

The 1980 National Natality Survey and National Fetal Mortality Survey—Methods Used and PHS Agency Participation

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Synopsis

Seven Public Health Service agencies collaborated with the National Center for Health Statistics in designing, funding, and analyzing the 1980 National Natality Survey (NNS) and 1980 National Fetal Mortality Survey (NFMS). The 1980 NNS-NFMS were nationally repre-

sentative surveys based on samples of 9,941 live birth vital records and 6,386 fetal death vital records, which were weighted up to reflect U.S. estimates of 3,612,258 live births and 19,202 fetal deaths at 28 weeks' gestation or more.

Four types of potential respondents who were associated with the sampled deliveries (married mothers, hospitals, attendants at delivery, and other medical providers of radiation procedures) were mailed eight-page questionnaires. The aim of the questionnaires was to expand our knowledge of the relationships of social, demographic, maternal health, infant health, and radiation characteristics to live births and late fetal deaths.

The methods used in the NNS-NFMS are described in detail since seven other articles and the editorial in this issue are based on these surveys. The availability of other NNS-NFMS data is also discussed.

THE SEVEN ANALYSES THAT FOLLOW are based on the 1980 National Natality Survey (NNS), the 1980 National Fetal Mortality Survey (NFMS), or both. They were prepared by researchers from seven Public Health Service (PHS) agencies that participated in designing and funding these surveys.

Before the surveys were begun, representatives of the following medical associations were asked to comment on the design and content of the surveys: the American College of Obstetricians and Gynecologists, American Hospital Association, American Medical Association, American Academy of Family Physicians, American Osteopathic Association, American College of Nurse-Midwives, American Dental Association, American Society of Radiologic Technologists, Society of Nuclear Medicine, and American College of Radiology.

Collaborative Efforts of PHS Agencies

The 1980 National Natality Survey and National Fetal Mortality Survey were major research efforts of the National Center for Health Statistics (NCHS), but colleagues in other PHS agencies determined much of the surveys' content. Moreover, the financial support that these agencies provided through NCHS's Reimbursable Work Program made the surveys possible. These agencies and their interests were as follows:

- The National Center for Devices and Radiological Health of the Food and Drug Administration wanted information on exposure to radiation procedures during pregnancy.
- The National Institute of Child Health and Human Development of the National Institutes of Health was interested in a wide variety of information on maternal and infant health, including information on infant feeding practices.
- The Bureau of Health Care Delivery and Assistance of the Health Resources and Services Administration supported the oversampling of low birth weight infants in the NNS so that special studies could be done of high-risk infants.
- The National Institute on Alcohol Abuse and Alcoholism of the Alcohol, Drug Abuse, and Mental Health Administration was interested in maternal drinking before and during pregnancy.
- The National Institute on Drug Abuse desired information on maternal smoking before and during pregnancy.
- The National Institute for Occupational Safety and Health of the Centers for Disease Control was concerned with the occupation, type of industry, and shift work of mothers and fathers.
- The Center for Health Promotion and Education of the Centers for Disease Control sought information on family planning and sterilization.

Although modifications to satisfy the needs of the participating PHS agencies were incorporated into the design and content of the two surveys, they remained cohesive data-collection instruments, capable of providing information comparable to that collected in previous natality surveys and therefore serving as a basis for studies of trends.

Followback Surveys and 1980 Innovations

A number of followback surveys (in which one or more informants identified on a vital record are followed back or contacted) had been conducted by the National Center for Health Statistics before 1980. National Natality Surveys were conducted in 1963, 1964–66, 1967–69, and 1972, a National Infant Mortality Survey was conducted in 1964–66, and National Mortality Surveys were conducted in 1961, 1962, 1963, 1964, 1965, and 1966–68.

The 1980 NNS and NFMS were nationally representative surveys. The NNS was based on a sample of 9,941 vital records for live births, and the NFMS was based on 6,386 vital records for fetal deaths occurring at 28 weeks' gestation or more. Married mothers, hospitals, attendants at delivery, and other medical providers of radiation procedures (four groups that were associated with the sampled deliveries) were mailed eight-page questionnaires. Their responses have greatly expanded our knowledge of the relationship of social and demographic characteristics, maternal health, infant health, and radiation exposure to live births and late fetal deaths. The mothers received 15-minute telephone interviews, and the medical sources 5-minute reminders if they did not respond to two waves of mailed questionnaires.

