

**VITAL and HEALTH STATISTICS**  
DATA FROM THE NATIONAL VITAL STATISTICS SYSTEM

**A study of infant mortality  
from linked records:**

**Method of Study and  
Registration Aspects**

PROPERTY OF THE  
PUBLICATIONS BRANCH  
EDITORIAL LIBRARY

**United States, 1960 live birth cohort**

Description of the study of infant mortality among the United States live birth cohort, 1960, including collection and preparation of records, results of record linkage, and implications for the study results and registration completeness.

---

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service  
Health Services and Mental Health Administration



Public Health Service Publication No. 1000-Series 20-No. 7

For sale by the Superintendent of Documents, U.S. Government Printing Office  
Washington, D.C., 20402 - Price 50 cents

# NATIONAL CENTER FOR HEALTH STATISTICS

THEODORE D. WOOLSEY, *Director*

PHILIP S. LAWRENCE, Sc.D., *Associate Director*

OSWALD K. SAGEN, Ph.D., *Assistant Director for Health Statistics Development*

WALT R. SIMMONS, M.A., *Assistant Director for Research and Scientific Development*

ALICE M. WATERHOUSE, M.D., *Medical Consultant*

JAMES E. KELLY, D.D.S., *Dental Advisor*

EDWARD E. MINTY, *Executive Officer*

MARGERY R. CUNNINGHAM, *Information Officer*

## OFFICE OF HEALTH STATISTICS ANALYSIS

IWAO M. MORIYAMA, Ph.D., *Director*

DEAN E. KRUEGER, M.S. *Deputy Director*

## DIVISION OF VITAL STATISTICS

ROBERT A. ISRAEL, M.S., *Director*

ROBERT A. ISRAEL, M.S., *Acting Chief, Mortality Statistics Branch*

JOHN E. PATTERSON, *Chief, Natality Statistics Branch*

LOREN E. CHANCELLOR, *Chief, Registration Methods Branch*

ALICE M. HETZEL, *Chief, Marriage and Divorce Statistics Branch*

ARNE B. NELSON, M.A., *Chief, Vital Records Survey Branch*

MICHAEL J. ZUGZDA, *Chief, Statistical Resources Section*

---

Public Health Service Publication No. 1000-Series 20-No. 7

*Library of Congress Catalog Card Number 73-602409*

# PREFACE

This report is one of a group of analytical studies of death in the first year of life among infants born alive in the United States in 1960. The mortality data are derived from infant death records linked to live birth records for the same infants, representing the mortality experience among the 1960 cohort of liveborn infants. This first report concerns itself with the record collection and registration aspects of the study.

The study required the preparation of a new file of linked records, each of which consisted of information partly from the death record and partly from the live birth record for the same infant. By combining the data from the two records, it became possible to relate age at death and cause of death to characteristics such as the infant's birth weight or the age of the mother, both of which are items on the live birth records but not on the death records.

In the conduct of the study, use was made of procedures already in existence for the regular production of national vital statistics. The National Center for Health Statistics had microfilm copies of the original records and computer tapes which contained selected data taken from the records. The States and some cities had alphabetic indexes of births and deaths and were the permanent custodians of the original records. Although the study was carried out by the National Center for Health Statistics, the **co**operative assistance of State and city offices of vital records **con**tributed substantially to the final outcome. This study of infant mortality is but one example in a long history of cooperative Federal-State relations in vital statistics.

### SYMBOLS

Data not available-----	---
Category not applicable-----	...
Quantity zero-----	-
Quantity more than 0 but less than 0.05----	0.0
Figure does not meet standards of reliability or precision-----	*

# CONTENTS

Preface-----	iii
Introduction -----	1
Basic Data-----	3
Collection of Records-----	3
Verification of Linkage-----	4
Completion of File-----	4
Results-----	6
Color and Sex-----	6
Age at Death-----	6
Geographic Variation-----	7
Cause of Death-----	14
Age of Mother-----	14
Birth Weight and Period of Gestation-----	14
Discussion -----	14
Implications for Registration of Live Births-----	15
Relationship to Birth Registration Completeness-----	18
Implications for Record Linkage Studies-----	18
Implications for Infant Mortality Rates-----	20
Conclusion -----	21
References -----	21
Detailed Tables-----	22
Appendix I. Technical Notes-----	41
Classification by Occurrence and Residence-----	41
Age of Mother-----	41
Race and Color-----	41
Hospital Delivery-----	41
Birth Weight-----	41
Period of Gestation-----	41
Control of Errors-----	42
Sampling of Birth Records-----	42
Registration Completeness-----	42
Appendix II. Standard Certificate of Live Birth-----	43
Appendix III. Standard Certificate of Death-----	44

*IN THIS REPORT* the method of study of infant mortality based on linked vital records for the 1960 United States live birth cohort is described with special attention to the registration aspects of the problem. Infant mortality is analyzed from a set of combined records consisting of information obtained partly from the live birth record and partly from the death record for specific individuals. The infant deaths relate to all infants born alive in the United States in 1960.

The records were accumulated through the cooperation of the National Center for Health Statistics and the 50 States and a few city vital records offices, which are the permanent custodians of the original records. In all, 109,861 deaths under 1 year of age among the 4,257,850 infants who were born alive in 1960 were identified. Of the deaths, 97.4 percent were successfully linked to the corresponding live birth records, 2.1 percent could not be linked either at the Center or in the State of birth, and 0.5 percent were supplied by the States but could not be found on the computer tapes at the Center.

The linkage of records was less complete for nonwhite infants (3.2 percent unlinked) than for white infants (1.7 percent), but there was no difference by sex within the color groups. When classified by age at death, linkage was less complete for infants who died during the first hour of life (3.1 percent unlinked) than for those who died during the remainder of the first month. Linkage was least complete as the age at death approached the end of the first year of life—reaching 4.8 percent of records unlinked for those infant deaths in the age group 6-11 months. Geographically, the proportion of records which were unlinked varied widely from zero for the State of Hawaii to 7.9 percent for New Mexico.

These findings are important from two points of view. First, they are useful in assessing the degree of understatement of mortality rates produced from this study. Second, they are useful in identifying some of the remaining registration problems.

This report introduces a group of reports on infant mortality among the 1960 United States live birth cohort. The results as they relate to infant mortality will be reported in this series in subsequent reports.

# A STUDY OF INFANT MORTALITY FROM LINKED RECORDS

## METHOD OF STUDY AND REGISTRATION ASPECTS

Helen C. Chase, Dr. P.H., *Office of Health Statistics Analysis*

### INTRODUCTION

Infant mortality remains a problem of concern in many parts of the world. In developing nations, high levels of infant mortality are recognized as problems warranting serious attention. In more advanced countries, as well, considerable effort is exerted to bring newborn infants through the hazardous first year of life.

In the United States, for a number of years, attention has been called to the failure of the infant mortality rates to maintain their former rate of decline.<sup>1-3</sup> Although this country has made great strides in reducing infant mortality, deaths among infants under 1 year of age remain an important public health problem. For example, there are more deaths during the first year of life than at ages 1-29 inclusive.

Infant mortality can be measured by any of a number of techniques. In usual vital statistics practice, the rates are derived from two independent sets of vital records for a common time interval: the numerators consist of deaths under 1 year of age derived from death records, and the denominators consist of live births derived from live birth records. Because rates are computed based on data obtained independently from two separate sets of records, they can be derived only for the characteristics which appear on both records, e.g., residence, color, and sex.

Rates obtained by this method of computation have a number of disadvantages. Even under conditions of complete registration of live births and infant deaths, these rates can provide only estimates of the risk of infant death. In any calendar year, some of the infants who die are born in the preceding year. Similarly, some of the infants who are born in that calendar year do not die until the following year. When this method of calculating infant mortality rates is used, it is assumed that deficiencies in infant deaths in one direction are offset by excesses in the other. This assumption is not too hazardous when the numbers of live births are fairly constant over the years, but it is less acceptable when the numbers of live births are increasing or decreasing rapidly from one year to the next.

This method has an additional disadvantage in that it limits the items which can be considered to those which appear on both the live birth and infant death records, and it is assumed that recorded information for these items is consistent. For example, responses to the sex item would be expected to be the same on both records. However, responses to the color item may be a little less consistent since it is reported differently on live birth and death records. Live birth records require the reporting of the color of the mother and the father, and the color of the infant is determined from these two items of information. Death records ask for the color of the deceased,



which for this study is the infant. Residence may vary between the time of birth and the time of an infant's death, and as a consequence the same infant may appear in different geographic areas in live birth and infant death tabulations. These rates are therefore only estimates of the risk or probability of infant death.

A more direct measure of infant mortality can be obtained by linking the live birth and corresponding infant death certificates for specific individuals, producing combined records and deriving mortality rates in relation to characteristics on the birth records. Such rates are termed "cohort" mortality rates. This method has the advantage of dealing with records relating to individuals rather than groups. Furthermore, rates obtained by this method quantify the risk of death among a specified group of individuals and therefore represent probabilities of infant death. For reliable rates, the cohort method depends on the success of record linkage in addition to the completeness of registration of both live births and infant deaths.

A second advantage of the cohort method is that the number of variables available for study is greatly increased. In addition to place of residence, color, and sex, other pertinent variables such as mother's age, order of birth, birth weight, and period of gestation are made available for study. A third advantage is that by using residence, color, and sex from the live birth records only, any discrepancy arising from inconsistencies between the birth and death records with regard to these variables is avoided.

In order to analyze infant mortality in the United States in greater depth, a nationwide cohort study was undertaken by the National Center for Health Statistics (NCHS) with the cooperation of the State vital statistics offices. Birth and death certificates were linked for each infant who was born in the United States in 1960 and who died before reaching 1 year of age. By combining information from the live birth records (appendix II) and the death records (appendix III), raw data were provided for a study of infant mortality among the cohort of infants born alive in the United States in 1960. The success of the study was predicated on the assumptions that the registration of live births and infant deaths was essentially complete and that it would be possible

to link the birth and death records for virtually all infants who were born in 1960 and who died before reaching 1 year of age. Since the preparation of the linked records required that the birth certificate be sought for each of more than 100,000 infants who died before age 1, an unusual opportunity was provided to identify a group of infants for whom live birth records could not be found. The unlinked records represented a functional failure in the registration system: either a failure to register the birth, or some other obstacle to the linkage operation. At best, the unlinked infant death records can provide leads to only a small portion of deficient live birth registration, since death occurs within a year for only about 2 percent of live births.

Two nationwide studies of birth registration completeness were conducted in connection with the 1940 and 1950 Censuses of Population.<sup>4,5</sup> In 1950, for example, after completing the regular census return, census enumerators prepared special "Infant Cards" for all infants in the household who were born alive during January through March 1950, regardless of their survival to the time of the census or of their death during the interval between birth and the census. These "Infant Cards" were compared with the live birth certificates for the same period, and the results were used to measure incomplete live birth registration. From the 1950 study, it was estimated that about 2.1 percent of live births were not registered.<sup>5</sup>

There have been no nationwide tests of registration completeness since 1950, and unfortunately, in the present study, there is no external source of information which can be used to measure completeness of live birth registration. The only segment of registration completeness which can be evaluated relates to those instances when the death certificates were available but no corresponding birth certificates could be found. Although this portion of incomplete live birth registration does not yield an overall estimate of incomplete birth registration, it provides insights into some of the factors which are associated with linkage failures and with functional registration failures.

For a few items of information, the use of unlinked records provides estimates of the degree of understatement of mortality rates which may

be due to failures in record linkage. Such estimates are possible for items which are common to the birth and death records as, for example, sex, color, and place of birth. However, for characteristics on the birth record which do not appear on the death record (such as age of mother, infant's birth weight, and period of gestation), estimates of the understatement of mortality rates cannot be derived.

The purpose of the present report is to describe the method of data collection used for the cohort study and to explore the data obtained in this study for leads to remaining problems of vital registration. The results of the study as they relate to infant mortality will be presented in other reports.

## BASIC DATA

Original birth and death certificates are kept on permanent file in State offices of vital records, or, in a few instances, in city offices of vital records. Microfilm copies of birth and death certificates are routinely sent to the National Center for Health Statistics by 54 reporting areas (50 States and the 4 cities of Baltimore, District of Columbia, New Orleans, and New York City).<sup>a</sup> These copies are used to produce national natality and mortality statistics. The Center does not, however, maintain an alphabetic index of births, and consequently it is inefficient and uneconomical to attempt to create a linked set of birth and death records from NCHS records alone.

### Collection of Records

To produce the infant mortality rates, two elements of information were needed: data for live births which occurred in 1960 and data for infant deaths which could be correlated with the birth characteristics. The data for live births, based on a 50-percent systematic sample, were already published in considerable detail in Volume I of *Vital Statistics of the United States, 1960*. In order to produce comparable data for the infants who died, it was necessary to bring together the birth and infant death records for

specific infants and to tabulate the infant death records according to the same characteristics which were already available for all live births. A more detailed description of the technical aspects of the coding and limitations of the data are contained in appendix I.

At the outset of the study, the National Center for Health Statistics requested the 54 reporting areas to provide linked birth and death records for each infant who met the study criteria—namely, that the infant was born in the United States in 1960 and that the infant died before reaching 1 year of age. Since the vital records of the United States were to be used to identify the infant deaths, a further limitation of the study was that the birth and death occurred in the United States. This limitation on the data was felt to be a minor one for the purposes of the study.

The preferred method for submitting linked records for the study was for the reporting areas to provide paired photocopies or microfilmed copies of the birth and death certificates for each infant who met the study criteria. These records became the base for a new set of punched cards which were prepared specifically for the cohort study. Because of differences in registration and record keeping systems in the reporting areas, it was not practical for all areas to follow the preferred method. In order to achieve coverage of the entire country, three methods were actually used.

The preferred method, that of providing paired records (either photocopies or microfilmed copies), was followed by 40 registration areas and accounted for about 54 percent of the infant deaths. Photocopies of linked records which were submitted by the reporting areas were verified to assure their proper linkage, and new punched cards were prepared for the study. A number of reporting areas submitted microfilm showing the related birth and death records in sequence. Photocopies were prepared from the microfilm, and after the copies were cut apart, the linkage of records was again verified to assure proper assemblage of each pair before punching.

Some of the larger States provided the information in an alternate manner. Since a number of these States already had punched cards for their linked records, they agreed to provide the infor-

<sup>a</sup>Records received from other areas such as Puerto Rico and the Virgin Islands are omitted for the purpose of this study.

mation contained in the cards either as lists or as duplicate sets of punched cards. The Center then proceeded to prepare the necessary copies from its routinely collected microfilm of birth and death records. This method was used by nine reporting areas, but because they were predominantly large States, their records represented about 39 percent of the infant deaths. New uniformly punched cards containing standard information were prepared by the Center to replace the cards or lists of varying format and content which were received from the reporting areas.

In the initial stages of the investigation, a few reporting areas indicated that, for a variety of reasons, they could not provide linked records. For these areas a third method was used. The Center sent a copy of the appropriate death certificates showing State of birth to the reporting areas. After searching their alphabetic birth indexes, the State offices entered the birth certificate number on each copy and returned the records to the Center. A search was then made of the NCHS microfilm, and infant death study cards were punched from the birth microfilm and the copy of the death record. This method was used for five States and accounted for about 7 percent of the infant deaths.

### Verification of Linkage

The following items, which are common to both live birth and infant death records, were the basis for determining whether or not a given birth and infant death record were for the same individual:

- Name of child
- Name of father
- Name of mother
- Sex of child
- Color (of parents, or child)
- Date of birth of child
- Place of birth of child

Because of inconsistencies in spelling and interpretation of certain items of information (e.g., color of mother and father on the birth record versus color of infant on the death record), an

undetermined amount of judgment entered into the final reconciliation of questionable cases.

As the linking of records progressed and the file of linked records was compiled, two files of unresolved cases were established from all available sources. One file consisted of death records for which no linked birth record could be found in the Center or in the registration office, and these are termed "unlinked death records" in the present study. The other unresolved file consisted of linked infant death and birth records supplied by registration offices for which no death record could be found on computer tapes at the Center.

### Completion of File

Because of the variety of methods used in data collection, it was felt that a final reconciliation of the file of linked records with a master file of infant deaths was necessary. At this point, the procedure outlined in figure 1 was effected. The frequencies shown at various steps of the operation are rounded because precise counts did not exist at every step, and estimates are shown in parentheses. Actual counts are shown without parentheses.

