the live-birth and infant-death components, and 26.8 percent of black mothers in the fetal-death component completed mail questionnaires. The percent of white mothers completing a personal or telephone interview ranged from 36.1 percent of mothers in the live-birth component to 29.7 percent of mothers in the fetal-death component. Black mothers who completed a personal or telephone interview ranged from 45.2 percent of mothers in the live-birth component to 37.0 percent of mothers in the fetal-death component.

### Request Statements From Mothers

Medical-source questionnaires were not mailed if mothers refused to sign a request statement authorizing the release of their medical records to the NCHS. Therefore, the availability of medical-source information may have differed by characteristics of the mother. [Tables 4 through 6](#) show the percent of respondent mothers by response method who provided a request statement according to maternal and infant characteristics. Information on response method was unknown for 357 women who had live births, 85 women who had fetal deaths, and 193 women who had infant deaths. Ninety-three percent of all respondent mothers signed a request statement. The proportion of mothers who agreed to the proxy request statement in a telephone interview was similar to the proportion of mothers who signed the request statement on the mail questionnaire or following a personal interview.

There was little variation in the overall percent of mothers in the live-birth component who provided a request statement according to the characteristics of the mother or the infant.

In the fetal-death and infant-death components, the percent of mothers who provided a request statement tended to

decline as the age of the mother increased. Mothers of races other than white or black were least likely to provide a request statement in the fetal-death component (90.0 percent). As the number of births increased for mothers in the infant-death component, the percent of mothers who provided a request statement decreased.

## Response Rates for Medical Sources

Copies of request statements were included in the mailings to hospitals and prenatal care providers. Table R presents response rates for hospital and primary prenatal care providers by the type of request statement that was sent. These response rates were calculated by combining information from multiple medical sources for each mother and dividing that number by the total number of mothers who signed request statements.

In the live-birth component, around 76 percent of hospitals that were sent any type of request statement responded. Among the primary prenatal care providers, 58.1 percent of providers sent signed request statements responded, compared with 54.7 percent for providers sent proxy request statements. In the fetal-death and infant-death components, the response rates for hospitals and primary prenatal care providers sent signed request statements were 2 and 7 percentage points higher than the response rates for sources that

were sent proxy statements. These findings suggest that medical sources were more likely to respond to a signed request statement than a proxy request statement.

Medical-source response rates by type of request statement and maternal characteristics are presented in tables 7–12. The number of respondents with unknown type of request statement in the live-birth cohort was 91 for hospitals and 83 for primary prenatal care providers, and 18 for hospitals and 17 for primary prenatal care providers in the infant-death cohort (data not shown). Characteristics for which the hospital response rate was more than 5 percentage points below the overall response rate included little or no prenatal care, less than 9 years of education, and residence in the Northeast. In all three components, response rates were more than 5 percentage points below the overall rate in mothers who were black, unmarried, had no prenatal care, or had less than 9 years of education.

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**Table R. Response rates for hospitals and prenatal care providers, by type of request statement, 1988 National Maternal and Infant Health Survey**

| Birth outcome                             | Type of request statement |         |       |         |
|---|---------------------------|---------|-------|---------|
|   | Total                     | Signed  | Proxy | Unknown |
|   |                           | Percent |       |         |
| Live birth:                               |                           |         |       |         |
| Hospitals . . . . .                       | 75.5                      | 75.6    | 75.1  | 74.7    |
| Primary prenatal care providers . . . . . | 56.9                      | 58.1    | 54.7  | 44.0    |
| Fetal death:                              |                           |         |       |         |
| Hospitals . . . . .                       | 74.2                      | 74.9    | 72.5  | ---     |
| Primary prenatal care providers . . . . . | 55.4                      | 57.9    | 48.9  | ---     |
| Infant death:                             |                           |         |       |         |
| Hospitals . . . . .                       | 73.2                      | 73.9    | 71.9  | 83.3    |
| Primary prenatal care providers . . . . . | 49.8                      | 52.1    | 45.1  | 61.1    |

--- Data not available.

NOTE: Response rates were calculated by combining information from multiple medical sources for each mother and dividing that number by the total number of mothers who signed request statements.

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**Table 1. Number and percent distribution of mothers in the live-birth cohort and response method, according to characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey—Con.**

| Characteristics of the mother or infant | Number of mothers | Respondents          |                 |      |          |           |     |         | Non-respondents |
|---|-------------------|----------------------|-----------------|------|----------|-----------|-----|---------|-----------------|
|   |                   | Total                | Response method |      |          |           |     | Unknown |                 |
|   |                   |                      | All respondents | Mail | Personal | Telephone |     |         |                 |
| Education of mother                     |                   | Percent distribution |                 |      |          |           |     |         |                 |
| 0–8 years . . . . .                     | 347               | 100.0                | 68.7            | 23.1 | 31.4     | 10.7      | 3.5 | 31.4    |                 |
| 9–11 years . . . . .                    | 2,409             | 100.0                | 71.8            | 21.3 | 29.6     | 17.8      | 3.1 | 28.3    |                 |
| 12 years . . . . .                      | 4,356             | 100.0                | 75.8            | 29.6 | 22.1     | 21.8      | 2.3 | 24.2    |                 |
| 13–15 years . . . . .                   | 1,887             | 100.0                | 81.0            | 38.6 | 15.5     | 24.2      | 2.7 | 19.0    |                 |
| 16 years or more . . . . .              | 1,177             | 100.0                | 83.3            | 50.0 | 9.2      | 21.1      | 3.0 | 16.8    |                 |
| Not stated . . . . .                    | 3,241             | 100.0                | 67.3            | 27.4 | 20.2     | 17.1      | 2.6 | 32.8    |                 |
| Region of residence                     |                   | Percent distribution |                 |      |          |           |     |         |                 |
| Northeast . . . . .                     | 2,563             | 100.0                | 67.6            | 30.5 | 17.2     | 16.9      | 3.0 | 32.4    |                 |
| Midwest . . . . .                       | 2,885             | 100.0                | 81.1            | 33.0 | 17.6     | 27.4      | 3.1 | 19.0    |                 |
| South . . . . .                         | 5,632             | 100.0                | 77.7            | 30.2 | 25.9     | 19.0      | 2.6 | 22.4    |                 |
| West . . . . .                          | 2,335             | 100.0                | 65.0            | 28.1 | 18.5     | 16.4      | 2.0 | 35.1    |                 |
| Missing . . . . .                       | 2                 | 100.0                | 0.0             | 0.0  | 0.0      | 0.0       | 0.0 | 100.0   |                 |

0.0 Quantity more than zero but less than 0.5.

**Table 2. Number and percent distribution of mothers in the fetal-death cohort and response method, according to characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Number of mothers | Respondents          |                 |      |          |           |      |         | Non-respondents |
|---|-------------------|----------------------|-----------------|------|----------|-----------|------|---------|-----------------|
|   |                   | Total                | Response method |      |          |           |      | Unknown |                 |
|   |                   |                      | All respondents | Mail | Personal | Telephone |      |         |                 |
| Total . . . . .                         |                   | Percent distribution |                 |      |          |           |      |         |                 |
|   | 4,772             | 100.0                | 69.3            | 34.9 | 16.8     | 15.8      | 1.8  | 30.7    |                 |
| Age of mother                           |                   | Percent distribution |                 |      |          |           |      |         |                 |
| Under 20 years . . . . .                | 686               | 100.0                | 67.6            | 28.3 | 21.9     | 15.9      | 1.5  | 32.5    |                 |
| 20–24 years . . . . .                   | 1,328             | 100.0                | 67.0            | 29.4 | 16.3     | 19.0      | 2.3  | 32.9    |                 |
| 25–29 years . . . . .                   | 1,317             | 100.0                | 70.9            | 39.6 | 15.1     | 14.9      | 1.3  | 29.2    |                 |
| 30–34 years . . . . .                   | 920               | 100.0                | 71.2            | 39.9 | 15.1     | 14.2      | 2.0  | 28.8    |                 |
| 35–39 years . . . . .                   | 410               | 100.0                | 73.1            | 39.0 | 20.0     | 12.9      | 1.2  | 26.8    |                 |
| 40 years and over . . . . .             | 103               | 100.0                | 64.1            | 31.1 | 15.5     | 14.6      | 2.9  | 35.9    |                 |
| Not stated . . . . .                    | 8                 | 100.0                | 12.5            | 0.0  | 0.0      | 0.0       | 12.5 | 87.5    |                 |
| Race of mother                          |                   | Percent distribution |                 |      |          |           |      |         |                 |
| White . . . . .                         | 2,675             | 100.0                | 72.1            | 40.8 | 13.4     | 16.3      | 1.6  | 28.0    |                 |
| Black . . . . .                         | 1,868             | 100.0                | 65.9            | 26.8 | 21.7     | 15.3      | 2.1  | 34.1    |                 |
| Other . . . . .                         | 149               | 100.0                | 67.1            | 31.5 | 16.8     | 17.5      | 1.3  | 32.9    |                 |
| Not stated . . . . .                    | 80                | 100.0                | 63.8            | 32.5 | 20.0     | 11.3      | 0.0  | 36.3    |                 |
| Marital status                          |                   | Percent distribution |                 |      |          |           |      |         |                 |
| Married . . . . .                       | 1,855             | 100.0                | 77.1            | 44.3 | 13.7     | 17.0      | 2.1  | 23.0    |                 |
| Unmarried . . . . .                     | 1,329             | 100.0                | 67.2            | 27.5 | 22.5     | 15.7      | 1.5  | 32.7    |                 |
| Not stated . . . . .                    | 1,588             | 100.0                | 62.1            | 30.1 | 15.7     | 14.6      | 1.7  | 37.9    |                 |
| Number of live births                   |                   | Percent distribution |                 |      |          |           |      |         |                 |
| None . . . . .                          | 1,951             | 100.0                | 69.4            | 35.9 | 14.2     | 17.6      | 1.7  | 30.6    |                 |
| 1 . . . . .                             | 1,184             | 100.0                | 72.0            | 38.9 | 15.8     | 15.6      | 1.7  | 28.0    |                 |
| 2 . . . . .                             | 768               | 100.0                | 68.8            | 32.8 | 19.9     | 13.8      | 2.3  | 31.1    |                 |
| 3 . . . . .                             | 332               | 100.0                | 69.0            | 34.0 | 19.0     | 14.5      | 1.5  | 31.0    |                 |
| 4 or more . . . . .                     | 325               | 100.0                | 63.8            | 22.2 | 28.0     | 12.6      | 1.0  | 36.3    |                 |
| Not stated . . . . .                    | 170               | 100.0                | 60.5            | 28.2 | 14.7     | 14.7      | 2.9  | 39.4    |                 |
| Missing . . . . .                       | 42                | 100.0                | 83.4            | 45.2 | 16.7     | 19.1      | 2.4  | 16.7    |                 |

