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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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Preface

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.

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Contents

Preface	iii
Abstract	1
Introduction	1
Design Specifications	2
Survey Objectives	2
Domain and Precision Specifications	2
Operational Requirements	3
Sample Design	3
Summary	3
Survey Procedures	4
Sources of Information	6
Data Processing and Imputation	12
Estimation	14
Sampling Error	16
Nonsampling Error	19
Response Characteristics	20
Response Rates From Mothers	20
Request Statements From Mothers	20
Response Rates for Medical Sources	21
References	21

Text Tables

A. Analytical subdomains classified by race and birth outcome in the 1988 National Maternal and Infant Health Survey	3
B. Expected and actual sample sizes, by race and birth outcome in the 1988 National Maternal and Infant Health Survey	3
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	5
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	5
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	6
F. Areas reporting selected items on the certificate of live birth for each State, 1988	7
G. Areas reporting selected items on the report of fetal death for each State, 1988	8
H. Areas reporting selected items on the certificate of infant death: Each State, 1988	9
J. Number of potential sources of information in the 1988 National Maternal and Infant Health Survey, by type of source and birth outcome	10
K. Number and percent distribution of mothers in the 1988 National Maternal and Infant Health Survey, according to response status	11

- 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 12
- M. Percent imputed for variables imputed in more than 10 percent of cases, 1988 National Maternal and Infant Health Survey 15
- 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. 16
- 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. 17
- P. 1988 National Maternal and Infant Health Survey poststratification cell definitions, number of infant deaths to residents of the United States in 1988, and sampling weights. 17
- Q. 1988 National Maternal and Infant Health Survey estimated inflation factors for racial and birthweight categories 18
- R. Response rates for hospitals and prenatal care providers by type of request statement: 1988 National Maternal and Infant Health Survey. 21

Detailed Tables

- 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 23
- 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 24
- 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 26
- 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. 28
- 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. 29
- 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. 30
- 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 32
- 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 33
- 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 34
- 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 36
- 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 37
- 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 38

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

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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 ¹	Sample size	Inverse of probability of selection	Average weight ²
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.

¹The 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.

²The 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 ¹	Sample size	Inverse of probability of selection	Average weight ²
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

¹The 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.

²The 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 ¹	Sample size	Inverse of probability of selection	Average weight ²
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.

¹The 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.

²The 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
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
Provided hospital(s) contact information			
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
Provided prenatal care provider(s)			
Contact information			
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 ¹	Race of child ²	Age of mother in years	Number of births in survey	Number of births in 1988 ^{3,4}	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.

¹M=married; UN=unmarried.

²W,O=white and other; B=black.

³The 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.

⁴The 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 ¹	Race of fetus ²	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 ³	Inverse of probability of selection	Inverse of response rate	Base weight	Poststratification adjustment	Final weight ⁴
	Race of child ¹	Sex of child ²	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.

¹W,O=white and other; B=black.²M=male; F=female.³The 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.⁴347 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 ± (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 ± (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 ± (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			
Trimester prenatal care began									
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	
Number of prenatal care visits									
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	
Education of mother									
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	
Region of residence									
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			
Total	8,166	100.0	65.3	27.5	19.5	16.0	2.3	34.7	
Percent distribution									
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 mother or infant	Number of mothers	Respondents							Non- respondents
		Total	Response method					Unknown	
			All respondents	Mail	Personal	Telephone			
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	(¹)
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	(¹)
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.

¹Rates 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	(¹)
Not stated	43.9	46.4	38.5	(¹)
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	(¹)
Not stated	75.0	63.6	100.0	(¹)
Marital status				
Married	75.0	75.8	72.4	71.4
Unmarried	71.1	70.6	71.5	90.9
Not stated	50.0	(¹)	50.0	(¹)
Number of live births				
None	0.0	(¹)	0.0	(¹)
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	(¹)
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	(¹)
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	(¹)
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	(¹)

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	(¹)
Missing	66.6	72.4	56.8	(¹)

0.0 Quantity more than zero but less than 0.5.

¹Rates 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	(¹)
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	(¹)	(¹)
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	(¹)
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.

¹Rates 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	(¹)
Not stated	31.7	32.1	30.8	(¹)
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	(¹)
Not stated	50.0	45.5	60.0	(¹)
Marital status				
Married	55.8	57.6	50.1	85.7
Unmarried	42.3	42.9	41.5	45.5
Not stated	0.0	(¹)	0.0	(¹)
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	(¹)
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	(¹)
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	(¹)
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	(¹)
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	(¹)

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	(¹)
Missing	43.1	47.2	36.2	(¹)

0.0 Quantity more than zero but less than 0.5.

¹Rates could not be calculated (0/0).

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