Although NCHS conducts all its followback surveys in basically the same way (that is, a nationally representative sample of vital records is selected from State vital records, and information is collected from the informants named on them), there were some innovations in the 1980 NNS and NFMS:

1. The 1980 NFMS was the first survey that NCHS ever conducted on fetal mortality; thus, all the information collected represents new baseline data on fetal mortality.

2. The same forms and cover letters were used for both the NFMS and the NNS, and the surveys were conducted in a parallel manner, but with different sampling fractions of the pertinent vital records and with different skip patterns on the questionnaires. Use of the same forms for two different national surveys was new. The parallel data collected permits women who delivered live-born infants to be compared with those who delivered stillborn infants.

3. The NNS oversampled low birth weight infants so that more detailed analyses could be conducted of high-risk infants; this kind of stratification was new in a National Natality Survey.

4. For the first time in an NNS, the National Center for Health Statistics collected medical data on out-of-wedlock deliveries; these data were collected from hospitals, attendants at delivery, and other medical providers of radiation procedures. The same medical data were also collected in the NFMS.

5. The fifth innovation was that consent statements were requested from the mother before collecting her medical information. On the last page of the mailed questionnaire was a statement for the mother to sign giving NCHS permission to obtain supplemental medical information from her medical sources. Also at the end of the telephone interview (conducted if the mother did not return the first two questionnaires mailed to her), a similar statement was read to the mother; her agreement was attested to by the signature of the NCHS statistical interviewer. Research on the NNS-NFMS showed that including the mother's consent statement (particularly if it was signed by the mother rather than the interviewer) along with the questionnaires that were mailed to the mother's sources of medical care significantly increased these sources' response rates (1).

6. The sixth innovation was in data content. The comparability of various data items in the 1980 NNS with items in the 1963, 1964–66, 1967–69, and 1972 NNS permits studies of trends. Also, there were new questions in the 1980 NNS-NFMS that were not posed in the earlier followback surveys, including some on new topics that are discussed in the papers that follow. These topics include drinking during pregnancy, data on Hispanics, the parents' occupation and type of industry, exposure to ultrasound and nuclear medicine during pregnancy, induction of labor, electronic fetal monitoring, and fetal scalp blood sampling.

7. The final innovation will be data linkage, instituted to further expand the 1980 NNS data set. Because of the oversampling of low birth weight infants, 2,214 of them were among the 9,941 total live-born infants sampled in the NNS. Of the 2,214, we project that 271 would have died in their first year of life. We are currently conducting a search of the 1980 and 1981 National Death Index in order to produce a numerically modest but extremely comprehensive infant mortality data set within the 1980 NNS.

More details on the content of the two surveys and their design, as well as about the pretest experiences that led us to certain decisions about their content and design, are presented elsewhere (2,3).

The 1980 National Natality Survey

The 1980 NNS was based on a probability sample of the registered live births in the United States during 1980. (It is estimated that 99.3 percent of all births in the United States in 1980 were registered.) The files of birth certificates in the 52 registration areas in the United States constituted the sampling frame for the survey. The registration areas include the 50 States, the District of Columbia, and New York City.

These registration areas assign a file number to each birth certificate received. These numbers are assigned consecutively from the beginning to the end of the year. For the 1980 NNS, the registration areas were instructed to sample certificates with file numbers ending with specified digits. These digits were specified so that 105 of every 10,000 certificates on file would be selected. If a certificate with the specified number was missing from the file, the next certificate in the sequence was to be selected. The registration areas were instructed to do the sampling as soon as certificates for the most recent month of registration were considered complete. Copies of sampled certificates were sent monthly to NCHS for further processing. When certificates were received by NCHS, the area's sampling was verified by examination of the file numbers. Incorrectly sampled certificates were eliminated, and missing certificates were obtained.

In a few instances, the sample of birth certificates was drawn by NCHS staff from microfilm copies of the certificates supplied by the registration areas.

Not all certificates that the States sent to NCHS were included in the NNS. Certificates for births that resulted in adoption and for births to nonresidents of the United States were excluded. Also, only certificates with file numbers ending with certain specified digits and for infants with birth weights of less than 2,500 gm were selected for the NNS. As mentioned, the sampling and selection procedures were designed to produce an over-sampling of low birth weight infants for analytical purposes.