**Table 2. Number and percent distribution of mothers in the fetal-death cohort and response method, according to characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey—Con.**

| Characteristics of the mother or infant | Number of mothers | Respondents |                 |      |          |           |     |         | Non-respondents |
|---|-------------------|-------------|-----------------|------|----------|-----------|-----|---------|-----------------|
|   |                   | Total       | Response method |      |          |           |     | Unknown |                 |
|   |                   |             | All respondents | Mail | Personal | Telephone |     |         |                 |
| <b>Trimester prenatal care began</b>    |                   |             |                 |      |          |           |     |         |                 |
| No care . . . . .                       | 339               | 100.0       | 43.7            | 15.0 | 13.6     | 13.0      | 2.1 | 56.3    |                 |
| First trimester . . . . .               | 2,862             | 100.0       | 73.6            | 40.8 | 14.6     | 16.6      | 1.6 | 26.4    |                 |
| Second trimester . . . . .              | 899               | 100.0       | 68.6            | 28.1 | 22.9     | 15.7      | 1.9 | 31.4    |                 |
| Third trimester . . . . .               | 262               | 100.0       | 72.1            | 27.9 | 30.0     | 11.1      | 3.1 | 37.0    |                 |
| Not stated . . . . .                    | 410               | 100.0       | 66.1            | 29.3 | 18.8     | 16.3      | 1.7 | 33.9    |                 |
| <b>Number of prenatal care visits</b>   |                   |             |                 |      |          |           |     |         |                 |
| No visits . . . . .                     | 295               | 100.0       | 46.1            | 16.3 | 14.9     | 12.9      | 2.0 | 53.9    |                 |
| 1–4 visits . . . . .                    | 548               | 100.0       | 66.0            | 25.9 | 24.6     | 13.3      | 2.2 | 33.9    |                 |
| 5–8 visits . . . . .                    | 1,089             | 100.0       | 74.2            | 38.8 | 17.3     | 16.4      | 1.7 | 25.8    |                 |
| 9–14 visits . . . . .                   | 1,189             | 100.0       | 77.2            | 43.1 | 14.6     | 17.6      | 1.9 | 23.0    |                 |
| 15–18 visits . . . . .                  | 196               | 100.0       | 75.1            | 42.9 | 12.8     | 18.4      | 1.0 | 25.5    |                 |
| 19 visits or more . . . . .             | 81                | 100.0       | 82.7            | 44.4 | 14.8     | 21.0      | 2.5 | 17.3    |                 |
| Not stated . . . . .                    | 1,374             | 100.0       | 63.7            | 30.6 | 16.5     | 14.9      | 1.7 | 36.4    |                 |
| <b>Education of mother</b>              |                   |             |                 |      |          |           |     |         |                 |
| 0–8 years . . . . .                     | 138               | 100.0       | 60.8            | 24.6 | 23.9     | 8.7       | 3.6 | 39.1    |                 |
| 9–11 years . . . . .                    | 700               | 100.0       | 67.5            | 28.0 | 23.4     | 15.0      | 1.1 | 32.4    |                 |
| 12 years . . . . .                      | 1,503             | 100.0       | 72.3            | 36.1 | 17.4     | 16.9      | 1.9 | 27.8    |                 |
| 13–15 years . . . . .                   | 598               | 100.0       | 75.7            | 43.7 | 11.4     | 18.4      | 2.2 | 24.4    |                 |
| 16 years or more . . . . .              | 383               | 100.0       | 81.1            | 56.1 | 8.1      | 15.9      | 1.0 | 18.8    |                 |
| Not stated . . . . .                    | 1,450             | 100.0       | 62.5            | 28.8 | 17.0     | 14.8      | 1.9 | 37.7    |                 |
| <b>Region of residence</b>              |                   |             |                 |      |          |           |     |         |                 |
| Percent distribution                    |                   |             |                 |      |          |           |     |         |                 |
| Northeast . . . . .                     | 937               | 100.0       | 60.3            | 31.5 | 12.9     | 13.3      | 2.6 | 39.7    |                 |
| Midwest . . . . .                       | 872               | 100.0       | 75.9            | 39.5 | 13.4     | 21.7      | 1.3 | 24.2    |                 |
| South . . . . .                         | 1,739             | 100.0       | 74.5            | 36.7 | 21.6     | 14.7      | 1.5 | 25.5    |                 |
| West . . . . .                          | 1,182             | 100.0       | 63.7            | 31.2 | 15.4     | 15.1      | 2.0 | 36.4    |                 |
| Missing . . . . .                       | 42                | 100.0       | 83.4            | 45.2 | 16.7     | 19.1      | 2.4 | 16.7    |                 |

0.0 Quantity more than zero but less than 0.5.



**Table 3. Number and percent distribution of mothers in the infant-death cohort and response method, according to characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Number of mothers | Respondents |                 |      |          |           |                      |         | Non-respondents |
|---|-------------------|-------------|-----------------|------|----------|-----------|----------------------|---------|-----------------|
|   |                   | Total       | Response method |      |          |           |                      | Unknown |                 |
|   |                   |             | All respondents | Mail | Personal | Telephone | Percent distribution |         |                 |
| Total . . . . .                         | 8,166             | 100.0       | 65.3            | 27.5 | 19.5     | 16.0      | 2.3                  | 34.7    |                 |
| Age of mother                           |                   |             |                 |      |          |           |                      |         |                 |
| Under 20 years . . . . .                | 1,522             | 100.0       | 71.7            | 26.0 | 24.6     | 18.3      | 2.8                  | 28.3    |                 |
| 20–24 years . . . . .                   | 2,234             | 100.0       | 70.1            | 26.3 | 22.9     | 18.8      | 2.1                  | 30.0    |                 |
| 25–29 years . . . . .                   | 1,897             | 100.0       | 72.4            | 32.0 | 20.5     | 17.3      | 2.6                  | 27.7    |                 |
| 30–34 years . . . . .                   | 1,193             | 100.0       | 74.0            | 37.4 | 18.4     | 16.1      | 2.1                  | 26.0    |                 |
| 35–39 years . . . . .                   | 422               | 100.0       | 72.8            | 37.0 | 17.1     | 15.6      | 3.1                  | 27.3    |                 |
| 40 years and over . . . . .             | 71                | 100.0       | 73.2            | 33.8 | 21.1     | 18.3      | 0.0                  | 26.8    |                 |
| Not stated . . . . .                    | 827               | 100.0       | 7.4             | 3.3  | 1.3      | 0.9       | 1.9                  | 92.6    |                 |
| Race of mother                          |                   |             |                 |      |          |           |                      |         |                 |
| White . . . . .                         | 3,423             | 100.0       | 76.4            | 39.8 | 16.9     | 17.8      | 1.9                  | 23.6    |                 |
| Black . . . . .                         | 3,776             | 100.0       | 68.4            | 22.0 | 25.7     | 17.4      | 3.3                  | 31.7    |                 |
| Other . . . . .                         | 168               | 100.0       | 72.7            | 27.4 | 23.8     | 19.1      | 2.4                  | 27.4    |                 |
| Not stated . . . . .                    | 799               | 100.0       | 2.1             | 0.6  | 0.6      | 0.8       | 0.1                  | 97.8    |                 |
| Marital status                          |                   |             |                 |      |          |           |                      |         |                 |
| Married . . . . .                       | 3,878             | 100.0       | 77.0            | 38.0 | 17.9     | 18.9      | 2.2                  | 23.0    |                 |
| Unmarried . . . . .                     | 3,520             | 100.0       | 66.6            | 21.9 | 25.5     | 16.2      | 3.0                  | 33.5    |                 |
| Not stated . . . . .                    | 768               | 100.0       | 0.3             | 0.0  | 0.3      | 0.0       | 0.0                  | 99.7    |                 |
| Number of live births                   |                   |             |                 |      |          |           |                      |         |                 |
| None . . . . .                          | 1                 | 100.0       | 100.0           | 0.0  | 100.0    | 0.0       | 0.0                  | 0.0     |                 |
| 1 . . . . .                             | 2,520             | 100.0       | 71.6            | 34.1 | 17.5     | 17.7      | 2.3                  | 28.4    |                 |
| 2 . . . . .                             | 2,031             | 100.0       | 70.7            | 30.1 | 20.2     | 17.7      | 2.7                  | 29.3    |                 |
| 3 . . . . .                             | 1,124             | 100.0       | 69.6            | 26.6 | 23.8     | 17.4      | 1.8                  | 30.4    |                 |
| 4 or more . . . . .                     | 1,049             | 100.0       | 63.7            | 21.0 | 25.9     | 14.0      | 2.8                  | 36.3    |                 |
| Not stated . . . . .                    | 85                | 100.0       | 58.8            | 23.5 | 21.2     | 10.6      | 3.5                  | 41.2    |                 |
| Missing . . . . .                       | 1,356             | 100.0       | 43.5            | 17.3 | 13.3     | 10.8      | 2.1                  | 56.5    |                 |
| Birthweight of infant                   |                   |             |                 |      |          |           |                      |         |                 |
| Less than 2,500 grams . . . . .         | 4,492             | 100.0       | 71.4            | 29.5 | 21.4     | 17.6      | 2.9                  | 28.6    |                 |
| 2,500 grams or more . . . . .           | 2,747             | 100.0       | 73.7            | 31.9 | 21.9     | 17.7      | 2.2                  | 26.3    |                 |
| Not stated . . . . .                    | 927               | 100.0       | 10.5            | 4.4  | 2.9      | 2.8       | 0.4                  | 89.4    |                 |
| Trimester prenatal care began           |                   |             |                 |      |          |           |                      |         |                 |
| No care . . . . .                       | 711               | 100.0       | 58.7            | 16.0 | 25.9     | 12.4      | 4.4                  | 41.4    |                 |
| First trimester . . . . .               | 4,580             | 100.0       | 75.6            | 35.2 | 19.5     | 18.6      | 2.3                  | 24.4    |                 |
| Second trimester . . . . .              | 1,442             | 100.0       | 69.0            | 24.1 | 25.5     | 16.8      | 2.6                  | 31.0    |                 |
| Third trimester . . . . .               | 282               | 100.0       | 69.5            | 25.2 | 25.2     | 16.3      | 2.8                  | 30.5    |                 |
| Not stated . . . . .                    | 1,151             | 100.0       | 22.8            | 8.8  | 6.7      | 6.5       | 0.8                  | 77.2    |                 |
| Number of prenatal care visits          |                   |             |                 |      |          |           |                      |         |                 |
| No visits . . . . .                     | 711               | 100.0       | 58.7            | 16.0 | 25.9     | 12.4      | 4.4                  | 41.4    |                 |
| 1–4 visits . . . . .                    | 1,365             | 100.0       | 71.8            | 26.0 | 25.1     | 18.2      | 2.5                  | 28.1    |                 |
| 5–8 visits . . . . .                    | 1,662             | 100.0       | 75.1            | 32.9 | 20.8     | 18.9      | 2.5                  | 24.9    |                 |
| 9–14 visits . . . . .                   | 2,016             | 100.0       | 78.3            | 36.2 | 20.2     | 19.5      | 2.4                  | 21.7    |                 |
| 15–18 visits . . . . .                  | 371               | 100.0       | 79.1            | 41.8 | 17.3     | 17.8      | 2.2                  | 21.0    |                 |
| 19 visits or more . . . . .             | 163               | 100.0       | 82.2            | 42.9 | 21.5     | 15.3      | 2.5                  | 17.8    |                 |
| Not stated . . . . .                    | 1,878             | 100.0       | 36.2            | 14.6 | 11.3     | 8.9       | 1.4                  | 63.8    |                 |
| Education of mother                     |                   |             |                 |      |          |           |                      |         |                 |
| 0–8 years . . . . .                     | 277               | 100.0       | 72.9            | 21.3 | 34.3     | 12.6      | 4.7                  | 27.1    |                 |
| 9–11 years . . . . .                    | 1,584             | 100.0       | 70.8            | 23.8 | 27.4     | 16.6      | 3.0                  | 29.2    |                 |
| 12 years . . . . .                      | 2,255             | 100.0       | 75.3            | 31.9 | 21.3     | 19.7      | 2.4                  | 24.7    |                 |
| 13–15 years . . . . .                   | 979               | 100.0       | 79.1            | 39.4 | 16.1     | 20.8      | 2.8                  | 20.8    |                 |
| 16 years or more . . . . .              | 504               | 100.0       | 82.7            | 50.4 | 11.3     | 19.4      | 1.6                  | 17.3    |                 |
| Not stated . . . . .                    | 2,567             | 100.0       | 43.5            | 17.5 | 14.3     | 10.1      | 1.6                  | 56.5    |                 |