Briefly, the procedure was as follows. The complete Center death tapes for the years 1960 and 1961 were reviewed, and all deaths which occurred among individuals under 1 year of age were extracted from them and converted to punched cards. The selection, which resulted in punched cards for about 219,000 infant deaths, included infants born in 1959, 1960, and 1961. This file was then reduced by eliminating the records for all infants who could *not* have been born in 1960. The year of birth, which was not part of the tape record, was estimated from the age at death and the month and year of death, which were part of the tape record. The method of elimination was such that only those infants who were definitely *not* born in 1960 were rejected, and all those possibly born in 1960 were retained. The selection procedure resulted in an almost equal division between those rejected (about 109,500) and those retained as a master file for further examination (about 109,300). The file of study punched cards, which had been pre-

pared earlier from linked records submitted by the registration areas and from other sources, was compared with the master file of 109,300 punched death cards, with about 102,400 agreements between the two files.

The remaining 6,900 punched cards in the master file represented infant death records in the routinely collected records at the Center for which the registration areas had not submitted linked birth and death records for the study. These punched cards were listed by State of birth, and the lists were sent to the reporting areas for a final search of their alphabetic birth indexes. As

a result, the registration offices were able to supply about 4,300 additional linked cases, and approximately 2,600 unlinked death records remained.

In addition to the 2,600 unlinked deaths which remained, the Center had accumulated a file of 830 linked records supplied by the registration offices which, at the time, could not be found on NCHS computer tape of death records. As a final cross-check at the Center, the files of 2,600 and 830 records were compared, and 300 additional linked cases were identified. The final result of all of the searching, linking, and cross-checking proce-

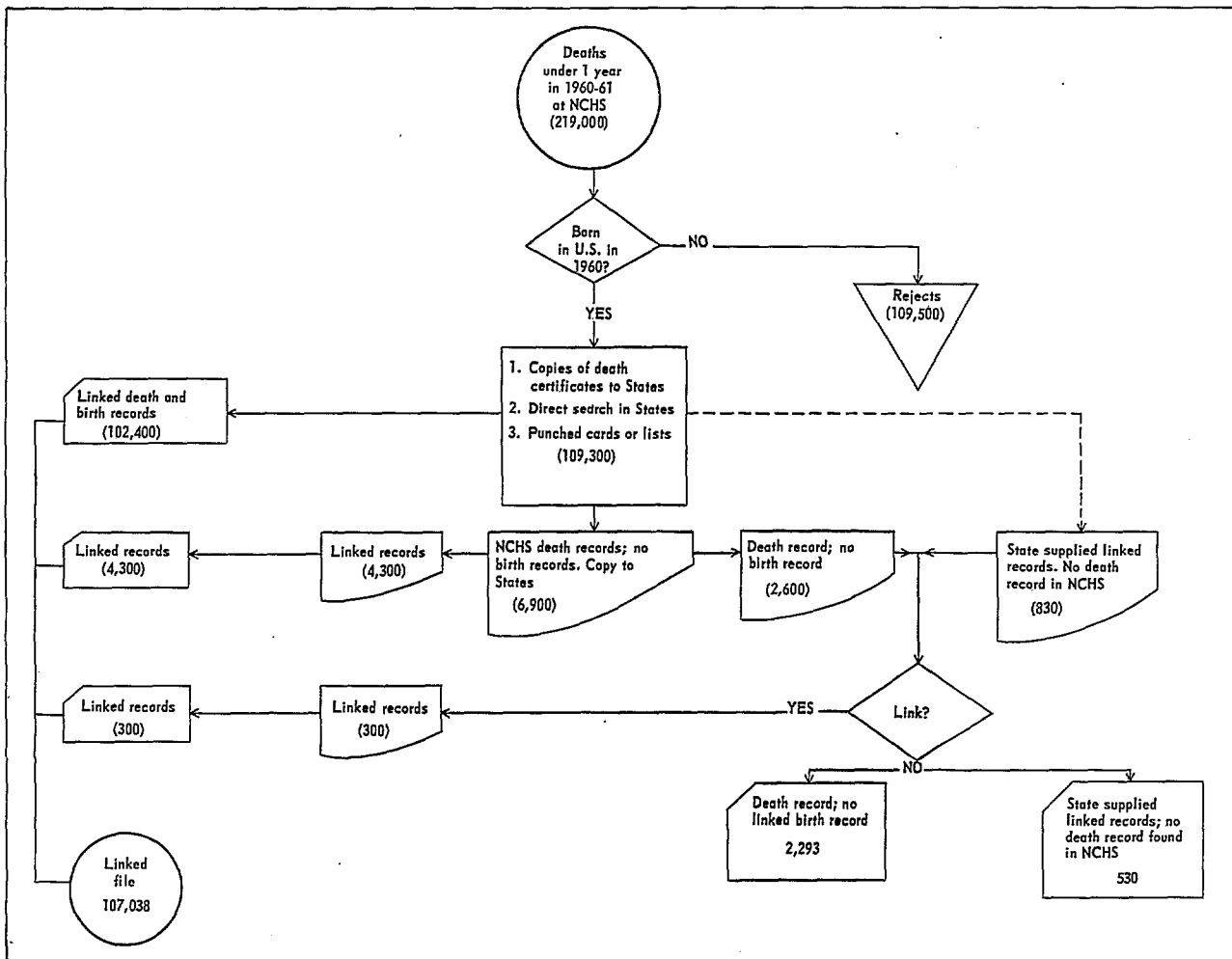


Figure 1. Reconciliation of records for the infant mortality study from linked records.

dures was the three files shown at the bottom of figure 1:

	Number	Percent
Total-----	109,861	100.0
Tape file of linked birth and death records-----	107,038	97.4
Card file of unlinked death records, no birth record found-----	2,293	2.1
Card file of linked records from registration areas, no death record found in NCHS tapes-----	530	0.5

Theoretically the group of 530 linked records should have been added to the 107,038 linked records since they too represented *bona fide* records of infants who were born alive in the United States in 1960 and who died before reaching age 1. At the time of analysis, however, the copies of records had been destroyed, and only the punched cards were available. Since some of the data which were punched into the cards in accordance with State codes were incompatible with the study codes, the cards could not be incorporated with the major file. Fortunately, they represented less than 1 percent of all infant

deaths, and their omission could not seriously bias the results.

## RESULTS

### Color and Sex

Data derived from the files of death records identify certain groups for which the record linkage was more successful than for others. For example, the linking of death records was more successful for white than for nonwhite infants (table A). Birth records could not be found for 1.7 percent of the white and for 3.2 percent of the nonwhite infant deaths. For the total group and within each of the color groups, there was little difference between the two sex groups.

### Age at Death

The distribution of infant death records by color, sex, and age at death is shown in table 1. By age at death, the proportions for which no birth certificates could be found were higher at the two ends of the age range. For deaths occurring within the first hour of life, no birth certificate could be found for 3.1 percent of the deaths. The rate declined in successive age groups to its lowest

Table A. Number and percentage distribution of infant deaths, by sex, type of record, and color: United States, 1960 live birth cohort

Type of record and color	Both sexes			Both sexes		
	Male	Female	Both sexes	Male	Female	
	Number of infant deaths			Percentage distribution		
Total records-----	109,861	63,272	46,589	100.0	100.0	100.0
White-----	81,610	47,444	34,166	100.0	100.0	100.0
Nonwhite-----	28,251	15,828	12,423	100.0	100.0	100.0
Linked records-----	107,038	61,651	45,387	97.4	97.4	97.4
White-----	79,819	46,386	33,433	97.8	97.8	97.9
Nonwhite-----	27,219	15,265	11,954	96.3	96.4	96.2
Unlinked death records-----	2,293	1,315	978	2.1	2.1	2.1
White-----	1,391	820	571	1.7	1.7	1.7
Nonwhite-----	902	495	407	3.2	3.1	3.3
No death record found in NCHS-----	530	306	224	0.5	0.5	0.5
White-----	400	238	162	0.5	0.5	0.5
Nonwhite-----	130	68	62	0.5	0.4	0.4

level at 2 days. It increased, thereafter, reaching its highest level (4.8 percent) in the oldest age group 6-11 months. This same general pattern is repeated for each sex and for each color-sex group. The proportions of unlinked records were higher for nonwhite than for white infants throughout.

### Geographic Variation

As was mentioned earlier, the linkage of the birth and death records began with the identification of the infant deaths. The standard death certificate, after which most State certificates are patterned (appendix III), contains an item requiring the entry of "birthplace (State or foreign country)." The great majority of infant deaths occur in the same States in which the infants are born. However, some prospective mothers cross State lines at the time of birth to reach the nearest hospital, and some infants move with their families from one State to another between birth and death. Thus in order to complete the set of linked records for this study, a certain amount of interstate searching was required. Upon completion of the study file of linked records, it was possible to identify State of birth for the linked and unlinked records and to identify the States with higher proportions of unlinked records. The geographic patterns of these proportions are of interest from two points of view. Statistically, they are of interest because of their possible effect on the mortality rates by geographic area. Administratively, they are of interest because they reflect deficiencies in functional registration.

The presentation of mortality rates in geographic detail is generally according to the mother's residence at time of the infant's birth. However, this information is not part of the death record and, as a consequence, data are not available for unlinked records by mother's residence. On the other hand, the death certificate includes the birthplace, and this information is also obtainable from live birth records. The following presentation is based on data by *place* of birth, and therefore relates more specifically to the registration than to the mortality aspects of the study. While the data can be used to assess the statistical effect of linkage failures for some

States where residence and birthplace are highly correlated, in other States any such transference of meaning should be avoided because of the disparity between the geographic allocation of residence and place of birth. (The degree of concordance of these two variables for individual States is shown in table 2.)

The results of the linkage of infant death and live birth records by State of birth are shown in table B. Among the 2,293 unlinked records there were 101 infant death records which failed to specify the State of birth and which were not linked by the States themselves. Of the remaining 2,192 unlinked records, the largest number of infants (395) was purported to have been born in Texas. Other States with 100 or more such events were also States with large populations: California (118), New York (165), and Pennsylvania (138).

The percentage of unlinked records by geographic division ranged from a low of 1.0 percent for the East North Central Division to a high of 4.4 percent in the West South Central Division. For individual States, the percentage of unlinked records varied from zero for Hawaii to 7.9 percent for New Mexico (fig. 2). Birth certificates could not be found for 5.0 percent or more of the infant deaths which were stated to have been born in Arkansas (6.2), New Mexico (7.9), Texas (5.6), and Utah (5.0).

When the States were divided into four approximately equal sized groups; the States in the quartile with the highest proportions of unlinked records were chiefly in the Southwest (Arizona, New Mexico, Texas) and northward east of the Rocky Mountains to the Canadian border (Nevada, Utah, Idaho). In the highest quartile, the only other instance of contiguous States was Maine and New Hampshire in the northeast corner of the country. The remaining States in the highest quartile were geographically separated: Arkansas, Kentucky, Rhode Island, South Carolina, and South Dakota.

*Color.*—The proportions of unlinked records demonstrate some interesting geographic differences by color (table C). The 530 records were omitted from this table because at the time of final analysis, they were no longer available for tabulation by State of birth and color. Their omission can, however, have little effect on the

Table B. Number and percentage distribution of infant deaths, by type of record: United States, each division and State, 1960 live birth cohort

State of birth	Total	Linked records	Unlinked death records	No death record found in NCHS	Total	Linked records	Unlinked death records	No death record found in NCHS
	Number of infant deaths				Percentage distribution			
United States-----	109,861	107,038	12,293	530	100.0	97.4	2.1	0.5
Geographic division:								
New England-----	5,233	5,063	142	28	100.0	96.8	2.7	0.5
Middle Atlantic-----	17,763	17,297	366	100	100.0	97.4	2.1	0.6
East North Central-----	20,960	20,662	207	91	100.0	98.6	1.0	0.4
West North Central-----	8,512	8,351	101	60	100.0	98.1	1.2	0.7
South Atlantic-----	19,005	18,615	295	95	100.0	97.9	1.6	0.5
East South Central-----	9,368	9,117	222	29	100.0	97.3	2.4	0.3
West South Central-----	12,295	11,712	541	42	100.0	95.3	4.4	0.3
Mountain-----	4,998	4,765	189	44	100.0	95.3	3.8	0.9
Pacific-----	11,626	11,456	129	41	100.0	98.5	1.1	0.4
New England:								
Maine-----	598	579	19	-	100.0	96.8	3.2	-
New Hampshire-----	345	330	14	1	100.0	95.7	4.1	0.3
Vermont-----	221	216	4	1	100.0	97.7	1.8	0.5
Massachusetts-----	2,476	2,405	60	11	100.0	97.1	2.4	0.4
Rhode Island-----	420	405	15	-	100.0	96.4	3.6	-
Connecticut-----	1,173	1,128	30	15	100.0	96.2	2.6	1.3
Middle Atlantic:								
New York-----	8,660	8,431	165	64	100.0	97.4	1.9	0.7
New Jersey-----	3,112	3,034	63	15	100.0	97.5	2.0	0.5
Pennsylvania-----	5,991	5,832	138	21	100.0	97.3	2.3	0.4
East North Central:								
Ohio-----	5,456	5,406	26	24	100.0	99.1	0.5	0.4
Indiana-----	2,788	2,717	57	14	100.0	97.5	2.0	0.5
Illinois-----	5,837	5,760	46	31	100.0	98.7	0.8	0.5
Michigan-----	4,706	4,635	61	10	100.0	98.5	1.3	0.2
Wisconsin-----	2,173	2,144	17	12	100.0	98.7	0.8	0.6
West North Central:								
Minnesota-----	1,894	1,866	16	12	100.0	98.5	0.8	0.6
Iowa-----	1,388	1,377	3	8	100.0	99.2	0.2	0.6
Missouri-----	2,438	2,377	40	21	100.0	97.5	1.6	0.9
North Dakota-----	407	405	2	-	100.0	99.5	0.5	-
South Dakota-----	507	472	24	11	100.0	93.1	4.7	2.2
Nebraska-----	767	764	3	-	100.0	99.6	0.4	-
Kansas-----	1,111	1,090	13	8	100.0	98.1	1.2	0.7
South Atlantic:								
Delaware-----	273	266	6	1	100.0	97.4	2.2	0.4
Maryland-----	1,900	1,868	24	8	100.0	98.3	1.3	0.4
District of Columbia-----	967	945	17	5	100.0	97.7	1.8	0.5
Virginia-----	2,670	2,605	50	15	100.0	97.6	1.9	0.6
West Virginia-----	1,049	1,016	23	10	100.0	96.9	2.2	1.0
North Carolina-----	3,464	3,400	53	11	100.0	98.2	1.5	0.3
South Carolina-----	2,044	1,959	76	9	100.0	95.8	3.7	0.4
Georgia-----	3,230	3,186	29	15	100.0	98.6	0.9	0.5
Florida-----	3,408	3,370	17	21	100.0	98.9	0.5	0.6
East South Central:								
Kentucky-----	2,030	1,929	95	6	100.0	95.0	4.7	0.3
Tennessee-----	2,459	2,435	13	11	100.0	99.0	0.5	0.4
Alabama-----	2,495	2,430	60	5	100.0	97.4	2.4	0.2
Mississippi-----	2,384	2,323	54	7	100.0	97.4	2.3	0.3
West South Central:								
Arkansas-----	1,105	1,026	69	10	100.0	92.9	6.2	0.9
Louisiana-----	2,827	2,770	52	5	100.0	98.0	1.8	0.2
Oklahoma-----	1,278	1,245	25	8	100.0	97.4	2.0	0.6
Texas-----	7,085	6,671	395	19	100.0	94.2	5.6	0.3
Mountain:								
Montana-----	419	413	2	4	100.0	98.6	0.5	1.0
Idaho-----	387	361	19	7	100.0	93.3	4.9	1.8
Wyoming-----	227	223	3	1	100.0	98.2	1.3	0.4
Colorado-----	1,192	1,166	19	7	100.0	97.8	1.6	0.6
New Mexico-----	939	862	74	3	100.0	91.8	7.9	0.3
Arizona-----	1,096	1,051	39	6	100.0	95.9	3.6	0.5
Utah-----	516	482	26	8	100.0	93.4	5.0	1.6
Nevada-----	222	207	7	8	100.0	93.2	3.2	3.6
Pacific:								
Washington-----	1,525	1,503	7	15	100.0	98.6	0.5	1.0
Oregon-----	904	893	2	9	100.0	98.8	0.2	1.0
California-----	8,511	8,380	118	13	100.0	98.5	1.4	0.2
Alaska-----	294	290	2	2	100.0	98.6	0.7	0.7
Hawaii-----	392	390	-	2	100.0	99.5	-	0.5

<sup>1</sup>Includes 101 infant deaths for which the place of birth was unknown or not stated.