The total number of registered live births to residents of the United States during 1980 was 3,612,258. Of this total, certificates for 10,615 were selected for the 1980 NNS by the methods outlined. Approximately 80 birth certificates were excluded at the request of State registrars of vital statistics. Among those excluded were certificates for births to unmarried mothers in New Jersey and Idaho. In addition, Idaho followed the procedure of requesting permission from married mothers to include the birth certificates of their infants in the survey and did not include the birth certificates of infants whose mothers refused permission. The State of Washington requested permission from unmarried mothers before including birth certificates of their infants in the survey; if

the mothers refused permission for the certificates to be included, they were not. In addition, a small, unknown number of birth certificates were not sampled because they were received by the registration areas after March 27, 1981.

During the survey, it became necessary to reduce the number of cases that required special handling. Two kinds required an excessive amount of time and effort. To send questionnaires to the attendants at a delivery, it was necessary to obtain their names and addresses. In some instances, however, this information was not recorded clearly on the vital record, so that it was difficult to identify these attendants from medical and telephone directories. Questionnaires were also sent to married women who had given birth. Although obtaining their names and addresses from the birth certificates was easier than obtaining those of birth attendants, sometimes the addresses were incomplete or no longer current, and the questionnaires mailed to these women were returned by the postmaster. Obtaining new return addresses for them was difficult. Therefore it was decided to exclude the 189 certificates on which the attendants' names and addresses were not decipherable and the 485 for which the mothers' questionnaires had been returned by the post office. The effects of eliminating these cases from the survey are discussed elsewhere (4-6). The survey finally included 9,941 certificates of live birth, or approximately 1 certificate for every 363 live births in 1980 to residents of the United States. A post-stratified ratio estimation procedure with 50 independent groups categorized by age, race, birth order, marital status, and birth weight was used to weight up the NNS sample of 9,941 births to the national count of 3,612,258 live births. NNS statistics technically refer to births rather than mothers, since about 2 percent of births are multiple, that is, twins, triplets, and so forth. However, the term mothers instead of births is frequently used as a matter of convenience, particularly when the focus is on mothers.

The 1980 National Fetal Mortality Survey

The 1980 National Fetal Mortality Survey was based on a probability sample of the registered fetal deaths in the United States during 1980. The designation for the document filed in the event of a fetal death differs among registration areas (certificate of fetal death, certificate of stillbirth, report of fetal death, and so forth). In this article, these documents are referred to as "reports of fetal death" or "reports." Reporting requirements for fetal deaths differ somewhat among the 52 State and independent registration areas.

Reports of fetal death were selected for inclusion in

the NFMS according to specific criteria. Reports of fetal deaths to nonresidents of the United States were not included. To assure that adequate medical information would be obtained, the NFMS was limited to late fetal deaths, which were more likely to have occurred in a hospital. Abortions were also excluded from the survey. The following kinds of fetal death reports were selected for inclusion: (a) those in which the length of pregnancy or the physician's estimate of its length was stated as 28 or more completed weeks or as 7 or more months; (b) those in which an explicit statement of gestational length was lacking and the delivery weight of the fetus was stated as 1,000 gm or more or as 2 lbs, 3 oz or more; or (c) those in which an explicit statement of gestational length and of delivery weight was lacking and the length of gestation, based on the date of the last menstrual period, was 196 days (28 weeks) or more. For ease of reference, the fetal deaths selected for inclusion in the NFMS are referred to as "fetal deaths with gestation of 28 weeks or more, or delivery weight of 1,000 gm or more." These late fetal deaths are often called "stillbirths."

A total of 7,391 reports of fetal death were selected for inclusion in the National Fetal Mortality Survey. Approximately 70 reports of fetal death were not selected at the request of State registrars of vital statistics. All reports involving unmarried mothers in New Jersey and Idaho were excluded. Also, Idaho requested permission from married mothers, and the State of Washington requested permission from unmarried mothers to include reports of their stillbirths in the survey. If the mothers refused permission, the reports were not included.

The files of reports of fetal death in 51 of the 52 registration areas constituted the sampling frame for the NFMS. (Michigan State law does not permit reports of fetal deaths in that State to be used for a followback survey of this kind.) The 51 registration areas assigned a file number to each fetal death report received, numbering the reports consecutively from the beginning to the end of the year.