**Table 3. Number and percent distribution of mothers in the infant-death cohort and response method, according to characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey—Con.**

| Characteristics of the<br>mother or infant | Number of<br>mothers | Respondents          |                    |      |          |           |         | Non-<br>respondents |
|--|----------------------|----------------------|--------------------|------|----------|-----------|---------|---------------------|
|  |                      | Total                | Response method    |      |          |           |         |                     |
|  |                      |                      | All<br>respondents | Mail | Personal | Telephone | Unknown |                     |
| Region of residence                        |                      | Percent distribution |                    |      |          |           |         |                     |
| Northeast . . . . .                        | 1,049                | 100.0                | 60.2               | 27.9 | 14.8     | 15.1      | 2.4     | 39.9                |
| Midwest . . . . .                          | 1,693                | 100.0                | 74.8               | 31.5 | 18.0     | 22.4      | 2.9     | 25.2                |
| South . . . . .                            | 2,986                | 100.0                | 72.9               | 29.6 | 25.3     | 15.8      | 2.2     | 27.1                |
| West . . . . .                             | 1,082                | 100.0                | 61.8               | 27.6 | 18.4     | 13.7      | 2.1     | 38.2                |
| Missing . . . . .                          | 1,356                | 100.0                | 43.5               | 17.3 | 13.3     | 10.8      | 2.1     | 56.5                |

0.0 Quantity more than zero but less than 0.5.

**Table 4. Number of respondent mothers in the live-birth cohort and percent who provided a request statement by method of response and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother and infant | All respondents       |  | Mail respondents      |  | Personal respondents  |  | Telephone respondents |  | Unknown respondents   |  |
|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|
|  | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement |
| Total                                    | 9,953                 | 93.4                                     | 4,088                 | 93.6                                     | 2,836                 | 95.4                                     | 2,672                 | 93.9                                     | 357                   | 72.0                                     |
| Age of mother                            |                       |  |                       |  |                       |  |                       |  |                       |  |
| Under 20 years                           | 1,653                 | 94.9                                     | 488                   | 94.5                                     | 642                   | 96.6                                     | 467                   | 95.5                                     | 56                    | 75.0                                     |
| 20–24 years                              | 2,866                 | 94.7                                     | 979                   | 93.9                                     | 952                   | 96.7                                     | 829                   | 95.8                                     | 106                   | 75.5                                     |
| 25–29 years                              | 2,848                 | 92.6                                     | 1,296                 | 93.1                                     | 703                   | 93.7                                     | 756                   | 92.5                                     | 93                    | 76.3                                     |
| 30–34 years                              | 1,851                 | 91.7                                     | 963                   | 93.5                                     | 379                   | 93.4                                     | 435                   | 92.0                                     | 74                    | 59.5                                     |
| 35–39 years                              | 631                   | 92.7                                     | 313                   | 93.6                                     | 129                   | 94.6                                     | 167                   | 92.2                                     | 22                    | 72.7                                     |
| 40 years and over                        | 104                   | 90.4                                     | 49                    | 93.9                                     | 31                    | 93.6                                     | 18                    | 83.3                                     | 6                     | 66.7                                     |
| Race of mother                           |                       |  |                       |  |                       |  |                       |  |                       |  |
| White                                    | 4,695                 | 93.6                                     | 2,411                 | 94.0                                     | 911                   | 95.9                                     | 1,237                 | 93.3                                     | 136                   | 74.3                                     |
| Black                                    | 4,956                 | 93.2                                     | 1,555                 | 92.7                                     | 1,839                 | 95.2                                     | 1,348                 | 94.4                                     | 214                   | 70.6                                     |
| Other                                    | 287                   | 93.4                                     | 114                   | 95.6                                     | 81                    | 92.6                                     | 85                    | 92.9                                     | 7                     | 71.4                                     |
| Not stated                               | 15                    | 100.0                                    | 8                     | 100.0                                    | 5                     | 100.0                                    | 2                     | 100.0                                    | 0                     | 0.0                                      |
| Marital status                           |                       |  |                       |  |                       |  |                       |  |                       |  |
| Married                                  | 5,868                 | 93.1                                     | 2,838                 | 93.7                                     | 1,243                 | 94.5                                     | 1,616                 | 92.8                                     | 171                   | 74.3                                     |
| Unmarried                                | 4,084                 | 93.9                                     | 1,249                 | 93.4                                     | 1,593                 | 96.1                                     | 1,056                 | 95.5                                     | 186                   | 69.9                                     |
| Not stated                               | 1                     | 100.0                                    | 1                     | 100.0                                    | 0                     | 0.0                                      | 0                     | 0.0                                      | 0                     | 0.0                                      |
| Number of live births                    |                       |  |                       |  |                       |  |                       |  |                       |  |
| 1  | 4,007                 | 93.2                                     | 1,688                 | 93.1                                     | 1,050                 | 94.8                                     | 1,129                 | 94.2                                     | 140                   | 74.3                                     |
| 2  | 3,045                 | 93.3                                     | 1,298                 | 93.4                                     | 825                   | 95.6                                     | 814                   | 94.1                                     | 108                   | 67.6                                     |
| 3  | 1,677                 | 93.3                                     | 664                   | 94.4                                     | 503                   | 95.2                                     | 446                   | 92.8                                     | 64                    | 70.3                                     |
| 4 or more                                | 1,184                 | 94.4                                     | 422                   | 94.6                                     | 448                   | 96.4                                     | 271                   | 93.4                                     | 43                    | 70.1                                     |
| Not stated                               | 40                    | 95.0                                     | 16                    | 100.0                                    | 10                    | 100.0                                    | 12                    | 91.7                                     | 2                     | 50.0                                     |
| Birthweight of infant                    |                       |  |                       |  |                       |  |                       |  |                       |  |
| Less than 2,500 grams                    | 3,044                 | 93.0                                     | 1,191                 | 93.2                                     | 927                   | 95.2                                     | 740                   | 93.7                                     | 186                   | 78.0                                     |
| 2,500 grams or more                      | 6,902                 | 93.6                                     | 2,896                 | 93.8                                     | 1,907                 | 95.5                                     | 1,930                 | 94.0                                     | 169                   | 65.1                                     |
| Not stated                               | 7                     | 85.7                                     | 1                     | 100.0                                    | 2                     | 100.0                                    | 2                     | 50.0                                     | 2                     | 100.0                                    |
| Trimester prenatal care began            |                       |  |                       |  |                       |  |                       |  |                       |  |
| No care                                  | 320                   | 90.0                                     | 85                    | 89.4                                     | 141                   | 93.6                                     | 66                    | 90.9                                     | 28                    | 71.4                                     |
| First trimester                          | 6,903                 | 93.4                                     | 3,120                 | 93.6                                     | 1,678                 | 94.8                                     | 1,880                 | 94.0                                     | 225                   | 75.6                                     |
| Second trimester                         | 2,013                 | 94.4                                     | 636                   | 95.0                                     | 775                   | 97.0                                     | 533                   | 94.0                                     | 69                    | 63.8                                     |
| Third trimester                          | 435                   | 92.9                                     | 149                   | 91.3                                     | 153                   | 90.0                                     | 116                   | 92.2                                     | 17                    | 64.7                                     |
| Not stated                               | 282                   | 90.8                                     | 98                    | 91.8                                     | 89                    | 91.0                                     | 77                    | 94.8                                     | 18                    | 66.7                                     |
| Number of prenatal care visits           |                       |  |                       |  |                       |  |                       |  |                       |  |
| No visits                                | 320                   | 90.0                                     | 85                    | 89.4                                     | 141                   | 93.6                                     | 66                    | 90.9                                     | 28                    | 71.4                                     |
| 1–4 visits                               | 814                   | 94.5                                     | 239                   | 95.4                                     | 311                   | 97.4                                     | 210                   | 95.2                                     | 54                    | 70.4                                     |
| 5–8 visits                               | 1,844                 | 94.5                                     | 684                   | 93.4                                     | 601                   | 97.5                                     | 491                   | 94.7                                     | 68                    | 77.9                                     |
| 9–14 visits                              | 4,628                 | 93.5                                     | 2,094                 | 93.9                                     | 1,134                 | 95.0                                     | 1,274                 | 93.6                                     | 126                   | 70.6                                     |
| 15–18 visits                             | 823                   | 93.3                                     | 363                   | 93.4                                     | 217                   | 94.9                                     | 224                   | 93.3                                     | 19                    | 73.7                                     |
| 19 visits or more                        | 260                   | 92.7                                     | 123                   | 91.9                                     | 54                    | 98.2                                     | 78                    | 91.0                                     | 5                     | 80.0                                     |
| Not stated                               | 1,264                 | 91.9                                     | 500                   | 93.0                                     | 378                   | 92.1                                     | 329                   | 94.2                                     | 57                    | 68.4                                     |
| Education of mother                      |                       |  |                       |  |                       |  |                       |  |                       |  |
| 0–8 years                                | 238                   | 93.3                                     | 80                    | 91.3                                     | 109                   | 96.3                                     | 37                    | 94.6                                     | 12                    | 75.0                                     |
| 9–11 years                               | 1,728                 | 95.3                                     | 513                   | 94.7                                     | 712                   | 97.1                                     | 429                   | 97.4                                     | 74                    | 68.9                                     |
| 12 years                                 | 3,300                 | 94.0                                     | 1,290                 | 94.0                                     | 961                   | 96.2                                     | 948                   | 94.0                                     | 101                   | 73.3                                     |
| 13–15 years                              | 1,529                 | 93.3                                     | 728                   | 94.2                                     | 293                   | 95.6                                     | 457                   | 93.0                                     | 51                    | 70.6                                     |
| 16 years or more                         | 979                   | 90.4                                     | 588                   | 91.7                                     | 108                   | 91.7                                     | 248                   | 89.1                                     | 35                    | 74.3                                     |
| Not stated                               | 2,179                 | 92.5                                     | 889                   | 93.4                                     | 653                   | 92.8                                     | 553                   | 93.7                                     | 84                    | 72.6                                     |
| Region of residence                      |                       |  |                       |  |                       |  |                       |  |                       |  |
| Northeast                                | 1,732                 | 91.7                                     | 782                   | 92.2                                     | 440                   | 95.0                                     | 434                   | 92.2                                     | 76                    | 65.8                                     |
| Midwest                                  | 2,336                 | 93.2                                     | 951                   | 94.3                                     | 507                   | 95.3                                     | 789                   | 93.5                                     | 89                    | 66.3                                     |
| South                                    | 4,369                 | 94.4                                     | 1,700                 | 93.7                                     | 1,456                 | 96.4                                     | 1,067                 | 94.7                                     | 146                   | 79.5                                     |
| West                                     | 1,516                 | 92.8                                     | 655                   | 93.9                                     | 433                   | 92.4                                     | 382                   | 94.2                                     | 46                    | 69.6                                     |