Table C. Number of infant deaths and percent unlinked infant death records, by color:  
United States, each division and State, 1960 live birth cohort

Division and State of birth	Total	White	Non-white	Total	White	Non-white
	Number of infant deaths			Percent unlinked death records		
United States-----	109,331	81,210	28,121	2.1	1.7	3.2
Geographic division:						
New England-----	5,205	4,866	339	2.7	2.7	2.7
Middle Atlantic-----	17,663	13,870	3,793	2.1	2.0	2.5
East North Central-----	20,869	17,131	3,738	1.0	0.8	1.9
West North Central-----	8,452	7,438	1,014	1.2	1.0	2.7
South Atlantic-----	18,910	10,336	8,574	1.6	1.0	2.2
East South Central-----	9,339	5,314	4,025	2.4	2.0	2.9
West South Central-----	12,253	8,299	3,954	4.4	3.5	6.3
Mountain-----	4,954	4,269	685	3.8	2.8	10.1
Pacific-----	11,585	9,625	1,960	1.1	1.0	1.8
New England:						
Maine-----	598	594	4	3.2	3.2	(1)
New Hampshire-----	344	343	1	4.1	4.1	(1)
Vermont-----	220	220	-	1.8	1.8	...
Massachusetts-----	2,465	2,306	159	2.4	2.3	3.8
Rhode Island-----	420	384	36	3.6	3.9	2-
Connecticut-----	1,158	1,019	139	2.6	2.6	2.2
Middle Atlantic:						
New York-----	8,596	6,650	1,946	1.9	2.0	1.6
New Jersey-----	3,097	2,377	720	2.0	1.6	3.3
Pennsylvania-----	5,970	4,843	1,127	2.3	2.0	3.5
East North Central:						
Ohio-----	5,432	4,500	932	0.5	0.4	1.1
Indiana-----	2,774	2,413	361	2.1	1.9	3.3
Illinois-----	5,806	4,373	1,433	0.8	0.8	0.8
Michigan-----	4,696	3,839	857	1.3	0.7	4.2
Wisconsin-----	2,161	2,006	155	0.8	0.7	1.3
West North Central:						
Minnesota-----	1,882	1,825	57	0.9	0.8	<sup>2</sup> 1.8
Iowa-----	1,380	1,342	38	0.2	0.1	<sup>2</sup> 2.6
Missouri-----	2,417	1,809	608	1.7	1.3	2.6
North Dakota-----	407	377	30	0.5	0.5	2-
South Dakota-----	496	396	100	4.8	4.0	8.0
Nebraska-----	767	710	57	0.4	0.4	2-
Kansas-----	1,103	979	124	1.2	1.2	0.8

See footnotes at end of table.

Table C. Number of infant deaths and percent unlinked infant death records, by color: United States, each division and State, 1960 live birth cohort—Con.

Division and State of birth	Number of infant deaths			Percent unlinked death records		
	Total	White	Non-white	Total	White	Non-white
<b>South Atlantic:</b>						
Delaware-----	272	167	105	2.2	2.4	1.9
Maryland-----	1,892	1,130	762	1.3	1.3	1.2
District of Columbia-----	962	415	547	1.8	1.0	2.4
Virginia-----	2,655	1,620	1,035	1.9	1.4	2.7
West Virginia-----	1,039	976	63	2.2	1.9	<sup>2</sup> 6.3
North Carolina-----	3,453	1,680	1,773	1.5	0.8	2.2
South Carolina-----	2,035	824	1,211	3.7	1.6	5.2
Georgia-----	3,215	1,542	1,673	0.9	0.5	1.3
Florida-----	3,387	1,982	1,405	0.5	0.4	0.6
<b>East South Central:</b>						
Kentucky-----	2,024	1,721	303	4.7	4.2	7.6
Tennessee-----	2,448	1,667	781	0.5	0.4	0.9
Alabama-----	2,490	1,228	1,262	2.4	1.9	2.9
Mississippi-----	2,377	698	1,679	2.3	0.7	2.9
<b>West South Central:</b>						
Arkansas-----	1,095	624	471	6.3	2.9	10.8
Louisiana-----	2,822	1,228	1,594	1.8	0.7	2.8
Oklahoma-----	1,270	986	284	2.0	1.6	3.2
Texas-----	7,066	5,461	1,605	5.6	4.5	9.2
<b>Mountain:</b>						
Montana-----	415	369	46	0.5	0.5	<sup>2</sup> -
Idaho-----	380	365	15	5.0	4.9	(1)
Wyoming-----	226	212	14	1.3	1.4	(1)
Colorado-----	1,185	1,113	72	1.6	1.6	<sup>2</sup> 1.4
New Mexico-----	936	781	155	7.9	4.9	23.2
Arizona-----	1,090	765	325	3.6	1.7	8.0
Utah-----	508	482	26	5.1	4.4	<sup>2</sup> 19.2
Nevada-----	214	182	32	3.3	3.8	<sup>2</sup> -
<b>Pacific:</b>						
Washington-----	1,510	1,381	129	0.5	0.4	0.8
Oregon-----	895	851	44	0.2	0.2	<sup>2</sup> -
California-----	8,498	7,153	1,345	1.4	1.2	2.5
Alaska-----	292	136	156	0.7	0.7	0.6
Hawaii-----	390	104	286	-	-	-
Not stated-----	101	62	39	...	...	...

<sup>1</sup>Percent not shown; based on less than 20 deaths.

<sup>2</sup>Based on at least 20, but less than 100 deaths.

States and the District of Columbia by the proportion of resident births occurring outside hospitals in 1960 and the percent of unlinked death records in the present study. Data for place of birth (in or outside hospitals) are by State of residence, and data for unlinked records are by place of occurrence of birth. For the country as a whole, 97.5 percent of all live births to residents of individual States occurred in the same States, and only 2.5 percent occurred in other than the States of residence. For individual States, the percentage was over 90 percent except for Maryland and New Hampshire (table 2).

The upper left quadrant of table D shows a concentration of States with relatively few births occurring outside hospitals and with relatively few unlinked infant death records. The two characteristics are not invariably associated,

however, because the upper right quadrant of the table shows a smaller number of States with relatively few births occurring outside hospitals but with higher proportions of unlinked infant death records. Although virtually all the live births in the latter States occurred in hospitals, there was comparatively less success linking the records than in the States in the upper left quadrant. The States in the upper right quadrant are relatively small in population, but in each instance the percentage of unlinked records was based on at least 200 infant deaths.

The lower left quadrant consists of States with higher proportions of births occurring outside hospitals, but with relatively few unlinked infant death records. This suggests that, despite fairly high proportions of births occurring outside hospitals, it is possible to achieve a fairly high

Table D. Distribution of States by percent of infants born outside hospitals and percent unlinked infant death records: United States, 1960 live birth cohort

Percent born outside hospitals	Number of States	Unlinked death records (percent)							
		Less than 1.0	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9
Total-----	51	15	13	10	5	3	3	1	1
Less than 1.0-----	24	Hawaii Iowa Minn. Nebraska N. Dakota Ohio Oregon Wash. Wis.	Calif. Kansas Michigan New York Wyoming	Conn. Indiana Mass. N. Jersey Pa.	Nevada Rhode Is.	(N.H.)	Idaho Utah		
1.0-1.9-----	9	Illinois Montana	Colorado D.C. Vermont	Delaware Oklahoma	Maine	S. Dakota			
2.0-2.9-----	2		(Md.) Missouri						
3.0-3.9-----	2			W. Va.	Arizona				
4.0-4.9-----	1		La.						
5.0-9.9-----	8	Alaska Florida Tenn.	N.C. Virginia			Kentucky	Texas		N. Mex.
10.0-14.9-----	2	Georgia						Arkansas	
15.0-19.9-----	2			Alabama	S.C.				
20.0 or more-----	1			Miss.					

NOTE: Table includes 50 States and the District of Columbia. States in parentheses have less than 90 percent of resident births occurring within the same State: Maryland (84.6 percent) and New Hampshire (87.3 percent).

degree of record linkage of infant death and live birth records.

The lower right quadrant of the table contains those relatively few States with higher proportions of live births occurring outside hospitals, and with high proportions of unlinked records. In summary, the data imply that although registration and record linkage are somewhat related to the level of hospital deliveries, other factors are operating also.

*Hospital delivery and color.*—When the geographic data are further subdivided by color, some of the patterns are brought even more sharply into focus (table 3). For white infants, the proportions of live births occurring outside hospitals were quite low for almost all States. Only three States had proportions higher than 5 percent: Kentucky (5.6), New Mexico (5.2), and Texas (5.7). In marked contrast, the proportions of nonwhite live births occurring outside hospitals were much higher, and in some States the proportion was almost 50 percent. The data in table 3 show the wide variation in the pattern of hospital deliveries for nonwhite infants and record linkage for individual States. Among the Southeastern States (those in the South Atlantic and East South Central Divisions, primarily), virtually all nonwhite infants were Negro (table 4). In a number of these States the proportion of nonwhite infants who were born outside hospitals was high, but the deficiency in record linkage was not nearly of the same magnitude:

State	Nonwhite infants born outside hospitals	Unlinked records among nonwhite infant deaths
	Percent	
Alabama-----	45.2	2.9
Florida-----	19.5	0.6
Georgia-----	31.9	1.3
Kentucky-----	10.5	7.6
Mississippi-----	49.4	2.9
North Carolina-----	25.2	2.2
South Carolina-----	39.9	5.2
Tennessee-----	14.6	0.9
Virginia-----	24.3	2.7

In each of these States the proportion of unlinked records for nonwhite infants exceeded that for white. In some States, however, the proportion of unlinked records for nonwhite infant deaths was below the national average of linkage failures for white infants (1.7 percent). Despite the large numbers of live births occurring outside hospitals in these States, it seems that the records for most infants who died during the first year of life were linked.

Among States having nonwhite populations which are predominantly American Indian, examples of the reverse situation are found:

State	Nonwhite infants born outside hospitals	Unlinked records among nonwhite infant deaths
	Percent	
Arizona-----	8.2	8.0
New Mexico-----	5.6	23.2
Utah-----	5.8	19.2

The 1950 test of birth registration completeness, which by design included all live births which occurred during January-March 1950, found that "the Indian had the poorest record of registration completeness (85.1 percent)."<sup>5</sup> The high proportion of unlinked records found in the present study for these areas was probably due, in part, to incomplete birth registration and, in part, to the structure of the American Indian names.

In attempting to interpret the remarks made here with regard to registration, it must be remembered that only that small portion of live birth registration which relates to infant deaths is represented in this report. The far greater number of liveborn infants who survived the infant period is not included. Yet, even the limited data shown here demonstrate deficiencies in the present vital records and vital statistics system.

## Cause of Death

The distributions of the 107,038 linked and 2,293 unlinked death records by cause of death are shown in table 5. Cause-of-death information is not available for the 530 deaths for which no record could be found in the Center's computer tapes, and this group of records is omitted from the table.

Unlinked records were widely distributed over the causes of death. In the infant and, more specifically, the neonatal periods, there were higher concentrations among unlinked records than among linked records of the causes associated with extrinsic rather than intrinsic factors: the infective and parasitic cause group (ICD cause numbers 001-138); influenza, pneumonia, and other respiratory diseases (480-527, 763); digestive diseases (530-587, 764); and homicide (E964, E980-E984). The excess in the last mentioned group is probably associated with unidentified dead foundlings since 72 of the 75 deaths in this group were allocated to the cause number used for such deaths (E983, assault by other means).

## Age of Mother

The percentage distribution of live births and infant deaths by color and age of mother is shown in table 6. In comparison with the group of linked records, records which could not be found in the Center's computer tapes showed a somewhat higher concentration among mothers under 25 years of age for both the white and nonwhite groups. Since the mother's age appears on the birth record but not on the death record, no information is available for the group of 2,293 records for which birth certificates could not be found, and these are omitted. There is, therefore, no estimate of the effect of linkage failure in infant mortality rates by age of mother.

## Birth Weight and Period of Gestation

The percentage distributions of live births and infant deaths by color and birth weight are shown in table 7, and by color and gestation in table 8. As in the table by age of mother, there was no information available on the birth characteris-

tics for the 2,293 records for which the birth certificates could not be found in either the Center's computer tapes or in the purported State of birth. Consequently, estimates of the effect of linkage failures on infant mortality rates by birth weight or period of gestation are not available.

Among the 530 records which could not be located in the Center's tapes, there was a greater concentration of heavier babies (table 7) and of infants with longer gestation periods (table 8) than among linked records. When the data were examined by age at death (table 1), a greater concentration of deaths in the postneonatal period was found:

Age	Linked records	No death record found in NCHS
	Percentage distribution	
Under 1 year----	100.0	100.0
Under 28 days-----	73.2	17.4
28 days-11 months----	26.8	68.3
Not stated-----	-	14.3

The same relationship was found for both white and nonwhite infants, and it was particularly strong for period of gestation. This suggests that the failure to find the 530 records in the Center's computer tapes was not related to prematurity or to early postnatal death, but may be related to other problems such as the spelling or structure of names, mobility of the population, or to delayed death registration.

## DISCUSSION

The accumulation of the data needed to conduct the cohort infant mortality study provided an opportunity to examine on a nationwide scale the success with which the birth certificates for the cohort were found in a Federal-State cooperative vital statistics system. Of the total of 109,861 eligible infant deaths which were identified by any

of the procedures which were used, live birth certificates were found for 107,038 (97.4 percent).

### Implications for Registration of Live Births

Interest in the completeness of birth and death registration is twofold. Legally, it is related to the ability or inability to produce legal records of vital events when they are needed. Statistically, the interest revolves around the assessment of the quality of the statistical information produced from the records for cohort studies of infant mortality.

One small group of linked records (530 or 0.5 percent) was supplied by the States but could not be located in the Center's computer tapes of death records. Since registration functions are carried out at the State level, the failure to locate these 530 records at the Center was not considered to be a deficiency in registration because the records were on file in the States, and the information was supplied by the registration offices when it was needed. These records may represent a deficiency in the national statistics, but since they constitute less than 1 percent of the deaths, they do not seriously affect the level of the infant mortality rates. The percent of records in this group of 530 records was not affected by sex or color (table A), and was affected in only a few instances by State of birth (table B). Age at death was not specified on 76 of the 530 records, but since the State offices were able to link the records, the omission of age at death may have been a deficiency in the preparation of the study punched cards or the computer tapes at the Center. Compared with the linked records, this group of records showed slightly more mothers under 25 years (table 6), greater concentrations of heavier infants (table 7), infants with longer periods of gestation (table 8), and postneonatal deaths (table 1). These irregularities may be associated with delayed death registration at the State level which caused the tape record to be placed on a later tape at the Center, or with punching errors which showed the age at death to be over 1 year or with births in a year other than 1960. Because these records represented only 0.5 percent of the infant deaths, they were considered to be the sum of a number of minor aberrations and within tolerable limits for the subject under study.

The group of 2,293 unlinked records may, to some degree, be indicative of failures in birth registration. Although the proportions of deaths which were unlinked do not represent all live births which were not registered, they represent that portion of live births which relate to infant death and are therefore pertinent to this study. The proportion of infant death records for which no birth record could be found was higher for nonwhite (3.2 percent) than for white infants (1.7 percent), but there was no essential difference by sex in the total group or in either of the two major color groups.

By age at death, the proportions of unlinked records were higher for infants who died within the first hour of life (3.1 percent) and during the intervals 28 days-5 months (3.3 percent) and 6-11 months of age (4.8 percent) than for those who died at the intermediate ages (1.0-2.5 percent). The percentage was lowest for infants who died at 2 days (1.0 percent), and it increased thereafter throughout the remainder of the age range. The same general pattern was evident for both white and nonwhite infants, but the percentage unlinked was higher for the nonwhite infants in each age group. There was no evidence of a sex differential within the total group or in either of the two major color groups.