As in the NNS, the registration areas were instructed to sample reports of fetal death that had file numbers ending with specified digits. The digits were so specified that 4 of every 10 reports would be included in the sample. If a report with the specified number was missing from the file, the next report in the sequence was to be selected. The registration areas were instructed to send copies of the sampled reports of fetal death to NCHS monthly. Upon receipt of the reports, NCHS verified the sampling by examination of the file numbers. Incorrectly sampled reports were eliminated, and missing reports were obtained. A small unknown number of reports of fetal death were not sampled because the registration areas received them after March

Table 1. Response rates for sources in 1980 NNS (National Natality Survey) and NFMS (National Fetal Mortality Survey) by type of source and marital status of mother

Sources	NNS response rates ¹ for live births to—		NFMS response rates ¹ for stillbirths to—	
	Married mothers	Unmarried mothers	Married mothers	Unmarried mothers
Named on vital records:				
Mothers	79.5	74.5
Hospitals	77.6	70.8	76.3	66.7
Attendants at delivery (usually physicians)	64.3	48.6	57.9	44.6
Named by mothers, hospitals, or attendants at delivery:				
Medical providers of ioniz- ing and nonionizing radia- tion ²	79.9	71.4	78.3	72.2
Physicians	51.7	55.7	57.8	50.5

¹ The response is the proportion of sources providing information expressed as a percentage.

² Dentists, chiropractors, therapists, and so forth.

27, 1981.

The number of reports of fetal death that were eligible for inclusion in the NFMS based on the gestation and birth weight criteria is not routinely available from the vital registration system. An estimate of the number of eligible fetal deaths was obtained by multiplying the number of late fetal death reports selected for the survey by the inverse of the sampling fraction and then adding the known number of fetal deaths in Michigan. This calculation provided an estimate of 19,202 fetal deaths at 28 weeks or more of gestation or involving a delivery weight of 1,000 gm or more. Because of the already noted exclusion of certain categories of fetal deaths by some States, this estimate of 19,202 may understate the number of late fetal deaths in the United States in 1980 by nearly 200.

Since the NNS and NFMS were conducted jointly, certain vital records had to be excluded from the 1980 NFMS for the same reasons that certain vital records had to be excluded from the 1980 National Natality Survey. A total of 1,005 reports of fetal death were excluded from the NFMS because of illegible names on vital records and postmaster returns. The survey therefore included 6,386 reports of fetal death. This figure represents approximately 1 in 3 of the estimated number of late fetal deaths in 1980. A ratio-adjustment procedure with 22 groups categorized by age, race, and marital status was used to weight up the NFMS sample of 6,386 late fetal deaths to the national estimate of 19,202 late fetal deaths. NFMS statistics refer to fetal deaths rather than to the women whose pregnancies ended in fetal deaths, since about 2 percent of fetal deaths involve multiple deliveries. However, for purposes of convenience, the

terms women and mothers are used interchangeably in discussing NFMS data.

Response rates for married mothers, hospitals, attendants at delivery (usually physicians), and medical sources of radiation procedures are shown in table 1. Response rates of this magnitude are generally considered acceptable for mail surveys of this type. A separate study of NNS-NFMS return rates (6) showed that return rates were significantly higher than response rates. The return rates were based on questionnaires completed by the appropriate respondent, completed by ineligible respondents, returned blank accompanied by a note of refusal, and returned by the Post Office as undeliverable.

Data Processing and Merging of Sources

The NNS-NFMS collect data from a number of sources. For notational ease, the following conventions are used in referencing each of these sources (also see chart):

- C = data from the birth or fetal death certificate
- M = data from the mother's questionnaire
- H = data from the hospital's questionnaire
- P = data from the physician's questionnaire
- X = data from the radiation questionnaire.

Circles with a bump represent a computer magnetic storage medium such as tape. Thus, the certificate data are initially stored on a tape separate from the other files; then the other files are cleaned and merged.

Some of the basic analysis is done on each data source separately; yet in the bulk of the analytical work, variables from more than one data source are used. For this reason, the end product from the processing box is one data tape containing all the data, and for each case, all the sources are merged into one unit.

The chart provides an overview of the entire cleanup and data-merging process. Each data source feeds into its own process box, which in turn feeds into other process boxes, which successively combine the data sets into the final tape.

The Imputation Process

The imputation process is used when data are missing because of unit nonresponse (missing questionnaire) or item nonresponse (missing response on an otherwise completed questionnaire). To impute missing data in the 1980 NNS-NFMS, we used predictor variables within a categorical matrix. The variables we used as predictors are well reported, and in most cases, they come from the vital record. The predictor variables for each case are recoded into a unique group, which are used as indices into the matrix. This matrix is then updated by each case.