0.0 Quantity more than zero but less than 0.5.

**Table 5. Number of respondent mothers in the fetal-death cohort and percent who provided a request statement by method of response and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother and infant | All respondents       |  | Mail respondents      |  | Personal respondents  |  | Telephone respondents |  | Unknown respondents   |  |
|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|
|  | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement |
| Total                                    | 3,309                 | 93.4                                     | 1,665                 | 95.0                                     | 803                   | 93.5                                     | 756                   | 93.5                                     | 85                    | 62.4                                     |
| Age of mother                            |                       |  |                       |  |                       |  |                       |  |                       |  |
| Under 20 years                           | 463                   | 93.5                                     | 194                   | 94.3                                     | 150                   | 95.3                                     | 109                   | 93.6                                     | 10                    | 50.0                                     |
| 20–24 years                              | 891                   | 93.4                                     | 391                   | 94.9                                     | 217                   | 94.0                                     | 252                   | 93.7                                     | 31                    | 67.7                                     |
| 25–29 years                              | 933                   | 94.0                                     | 521                   | 96.0                                     | 199                   | 90.5                                     | 196                   | 94.9                                     | 17                    | 64.7                                     |
| 30–34 years                              | 655                   | 94.1                                     | 367                   | 95.4                                     | 139                   | 94.2                                     | 131                   | 93.9                                     | 18                    | 66.7                                     |
| 35–39 years                              | 300                   | 92.0                                     | 160                   | 91.9                                     | 82                    | 95.1                                     | 53                    | 92.5                                     | 5                     | 40.0                                     |
| 40 years and over                        | 66                    | 87.9                                     | 32                    | 93.8                                     | 16                    | 93.8                                     | 15                    | 73.3                                     | 3                     | 66.7                                     |
| Not stated                               | 1                     | 0.0                                      | 0                     | 0.0                                      | 0                     | 0.0                                      | 0                     | 0.0                                      | 1                     | 0.0                                      |
| Race of mother                           |                       |  |                       |  |                       |  |                       |  |                       |  |
| White                                    | 1,927                 | 94.5                                     | 1,091                 | 95.4                                     | 357                   | 93.8                                     | 436                   | 95.4                                     | 43                    | 65.1                                     |
| Black                                    | 1,231                 | 91.9                                     | 501                   | 93.8                                     | 405                   | 93.1                                     | 285                   | 91.2                                     | 40                    | 60.0                                     |
| Other                                    | 100                   | 90.0                                     | 47                    | 93.6                                     | 25                    | 92.0                                     | 26                    | 84.6                                     | 2                     | 50.0                                     |
| Not stated                               | 51                    | 100.0                                    | 26                    | 100.0                                    | 16                    | 100.0                                    | 9                     | 100.0                                    | 0                     | 0.0                                      |
| Marital status                           |                       |  |                       |  |                       |  |                       |  |                       |  |
| Married                                  | 1,429                 | 94.0                                     | 821                   | 95.3                                     | 254                   | 94.9                                     | 316                   | 94.3                                     | 38                    | 57.9                                     |
| Unmarried                                | 894                   | 93.6                                     | 366                   | 94.3                                     | 299                   | 95.7                                     | 209                   | 92.8                                     | 20                    | 60.0                                     |
| Not stated                               | 986                   | 92.5                                     | 478                   | 95.0                                     | 250                   | 89.6                                     | 231                   | 93.1                                     | 27                    | 70.4                                     |
| Number of live births                    |                       |  |                       |  |                       |  |                       |  |                       |  |
| None                                     | 1,354                 | 93.6                                     | 19                    | 100.0                                    | 7                     | 85.7                                     | 8                     | 87.5                                     | 1                     | 0.0                                      |
| 1  | 852                   | 93.9                                     | 460                   | 93.9                                     | 187                   | 95.7                                     | 185                   | 94.6                                     | 20                    | 70.0                                     |
| 2  | 529                   | 92.1                                     | 252                   | 95.6                                     | 153                   | 90.9                                     | 106                   | 91.5                                     | 18                    | 55.6                                     |
| 3  | 229                   | 91.7                                     | 113                   | 94.7                                     | 63                    | 90.5                                     | 48                    | 93.8                                     | 5                     | 20.0                                     |
| 4 or more                                | 207                   | 96.6                                     | 72                    | 97.2                                     | 91                    | 96.7                                     | 41                    | 95.1                                     | 3                     | 100.0                                    |
| Not stated                               | 103                   | 93.2                                     | 48                    | 93.8                                     | 25                    | 100.0                                    | 25                    | 92.0                                     | 5                     | 60.0                                     |
| Missing                                  | 35                    | 91.4                                     | 701                   | 95.2                                     | 277                   | 92.8                                     | 343                   | 93.6                                     | 33                    | 66.7                                     |
| Trimester prenatal care began            |                       |  |                       |  |                       |  |                       |  |                       |  |
| No care                                  | 148                   | 87.2                                     | 51                    | 84.3                                     | 46                    | 91.3                                     | 44                    | 93.2                                     | 7                     | 42.9                                     |
| First trimester                          | 2,108                 | 94.2                                     | 1,168                 | 95.3                                     | 419                   | 93.8                                     | 475                   | 94.7                                     | 46                    | 63.0                                     |
| Second trimester                         | 617                   | 92.7                                     | 253                   | 95.7                                     | 206                   | 93.7                                     | 141                   | 90.8                                     | 17                    | 52.9                                     |
| Third trimester                          | 165                   | 93.3                                     | 73                    | 94.5                                     | 55                    | 92.7                                     | 29                    | 89.7                                     | 8                     | 100.0                                    |
| Not stated                               | 271                   | 93.0                                     | 120                   | 95.0                                     | 77                    | 93.5                                     | 67                    | 92.5                                     | 7                     | 57.1                                     |
| Number of prenatal care visits           |                       |  |                       |  |                       |  |                       |  |                       |  |
| No visits                                | 136                   | 86.8                                     | 48                    | 83.3                                     | 44                    | 90.9                                     | 38                    | 92.1                                     | 6                     | 50.0                                     |
| 1–4 visits                               | 362                   | 92.8                                     | 142                   | 95.1                                     | 135                   | 93.3                                     | 73                    | 89.0                                     | 12                    | 83.3                                     |
| 5–8 visits                               | 808                   | 93.9                                     | 422                   | 95.7                                     | 188                   | 95.2                                     | 179                   | 93.3                                     | 19                    | 47.4                                     |
| 9–14 visits                              | 916                   | 94.1                                     | 512                   | 95.1                                     | 173                   | 93.6                                     | 209                   | 95.7                                     | 22                    | 59.1                                     |
| 15–18 visits                             | 146                   | 93.2                                     | 84                    | 94.1                                     | 25                    | 96.0                                     | 36                    | 91.7                                     | 1                     | 0.0                                      |
| 19 visits or more                        | 67                    | 100.0                                    | 36                    | 100.0                                    | 12                    | 100.0                                    | 17                    | 100.0                                    | 2                     | 100.0                                    |
| Not stated                               | 874                   | 93.1                                     | 421                   | 95.0                                     | 226                   | 92.0                                     | 204                   | 93.1                                     | 23                    | 69.6                                     |
| Education of mother                      |                       |  |                       |  |                       |  |                       |  |                       |  |
| 0–8 years                                | 84                    | 97.6                                     | 34                    | 100.0                                    | 33                    | 97.0                                     | 12                    | 91.7                                     | 5                     | 100.0                                    |
| 9–11 years                               | 473                   | 93.0                                     | 196                   | 94.4                                     | 164                   | 95.1                                     | 105                   | 93.3                                     | 8                     | 12.5                                     |
| 12 years                                 | 1,085                 | 93.4                                     | 542                   | 94.5                                     | 261                   | 93.5                                     | 254                   | 94.5                                     | 28                    | 60.7                                     |
| 13–15 years                              | 452                   | 93.1                                     | 261                   | 93.9                                     | 68                    | 95.6                                     | 110                   | 91.8                                     | 13                    | 76.9                                     |
| 16 years or more                         | 311                   | 94.2                                     | 215                   | 96.3                                     | 31                    | 93.6                                     | 61                    | 90.2                                     | 4                     | 50.0                                     |
| Not stated                               | 904                   | 93.3                                     | 417                   | 95.4                                     | 246                   | 91.5                                     | 214                   | 94.4                                     | 27                    | 66.7                                     |
| Region of residence                      |                       |  |                       |  |                       |  |                       |  |                       |  |
| Northeast                                | 565                   | 90.6                                     | 295                   | 94.6                                     | 121                   | 88.4                                     | 125                   | 92.0                                     | 24                    | 45.8                                     |
| Midwest                                  | 661                   | 94.7                                     | 344                   | 95.9                                     | 117                   | 93.2                                     | 189                   | 94.7                                     | 11                    | 72.7                                     |
| South                                    | 1,296                 | 94.0                                     | 638                   | 94.2                                     | 376                   | 96.3                                     | 256                   | 93.4                                     | 26                    | 61.5                                     |
| West                                     | 752                   | 93.6                                     | 369                   | 95.4                                     | 182                   | 91.8                                     | 178                   | 93.8                                     | 23                    | 78.3                                     |
| Missing                                  | 35                    | 91.4                                     | 19                    | 100.0                                    | 7                     | 85.7                                     | 8                     | 87.5                                     | 1                     | 0.0                                      |