The elevations at the two extremes of the infant age scale for both white and nonwhite infants suggest that two separate sets of factors were operating. For infants who died within an hour of birth, birth certificates could not be found for 3.1 percent of the death records. The reasons are probably related to the early demise of the infant. About one-fifth of the unlinked death records for infants who died within an hour of birth appeared to be for unidentified foundlings; for these records, linkage failure was due to the lack of identity of the deceased. Other failures to link records may have been associated with delivery of the infant at home when registration is sometimes overlooked or with an oversight on the part of hospital staffs to file a birth certificate in those instances when infants died very soon after birth. Optimum record linkage occurred for infants who survived the first hour of life, but who died during the remainder of the first week of life.

Higher percentages of unlinked records also occurred for infants who died after the first

week of life. For these infants, the proportions of unlinked records increased with age at death. After the first hour of life, the percentage of unlinked infant deaths was highest in the last 6 months of the first year (4.8 percent).

Registration problems associated with the older infant age groups are quite different from those associated with death in the first hour of life. After the first week of life, virtually all infants have left the hospital, and as they survive to older ages the possibilities of name changes due to adoption or other changes in family affiliation increase. With time, there are also changes in residence which may make it more difficult to link the death and birth records. The effect of the mobility of the population would be expected to increase as time from birth increases, and such a trend is suggested in the data.

One perplexing group of records was about 500 death records for infants who died in hospitals at an early age (3 days or less) and whose birth records could not be found. Since a high proportion of live births occur in hospitals (96.6 percent in 1960), it was felt that either the birth records should have been prepared at the hospital or that the hospital should have had enough information available to determine where the birth occurred. Because of the long delay in pursuing this aspect of the study, it was not feasible to contact all of the States on the subject. The registrars of a few States offered to look into the matter because they were particularly interested in identifying the source of the difficulty.

In Mississippi, 11 such deaths were investigated. It was found that of the 11, nine of the infants were born outside hospitals (five were stated to have been born at home). The other two infants were born in hospitals, but no birth record had been filed for one and neither a birth record nor a death record could be found at the hospital for the other.

In North Carolina, the vital records were searched and copies of nine missing birth records were found which had been filed with the local registrars from 4 to 14 months after the deaths of the infants. Seven of the nine records were filed from 4 to 7 months after death. These records were clustered by date of filing, suggesting that they were identified through some Statewide linkage procedure and that efforts were made to

obtain a delayed birth registration for each child. Among this group of nine infants, three were born at home and six were born in hospitals.

In New York City only two such events were identified for further search: one was born at home and the other in a hospital. The results of these fragmentary investigations indicated that continued effort is needed to stimulate complete birth registration, and that birth registration is not complete for infants who are born inside as well as for those born outside hospitals.

Tabulations by State of birth are particularly relevant to the process of registration. Tables B and C indicate States where some of the greatest deficiencies exist and where further educational efforts may be needed. The proportion of unlinked infant death records ranged from zero for the State of Hawaii to 7.9 percent for New Mexico. All of the States with percentages of 5.0 percent or higher were among the States in the West South Central and Mountain Divisions.

The higher rates of unlinked records were not associated with the size of the 50 States as determined by population size, but showed some association with population density (population per square mile):

Density	Number of States	Percent unlinked	Range
0.4- 18.4---	13	2.8	0.2-7.9
26.6- 64.0---	12	3.0	0.2-5.6
67.3-100.4---	13	1.6	0-4.7
128.9-812.4---	12	1.6	0.5-3.6

The two less densely populated quartiles show higher proportions of unlinked records than the more densely populated quartiles. The lower limits of the range did not differ much, a result of approaching an irreducible minimum. However, the upper limits of the range decreased steadily with increasing population density.

For most States, there appeared to be a positive association between the proportion of live births that occurred in hospitals and the success in record linkage (table D). Particularly among nonwhite infants, a number of States with

high proportions of live births outside hospitals had fairly low proportions of unlinked records. These States had large proportions of Negro births among the nonwhite group. A few States with low proportions of births outside hospitals had high proportions of unlinked records. In these States, the American Indians were the predominant nonwhite constituent. These patterns are consistent with those shown in earlier studies of birth registration completeness, which demonstrated that registration was less complete for nonwhite than for white infants, and poorest for American Indians.<sup>5</sup>

Registration of live births has been shown to be more complete for live births occurring in hospitals than for those occurring outside hospitals in both the 1940 and 1950 tests of registration completeness.<sup>4,5</sup> From spot checks in three areas in the present study, it is apparent that incomplete registration still exists for infants born in hospitals as well as for those born outside hospitals. Routine record linkage of infant death and live birth records is one way of monitoring at least a portion of incomplete birth registration.

Record linkage has also been useful in detecting a portion of incomplete death registration. A study in North Carolina linked live birth records for infants who weighed 1,500 grams or less at birth to the death records.<sup>6</sup> The purpose of the study was to determine whether there were any unregistered deaths among this group. Since these very small infants rarely survive, virtually all of these infants should have appeared in the death register, and by using hospital records, the death or survival of each infant was verified. The study demonstrated that 6.3 percent of the deaths among these very small infants were not registered. Such record linkage studies are useful in discussing registration completeness with hospital staffs. However, the discussions with hospital personnel will have little effect on the registration of births which occur outside hospitals. As an example, in 1960, 27.3 percent of the live births to residents of Mississippi occurred outside hospitals. In such States, where significant numbers of live births occur outside hospitals, educational efforts must be much more widespread to include physicians and midwives who attend deliveries outside hospitals as well as hospital staffs. It is generally admitted that the births which are least likely to be

registered are those which are unattended by any member of the medical or paramedical groups. Another problem is associated with sparsely populated States where the distance from place of birth to the registration office also presents deterrents to complete registration.

In addition to the possibility of an outright failure to register a birth, a number of other obstacles to record linkage should be mentioned. If the infant's name is not spelled consistently on the birth and infant death records, it may be impossible to link the records. If the two documents are prepared in different settings by different individuals, it is easy to imagine such inconsistencies occurring. Minor deviations in spelling can sometimes be allowed for in searching for birth records, but inconsistent spelling cannot be overcome in all instances. In addition, the structure of the names of certain subgroups of the population are also known to present deterrents to record linkage. Indian names—because of their structure—present a particular problem in record linkage for this subgroup of nonwhite infants. Names of Spanish origin which are often but not consistently compounded are frequently encountered in New Mexico and Texas and may contribute to the higher proportions of unlinked records among white infant deaths in States with sizable Spanish-American populations.

Another obstacle to record linkage may be the improper entry of the State of birth on the infant death record. If the State of birth is incorrectly given on the death certificate, the birth record may be irretrievable unless a search is conducted in each of the States, a time-consuming operation. This possible source of difficulty is felt to be of some relevance among Mexicans or Mexican Americans who crossed over into States bordering Mexico and who erroneously reported a State in the United States as the place of birth on the infant's death certificate.

In some cases, the legitimation or adoption of an infant may impede record linkage. When such legal procedures take place, it is necessary to revise or replace the birth record to reflect a change in name. If the infant dies before legal steps are completed and the changes have been reflected in the birth record, the names of the infant on the death and live birth records may not



correspond. In such instances, it may be impossible to link the records.

Finally, there are those relatively infrequent instances illustrated by an unidentified dead foundling whose birth was probably not registered, and whose name and place of birth were unknown at time of discovery. It is impossible to provide linked birth records for such infant deaths.

#### Relationship to Birth Registration Completeness

It was pointed out earlier that failures in record linkage in the present study cannot be interpreted to represent overall percentages of incomplete birth registration for 1960. Nevertheless, in combination with the events of January-March 1950, the data suggest that live birth registration has improved:

Class of records	Total	White	Non-white
	Percent unlinked records		
1960:			
Infant death-----	2.1	1.7	3.2
Neonatal death-----	1.5	1.2	2.4
January-March 1950:			
Neonatal death <sup>7</sup> --	2.4	2.0	4.6
Live birth <sup>5</sup> -----	2.1	1.4	6.5

In the earlier study, record linkage between infant cards and vital records was a little better for live births (97.9 percent) than for neonatal deaths (97.6 percent). Over the decade, the linkage of neonatal deaths and live birth records appears to have improved. The linkage of neonatal deaths was 97.6 percent in the earlier study (infant cards and vital records), and 98.5 percent in the later study (infant death and live birth records). If the same relationship between live births and neonatal deaths which was found in January-March 1950 continued to exist in 1960,

then the registration of live births would be expected to be more than 98.5 percent complete in 1960. Independent estimates of birth registration completeness for 1960, which were prepared by the Division of Vital Statistics, NCHS, are as follows:<sup>8</sup>

<i>Percent</i>	
United States----	98.9
White -----	99.3
Nonwhite -----	96.4

#### Implications for Record Linkage Studies

The data from the 1960 cohort study also provided insights into the possible effects of conducting linkage studies at the State level. A high proportion of infants who died before reaching age 1 apparently were born in the same State where the death occurred: nationally, the proportion was 97.9 percent (table E). For individual States, the proportions were at least 94.8 percent, and in one instance (California) reached virtually 100 percent (table 9). If the areas of consideration are

Table E. Number and percentage distribution of infant deaths, by place of birth and place of death and type of record: United States, 1960 live birth cohort

Type of record	All infant deaths	Born and died in same State	Born in State other than State of death
Number of infant deaths			
Total records-----	109,331	107,028	2,308
Linked records-----	107,038	105,229	1,809
Unlinked death records--	2,293	1,799	494
Percentage distribution			
Total records-----	100.0	100.0	100.0
Linked records-----	97.9	98.3	78.5
Unlinked death records--	2.1	1.7	21.5
Total records-----	100.0	97.9	2.1
Linked records-----	100.0	98.3	1.7
Unlinked death records--	100.0	78.5	21.5

enlarged to encompass geographic divisions, at least 97.2 percent of the infant deaths recorded in any division related to infants who were born in the same geographic division.

Based on the information provided on the death records, the linkage of records was more likely to be successful if the birth and death occurred in the same State (98.3 percent) than if they occurred in different States (78.5 percent). An element which cannot be overlooked is the possibility that among the 2,293 unlinked death records there may have been a number of records with the State of birth incorrectly entered. Had the 2,293 unlinked death records been available at the time of final analysis, it would have been possible to search for at least a sample of them in all States and, thus, to estimate how often the State of birth was incorrectly entered on the death records. However, since the records were no longer available, this avenue of investigation was closed.

In any event, the linkage of infant death and live birth records was largely an intrastate matter: nationwide, the State of birth and State of death agreed and the records were linked for 96.2 percent of the infant deaths. For individual States, there was concurrence between State of birth and death, and the records were linked for at least 91.7 percent of the cases. If the area of consideration is enlarged to include geographic divisions rather than individual States, the rate of concurrence and linkage is increased to at least 94.0 percent. These findings are encouraging to the conduct of linked record studies of infant mortality in each of the States. At least 90 percent of this type of record linkage can be accomplished within any State's own record system.

Possible exceptions were thought to exist in the three city-State systems where separate central files of vital records are maintained for a major city and for the remainder of the State, i.e., Baltimore and Maryland, New Orleans and Louisiana, New York City and Upstate New York (New York State exclusive of New York City). From another cohort study based on linked records which was conducted in Upstate New York, an estimate of the experience in one such situation was obtained.<sup>9</sup> The study consisted of linking all death certificates for infants and children who died before reaching 5 years of age in the years 1950-

57 to the corresponding live birth records for births which occurred in 1950-52. With particular reference to the infant period, the following was found:

Item	Age at death		
	Under 1 year	Under 28 days	28 days-11 months
Infant deaths recorded in Upstate New York-----	3,904	2,930	974
Born in Upstate New York---	3,806	2,913	893
Certificate found-----	3,803	2,911	892
Certificate not found----	3	2	1
Born in New York City or in other States-----	89	10	79
Place of birth not stated--	9	7	2

Live birth certificates for 97.5 percent of the infants who were born in Upstate New York during 1950-52 and who died in that area during 1950-53 were found within the State's own filing system without reference to the files of New York City or those of other States. Even in this atypical situation, where two sets of permanent files of vital records are maintained within a single State, a large part of record linkage between infant death and live birth records remains an internal matter.

The remaining interstate records needed for such studies of infant mortality are supplied through a system of interstate exchange of transcripts which is conducted by the Division of Vital Statistics (DVS), National Center for Health Statistics. Each registration area periodically sends DVS a photocopy or transcript of each infant death certificate for infants who died before reaching age 1 but who were born in another registration area. Quarterly, the copies are sent to the State of birth. Using these transcripts to supplement their own records, interested investigators in any State can compile a set of infant death records which refer to the total live births which occurred in that State in a given year.

A number of States have successfully instituted routine programs of record linkage of infant death records. As early as 1962, at least 36 States were linking infant or neonatal death records to live birth records annually; 27 States

had programs for the infant period and the remainder for the neonatal period.<sup>10</sup> This activity permits the States to prepare annual tabulations of infant deaths by weight at birth, period of gestation, birth order, age of mother, and other variables shown on birth certificates but not on death certificates. In modern vital statistics, record linkage of infant deaths and live births is becoming an integral part of many of the State vital statistics systems.

### Implications for Infant Mortality Rates

The primary purpose of the 1960 live birth cohort study of infant mortality from which the data in this report were derived was to study infant mortality in relation to a number of characteristics recorded on live birth records. The failure to link all of the infant death records will, in effect, understate to varying degrees the mortality rates which are based on linked records. For example, the infant mortality rate of 25.1 per 1,000 live births based on linked records may be as high as 25.8 per 1,000 live births if the rate is increased to allow for linkage failures.

Of the total of 109,861 infant deaths which were identified in the study, birth certificates could not be found for 2.1 percent. Among the factors analyzed, the sex of the infant showed little relationship to the level of record linkage, while color was an important correlate. Record linkage was less complete for nonwhite than for white infant deaths: 3.2 and 1.7 percent unlinked, respectively.

By age, as well, there were variations in the degree of unlinked records:

	<i>Percent</i>
Under 1 hour-----	3.1
1-23 hours-----	1.1
1 day-----	1.2
2 days-----	1.0
3 days-----	1.5
4-6 days-----	1.5
7-13 days-----	2.2
14-27 days-----	2.5
28 days-5 months-----	3.3
6-11 months-----	4.8

This same general pattern is repeated for each color-sex group. The proportion of unlinked records was higher for nonwhite than white infant deaths throughout the age range.

Among the causes of death, record linkage was poorer for infants dying of causes associated with extrinsic than intrinsic factors. However, this finding may reflect the higher proportions of unlinked records in the postneonatal periods when environmental factors predominate, rather than an association with cause *per se*.

Geographically, the percent of infant death records which were unlinked varied from zero for the State of Hawaii to 7.9 percent for New Mexico. Record linkage was poorest in States with relatively high proportions of American Indians. As a consequence, the infant mortality rates derived from this study for individual States are expected to be deficient to varying degrees.

For nationwide rates, the data presented in this report can be used to gauge the degree to which linkage failures could lead to an understatement of the mortality rates. For State rates, this will not be universally possible. The data in this report are presented by the State of birth, while infant mortality rates are presented by place of mother's residence at the time of the infant's birth. Although there is usually a high degree of concordance between these two characteristics, the degree of concordance was as low as 84.6 percent for the State of Maryland (table 2). Therefore, State data in this report should be used with caution in gauging the understatement of the infant mortality rates in the cohort study. The proportions of unlinked records should be used only as rough guides to assist in determining whether differences in mortality rates could possibly be accounted for on the basis of failures in record linkage.

One other factor could not be examined within the framework of the study. The proportions of unlinked records refer to infant death records for which no linked birth records could be found. However, some infant deaths go unregistered and there are no data available as to their number. Such unregistered infant deaths are not included in the 1960 cohort study in any form. The magnitude of this deficiency remains unknown, but is presumed to be small on a nationwide scale. Its magnitude for some small geographic areas

may not be negligible, but their location and magnitude are unknown.

## CONCLUSION

This report presents the background and study method for a study of infant mortality among the cohort of infants born alive in the United States in 1960. Included are a description of the data collection, the results of record linkage, and a discussion of the implications for the study itself and for vital registration.