Overview of data cleanup processes in the 1980 National Natality Survey and 1980 National Fetal Mortality Survey

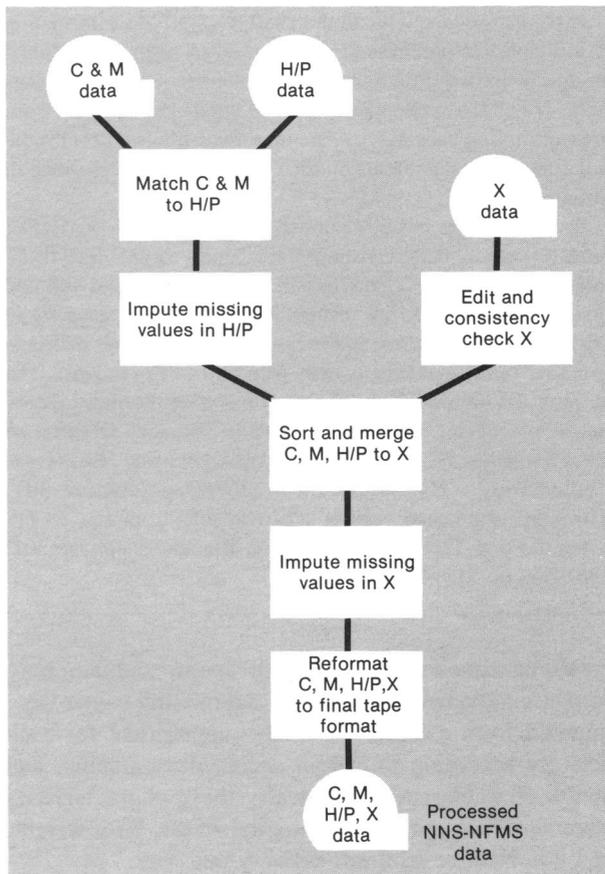


Table 2. Matrix to impute a mother's missing education value

Mother's age (years)	Values for live births to white mothers with birth orders of—			Values for live births to all other mothers with birth orders of—		
	1st	2d	3d or higher	1st	2d	3d or higher
15 or under .	10	8	6	8	8	8
20–24	12	10	10	12	10	8
25–29	16	14	12	14	12	10
30 or older . .	16	16	12	16	14	12

Thus, a mother for whom a variable is missing receives the value from a similar woman having the same predictor profile. In the example in table 2, information on the mother's education is missing. If the woman was 21 years old, black, and her first live-born infant was delivered in 1980, we would impute 12 years of education to her only if there was no other woman like her in the data file. However, 99 percent of the time there would be a similar woman, so that the woman with the missing education value would receive the similar woman's re-

Availability of public use tapes and of reports

A public use tape with all the 1980 NNS-NFMS information is available for purchase at a cost of \$125 from the National Technical Information Service, 5285 Port Royal Rd., Springfield, Va. 22161, telephone 703: 487-4650. Data tapes from previous followback surveys are also available from NTIS; the full contents of data items on the earlier tapes are described in reference 7.

Besides reports recently published (8-11), a wide variety of other reports are underway at NCHS. Topics include fetal death ratios according to characteristics of mothers and infants; trends in medical X-ray examinations during pregnancy, in postpartum sterilization, and in interval between first marriage and first birth; maternal weight gain and birth outcome; and number and timing failures in family planning. For information on these, contact the Natality Statistics Branch, Division of Vital Statistics, NCHS, 3700 East-West Highway, Rm. 1-44, Center Bldg., Hyattsville, Md. 20782, telephone 301: 436-8954. Published reports are available from the NCHS Scientific and Technical Information Branch, telephone 301: 436-8500 or 301: 436-NCHS.

ported education value. Unit nonresponse and item nonresponse were treated the same, and missing values were imputed from a matrix of values appropriate for each delivery according to certain social, demographic, and health characteristics. Typically these characteristics were age, race, birth order, marital status, birth weight, and live birth or stillbirth delivery outcome.

For some analyses, use of imputed data is entirely appropriate, for example, to make a national estimate of a number, rate, ratio, or percentage. Also, national estimates of certain types of relationships can be made with the full data set, which includes both information from the respondent and imputed data. On the other hand, certain analyses and certain kinds of investigations require respondent-reported data only. Furthermore, some investigations may have to be restricted to a subset of the data—for example, to hospital births only, married mothers only, or first births only. Each paper in this section clearly identifies which portion of the data set is being used in the particular analysis. Because different data subsets are used in different analyses, estimates of the same characteristic may differ.

Reliability

The probability design of the surveys makes possible the calculation of sampling errors. The standard error is a measure of the sampling variation that occurs by chance because only a sample rather than an entire population is surveyed. Nonresponse is taken into account in the calculation of sampling errors, and the results discussed in the articles that follow are statistically significant at the 0.05 level with two-tailed normal deviate tests.

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