0.0 Quantity more than zero but less than 0.5.

**Table 6. Number of respondent mothers in the infant-death cohort and percent who provided a request statement by method of response and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother and infant | All respondents       |  | Mail respondents      |  | Personal respondents  |  | Telephone respondents |  | Unknown respondents   |  |
|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|
|  | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement |
| Total                                    | 5,332                 | 92.9                                     | 2,244                 | 94.9                                     | 1,592                 | 93.1                                     | 1,303                 | 92.6                                     | 193                   | 70.5                                     |
| Age of mother                            |                       |  |                       |  |                       |  |                       |  |                       |  |
| Under 20 years                           | 1,092                 | 94.1                                     | 396                   | 96.0                                     | 375                   | 95.5                                     | 278                   | 94.2                                     | 43                    | 65.1                                     |
| 20–24 years                              | 1,565                 | 93.2                                     | 588                   | 94.7                                     | 511                   | 92.2                                     | 419                   | 93.8                                     | 47                    | 80.9                                     |
| 25–29 years                              | 1,372                 | 93.0                                     | 607                   | 94.6                                     | 388                   | 93.0                                     | 328                   | 93.6                                     | 49                    | 69.4                                     |
| 30–34 years                              | 883                   | 91.6                                     | 446                   | 94.4                                     | 220                   | 90.5                                     | 192                   | 88.5                                     | 25                    | 76.0                                     |
| 35–39 years                              | 307                   | 96.1                                     | 156                   | 97.4                                     | 72                    | 97.2                                     | 66                    | 93.9                                     | 13                    | 84.6                                     |
| 40 years and over                        | 52                    | 88.5                                     | 24                    | 87.5                                     | 15                    | 100.0                                    | 13                    | 76.9                                     | 0                     | 0.0                                      |
| Not stated                               | 61                    | 67.2                                     | 27                    | 88.9                                     | 11                    | 72.7                                     | 7                     | 42.9                                     | 16                    | 37.5                                     |
| Race of mother                           |                       |  |                       |  |                       |  |                       |  |                       |  |
| White                                    | 2,614                 | 93.6                                     | 1,363                 | 94.9                                     | 577                   | 92.7                                     | 610                   | 93.1                                     | 64                    | 76.7                                     |
| Black                                    | 2,579                 | 92.2                                     | 830                   | 94.9                                     | 970                   | 93.3                                     | 655                   | 92.1                                     | 124                   | 65.3                                     |
| Other                                    | 122                   | 93.4                                     | 46                    | 93.5                                     | 40                    | 95.0                                     | 32                    | 93.8                                     | 4                     | 75.0                                     |
| Not stated                               | 17                    | 94.1                                     | 5                     | 100.0                                    | 5                     | 80.0                                     | 6                     | 100.0                                    | 1                     | 100.0                                    |
| Marital status                           |                       |  |                       |  |                       |  |                       |  |                       |  |
| Married                                  | 2,988                 | 93.0                                     | 1,475                 | 95.0                                     | 694                   | 91.9                                     | 733                   | 92.5                                     | 86                    | 70.9                                     |
| Unmarried                                | 2,342                 | 92.8                                     | 769                   | 94.7                                     | 896                   | 94.0                                     | 570                   | 92.8                                     | 107                   | 70.1                                     |
| Not stated                               | 2                     | 100.0                                    | 0                     | 0.0                                      | 2                     | 100.0                                    | 0                     | 0.0                                      | 0                     | 0.0                                      |
| Number of live births                    |                       |  |                       |  |                       |  |                       |  |                       |  |
| None                                     | 1                     | 100.0                                    | 235                   | 93.2                                     | 180                   | 95.0                                     | 146                   | 89.0                                     | 29                    | 51.7                                     |
| 1  | 1,805                 | 93.4                                     | 859                   | 95.3                                     | 442                   | 93.4                                     | 446                   | 92.8                                     | 58                    | 69.0                                     |
| 2  | 1,436                 | 94.0                                     | 611                   | 94.6                                     | 411                   | 94.9                                     | 360                   | 94.4                                     | 54                    | 77.8                                     |
| 3  | 782                   | 93.1                                     | 299                   | 94.3                                     | 268                   | 91.4                                     | 195                   | 94.9                                     | 20                    | 80.0                                     |
| 4 or more                                | 668                   | 91.6                                     | 220                   | 96.8                                     | 272                   | 91.5                                     | 147                   | 87.8                                     | 29                    | 72.4                                     |
| Not stated                               | 50                    | 84.0                                     | 20                    | 90.0                                     | 18                    | 72.2                                     | 9                     | 100.0                                    | 3                     | 66.7                                     |
| Missing                                  | 590                   | 90.7                                     | 0                     | 0.0                                      | 1                     | 100.0                                    | 0                     | 0.0                                      | 0                     | 0.0                                      |
| Birthweight of infant                    |                       |  |                       |  |                       |  |                       |  |                       |  |
| Less than 2,500 grams                    | 3,208                 | 93.0                                     | 1,327                 | 94.7                                     | 963                   | 93.8                                     | 790                   | 92.5                                     | 128                   | 71.9                                     |
| 2,500 grams or more                      | 2,026                 | 92.9                                     | 876                   | 95.2                                     | 602                   | 92.5                                     | 487                   | 92.4                                     | 61                    | 68.9                                     |
| Not stated                               | 98                    | 89.8                                     | 41                    | 92.7                                     | 27                    | 81.5                                     | 26                    | 100.0                                    | 4                     | 50.0                                     |
| Trimester prenatal care began            |                       |  |                       |  |                       |  |                       |  |                       |  |
| No care                                  | 417                   | 89.7                                     | 114                   | 91.2                                     | 184                   | 92.9                                     | 88                    | 89.8                                     | 31                    | 64.5                                     |
| First trimester                          | 3,462                 | 93.3                                     | 1,611                 | 95.2                                     | 892                   | 93.8                                     | 852                   | 92.0                                     | 107                   | 70.1                                     |
| Second trimester                         | 995                   | 93.3                                     | 347                   | 95.4                                     | 368                   | 92.7                                     | 242                   | 94.6                                     | 38                    | 71.1                                     |
| Third trimester                          | 196                   | 95.4                                     | 71                    | 95.8                                     | 71                    | 95.8                                     | 46                    | 97.8                                     | 8                     | 75.0                                     |
| Not stated                               | 262                   | 90.1                                     | 101                   | 92.1                                     | 77                    | 84.4                                     | 75                    | 93.3                                     | 9                     | 88.9                                     |
| Number of prenatal care visits           |                       |  |                       |  |                       |  |                       |  |                       |  |
| No visits                                | 417                   | 89.7                                     | 114                   | 91.2                                     | 184                   | 92.9                                     | 88                    | 89.8                                     | 31                    | 64.5                                     |
| 1–4 visits                               | 981                   | 94.1                                     | 355                   | 96.6                                     | 343                   | 93.9                                     | 249                   | 94.0                                     | 34                    | 70.6                                     |
| 5–8 visits                               | 1,248                 | 92.7                                     | 546                   | 94.3                                     | 346                   | 94.2                                     | 314                   | 91.7                                     | 42                    | 66.7                                     |
| 9–14 visits                              | 1,579                 | 93.4                                     | 730                   | 95.1                                     | 407                   | 92.9                                     | 394                   | 94.2                                     | 48                    | 66.7                                     |
| 15–18 visits                             | 293                   | 94.2                                     | 155                   | 95.5                                     | 64                    | 93.8                                     | 66                    | 93.9                                     | 8                     | 75.0                                     |
| 19 visits or more                        | 134                   | 94.8                                     | 70                    | 94.3                                     | 35                    | 97.1                                     | 25                    | 92.0                                     | 4                     | 100.0                                    |
| Not stated                               | 680                   | 91.5                                     | 274                   | 94.5                                     | 213                   | 89.7                                     | 167                   | 89.8                                     | 26                    | 84.6                                     |
| Education of mother                      |                       |  |                       |  |                       |  |                       |  |                       |  |
| 0–8 years                                | 202                   | 92.6                                     | 59                    | 94.9                                     | 95                    | 91.6                                     | 35                    | 94.3                                     | 13                    | 84.6                                     |
| 9–11 years                               | 1,122                 | 93.7                                     | 377                   | 95.5                                     | 434                   | 94.7                                     | 263                   | 94.3                                     | 48                    | 66.7                                     |
| 12 years                                 | 1,699                 | 92.6                                     | 719                   | 95.1                                     | 480                   | 92.5                                     | 445                   | 91.9                                     | 55                    | 67.3                                     |
| 13–15 years                              | 775                   | 91.6                                     | 386                   | 93.0                                     | 158                   | 93.0                                     | 204                   | 89.2                                     | 27                    | 81.5                                     |
| 16 years or more                         | 417                   | 92.6                                     | 254                   | 93.3                                     | 57                    | 93.0                                     | 98                    | 94.9                                     | 8                     | 37.5                                     |
| Not stated                               | 1,117                 | 93.6                                     | 449                   | 96.4                                     | 368                   | 92.4                                     | 258                   | 93.8                                     | 42                    | 73.8                                     |