The study demonstrated that a high proportion of infant death records can be linked to their respective birth records, thus providing an opportunity for studying infant mortality on a cohort basis. Mortality rates based on a cohort of live

births permit the examination of patterns and relationships associated with characteristics at birth which are unavailable from routinely produced data. Among these characteristics are age of mother, birth order, birth weight, and period of gestation.

The availability of direct observations in relation to these characteristics provides a powerful addition to the knowledge of factors associated with infant mortality. The increased knowledge available from such studies could be useful to those who are seeking to prevent infant death, those who are planning programs to provide care for infants, and to research workers who are interested in relationships between mortality and birth characteristics in the general population as well as in the clinical setting.

## REFERENCES

<sup>1</sup>Moriyama, I. M.: Recent changes in infant mortality trend. *Pub. Health Rep.* 75(5):391-405, May 1960.

<sup>2</sup>Shapiro, S., and Moriyama, I. M.: International trends in infant mortality and their implications for the United States. *Am. J. Pub. Health.* 53:747-760, May 1963.

<sup>3</sup>National Center for Health Statistics: International comparison of perinatal and infant mortality: The United States and six West European countries. *Vital and Health Statistics.* PHS Pub. No. 1000-Series 3-No. 6. Public Health Service. Washington. U.S. Government Printing Office, Mar. 1967.

<sup>4</sup>U.S. Bureau of the Census: Studies in completeness of birth registration, Part I. Completeness of birth registration in the United States, December 1, 1939 to March 31, 1940, by R. D. Grove. *Vital Statistics—Special Reports*, Vol. 17, No. 18. Washington, D.C., Apr. 1943.

<sup>5</sup>National Office of Vital Statistics: Birth registration completeness in the United States and geographic areas, 1950, by S. Shapiro and J. Schachter. *Vital Statistics—Special Reports*, Vol. 39, No. 2. Public Health Service. Washington, D.C., Sept. 1954. pp. 37-93.

<sup>6</sup>Rogers, P. B., Council, C. R., and Abernathy, J. R.: Testing death registration completeness in a group of premature infants. *Pub. Health Rep.* 76(8):717-724, Aug. 1961.

<sup>7</sup>National Center for Health Statistics: Weight at birth and survival of the newborn, United States, early 1950. *Vital and Health Statistics.* PHS Pub. No. 1000-Series 21-No. 3. Public Health Service. Washington. U.S. Government Printing Office, July 1965.

<sup>8</sup>National Center for Health Statistics: *Vital Statistics of the United States, 1960*, Volume I. Public Health Service. Washington. U.S. Government Printing Office, 1962.

<sup>9</sup>Chase, H. C.: Father's occupation, parental age, and infant's birth rank. *The Relationship of Certain Biologic and Socioeconomic Factors to Fetal, Infant, and Early Childhood Mortality*, Part I. Washington, D.C. Children's Bureau, 1964.

<sup>10</sup>National Vital Statistics Division: *Report for Discussion of the Study Group on Guide Material for Comparable Studies on Maternal, Perinatal and Postneonatal Events Reported on Vital Records*, a report by The Public Health Conference on Records and Statistics. Doc. No. 534.6. Public Health Service. Washington, D.C., May 1962.

<sup>11</sup>National Office of Vital Statistics: Part II, Coding and punching geographic and personal particulars. Section B, Births, deaths, and fetal deaths occurring in 1960. *Vital Statistics Instruction Manual.* Public Health Service. Washington, D.C., Oct. 1960.

<sup>12</sup>National Vital Statistics Division: Matched record comparison of birth certificate and census information, United States, 1950, by J. Schachter. *Vital Statistics—Special Reports*, Vol. 47, No. 12. Public Health Service. Washington, D.C., Mar. 1962.



## DETAILED TABLES

		Page
Table 1.	Number and percentage distribution of infant deaths, by type of record, color, sex, and age at death: United States, 1960 live birth cohort-----	23
	2. Live births by place of occurrence and residence, and percent resident of and born in same area: United States, each division and State, 1960 live birth cohort-----	26
	3. Percent of infants born outside hospitals and percent unlinked infant death records, by color: United States, each division and State, 1960 live birth cohort--	28
	4. Live births by specified race and sex: United States, each division and State, 1960 live birth cohort-----	30
	5. Number and percentage distribution of infant death records, by 55 selected causes of death, color, and age at death: United States, 1960 live birth cohort-----	32
	6. Number and percentage distribution of live births and infant deaths, by type of record, color, and age of mother: United States, 1960 live birth cohort-----	36
	7. Number and percentage distribution of live births and infant deaths, by type of record, color, and birth weight: United States, 1960 live birth cohort-----	37
	8. Number and percentage distribution of live births and infant deaths, by type of record, color, and period of gestation: United States, 1960 live birth cohort---	38
	9. Infant deaths by place of birth, place of death, type of record; percent born and died in same area, and percent linked records among infant deaths in area: United States, each division and State, 1960 live birth cohort-----	39

Table 1. Number and percentage distribution of infant deaths, by type of record, color, sex, and age at death: United States, 1960 live birth cohort

Color, sex, and age at death	Total	Linked records	Unlinked death records	No death record found in NCHS	Total	Linked records	Unlinked death records	No death record found in NCHS
<u>TOTAL</u>								
<u>Both sexes</u>								
	Number of infant deaths				Percentage distribution			
All ages-----	109,861	107,038	2,293	530	100.0	97.4	2.1	0.5
Under 1 hour-----	8,078	7,811	251	16	100.0	96.7	3.1	0.2
1-23 hours-----	35,940	35,506	406	28	100.0	98.8	1.1	0.1
1 day-----	11,534	11,388	135	11	100.0	98.7	1.2	0.1
2 days-----	7,530	7,443	75	12	100.0	98.8	1.0	0.2
3 days-----	3,526	3,469	53	4	100.0	98.4	1.5	0.1
4-6 days-----	4,489	4,414	67	8	100.0	98.3	1.5	0.2
7-13 days-----	4,190	4,091	93	6	100.0	97.6	2.2	0.1
14-27 days-----	4,324	4,208	109	7	100.0	97.3	2.5	0.2
Unknown days-----	1	-	1	-	(1)	-	(1)	-
Under 28 days-----	79,612	78,330	1,190	92	100.0	98.4	1.5	0.1
28 days-5 months-----	22,664	21,641	746	277	100.0	95.5	3.3	1.2
6-11 months-----	7,509	7,067	357	85	100.0	94.1	4.8	1.1
Not stated-----	76	-	-	76	100.0	-	-	100.0
<u>Male</u>								
All ages-----	63,272	61,651	1,315	306	100.0	97.4	2.1	0.5
Under 1 hour-----	4,355	4,208	139	8	100.0	96.6	3.2	0.2
1-23 hours-----	20,973	20,720	236	17	100.0	98.8	1.1	0.1
1 day-----	6,843	6,754	83	6	100.0	98.7	1.2	0.1
2 days-----	4,531	4,483	43	5	100.0	98.9	0.9	0.1
3 days-----	2,125	2,094	29	2	100.0	98.5	1.4	0.1
4-6 days-----	2,552	2,508	39	5	100.0	98.3	1.5	0.2
7-13 days-----	2,319	2,265	51	3	100.0	97.7	2.2	0.1
14-27 days-----	2,476	2,410	62	4	100.0	97.3	2.5	0.2
Unknown days-----	-	-	-	-	-	-	-	-
Under 28 days-----	46,174	45,442	682	50	100.0	98.4	1.5	0.1
28 days-5 months-----	12,968	12,360	436	172	100.0	95.3	3.4	1.3
6-11 months-----	4,097	3,849	197	51	100.0	93.9	4.8	1.2
Not stated-----	33	-	-	33	100.0	-	-	100.0
<u>Female</u>								
All ages-----	46,589	45,387	978	224	100.0	97.4	2.1	0.5
Under 1 hour-----	3,723	3,603	112	8	100.0	96.8	3.0	0.2
1-23 hours-----	14,967	14,786	170	11	100.0	98.8	1.1	0.1
1 day-----	4,691	4,634	52	5	100.0	98.8	1.1	0.1
2 days-----	2,999	2,960	32	7	100.0	98.7	1.1	0.2
3 days-----	1,401	1,375	24	2	100.0	98.1	1.7	0.2
4-6 days-----	1,937	1,906	28	3	100.0	98.4	1.4	0.2
7-13 days-----	1,871	1,826	42	3	100.0	97.6	2.2	0.2
14-27 days-----	1,848	1,798	47	3	100.0	97.3	2.5	0.2
Unknown days-----	1	-	1	-	(1)	-	(1)	-
Under 28 days-----	33,438	32,888	508	42	100.0	98.4	1.5	0.1
28 days-5 months-----	9,696	9,281	310	105	100.0	95.7	3.2	1.1
6-11 months-----	3,412	3,218	160	34	100.0	94.3	4.7	1.0
Not stated-----	43	-	-	43	100.0	-	-	100.0

See footnotes at end of table.

Table 1. Number and percentage distribution of infant deaths, by type of record, color, sex, and age at death: United States, 1960 live birth cohort—Con.

Color, sex, and age at death	Total	Linked records	Unlinked death records	No death record found in NCHS	Total	Linked records	Unlinked death records	No death record found in NCHS
<u>WHITE</u>								
<u>Both sexes</u>								
	Number of infant deaths				Percentage distribution			
All ages-----	81,610	79,819	1,391	400	100.0	97.8	1.7	0.5
Under 1 hour-----	6,433	6,241	178	14	100.0	97.0	2.8	0.2
1-23 hours-----	27,925	27,645	256	24	100.0	99.0	0.9	0.1
1 day-----	9,054	8,958	87	9	100.0	98.9	1.0	0.1
2 days-----	6,142	6,078	55	9	100.0	99.0	0.9	0.1
3 days-----	2,795	2,761	31	3	100.0	98.8	1.1	0.1
4-6 days-----	3,367	3,324	37	6	100.0	98.7	1.1	0.2
7-13 days-----	3,039	2,980	53	6	100.0	98.1	1.7	0.2
14-27 days-----	2,848	2,786	58	4	100.0	97.8	2.0	0.1
Unknown days-----	1	-	1	-	(1)	-	(1)	-
Under 28 days-----	61,604	60,773	756	75	100.0	98.7	1.2	0.1
28 days-5 months-----	14,913	14,282	423	208	100.0	95.8	2.8	1.4
6-11 months-----	5,040	4,764	212	64	100.0	94.5	4.2	1.3
Not stated-----	53	-	-	53	100.0	-	-	100.0
<u>Male</u>								
All ages-----	47,444	46,386	820	238	100.0	97.8	1.7	0.5
Under 1 hour-----	3,460	3,351	101	8	100.0	96.8	2.9	0.2
1-23 hours-----	16,461	16,286	161	14	100.0	98.9	1.0	0.1
1 day-----	5,407	5,344	58	5	100.0	98.8	1.1	0.1
2 days-----	3,721	3,687	29	5	100.0	99.1	0.8	0.1
3 days-----	1,678	1,657	19	2	100.0	98.7	1.1	0.1
4-6 days-----	1,923	1,900	20	3	100.0	98.8	1.0	0.2
7-13 days-----	1,716	1,686	27	3	100.0	98.3	1.6	0.2
14-27 days-----	1,665	1,626	37	2	100.0	97.7	2.2	0.1
Unknown days-----	-	-	-	-	-	-	-	-
Under 28 days-----	36,031	35,537	452	42	100.0	98.6	1.3	0.1
28 days-5 months-----	8,638	8,258	248	132	100.0	95.6	2.9	1.5
6-11 months-----	2,749	2,591	120	38	100.0	94.3	4.4	1.4
Not stated-----	26	-	-	26	100.0	-	-	100.0
<u>Female</u>								
All ages-----	34,166	33,433	571	162	100.0	97.9	1.7	0.5
Under 1 hour-----	2,973	2,890	77	6	100.0	97.2	2.6	0.2
1-23 hours-----	11,464	11,359	95	10	100.0	99.1	0.8	0.1
1 day-----	3,647	3,614	29	4	100.0	99.1	0.8	0.1
2 days-----	2,421	2,391	26	4	100.0	98.8	1.1	0.2
3 days-----	1,117	1,104	12	1	100.0	98.8	1.1	0.1
4-6 days-----	1,444	1,424	17	3	100.0	98.6	1.2	0.2
7-13 days-----	1,323	1,294	26	3	100.0	97.8	2.0	0.2
14-27 days-----	1,183	1,160	21	2	100.0	98.1	1.8	0.2
Unknown days-----	1	-	1	-	(1)	-	(1)	-
Under 28 days-----	25,573	25,236	304	33	100.0	98.7	1.2	0.1
28 days-5 months-----	6,275	6,024	175	76	100.0	96.0	2.8	1.2
6-11 months-----	2,291	2,173	92	26	100.0	94.8	4.0	1.1
Not stated-----	27	-	-	27	100.0	-	-	100.0

See footnotes at end of table.

Table 1. Number and percentage distribution of infant deaths, by type of record, color, sex, and age at death: United States, 1960 live birth cohort—Con.

Color, sex, and age at death	Total	Linked records	Unlinked death records	No death record found in NCHS	Total	Linked records	Unlinked death records	No death record found in NCHS
<b>NONWHITE</b>								
<b>Both sexes</b>								
Number of infant deaths								
All ages-----	28,251	27,219	902	130	100.0	96.3	3.2	0.5
Percentage distribution								
Under 1 hour-----	1,645	1,570	73	2	100.0	95.4	4.4	0.1
1-23 hours-----	8,015	7,861	150	4	100.0	98.1	1.9	0.0
1 day-----	2,480	2,430	48	2	100.0	98.0	1.9	0.1
2 days-----	1,388	1,365	20	3	100.0	98.3	1.4	0.2
3 days-----	731	708	22	1	100.0	96.9	3.0	0.1
4-6 days-----	1,122	1,090	30	2	100.0	97.1	2.7	0.2
7-13 days-----	1,151	1,111	40	-	100.0	96.5	3.5	-
14-27 days-----	1,476	1,422	51	3	100.0	96.3	3.5	0.2
Unknown days-----	-	-	-	-	-	-	-	-
Under 28 days-----	18,008	17,557	434	17	100.0	97.5	2.4	0.1
28 days-5 months-----	7,751	7,359	323	69	100.0	94.9	4.2	0.9
6-11 months-----	2,469	2,303	145	21	100.0	93.3	5.9	0.9
Not stated-----	23	-	-	23	100.0	-	-	100.0
<b>Male</b>								
All ages-----	15,828	15,265	495	68	100.0	96.4	3.1	0.4
Under 1 hour-----	895	857	38	-	100.0	95.8	4.2	-
1-23 hours-----	4,512	4,434	75	3	100.0	98.3	1.7	0.1
1 day-----	1,436	1,410	25	1	100.0	98.2	1.7	0.1
2 days-----	810	796	14	-	100.0	98.3	1.7	-
3 days-----	447	437	10	-	100.0	97.8	2.2	-
4-6 days-----	629	608	19	2	100.0	96.7	3.0	0.3
7-13 days-----	603	579	24	-	100.0	96.0	4.0	-
14-27 days-----	811	784	25	2	100.0	96.7	3.1	0.2
Unknown days-----	-	-	-	-	-	-	-	-
Under 28 days-----	10,143	9,905	230	8	100.0	97.7	2.3	0.1
28 days-5 months-----	4,330	4,102	188	40	100.0	94.7	4.3	0.9
6-11 months-----	1,348	1,258	77	13	100.0	93.3	5.7	1.0
Not stated-----	7	-	-	7	(1)	-	-	(1)
<b>Female</b>								
All ages-----	12,423	11,954	407	62	100.0	96.2	3.3	0.5
Under 1 hour-----	750	713	35	2	100.0	95.1	4.7	0.3
1-23 hours-----	3,503	3,427	75	1	100.0	97.8	2.1	0.0
1 day-----	1,044	1,020	23	1	100.0	97.7	2.2	0.1
2 days-----	578	569	6	3	100.0	98.4	1.0	0.5
3 days-----	284	271	12	1	100.0	95.4	4.2	0.4
4-6 days-----	493	482	11	-	100.0	97.8	2.2	-
7-13 days-----	548	532	16	-	100.0	97.1	2.9	-
14-27 days-----	665	638	26	1	100.0	95.9	3.9	0.2
Unknown days-----	-	-	-	-	-	-	-	-
Under 28 days-----	7,865	7,652	204	9	100.0	97.3	2.6	0.1
28 days-5 months-----	3,421	3,257	135	29	100.0	95.2	3.9	0.8
6-11 months-----	1,121	1,045	68	8	100.0	93.2	6.1	0.7
Not stated-----	16	-	-	16	(1)	-	-	(1)

<sup>1</sup>Percent not shown; based on less than 20 deaths.



Table 2. Live births by place of occurrence and residence, and percent resident of and born in same area: United States, each division and State, 1960 live birth cohort

Division and State	Occurred in specified area		Occurred in and resident of specified area <sup>1</sup>	Resident of specified area		Percent resident of and born in same area
	Total	Nonresident <sup>1</sup>		Total	Occurred elsewhere <sup>1</sup>	
	Number of live births					
United States-----	4,257,850	...	...	4,257,850	...	...
Geographic division:						
New England-----	237,882	2,372	235,510	236,758	1,248	99.5
Middle Atlantic-----	731,870	2,916	728,954	733,294	4,340	99.4
East North Central-----	872,834	5,970	866,864	877,300	10,436	98.8
West North Central-----	371,604	6,498	365,106	368,888	3,782	99.0
South Atlantic-----	628,418	6,758	621,660	628,716	7,056	98.9
East South Central-----	297,152	7,546	289,606	294,240	4,634	98.4
West South Central-----	430,014	2,724	427,290	430,922	3,632	99.2
Mountain-----	188,112	3,854	184,258	187,062	2,804	98.5
Pacific-----	499,964	1,380	498,584	500,670	2,086	99.6
New England:						
Maine-----	23,874	1,218	22,656	23,218	562	97.6
New Hampshire-----	13,158	1,072	12,086	13,844	1,758	87.3
Vermont-----	9,178	494	8,684	9,408	724	92.3
Massachusetts-----	116,510	2,906	113,604	115,124	1,520	98.7
Rhode Island-----	19,294	1,644	17,650	18,396	746	95.9
Connecticut-----	55,868	774	55,094	56,768	1,674	97.1
Middle Atlantic:						
New York-----	361,186	4,470	356,716	359,452	2,736	99.2
New Jersey-----	127,566	1,482	126,084	132,374	6,290	95.2
Pennsylvania-----	243,118	5,778	237,340	241,468	4,128	98.3
East North Central:						
Ohio-----	230,042	3,542	226,500	230,718	4,218	98.2
Indiana-----	113,154	3,244	109,910	112,722	2,812	97.5
Illinois-----	236,204	3,858	232,346	238,928	6,582	97.2
Michigan-----	194,074	1,102	192,972	195,336	2,364	98.8
Wisconsin-----	99,360	1,880	97,480	99,596	2,116	97.9
West North Central:						
Minnesota-----	87,586	2,242	85,344	87,594	2,250	97.4
Iowa-----	64,806	2,450	62,356	64,162	1,806	97.2
Missouri-----	101,672	6,944	94,728	97,926	3,198	96.7
North Dakota-----	16,594	1,140	15,454	16,626	1,172	93.0
South Dakota-----	17,630	852	16,778	17,620	842	95.2
Nebraska-----	34,158	1,118	33,040	34,262	1,222	96.4
Kansas-----	49,158	2,200	46,958	50,698	3,740	92.6

See footnote at end of table.

Table 2. Live births by place of occurrence and residence, and percent resident of and born in same area: United States, each division and State, 1960 live birth cohort—Con.

Division and State	Occurred in specified area		Occurred in and resident of specified area <sup>1</sup>	Resident of specified area		Percent resident of and born in same area
	Total	Nonresident <sup>1</sup>		Total	Occurred elsewhere <sup>1</sup>	
	Number of live births					
<b>South Atlantic:</b>						
Delaware-----	11,636	600	11,036	11,580	544	95.3
Maryland-----	68,738	3,326	65,412	77,350	11,938	84.6
District of Columbia-----	33,550	15,354	18,196	19,872	1,676	91.6
Virginia-----	89,186	2,012	87,174	95,534	8,360	91.2
West Virginia-----	40,492	3,384	37,108	39,474	2,366	94.0
North Carolina-----	109,820	1,646	108,174	109,774	1,600	98.5
South Carolina-----	59,556	1,378	58,178	59,812	1,634	97.3
Georgia-----	100,942	2,786	98,156	99,750	1,594	98.4
Florida-----	114,498	574	113,924	115,570	1,646	98.6
<b>East South Central:</b>						
Kentucky-----	73,724	3,872	69,852	72,208	2,356	96.7
Tennessee-----	83,576	3,722	79,854	82,036	2,182	97.3
Alabama-----	80,180	1,468	78,712	80,846	2,134	97.4
Mississippi-----	59,672	1,510	58,162	59,150	988	98.3
<b>West South Central:</b>						
Arkansas-----	40,960	1,626	39,334	40,582	1,248	96.9
Louisiana-----	90,210	1,134	89,076	90,212	1,136	98.7
Oklahoma-----	50,270	820	49,450	50,986	1,536	97.0
Texas-----	248,574	1,712	246,862	249,142	2,280	99.1
<b>Mountain:</b>						
Montana-----	17,258	146	17,112	17,444	332	98.1
Idaho-----	17,022	694	16,328	17,176	848	95.1
Wyoming-----	8,336	272	8,064	8,512	448	94.7
Colorado-----	45,184	2,818	42,366	42,912	546	98.7
New Mexico-----	29,858	546	29,312	30,680	1,368	95.5
Arizona-----	36,520	522	35,998	36,760	762	97.9
Utah-----	26,656	666	25,990	26,308	318	98.8
Nevada-----	7,278	234	7,044	7,270	226	96.9
<b>Pacific:</b>						
Washington-----	65,288	990	64,298	65,278	980	98.5
Oregon-----	38,532	976	37,556	38,414	858	97.8
California-----	371,476	770	370,706	372,210	1,504	99.6
Alaska-----	7,466	-	7,466	7,562	96	98.7
Hawaii-----	17,202	46	17,156	17,206	50	99.7

<sup>1</sup>Totals for the geographic divisions do not equal the sum of the individual States, because of differences between place of birth and mother's residence at time of birth which affected State data but did not affect divisional data.

Table 3. Percent of infants born outside hospitals and percent unlinked infant death records, by color: United States, each division and State, 1960 live birth cohort

Division and State	Total		White		Nonwhite	
	Born outside hospital <sup>1</sup>	Unlinked death records <sup>2</sup>	Born outside hospital <sup>1</sup>	Unlinked death records <sup>2</sup>	Born outside hospital <sup>1</sup>	Unlinked death records <sup>2</sup>
	Percent					
United States-----	3.4	2.1	1.2	1.7	15.0	3.2
Geographic division:						
New England-----	0.5	2.7	0.4	2.7	0.8	2.7
Middle Atlantic-----	0.9	2.1	0.7	2.0	2.2	2.5
East North Central-----	1.0	1.0	0.7	0.8	3.4	1.9
West North Central-----	0.9	1.2	0.7	1.0	3.9	2.7
South Atlantic-----	7.8	1.6	1.2	1.0	23.5	2.2
East South Central-----	13.3	2.4	3.1	2.0	37.8	2.9
West South Central-----	6.3	4.4	4.0	3.5	15.2	6.3
Mountain-----	2.0	3.8	1.7	2.8	5.5	10.1
Pacific-----	0.9	1.1	0.8	1.0	2.1	1.8
New England:						
Maine-----	1.4	3.2	1.4	3.2	-	(3)
New Hampshire-----	0.4	4.1	0.4	4.1	4-	(8)
Vermont-----	1.1	1.8	1.1	1.8	...	...
Massachusetts-----	0.3	2.4	0.3	2.3	1.1	3.8
Rhode Island-----	0.3	3.6	0.3	3.9	0.8	4-
Connecticut-----	0.3	2.6	0.3	2.6	0.7	2.2
Middle Atlantic:						
New York-----	0.9	1.9	0.6	2.0	2.7	1.6
New Jersey-----	0.7	2.0	0.5	1.6	2.1	3.3
Pennsylvania-----	0.9	2.3	0.8	2.0	1.4	3.5
East North Central:						
Ohio-----	0.8	0.5	0.8	0.4	0.9	1.1
Indiana-----	0.9	2.1	0.7	1.9	2.7	3.3
Illinois-----	1.8	0.8	1.0	0.8	6.3	0.8
Michigan-----	0.6	1.3	0.5	0.7	1.7	4.2
Wisconsin-----	0.4	0.8	0.3	0.7	2.1	1.3
West North Central:						
Minnesota-----	0.4	0.9	0.4	0.8	2.2	41.8
Iowa-----	0.4	0.2	0.4	0.1	1.4	42.6
Missouri-----	2.1	1.7	1.6	1.3	5.3	2.6
North Dakota-----	0.2	0.5	0.2	0.5	0.6	4-
South Dakota-----	1.1	4.8	0.7	4.0	5.8	8.0
Nebraska-----	0.4	0.4	0.3	0.4	1.1	4-
Kansas-----	0.5	1.2	0.4	1.2	1.2	0.8

See footnotes at end of table.

Table 3. Percent of infants born outside hospitals and percent unlinked infant death records, by color: United States, each division and State, 1960 live birth cohort--Con.

Division and State	Total		White		Nonwhite	
	Born outside hospital <sup>1</sup>	Unlinked death records <sup>2</sup>	Born outside hospital <sup>1</sup>	Unlinked death records <sup>2</sup>	Born outside hospital <sup>1</sup>	Unlinked death records <sup>2</sup>
	Percent					
South Atlantic:						
Delaware-----	1.8	2.2	0.7	2.4	6.9	1.9
Maryland-----	2.0	1.3	0.7	1.3	6.5	1.2
District of Columbia-----	1.5	1.8	0.5	1.0	2.0	2.4
Virginia-----	7.3	1.9	1.6	1.4	24.3	2.7
West Virginia-----	3.3	2.2	3.2	1.9	6.8	<sup>4</sup> 6.3
North Carolina-----	8.5	1.5	0.8	0.8	25.2	2.2
South Carolina-----	17.6	3.7	1.3	1.6	39.9	5.2
Georgia-----	12.0	0.9	1.0	0.5	31.9	1.3
Florida-----	6.0	0.5	1.0	0.4	19.5	0.6
East South Central:						
Kentucky-----	6.0	4.7	5.6	4.2	10.5	7.6
Tennessee-----	5.0	0.5	2.2	0.4	14.6	0.9
Alabama-----	18.0	2.4	2.0	1.9	45.2	2.9
Mississippi-----	27.3	2.3	1.2	0.7	49.4	2.9
West South Central:						
Arkansas-----	13.5	6.3	2.1	2.9	39.9	10.8
Louisiana-----	4.1	1.8	0.5	0.7	9.7	2.8
Oklahoma-----	1.9	2.0	0.9	1.6	8.1	3.2
Texas-----	6.9	5.6	5.7	4.5	13.6	9.2
Mountain:						
Montana-----	1.0	0.5	0.9	0.5	2.0	4.
Idaho-----	0.8	5.0	0.8	4.9	1.8	( <sup>3</sup> )
Wyoming-----	0.3	1.3	0.3	1.4	1.4	( <sup>3</sup> )
Colorado-----	1.0	1.6	1.0	1.6	1.0	<sup>4</sup> 1.4
New Mexico-----	5.2	7.9	5.2	4.9	5.6	23.2
Arizona-----	3.1	3.6	2.2	1.7	8.2	8.0
Utah-----	0.6	5.1	0.5	4.4	5.8	<sup>4</sup> 19.2
Nevada-----	0.6	3.3	0.3	3.8	2.3	4.
Pacific:						
Washington-----	0.5	0.5	0.5	0.4	1.0	0.8
Oregon-----	0.7	0.2	0.7	0.2	1.6	4.
California-----	0.9	1.4	0.8	1.2	1.3	2.5
Alaska-----	8.7	0.7	1.3	0.7	24.9	0.6
Hawaii-----	0.7	-	0.3	-	0.8	-

<sup>1</sup>By mother's residence at time of infant's birth.

<sup>2</sup>By place of birth.

<sup>3</sup>Percent not shown; based on less than 20 events.

<sup>4</sup>Based on at least 20, but less than 100 events.

Table 4. Live births by specified race and sex: United States, each division and State, 1960 live birth cohort

[By place of residence. Data refer only to births occurring within the United States, including Alaska and Hawaii. Based on a 50-percent sample]

Division and State	All races			White	
	Total	Male	Female	Male	Female
United States-----	4,257,850	2,179,708	2,078,142	1,848,192	1,752,552
Geographic division:					
New England-----	236,758	121,464	115,294	116,840	110,826
Middle Atlantic-----	733,294	374,936	358,358	329,976	313,720
East North Central-----	877,300	448,612	428,688	399,688	380,254
West North Central-----	368,888	189,480	179,408	177,726	168,200
South Atlantic-----	628,716	321,924	306,792	228,364	215,064
East South Central-----	294,240	150,524	143,716	107,256	100,500
West South Central-----	430,922	220,566	210,356	174,354	165,474
Mountain-----	187,062	95,598	91,464	88,560	84,466
Pacific-----	500,670	256,604	244,066	225,428	214,048
New England:					
Maine-----	23,218	11,948	11,270	11,790	11,118
New Hampshire-----	13,844	7,088	6,756	7,042	6,708
Vermont-----	9,408	4,792	4,616	4,786	4,612
Massachusetts-----	115,124	59,264	55,860	57,080	53,766
Rhode Island-----	18,396	9,390	9,006	9,006	8,646
Connecticut-----	56,768	28,982	27,786	27,136	25,976
Middle Atlantic:					
New York-----	359,452	183,932	175,520	160,718	152,198
New Jersey-----	132,374	67,316	65,058	58,350	56,412
Pennsylvania-----	241,468	123,688	117,780	110,908	105,110
East North Central:					
Ohio-----	230,718	118,142	112,576	105,906	100,600
Indiana-----	112,722	57,604	55,118	52,846	50,486
Illinois-----	238,928	122,114	116,814	103,018	97,672
Michigan-----	195,336	99,730	95,606	88,878	84,910
Wisconsin-----	99,596	51,022	48,574	49,040	46,586
West North Central:					
Minnesota-----	87,594	44,916	42,678	44,118	41,840
Iowa-----	64,162	33,126	31,036	32,622	30,546
Missouri-----	97,926	50,300	47,626	43,356	41,134
North Dakota-----	16,626	8,486	8,140	8,180	7,822
South Dakota-----	17,620	8,928	8,692	8,290	7,988
Nebraska-----	34,262	17,742	16,520	16,978	15,770
Kansas-----	50,698	25,982	24,716	24,182	23,100
South Atlantic:					
Delaware-----	11,580	5,992	5,588	4,890	4,556
Maryland-----	77,350	39,832	37,518	31,070	28,960
District of Columbia-----	19,872	10,206	9,666	3,208	2,988
Virginia-----	95,534	48,496	47,038	36,586	35,128
West Virginia-----	39,474	20,282	19,192	19,268	18,296
North Carolina-----	109,774	56,316	53,458	38,826	36,432
South Carolina-----	59,812	30,672	29,140	17,962	16,622
Georgia-----	99,750	51,280	48,470	33,380	30,912
Florida-----	115,570	58,848	56,722	43,174	41,170
East South Central:					
Kentucky-----	72,208	37,382	34,826	34,182	31,778
Tennessee-----	82,036	41,896	40,140	32,876	30,988
Alabama-----	80,846	41,324	39,522	26,304	24,524
Mississippi-----	59,150	29,922	29,228	13,894	13,210
West South Central:					
Arkansas-----	40,582	20,562	20,020	14,372	13,994
Louisiana-----	90,212	46,060	44,152	28,314	26,978
Oklahoma-----	50,986	26,216	24,770	22,670	21,240
Texas-----	249,142	127,728	121,414	108,998	103,262
Mountain:					
Montana-----	17,444	8,978	8,466	8,350	7,818
Idaho-----	17,176	8,766	8,410	8,630	8,216
Wyoming-----	8,512	4,350	4,162	4,212	4,012
Colorado-----	42,912	21,828	21,084	21,050	20,270
New Mexico-----	30,680	15,542	15,138	13,904	13,500
Arizona-----	36,760	18,948	17,812	16,008	14,978
Utah-----	26,308	13,480	12,828	13,190	12,562
Nevada-----	7,270	3,706	3,564	3,216	3,110
Pacific:					
Washington-----	65,278	33,338	31,940	31,638	30,072
Oregon-----	38,414	19,590	18,824	18,878	18,200
California-----	372,210	190,806	181,404	169,448	160,724
Alaska-----	7,562	3,862	3,700	2,656	2,546
Hawaii-----	17,206	9,008	8,198	2,808	2,506

<sup>1</sup>Includes 112 births to Aleuts and 562 births to Eskimos. (In addition, there were 38 births to Aleuts and Eskimos residing in other States.)