**Table 6. Number of respondent mothers in the infant-death cohort and percent who provided a request statement by method of response and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey—Con.**

| Characteristics of the mother and infant | All respondents       |  | Mail respondents      |  | Personal respondents  |  | Telephone respondents |  | Unknown respondents   |  |
|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|
|  | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement | Number of respondents | Percent who provided a request statement |
| Region of residence                      |                       |  |                       |  |                       |  |                       |  |                       |  |
| Northeast . . . . .                      | 631                   | 91.1                                     | 293                   | 92.2                                     | 155                   | 91.0                                     | 158                   | 92.4                                     | 25                    | 72.0                                     |
| Midwest . . . . .                        | 1,266                 | 93.1                                     | 534                   | 95.7                                     | 304                   | 91.5                                     | 379                   | 93.4                                     | 49                    | 73.5                                     |
| South . . . . .                          | 2,176                 | 93.7                                     | 883                   | 94.9                                     | 754                   | 93.8                                     | 472                   | 94.1                                     | 67                    | 73.1                                     |
| West . . . . .                           | 669                   | 93.7                                     | 299                   | 97.3                                     | 199                   | 93.0                                     | 148                   | 90.0                                     | 23                    | 78.3                                     |
| Missing . . . . .                        | 590                   | 90.7                                     | 235                   | 93.2                                     | 180                   | 95.0                                     | 146                   | 89.0                                     | 29                    | 51.7                                     |

0.0 Quantity more than zero but less than 0.5.

**Table 7. Response rates for hospitals of mothers in the live-birth cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Type of request statement |        |         |                  |
|---|---------------------------|--------|---------|------------------|
|   | All types                 | Signed | Proxy   | Unknown          |
|   |                           |        | Percent |                  |
| Total                                   | 75.5                      | 75.6   | 75.1    | 74.7             |
| Age of mother                           |                           |        |         |                  |
| Under 20 years                          | 73.9                      | 72.6   | 75.7    | 79.0             |
| 20–24 years                             | 74.4                      | 74.9   | 73.7    | 72.4             |
| 25–29 years                             | 77.2                      | 77.6   | 76.4    | 68.4             |
| 30–34 years                             | 75.4                      | 75.4   | 75.3    | 80.0             |
| 35–39 years                             | 76.8                      | 76.9   | 76.3    | 75.0             |
| 40 years and over                       | 75.5                      | 77.4   | 71.0    | 100.0            |
| Race of mother                          |                           |        |         |                  |
| White                                   | 79.2                      | 80.0   | 76.7    | 81.8             |
| Black                                   | 71.8                      | 70.1   | 74.2    | 71.6             |
| Other                                   | 77.6                      | 77.2   | 78.1    | 100.0            |
| Not stated                              | 86.7                      | 100.0  | 60.0    | ( <sup>1</sup> ) |
| Marital status                          |                           |        |         |                  |
| Married                                 | 77.6                      | 77.9   | 76.4    | 83.3             |
| Unmarried                               | 72.4                      | 71.3   | 74.1    | 67.4             |
| Not stated                              | 0.0                       | 0.0    |         |                  |
| Number of live births                   |                           |        |         |                  |
| 1                                       | 74.8                      | 75.1   | 74.4    | 69.1             |
| 2                                       | 75.6                      | 76.0   | 74.7    | 81.3             |
| 3                                       | 77.2                      | 77.4   | 76.8    | 77.8             |
| 4 or more                               | 75.2                      | 75.1   | 75.6    | 72.7             |
| Not stated                              | 70.8                      | 67.9   | 72.6    | 100.0            |
| Missing                                 | 73.8                      | 70.0   | 80.0    | 100.0            |
| Birthweight of infant                   |                           |        |         |                  |
| Less than 2,500 grams                   | 72.2                      | 72.5   | 71.6    | 74.2             |
| 2,500 grams or more                     | 76.8                      | 76.9   | 76.8    | 100.0            |
| Not stated                              | 100.0                     | 100.0  | 100.0   | 100.0            |
| Trimester prenatal care began           |                           |        |         |                  |
| No care                                 | 67.4                      | 65.7   | 68.9    | 69.2             |
| First trimester                         | 76.7                      | 76.6   | 76.9    | 74.1             |
| Second trimester                        | 73.1                      | 73.4   | 72.3    | 87.5             |
| Third trimester                         | 75.5                      | 76.1   | 74.5    | ( <sup>1</sup> ) |
| Not stated                              | 71.9                      | 71.2   | 74.1    | 62.5             |
| Number of prenatal care visits          |                           |        |         |                  |
| No visits                               | 67.4                      | 65.7   | 68.9    | 69.2             |
| 1–4 visits                              | 70.5                      | 65.7   | 77.0    | 71.4             |
| 5–8 visits                              | 72.6                      | 73.5   | 71.0    | 79.2             |
| 9–14 visits                             | 77.6                      | 78.1   | 76.5    | 72.7             |
| 15–18 visits                            | 78.9                      | 78.7   | 79.1    | 100.0            |
| 19 visits or more                       | 78.8                      | 77.8   | 82.5    | 50.0             |
| Not stated                              | 73.8                      | 73.5   | 74.4    | 76.5             |
| Education of mother                     |                           |        |         |                  |
| 0–8 years                               | 71.2                      | 76.5   | 65.7    | 60.0             |
| 9–11 years                              | 72.4                      | 71.5   | 73.5    | 76.9             |
| 12 years                                | 76.9                      | 77.3   | 76.2    | 74.1             |
| 13–15 years                             | 78.8                      | 79.6   | 77.4    | 50.0             |
| 16 years or more                        | 79.8                      | 79.4   | 82.0    | 77.8             |
| Not stated                              | 71.9                      | 70.5   | 74.2    | 88.0             |
| Region of residence                     |                           |        |         |                  |
| Northeast                               | 68.8                      | 69.3   | 67.5    | 73.7             |
| Midwest                                 | 83.9                      | 84.5   | 82.4    | 77.3             |
| South                                   | 72.9                      | 72.2   | 74.2    | 70.0             |
| West                                    | 77.4                      | 77.1   | 77.8    | 90.0             |

0.0 Quantity more than zero but less than 0.5.

<sup>1</sup>Rates could not be calculated (0/0).

**Table 8. Response rates for hospitals of mothers in the fetal-death cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Type of request statement |        |       |
|---|---------------------------|--------|-------|
|   | All types                 | Signed | Proxy |
| Total                                   | 74.2                      | 74.9   | 72.5  |
| Age of mother                           |                           |        |       |
| Under 20 years                          | 73.4                      | 72.2   | 75.7  |
| 20–24 years                             | 74.0                      | 74.6   | 72.7  |
| 25–29 years                             | 76.3                      | 76.4   | 76.1  |
| 30–34 years                             | 77.3                      | 77.1   | 77.7  |
| 35–39 years                             | 68.0                      | 71.8   | 59.5  |
| 40 years and over                       | 77.1                      | 82.1   | 68.2  |
| Not stated                              | 52.2                      | 58.3   | 38.1  |
| Race of mother                          |                           |        |       |
| White                                   | 77.2                      | 78.7   | 72.1  |
| Black                                   | 70.2                      | 68.6   | 73.4  |
| Other                                   | 69.4                      | 71.8   | 63.0  |
| Not stated                              | 64.1                      | 59.3   | 75.0  |
| Marital status                          |                           |        |       |
| Married                                 | 76.5                      | 77.8   | 71.9  |
| Unmarried                               | 72.2                      | 70.1   | 76.0  |
| Not stated                              | 68.4                      | 69.7   | 65.3  |
| Number of live births                   |                           |        |       |
| None                                    | 74.0                      | 75.3   | 69.4  |
| 1                                       | 73.1                      | 73.5   | 71.8  |
| 2                                       | 76.7                      | 79.7   | 69.9  |
| 3                                       | 78.3                      | 81.9   | 68.6  |
| 4 or more                               | 70.0                      | 67.9   | 72.5  |
| Not stated                              | 61.5                      | 66.7   | 57.1  |
| Missing                                 | 74.3                      | 73.8   | 75.3  |
| Trimester prenatal care began           |                           |        |       |
| No care                                 | 63.2                      | 63.2   | 63.3  |
| First trimester                         | 75.9                      | 76.7   | 73.6  |
| Second trimester                        | 73.5                      | 72.7   | 75.0  |
| Third trimester                         | 67.5                      | 69.7   | 64.6  |
| Not stated                              | 68.3                      | 68.2   | 68.5  |
| Number of prenatal care visits          |                           |        |       |
| No visits                               | 63.4                      | 62.8   | 64.6  |
| 1–4 visits                              | 70.4                      | 67.7   | 74.0  |
| 5–8 visits                              | 75.7                      | 77.0   | 72.4  |
| 9–14 visits                             | 76.4                      | 77.7   | 72.3  |
| 15–18 visits                            | 75.1                      | 74.7   | 76.6  |
| 19 visits or more                       | 71.3                      | 69.8   | 75.7  |
| Not stated                              | 71.6                      | 71.8   | 71.0  |
| Education of mother                     |                           |        |       |
| 0–8 years                               | 65.4                      | 63.2   | 67.1  |
| 9–11 years                              | 75.2                      | 74.0   | 77.5  |
| 12 years                                | 74.3                      | 74.9   | 72.7  |
| 13–15 years                             | 75.6                      | 76.6   | 72.2  |
| 16 years or more                        | 75.3                      | 77.6   | 58.7  |
| Not stated                              | 71.7                      | 70.7   | 73.8  |
| Region of residence                     |                           |        |       |
| Northeast                               | 66.4                      | 69.1   | 57.3  |
| Midwest                                 | 80.8                      | 81.0   | 80.3  |
| South                                   | 73.9                      | 74.9   | 72.1  |
| West                                    | 77.3                      | 80.3   | 66.7  |
| Missing                                 | 74.5                      | 74.0   | 75.7  |