<sup>2</sup>Includes 122 births to Aleuts and 488 births to Eskimos. (In addition there were 30 births to Aleuts and Eskimos residing in other States.)

<sup>3</sup>Includes 2,498 births to Hawaiians and Part-Hawaiians. (In addition there were 356 births to Hawaiians and Part-Hawaiians residing in other States.)

<sup>4</sup>Includes 2,246 births to Hawaiians and Part-Hawaiians. (In addition there were 320 births to Hawaiians and Part-Hawaiians residing in other States.)

Source: National Center for Health Statistics, *Vital Statistics of the United States, 1960*, Vol. I, Public Health Service, Washington, U.S. Government Printing Office 1962, p. 2-7.

Table 4. Live births by specified race and sex: United States, each division and State, 1960 live birth cohort—Con.  
 [By place of residence. Data refer only to births occurring within the United States, including Alaska and Hawaii. Based on a 50-percent sample]

Negro		Indian		Chinese		Japanese		Other races	
Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
303,566	298,698	10,512	10,602	2,966	2,880	6,688	6,304	7,784	7,106
4,208	4,102	52	72	128	116	136	86	100	92
43,494	43,170	232	244	560	606	320	322	354	296
47,548	47,096	558	528	192	172	412	420	214	218
9,876	9,268	1,498	1,632	54	50	208	168	118	90
91,990	90,344	848	764	112	102	324	312	286	206
43,050	43,036	76	64	30	32	72	58	40	26
44,606	43,314	1,234	1,212	70	76	222	188	80	92
2,384	2,348	4,152	4,192	82	86	264	250	156	122
16,410	16,020	1,862	1,894	1,738	1,640	4,730	4,500	6,436	5,964
86	88	32	30	8	4	26	16	6	14
34	38	-	-	2	4	6	6	4	-
4	-	-	-	-	2	2	2	-	-
1,942	1,886	14	30	88	86	78	40	62	52
344	328	6	6	18	4	2	10	14	12
1,798	1,762	-	6	12	16	22	12	14	14
22,234	22,326	206	214	436	490	166	172	172	120
8,728	8,416	4	10	74	56	106	88	54	76
12,532	12,428	22	20	50	60	48	62	128	100
12,040	11,806	24	26	38	30	94	74	40	40
4,686	4,554	4	10	16	10	26	32	26	26
18,670	18,684	96	100	86	86	176	200	68	72
10,596	10,434	106	104	36	30	66	74	48	54
1,556	1,618	328	288	16	16	50	40	32	26
328	332	378	426	24	12	30	36	38	32
442	428	32	30	4	8	18	16	8	8
6,858	6,414	26	28	14	14	28	22	18	14
32	14	256	296	2	-	12	6	4	2
22	28	604	666	2	-	8	10	2	-
604	598	124	120	2	8	14	22	20	2
1,590	1,454	78	66	6	8	98	56	28	32
1,092	1,018	-	-	-	4	10	6	-	4
8,600	8,406	20	30	34	24	44	66	64	32
6,860	6,594	10	4	36	34	30	10	62	36
11,780	11,780	22	18	10	10	56	66	42	36
1,002	888	2	2	-	2	6	4	4	-
16,654	16,288	722	642	6	4	68	62	40	30
12,652	12,470	18	18	-	-	16	18	24	12
17,824	17,502	4	6	8	4	36	28	28	18
15,526	15,398	50	44	18	20	58	52	22	38
3,132	3,012	6	-	6	4	38	26	18	6
8,990	9,108	2	2	10	14	12	12	6	16
14,990	14,976	4	6	2	4	14	8	10	4
15,938	15,940	64	56	12	10	8	12	6	-
6,164	6,000	2	10	4	6	16	6	4	4
17,652	17,078	50	42	10	8	26	34	8	12
2,372	2,358	1,118	1,114	4	2	34	32	18	24
18,418	17,878	64	46	52	60	146	116	50	52
38	38	552	580	2	4	22	16	14	10
22	30	72	106	4	6	26	36	12	16
38	38	82	94	4	4	12	8	2	6
576	620	80	98	12	14	62	46	48	36
348	388	1,204	1,192	8	6	56	48	22	4
942	872	1,908	1,846	34	38	24	42	32	36
80	56	134	154	14	8	44	36	18	12
340	306	120	122	4	6	18	18	8	2
762	854	408	448	86	64	244	276	200	226
328	306	216	176	30	42	88	48	50	52
15,056	14,658	924	870	1,228	1,206	2,338	2,264	1,812	1,682
148	122	302	380	4	2	28	16	724	2,634
116	80	12	20	390	326	2,032	1,896	83,650	43,370

Table 5. Number and percentage distribution of infant death records, by 55 selected causes of death, color, and age at death: United States, 1960 live birth cohort

Cause of death (Seventh Revision of the International Lists, 1955)		Total	
		Under 1 year	
		Linked records	Unlinked death records
		Number	
1	All causes-----	107,038	2,293
		Percentage distribution	
2	All causes-----	100.0	100.0
3	Dysentery, all forms-----045-048	0.1	0.4
4	Septicemia and pyemia-----053	0.4	0.5
5	Whooping cough-----056	0.1	0.2
6	Meningococcal infections-----057	0.2	0.2
7	Tetanus-----061	0.1	0.6
8	Other infective and parasitic diseases-----001-044,049-052,054,055,058-060,062-138	0.5	1.0
9	Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues-----140-205	0.2	0.4
10	Benign neoplasms and neoplasms of unspecified nature-----210-239	0.1	0.1
11	Diseases of thymus gland-----273	0.1	0.0
12	Meningitis, except meningococcal and tuberculous-----340	0.8	1.3
13	Other diseases of nervous system and sense organs--330-334,341-398	0.8	0.7
14	Acute upper respiratory infections-----470-475	0.4	0.4
15	Influenza and pneumonia, except pneumonia of newborn-480-483,490-493	8.4	13.9
16	Influenza-----480-483	0.3	0.6
17	Pneumonia, except pneumonia of newborn-----490-493	8.1	13.3
18	Bronchitis-----500-502	0.6	0.7
19	Other diseases of respiratory system-----510-522,525-527	1.4	1.6
20	Pulmonary congestion and hypostasis-----522	0.2	0.1
21	Other chronic interstitial pneumonia-----525	0.8	1.4
22	Bronchiectasis-----526	0.0	-
23	Other diseases of lung and pleural cavity-----527.2	0.2	0.1
24	All other diseases of respiratory system-----510-521,527.1	0.2	-
25	Hernia and intestinal obstruction-----560,561,570	0.8	0.7
26	Gastritis, duodenitis, enteritis, and colitis, except diarrhea of newborn-----543,571,572	2.2	5.5
27	Other diseases of digestive system-----530-542,544-553,573-587	0.6	0.8
28	Congenital malformations-----750-759	13.9	12.7
29	Spina bifida and meningocele-----751	1.0	0.9
30	Congenital hydrocephalus and other congenital malformations of nervous system and sense organs-----752,753	1.5	1.4
31	Congenital malformations of circulatory system-----754	6.8	7.0
32	Other congenital malformations-----750,755-759	4.6	3.5
33	Certain diseases of early infancy-----760-776	61.6	41.6
34	Birth injuries-----760,761	9.4	5.8
35	Without mention of immaturity (.0)-----	3.7	3.5
36	With immaturity (.5)-----	5.7	2.2
37	Intracranial and spinal injury at birth-----760	2.9	1.7
38	Without mention of immaturity (.0)-----	1.7	1.3
39	With immaturity (.5)-----	1.2	0.4
40	Other birth injury-----761	6.4	4.1
41	Without mention of immaturity (.0)-----	2.0	2.3
42	With immaturity (.5)-----	4.5	1.8

Table 5. Number and percentage distribution of infant death records, by 55 selected causes of death, color, and age at death: United States, 1960 live birth cohort—Con.

Total				White		Nonwhite		
Under 28 days		28 days-11 months		Under 1 year				
Linked records	Unlinked death records	Linked records	Unlinked death records	Linked records	Unlinked death records	Linked records	Unlinked death records	
Number								
78,330	1,190	28,708	1,103	79,819	1,391	27,219	902	1
Percentage distribution								
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	2
0.0	0.1	0.3	0.8	0.1	0.4	0.2	0.6	3
-	-	1.3	1.0	0.3	0.5	0.4	0.4	4
0.0	0.1	0.2	0.4	0.0	0.1	0.1	0.4	5
0.0	-	0.5	0.4	0.2	0.3	0.1	-	6
0.1	1.2	0.0	-	0.0	0.2	0.1	1.2	7
0.1	0.5	1.4	1.5	0.4	1.1	0.6	0.9	8
0.0	0.2	0.8	0.7	0.3	0.6	0.1	0.2	9
0.1	0.2	0.2	0.1	0.1	0.2	0.1	-	10
0.0	-	0.3	0.1	0.1	0.1	0.0	-	11
0.3	0.3	2.2	2.4	0.7	0.8	1.1	2.1	12
0.2	0.1	2.5	1.5	0.8	1.0	0.7	0.3	13
0.1	0.1	1.2	0.8	0.3	0.4	0.5	0.6	14
0.1	0.3	31.2	28.6	6.9	11.9	12.7	17.0	15
0.1	0.3	0.9	1.0	0.2	0.4	0.6	0.9	16
0.0	-	30.3	27.6	6.8	11.4	12.1	16.1	17
0.1	0.2	2.0	1.4	0.6	0.9	0.5	0.6	18
0.2	-	4.5	3.4	1.3	1.4	1.6	2.0	19
0.1	-	0.5	0.3	0.2	0.1	0.1	0.1	20
0.0	-	3.0	2.9	0.8	1.1	1.0	1.9	21
-	-	0.0	-	-	-	0.0	-	22
0.1	-	0.7	0.2	0.2	0.1	0.3	-	23
0.1	-	0.3	-	0.2	-	0.1	-	24
0.8	0.3	0.8	1.0	0.9	0.8	0.5	0.4	25
0.0	0.1	8.2	11.4	1.5	4.2	4.5	7.6	26
0.4	0.6	1.2	1.1	0.6	1.0	0.6	0.6	27
12.5	9.7	17.7	16.0	16.2	17.3	7.2	5.5	28
0.7	0.5	1.7	1.3	1.2	1.3	0.3	0.2	29
1.1	0.8	2.6	2.0	1.7	1.9	0.8	0.6	30
5.6	4.2	10.2	10.0	7.9	9.8	3.7	2.7	31
5.1	4.2	3.2	2.7	5.4	4.4	2.4	2.1	32
82.4	73.3	4.9	7.4	62.9	41.9	57.8	41.1	33
12.8	11.1	0.0	-	10.3	6.1	6.5	5.2	34
5.0	6.8	0.0	-	3.9	3.5	3.0	3.7	35
7.8	4.3	0.0	-	6.5	2.7	3.4	1.6	36
4.0	3.3	0.0	-	3.0	1.4	2.6	2.2	37
2.3	2.4	0.0	-	1.8	1.2	1.4	1.4	38
1.7	0.8	-	-	1.2	0.2	1.2	0.8	39
8.8	7.8	0.0	-	7.3	4.7	3.9	3.0	40
2.7	4.4	0.0	-	2.1	2.3	1.6	2.2	41
6.1	3.4	0.0	-	5.2	2.4	2.3	0.8	42



Table 5. Number and percentage distribution of infant death records, by 55 selected causes of death, color, and age at death: United States, 1960. Live birth cohort--Con.

Cause of death (Seventh Revision of the International Lists, 1955)		Total	
		Under 1 year	
		Linked records	Unlinked death records
Certain diseases of early infancy--Con.		Percentage distribution	
1	Postnatal asphyxia and atelectasis-----762	18.0	9.3
2	Without mention of immaturity (.0)-----	4.8	4.2
3	With immaturity (.5)-----	13.2	5.1
4	Pneumonia of newborn-----763	3.2	3.0
5	Without mention of immaturity (.0)-----	2.3	2.2
6	With immaturity (.5)-----	0.9	0.7
7	Diarrhea of newborn-----764	0.4	0.6
8	Without mention of immaturity (.0)-----	0.3	0.5
9	With immaturity (.5)-----	0.1	0.1
10	Other infections of newborn-----765-768	0.7	0.9
11	Without mention of immaturity (.0)-----	0.5	0.7
12	With immaturity (.5)-----	0.2	0.2
13	Neonatal disorders arising from certain diseases of mother during pregnancy-----769	0.9	0.8
14	Without mention of immaturity (.0-.4)-----	0.3	0.3
15	With immaturity (.5-.9)-----	0.6	0.5
16	Hemolytic disease of newborn (erythroblastosis)-----770	2.0	1.1
17	Without mention of immaturity (.0-.2)-----	1.6	0.8
18	With immaturity (.5-.7)-----	0.4	0.3
19	Hemorrhagic disease of newborn-----771	0.6	0.4
20	Without mention of immaturity (.0)-----	0.4	0.3
21	With immaturity (.5)-----	0.2	0.0
22	Ill-defined diseases peculiar to early infancy, including nutritional maladjustment-----772,773	7.3	6.1
23	Without mention of immaturity (.0)-----	2.1	3.7
24	With immaturity (.5)-----	5.3	2.4
25	Immaturity without mention of any other subsidiary condition-774	1.2	0.8
26	Immaturity, unqualified-----776	17.9	12.9
27	Symptoms and ill-defined conditions-----780-793,795	2.2	5.3
28	All other diseases-----Residual	1.2	2.4
29	Accidents-----E800,E962	3.3	5.4
30	Inhalation and ingestion of food or other object causing obstruction or suffocation-----E921,E922	1.1	1.1
31	Accidental mechanical suffocation in bed and cradle-----E924	0.9	1.3
32	Other accidental causes-----E800-E920,E923,E925-E962	1.3	3.1
33	Homicide-----E964,E980-E984	0.1	3.3

Table 5. Number and percentage distribution of infant death records, by 55 selected causes of death, color, and age at death: United States, 1960 live birth cohort--Con.