0.0 Quantity more than zero but less than 0.5.



**Table 9. Response rates for hospitals of mothers in the infant-death cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Type of request statement |                  |         |                  |
|---|---------------------------|------------------|---------|------------------|
|   | All types                 | Signed           | Proxy   | Unknown          |
| Total                                   | 73.2                      | 73.9             | 71.9    | 83.3             |
|   |                           |                  | Percent |                  |
| Age of mother                           |                           |                  |         |                  |
| Under 20 years                          | 71.1                      | 71.2             | 70.9    | 80.0             |
| 20–24 years                             | 74.4                      | 73.9             | 75.1    | 100.0            |
| 25–29 years                             | 76.4                      | 78.4             | 71.8    | 83.3             |
| 30–34 years                             | 71.6                      | 71.6             | 71.2    | 100.0            |
| 35–39 years                             | 70.9                      | 73.2             | 64.6    | 66.7             |
| 40 years and over                       | 67.4                      | 70.0             | 62.5    | ( <sup>1</sup> ) |
| Not stated                              | 43.9                      | 46.4             | 38.5    | ( <sup>1</sup> ) |
| Race of mother                          |                           |                  |         |                  |
| White                                   | 77.6                      | 78.8             | 73.7    | 100.0            |
| Black                                   | 68.5                      | 67.3             | 70.2    | 76.9             |
| Other                                   | 77.2                      | 74.0             | 83.8    | ( <sup>1</sup> ) |
| Not stated                              | 75.0                      | 63.6             | 100.0   | ( <sup>1</sup> ) |
| Marital status                          |                           |                  |         |                  |
| Married                                 | 75.0                      | 75.8             | 72.4    | 71.4             |
| Unmarried                               | 71.1                      | 70.6             | 71.5    | 90.9             |
| Not stated                              | 50.0                      | ( <sup>1</sup> ) | 50.0    | ( <sup>1</sup> ) |
| Number of live births                   |                           |                  |         |                  |
| None                                    | 0.0                       | ( <sup>1</sup> ) | 0.0     | ( <sup>1</sup> ) |
| 1                                       | 73.6                      | 74.1             | 72.2    | 85.7             |
| 2                                       | 75.4                      | 76.4             | 73.2    | 75.0             |
| 3                                       | 75.8                      | 74.6             | 78.2    | 50.0             |
| 4 or more                               | 69.5                      | 66.2             | 73.8    | 100.0            |
| Not stated                              | 74.3                      | 71.9             | 75.0    | 100.0            |
| Missing                                 | 67.6                      | 72.0             | 60.5    |                  |
| Birthweight of infant                   |                           |                  |         |                  |
| Less than 2,500 grams                   | 72.3                      | 72.4             | 71.9    | 86.7             |
| 2,500 grams or more                     | 74.9                      | 76.3             | 72.0    | 66.7             |
| Not stated                              | 68.2                      | 69.2             | 65.2    | ( <sup>1</sup> ) |
| Trimester prenatal care began           |                           |                  |         |                  |
| No care                                 | 64.7                      | 62.8             | 66.3    | 100.0            |
| First trimester                         | 75.1                      | 76.3             | 72.3    | 80.0             |
| Second trimester                        | 71.8                      | 71.6             | 71.8    | 100.0            |
| Third trimester                         | 68.5                      | 67.8             | 70.4    | 0.0              |
| Not stated                              | 69.9                      | 64.2             | 82.4    | ( <sup>1</sup> ) |
| Number of prenatal care visits          |                           |                  |         |                  |
| No visits                               | 64.7                      | 62.8             | 66.3    | 100.0            |
| 1–4 visits                              | 73.0                      | 74.4             | 70.6    | 80.0             |
| 5–8 visits                              | 71.8                      | 72.4             | 70.5    | 83.3             |
| 9–14 visits                             | 76.1                      | 76.4             | 75.3    | 100.0            |
| 15–18 visits                            | 79.0                      | 80.4             | 74.2    | ( <sup>1</sup> ) |
| 19 visits or more                       | 72.4                      | 75.9             | 66.7    | 0.0              |
| Not stated                              | 72.0                      | 70.7             | 74.4    | 100.0            |
| Education of mother                     |                           |                  |         |                  |
| 0–8 years                               | 70.1                      | 66.0             | 74.2    | 100.0            |
| 9–11 years                              | 72.9                      | 72.7             | 73.0    | 85.7             |
| 12 years                                | 76.2                      | 76.6             | 75.5    | 80.0             |
| 13–15 years                             | 74.1                      | 75.4             | 69.8    | 75.0             |
| 16 years or more                        | 79.5                      | 81.4             | 69.4    | 100.0            |
| Not stated                              | 66.7                      | 66.8             | 66.7    | ( <sup>1</sup> ) |

**Table 9. Response rates for hospitals of mothers in the infant-death cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey—Con.**

| Characteristic of the mother or infant | Type of request statement |         |       |                  |
|--|---------------------------|---------|-------|------------------|
|  | All types                 | Signed  | Proxy | Unknown          |
| Region of residence                    |                           | Percent |       |                  |
| Northeast . . . . .                    | 72.4                      | 73.8    | 68.3  | 100.0            |
| Midwest . . . . .                      | 82.3                      | 83.1    | 80.0  | 100.0            |
| South . . . . .                        | 70.6                      | 68.8    | 73.7  | 70.0             |
| West . . . . .                         | 71.3                      | 71.6    | 70.7  | ( <sup>1</sup> ) |
| Missing . . . . .                      | 66.6                      | 72.4    | 56.8  | ( <sup>1</sup> ) |

0.0 Quantity more than zero but less than 0.5.

<sup>1</sup>Rates could not be calculated (0/0).

**Table 10. Response rates for primary prenatal care providers of mothers in the live-birth cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Type of request statement |        |                  |                  |
|---|---------------------------|--------|------------------|------------------|
|   | All types                 | Signed | Proxy            | Unknown          |
|   |                           |        | Percent          |                  |
| Total . . . . .                         | 56.9                      | 58.1   | 54.7             | 44.0             |
| Age of mother                           |                           |        |                  |                  |
| Under 20 years . . . . .                | 53.3                      | 51.6   | 55.7             | 52.6             |
| 20–24 years . . . . .                   | 54.0                      | 55.5   | 52.0             | 31.0             |
| 25–29 years . . . . .                   | 59.5                      | 60.2   | 57.9             | 42.1             |
| 30–34 years . . . . .                   | 60.8                      | 62.7   | 55.1             | 46.7             |
| 35–39 years . . . . .                   | 56.4                      | 57.9   | 51.1             | 62.5             |
| 40 years and over . . . . .             | 64.9                      | 67.7   | 58.1             | 100.0            |
| Race of mother                          |                           |        |                  |                  |
| White . . . . .                         | 64.0                      | 65.7   | 58.5             | 54.6             |
| Black . . . . .                         | 50.0                      | 48.5   | 52.8             | 40.3             |
| Other . . . . .                         | 56.7                      | 58.2   | 53.7             | 50.0             |
| Not stated . . . . .                    | 66.7                      | 80.0   | 40.0             | ( <sup>1</sup> ) |
| Marital status                          |                           |        |                  |                  |
| Married . . . . .                       | 61.3                      | 62.5   | 57.9             | 52.4             |
| Unmarried . . . . .                     | 50.7                      | 50.0   | 52.2             | 36.7             |
| Not stated . . . . .                    | 0.0                       | 0.0    | ( <sup>1</sup> ) | ( <sup>1</sup> ) |
| Number of live births                   |                           |        |                  |                  |
| 1 . . . . .                             | 56.4                      | 56.9   | 55.7             | 42.9             |
| 2 . . . . .                             | 59.6                      | 61.0   | 56.6             | 43.8             |
| 3 . . . . .                             | 55.4                      | 57.5   | 51.7             | 38.9             |
| 4 or more . . . . .                     | 56.9                      | 57.6   | 55.5             | 72.7             |
| Not stated . . . . .                    | 43.4                      | 45.3   | 43.1             | 0.0              |
| Missing . . . . .                       | 42.9                      | 46.3   | 38.6             | 0.0              |
| Birthweight of infant                   |                           |        |                  |                  |
| Less than 2,500 grams . . . . .         | 53.3                      | 55.7   | 49.6             | 42.7             |
| 2,500 grams or more . . . . .           | 58.5                      | 59.1   | 57.2             | 100.0            |
| Not stated . . . . .                    | 66.7                      | 66.7   | 50.0             | 100.0            |
| Trimester prenatal care began           |                           |        |                  |                  |
| No care . . . . .                       | 15.3                      | 17.5   | 13.6             | 7.7              |
| First trimester . . . . .               | 59.9                      | 60.5   | 58.4             | 53.7             |
| Second trimester . . . . .              | 54.8                      | 54.6   | 55.5             | 37.5             |
| Third trimester . . . . .               | 50.5                      | 53.4   | 45.8             | ( <sup>1</sup> ) |
| Not stated . . . . .                    | 54.7                      | 56.4   | 51.8             | 50.0             |
| Number of prenatal care visits          |                           |        |                  |                  |
| No visits . . . . .                     | 15.3                      | 17.5   | 13.6             | 7.7              |
| 1–4 visits . . . . .                    | 51.5                      | 52.9   | 49.2             | 57.1             |
| 5–8 visits . . . . .                    | 56.3                      | 57.5   | 54.4             | 50.0             |
| 9–14 visits . . . . .                   | 60.5                      | 61.0   | 59.5             | 45.5             |
| 15–18 visits . . . . .                  | 61.1                      | 58.9   | 66.2             | 66.7             |
| 19 visits or more . . . . .             | 60.6                      | 60.2   | 61.9             | 50.0             |
| Not stated . . . . .                    | 54.9                      | 57.0   | 51.2             | 41.2             |
| Education of mother                     |                           |        |                  |                  |
| 0–8 years . . . . .                     | 51.4                      | 51.3   | 50.0             | 80.0             |
| 9–11 years . . . . .                    | 52.1                      | 51.4   | 53.1             | 46.2             |
| 12 years . . . . .                      | 57.9                      | 58.8   | 56.4             | 48.2             |
| 13–15 years . . . . .                   | 61.2                      | 62.2   | 58.5             | 41.7             |
| 16 years or more . . . . .              | 62.0                      | 62.4   | 60.9             | 44.4             |
| Not stated . . . . .                    | 54.6                      | 56.5   | 51.7             | 32.0             |
| Region of residence                     |                           |        |                  |                  |
| Northeast . . . . .                     | 55.3                      | 58.6   | 48.4             | 47.4             |
| Midwest . . . . .                       | 58.7                      | 60.1   | 55.7             | 31.8             |
| South . . . . .                         | 55.7                      | 55.0   | 57.2             | 47.5             |
| West . . . . .                          | 59.6                      | 62.7   | 52.5             | 50.0             |

0.0 Quantity more than zero but less than 0.5.

<sup>1</sup>Rates could not be calculated (0/0).

**Table 11. Response rates for primary prenatal care providers of mothers in the fetal-death cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Type of request statement |         |       |
|---|---------------------------|---------|-------|
|   | All types                 | Signed  | Proxy |
|   |                           | Percent |       |
| Total . . . . .                         | 55.4                      | 57.9    | 48.9  |
| Age of mother                           |                           |         |       |
| Under 20 years . . . . .                | 50.4                      | 50.2    | 50.7  |
| 20–24 years . . . . .                   | 54.9                      | 55.6    | 53.3  |
| 25–29 years . . . . .                   | 56.0                      | 58.3    | 47.9  |
| 30–34 years . . . . .                   | 60.0                      | 64.0    | 45.4  |
| 35–39 years . . . . .                   | 58.1                      | 63.3    | 46.4  |
| 40 years and over . . . . .             | 49.2                      | 56.4    | 36.4  |
| Not stated . . . . .                    | 43.5                      | 45.8    | 38.1  |
| Race of mother                          |                           |         |       |
| White . . . . .                         | 61.0                      | 64.8    | 48.2  |
| Black . . . . .                         | 47.3                      | 45.8    | 50.1  |
| Other . . . . .                         | 51.0                      | 50.7    | 51.9  |
| Not stated . . . . .                    | 43.6                      | 51.9    | 25.0  |
| Marital status                          |                           |         |       |
| Married . . . . .                       | 59.0                      | 62.2    | 47.8  |
| Unmarried . . . . .                     | 50.8                      | 50.0    | 52.2  |
| Not stated . . . . .                    | 49.4                      | 51.8    | 43.8  |
| Number of live births                   |                           |         |       |
| None . . . . .                          | 55.7                      | 57.1    | 50.9  |
| 1 . . . . .                             | 57.3                      | 60.5    | 47.6  |
| 2 . . . . .                             | 62.2                      | 65.1    | 55.4  |
| 3 . . . . .                             | 56.6                      | 56.4    | 57.1  |
| 4 or more . . . . .                     | 47.3                      | 58.5    | 32.5  |
| Not stated . . . . .                    | 23.1                      | 33.3    | 14.3  |
| Missing . . . . .                       | 53.9                      | 56.0    | 48.5  |
| Trimester began prenatal care           |                           |         |       |
| No care . . . . .                       | 11.8                      | 13.8    | 8.2   |
| First trimester . . . . .               | 58.5                      | 60.3    | 52.9  |
| Second trimester . . . . .              | 54.6                      | 57.5    | 49.4  |
| Third trimester . . . . .               | 50.0                      | 53.0    | 45.8  |
| Not stated . . . . .                    | 57.0                      | 60.6    | 48.2  |
| Number of prenatal care visits          |                           |         |       |
| No visits . . . . .                     | 11.9                      | 14.0    | 8.3   |
| 1–4 visits . . . . .                    | 47.5                      | 49.5    | 44.8  |
| 5–8 visits . . . . .                    | 58.5                      | 59.5    | 55.7  |
| 9–14 visits . . . . .                   | 59.5                      | 62.1    | 51.2  |
| 15–18 visits . . . . .                  | 61.2                      | 62.1    | 57.5  |
| 19 visits or more . . . . .             | 54.6                      | 58.5    | 43.2  |
| Not stated . . . . .                    | 56.8                      | 58.5    | 52.2  |
| Education of mother                     |                           |         |       |
| 0–8 years . . . . .                     | 38.2                      | 40.4    | 36.7  |
| 9–11 years . . . . .                    | 51.1                      | 51.9    | 49.5  |
| 12 years . . . . .                      | 57.2                      | 59.6    | 51.1  |
| 13–15 years . . . . .                   | 56.9                      | 58.5    | 50.4  |
| 16 years or more . . . . .              | 61.4                      | 63.0    | 50.0  |
| Not stated . . . . .                    | 52.8                      | 55.3    | 47.6  |
| Region of residence                     |                           |         |       |
| Northeast . . . . .                     | 53.3                      | 56.8    | 41.6  |
| Midwest . . . . .                       | 60.0                      | 62.2    | 50.7  |
| South . . . . .                         | 54.7                      | 56.9    | 50.2  |
| West . . . . .                          | 62.4                      | 66.7    | 47.6  |
| Missing . . . . .                       | 54.2                      | 56.1    | 49.4  |

**Table 12. Response rates for primary prenatal care providers of mothers in the infant-death cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey**

| Characteristics of the mother or infant | Type of request statement |                  |         |                  |
|---|---------------------------|------------------|---------|------------------|
|   | All types                 | Signed           | Proxy   | Unknown          |
|   |                           |                  | Percent |                  |
| Total . . . . .                         | 49.8                      | 52.1             | 45.1    | 61.1             |
| Age of mother                           |                           |                  |         |                  |
| Under 20 years . . . . .                | 44.6                      | 46.2             | 41.8    | 40.0             |
| 20–24 years . . . . .                   | 47.9                      | 50.2             | 44.0    | 0.0              |
| 25–29 years . . . . .                   | 54.6                      | 56.4             | 50.3    | 83.3             |
| 30–34 years . . . . .                   | 53.0                      | 55.1             | 47.2    | 50.0             |
| 35–39 years . . . . .                   | 51.9                      | 54.5             | 43.0    | 100.0            |
| 40 years and over . . . . .             | 41.3                      | 46.7             | 31.3    | ( <sup>1</sup> ) |
| Not stated . . . . .                    | 31.7                      | 32.1             | 30.8    | ( <sup>1</sup> ) |
| Race of mother                          |                           |                  |         |                  |
| White . . . . .                         | 57.3                      | 59.2             | 51.0    | 100.0            |
| Black . . . . .                         | 42.0                      | 42.4             | 41.4    | 46.2             |
| Other . . . . .                         | 51.8                      | 53.3             | 48.7    | ( <sup>1</sup> ) |
| Not stated . . . . .                    | 50.0                      | 45.5             | 60.0    | ( <sup>1</sup> ) |
| Marital status                          |                           |                  |         |                  |
| Married . . . . .                       | 55.8                      | 57.6             | 50.1    | 85.7             |
| Unmarried . . . . .                     | 42.3                      | 42.9             | 41.5    | 45.5             |
| Not stated . . . . .                    | 0.0                       | ( <sup>1</sup> ) | 0.0     | ( <sup>1</sup> ) |
| Number of live births                   |                           |                  |         |                  |
| None . . . . .                          | 0.0                       |                  | 0.0     |                  |
| One . . . . .                           | 50.9                      | 51.8             | 48.3    | 57.1             |
| Two . . . . .                           | 52.4                      | 55.8             | 44.4    | 100.0            |
| Three . . . . .                         | 52.3                      | 52.6             | 52.2    | 0.0              |
| Four or more . . . . .                  | 47.5                      | 49.3             | 44.0    | 100.0            |
| Not stated . . . . .                    | 38.6                      | 37.5             | 41.7    | 0.0              |
| Missing . . . . .                       | 41.8                      | 46.6             | 34.3    | ( <sup>1</sup> ) |
| Birthweight of infant                   |                           |                  |         |                  |
| Less than 2,500 grams . . . . .         | 47.1                      | 48.9             | 43.4    | 66.7             |
| 2,500 grams or more . . . . .           | 53.9                      | 56.8             | 47.8    | 33.3             |
| Not stated . . . . .                    | 54.6                      | 53.9             | 56.5    | ( <sup>1</sup> ) |
| Missing . . . . .                       |                           |                  |         |                  |
| Trimester prenatal care began           |                           |                  |         |                  |
| No care . . . . .                       | 15.5                      | 14.9             | 16.3    | 0.0              |
| First trimester . . . . .               | 54.2                      | 56.1             | 49.4    | 80.0             |
| Second trimester . . . . .              | 50.2                      | 50.6             | 49.3    | 60.0             |
| Third trimester . . . . .               | 48.7                      | 49.6             | 47.9    | 0.0              |
| Not stated . . . . .                    | 43.6                      | 45.1             | 40.5    | ( <sup>1</sup> ) |
| Number of prenatal care visits          |                           |                  |         |                  |
| No visits . . . . .                     | 15.5                      | 14.9             | 16.3    | 0.0              |
| 1–4 visits . . . . .                    | 47.4                      | 48.6             | 45.1    | 60.0             |
| 5–8 visits . . . . .                    | 54.0                      | 54.3             | 52.7    | 100.0            |
| 9–14 visits . . . . .                   | 56.2                      | 58.2             | 51.3    | 33.3             |
| 15–18 visits . . . . .                  | 57.3                      | 59.8             | 48.4    | ( <sup>1</sup> ) |
| 19 visits or more . . . . .             | 54.3                      | 49.4             | 64.1    | 100.0            |
| Not stated . . . . .                    | 47.0                      | 50.3             | 41.1    | 0.0              |
| Education of mother                     |                           |                  |         |                  |
| 0–8 years . . . . .                     | 43.3                      | 40.2             | 47.2    | 0.0              |
| 9–11 years . . . . .                    | 43.8                      | 46.6             | 39.6    | 57.1             |
| 12 years . . . . .                      | 51.7                      | 53.0             | 48.9    | 40.0             |
| 13–15 years . . . . .                   | 55.6                      | 57.0             | 50.3    | 100.0            |
| 16 years or more . . . . .              | 61.1                      | 60.7             | 62.9    | 100.0            |
| Not stated . . . . .                    | 46.2                      | 49.1             | 41.0    | ( <sup>1</sup> ) |

**Table 12. Response rates for primary prenatal care providers of mothers in the infant-death cohort by type of request statement and characteristics of the mother and infant: 1988 National Maternal and Infant Health Survey—Con.**

| Characteristics of the mother or infant | Type of request statement |        |         |                  |
|---|---------------------------|--------|---------|------------------|
|   | All types                 | Signed | Proxy   | Unknown          |
| Region of residence                     |                           |        | Percent |                  |
| Northeast . . . . .                     | 55.5                      | 58.8   | 47.3    | 66.7             |
| Midwest . . . . .                       | 49.8                      | 53.3   | 39.3    | 80.0             |
| South . . . . .                         | 49.0                      | 49.0   | 49.0    | 50.0             |
| West . . . . .                          | 53.0                      | 56.1   | 46.6    | ( <sup>1</sup> ) |
| Missing . . . . .                       | 43.1                      | 47.2   | 36.2    | ( <sup>1</sup> ) |

0.0 Quantity more than zero but less than 0.5.

<sup>1</sup>Rates could not be calculated (0/0).

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