Total				White		Nonwhite		
Under 28 days		28 days-11 months		Under 1 year				
Linked records	Unlinked death records	Linked records	Unlinked death records	Linked records	Unlinked death records	Linked records	Unlinked death records	
Percentage distribution								
24.3	17.1	1.0	0.9	18.8	9.8	15.9	8.4	1
6.3	7.3	0.8	0.8	5.1	4.2	3.9	4.2	2
18.0	9.7	0.2	0.1	13.6	5.7	12.0	4.2	3
4.4	5.7	...	...	2.9	2.7	4.3	3.3	4
3.2	4.3	...	...	2.0	2.0	3.2	2.5	5
1.2	1.4	...	...	0.8	0.7	1.1	0.8	6
0.6	1.2	0.0	-	0.3	0.6	0.9	0.6	7
0.4	0.9	0.0	-	0.2	0.5	0.7	0.4	8
0.1	0.3	-	-	0.1	0.1	0.2	0.1	9
0.9	1.6	0.0	0.1	0.6	0.6	0.9	1.2	10
0.6	1.3	0.0	0.1	0.4	0.5	0.5	1.0	11
0.3	0.3	0.0	-	0.2	0.1	0.3	0.2	12
1.2	1.6	0.0	-	1.0	0.9	0.8	0.7	13
0.4	0.7	0.0	-	0.3	0.4	0.3	0.3	14
0.8	0.9	0.0	-	0.6	0.6	0.5	0.3	15
2.7	1.8	0.1	0.3	2.5	1.5	0.5	0.4	16
2.1	1.5	0.1	0.1	2.0	1.3	0.4	0.1	17
0.6	0.3	0.0	0.2	0.5	0.2	0.1	0.3	18
0.8	0.8	0.0	-	0.5	0.5	0.7	0.2	19
0.5	0.7	0.0	-	0.3	0.4	0.4	0.2	20
0.3	0.1	0.0	-	0.2	0.1	0.2	-	21
9.1	7.1	2.5	5.2	7.3	5.8	7.4	6.8	22
2.1	2.6	2.1	4.9	1.9	3.3	2.5	4.3	23
7.1	4.5	0.4	0.3	5.4	2.4	4.9	2.4	24
1.3	0.8	0.9	0.7	1.1	0.8	1.4	0.8	25
24.3	24.5	0.4	0.3	17.6	12.4	18.6	13.5	26
1.3	4.3	4.9	6.4	1.2	3.5	5.3	8.2	27
0.5	0.8	3.1	4.2	1.3	2.6	1.2	2.2	28
0.7	1.6	10.3	9.5	3.1	5.2	3.8	5.8	29
0.4	0.4	3.0	1.8	1.1	1.2	1.1	0.9	30
0.2	0.3	2.9	2.3	0.8	1.3	1.1	1.2	31
0.2	0.8	4.4	5.4	1.2	2.7	1.6	3.7	32
0.1	6.3	0.2	-	0.1	4.0	0.2	2.2	33

Table 6. Number and percentage distribution of live births and infant deaths, by type of record, color, and age of mother: United States, 1960 live birth cohort

Color and age of mother	Live births	Infant deaths		
		Total	Linked records	No death record found in NCHS
Number				
Total-----	4,257,850	107,568	107,038	530
White-----	3,600,744	80,219	79,819	400
Nonwhite-----	657,106	27,349	27,219	130
Percentage distribution				
<u>Total</u>				
All ages-----	100.0	100.0	100.0	100.0
Under 15 years-----	0.2	0.4	0.4	-
15-19 years-----	13.8	18.0	18.0	19.6
20-24 years-----	33.5	32.2	32.2	35.8
25-29 years-----	25.7	22.8	22.8	21.5
30-34 years-----	16.2	15.2	15.2	12.6
35 years and over-----	10.7	11.4	11.4	9.6
Not stated-----	...	0.0	...	0.8
<u>White</u>				
All ages-----	100.0	100.0	100.0	100.0
Under 15 years-----	0.1	0.1	0.2	-
15-19 years-----	12.7	16.1	16.1	17.8
20-24 years-----	33.9	32.8	32.8	36.3
25-29 years-----	26.2	23.6	23.6	21.8
30-34 years-----	16.3	15.6	15.6	13.8
35 years and over-----	10.8	11.8	11.8	9.8
Not stated-----	...	0.0	...	0.8
<u>Nonwhite</u>				
All ages-----	100.0	100.0	100.0	100.0
Under 15 years-----	0.6	1.0	1.0	-
15-19 years-----	19.6	23.4	23.4	25.4
20-24 years-----	31.5	30.5	30.5	34.6
25-29 years-----	22.9	20.7	20.7	20.8
30-34 years-----	15.1	14.0	14.0	9.2
35 years and over-----	10.2	10.3	10.4	9.2
Not stated-----	...	0.0	...	0.8

Table 7. Number and percentage distribution of live births and infant deaths, by type of record, color, and birth weight: United States, 1960 live birth cohort

Color and birth weight	Live births	Infant deaths		
		Total	Linked records	No death record found in NCHS
Number				
Total-----	4,257,850	107,568	107,038	530
White-----	3,600,744	80,219	79,819	400
Nonwhite-----	657,106	27,349	27,219	130
Percentage distribution				
<u>Total</u>				
All birth weights-----	100.0	100.0	100.0	100.0
1,000 grams or less-----	0.6	20.8	20.9	5.1
1,001-1,500 grams-----	0.7	14.2	14.2	5.3
1,501-2,000 grams-----	1.5	11.9	11.9	6.4
2,001-2,500 grams-----	5.1	11.9	11.9	13.6
2,501-3,000 grams-----	18.5	14.0	14.0	20.2
3,001-3,500 grams-----	38.0	15.4	15.3	24.9
3,501-4,000 grams-----	26.8	8.5	8.5	15.8
4,001-4,500 grams-----	7.5	2.5	2.5	4.5
4,501-5,000 grams-----	1.4	0.6	0.6	1.1
5,001 grams or more-----	0.2	0.2	0.2	0.6
Not stated-----	...	0.0	...	2.5
<u>White</u>				
All birth weights-----	100.0	100.0	100.0	100.0
1,000 grams or less-----	0.5	20.3	20.4	4.8
1,001-1,500 grams-----	0.6	14.4	14.5	5.3
1,501-2,000 grams-----	1.3	12.5	12.5	5.0
2,001-2,500 grams-----	4.5	11.9	11.9	13.3
2,501-3,000 grams-----	17.2	13.5	13.5	19.8
3,001-3,500 grams-----	38.1	15.3	15.2	24.8
3,501-4,000 grams-----	28.2	8.8	8.7	18.3
4,001-4,500 grams-----	8.0	2.5	2.5	4.3
4,501-5,000 grams-----	1.4	0.6	0.6	1.5
5,001 grams or more-----	0.2	0.2	0.2	0.8
Not stated-----	...	0.0	...	2.5
<u>Nonwhite</u>				
All birth weights-----	100.0	100.0	100.0	100.0
1,000 grams or less-----	1.0	22.3	22.4	6.2
1,001-1,500 grams-----	1.2	13.5	13.6	5.4
1,501-2,000 grams-----	2.5	10.2	10.2	10.8
2,001-2,500 grams-----	8.3	11.9	11.8	14.6
2,501-3,000 grams-----	25.3	15.4	15.4	21.5
3,001-3,500 grams-----	37.1	15.6	15.6	25.4
3,501-4,000 grams-----	18.9	7.8	7.8	8.5
4,001-4,500 grams-----	4.6	2.3	2.3	5.4
4,501-5,000 grams-----	1.1	0.6	0.6	-
5,001 grams or more-----	0.2	0.2	0.2	-
Not stated-----	...	0.0	...	2.3

Table 8. Number and percentage distribution of live births and infant deaths, by type of record, color, and period of gestation: United States, 1960 live birth cohort

Color and period of gestation	Live births	Infant deaths		
		Total	Linked records	No death record found in NCHS
Number				
Total-----	4,257,850	107,568	107,038	530
White-----	3,600,744	80,219	79,819	400
Nonwhite-----	657,106	27,349	27,219	130
Percentage distribution				
<u>Total</u>				
All gestations-----	100.0	100.0	100.0	100.0
Under 20 weeks-----	0.0	1.0	1.0	0.2
20-27 weeks-----	0.6	18.3	18.4	4.7
28-31 weeks-----	0.8	13.2	13.3	6.2
32-35 weeks-----	2.2	10.8	10.9	5.1
36 weeks-----	3.1	5.0	5.0	4.9
37-39 weeks-----	15.0	9.1	9.1	14.0
40 weeks and over-----	72.5	34.6	34.5	59.4
Not stated-----	5.7	7.9	7.9	5.5
<u>White</u>				
All gestations-----	100.0	100.0	100.0	100.0
Under 20 weeks-----	0.0	0.8	0.8	-
20-27 weeks-----	0.5	18.3	18.4	4.5
28-31 weeks-----	0.7	13.4	13.4	5.5
32-35 weeks-----	2.0	11.7	11.7	4.8
36 weeks-----	2.8	4.9	4.9	4.5
37-39 weeks-----	15.3	9.8	9.8	15.5
40 weeks and over-----	72.8	32.9	32.8	59.0
Not stated-----	6.1	8.1	8.1	6.3
<u>Nonwhite</u>				
All gestations-----	100.0	100.0	100.0	100.0
Under 20 weeks-----	0.1	1.5	1.5	0.8
20-27 weeks-----	1.0	18.3	18.4	5.4
28-31 weeks-----	1.5	12.8	12.8	8.5
32-35 weeks-----	3.4	8.4	8.4	6.2
36 weeks-----	5.0	5.3	5.3	6.2
37-39 weeks-----	13.8	7.0	6.9	9.2
40 weeks and over-----	71.2	39.5	39.4	60.8
Not stated-----	3.9	7.3	7.3	3.1

Table 9. Infant deaths by place of birth, place of death, type of record; percent born and died in same area, and percent linked records among infant deaths in area: United States, each division and State, 1960 live birth cohort

Division and State	Linked records			Unlinked death records			Percent born and died in same area	Percent linked records among infant deaths in area
	Deaths occurring in specified area	Born and died in same area <sup>1</sup>	Born alive in specified area	Deaths occurring in specified area	Born and died in same area <sup>1</sup>	Born alive in specified area		
United States-----	107,038	...	107,038	2,293	...	<sup>2</sup> 2,293	...	...
Geographic division:								
New England-----	5,066	5,046	5,063	155	130	142	99.1	96.6
Middle Atlantic-----	17,305	17,236	17,297	383	331	366	99.3	97.4
East North Central---	20,652	20,517	20,662	203	179	207	99.2	98.4
West North Central---	8,379	8,236	8,351	126	90	101	97.9	96.8
South Atlantic-----	18,580	18,437	18,615	337	274	295	98.9	97.5
East South Central---	9,155	8,983	9,117	226	200	222	97.9	95.8
West South Central---	11,691	11,585	11,712	564	518	541	98.8	94.5
Mountain-----	4,824	4,713	4,765	189	161	189	97.2	94.0
Pacific-----	11,386	11,353	11,456	110	102	129	99.6	98.8
New England:								
Maine-----	583	574	579	13	13	19	98.5	96.3
New Hampshire-----	337	325	330	-	-	14	96.4	96.4
Vermont-----	216	212	216	2	1	4	97.7	97.2
Massachusetts-----	2,393	2,393	2,405	119	54	60	97.4	95.3
Rhode Island-----	407	403	405	7	3	15	98.1	97.3
Connecticut-----	1,130	1,122	1,128	14	10	30	99.0	98.1
Middle Atlantic:								
New York-----	8,425	8,373	8,431	190	142	165	98.8	97.2
New Jersey-----	2,992	2,949	3,034	66	51	63	98.1	96.4
Pennsylvania-----	5,888	5,800	5,832	127	118	138	98.4	96.4
East North Central:								
Ohio-----	5,429	5,356	5,406	27	19	26	98.5	98.2
Indiana-----	2,699	2,649	2,717	49	44	57	98.0	96.4
Illinois-----	5,754	5,648	5,760	48	35	46	97.9	97.3
Michigan-----	4,633	4,603	4,635	61	58	61	99.3	98.1
Wisconsin-----	2,137	2,107	2,144	18	13	17	98.4	97.8
West North Central:								
Minnesota-----	1,906	1,843	1,866	20	12	16	96.3	95.7
Iowa-----	1,374	1,343	1,377	4	2	3	97.6	97.5
Missouri-----	2,397	2,310	2,377	41	32	40	96.1	94.7
North Dakota-----	402	394	405	5	2	2	97.3	96.8
South Dakota-----	448	436	472	26	21	24	96.4	92.0
Nebraska-----	753	731	764	9	3	3	96.3	95.9
Kansas-----	1,099	1,068	1,090	21	9	13	96.2	95.4

See footnotes at end of table.

Table 9. Infant deaths by place of birth, place of death, type of record; percent born and died in same area, and percent linked records among infant deaths in area: United States, each division and State, 1960 live birth cohort—Con.

Division and State	Linked records			Unlinked death records			Percent born and died in same area	Percent linked records among infant deaths in area
	Deaths occurring in specified area	Born and died in same area <sup>1</sup>	Born alive in specified area	Deaths occurring in specified area	Born and died in same area <sup>1</sup>	Born alive in specified area		
<b>South Atlantic:</b>								
Delaware-----	260	256	266	4	3	6	98.1	97.0
Maryland-----	1,900	1,830	1,868	48	22	24	95.1	93.9
District of Columbia-----	931	897	945	24	12	17	95.2	93.9
Virginia-----	2,610	2,544	2,605	54	37	50	96.9	95.5
West Virginia-----	988	974	1,016	22	18	23	98.2	96.4
North Carolina-----	3,403	3,358	3,400	55	47	53	98.5	97.1
South Carolina-----	1,965	1,929	1,959	80	72	76	97.8	94.3
Georgia-----	3,171	3,111	3,186	34	22	29	97.8	97.1
Florida-----	3,352	3,284	3,370	16	7	17	97.7	97.5
<b>East South Central:</b>								
Kentucky-----	1,909	1,867	1,929	85	78	95	97.5	93.6
Tennessee-----	2,495	2,386	2,435	29	8	13	94.8	94.5
Alabama-----	2,445	2,385	2,430	55	51	60	97.4	95.4
Mississippi-----	2,306	2,273	2,323	57	50	54	98.3	96.2
<b>West South Central:</b>								
Arkansas-----	1,008	980	1,026	65	56	69	96.6	96.2
Louisiana-----	2,781	2,746	2,770	55	48	52	98.5	96.8
Oklahoma-----	1,239	1,204	1,245	28	20	25	96.6	96.8
Texas-----	6,663	6,583	6,671	416	383	395	98.4	93.0
<b>Mountain:</b>								
Montana-----	414	406	413	4	1	2	97.4	97.1
Idaho-----	360	342	361	15	15	19	95.2	91.2
Wyoming-----	221	214	223	2	-	3	96.0	96.0
Colorado-----	1,200	1,146	1,166	17	9	19	94.9	94.2
New Mexico-----	885	852	862	44	34	74	95.4	91.7
Arizona-----	1,053	1,022	1,051	62	35	39	94.8	91.7
Utah-----	484	475	482	34	23	26	96.1	91.7
Nevada-----	207	202	207	11	7	7	95.9	92.7
<b>Pacific:</b>								
Washington-----	1,503	1,474	1,503	6	3	7	97.9	97.7
Oregon-----	896	872	893	7	2	2	96.8	96.6
California-----	8,303	8,302	8,380	95	93	118	100.0	98.9
Alaska-----	292	287	290	1	1	2	98.3	98.0
Hawaii-----	392	389	390	1	-	-	99.0	99.0

<sup>1</sup>Totals for the geographic divisions do not equal the sum of the individual States because of differences between State of birth and State of death, which affect State data but do not affect divisional data.

<sup>2</sup>Includes 101 infant deaths for which the place of birth was unknown or not stated and which are not shown in any State total.

## APPENDIX I

### TECHNICAL NOTES

The data in this report are derived from two sources. Data referring to all live births in 1960 are taken from Volume I of *Vital Statistics of the United States, 1960*. Data on birth characteristics of infants in the 1960 live birth cohort who died before reaching age 1 are derived from computer tapes prepared from a new set of punched cards which contained both birth and death information.

The punching instructions for detailed information in the new set of cards corresponded to the instructions for preparing cards for use in *Vital Statistics of the United States, 1960*. The classification and interpretation of certain important items is discussed in the following pages. The complete rules followed in the classification of geographic and personal items for births are set forth in *Vital Statistics Instruction Manual*.<sup>11</sup>

#### Classification by Occurrence and Residence

For the 1960 statistics by place of occurrence, events are classified according to the place where the birth occurred. Place of residence in birth statistics refers to the geographic area which constituted the mother's usual residence at time of the birth.

For residence statistics, all events occurring within the United States (i.e., 50 States and the District of Columbia) are allocated to a place of residence within the United States. For nonresident aliens, the place of residence is considered to be the same as the place of occurrence.

#### Age of Mother

The birth certificate asks for "Age (at time of this birth)." Some sources of minor errors in the age data have been noted. A small number of records are filed with age unspecified, and some births are not registered. Measures of variation of completeness of registration with age of mother are available from tests of completeness in 1950 and 1940.<sup>4,5</sup> They show that registration completeness is approximately the same for all ages except for the oldest age group, where it is lower.

#### Race and Color

Births in the United States in 1960 are classified as white, Negro, American Indian, Chinese, Japanese, Aleut, Eskimo, Hawaiian and Part-Hawaiian (combined), and "other nonwhite."

The category "white" includes, in addition to persons reported as "white," those reported as Mexican or Puerto Rican. With one exception, a reported mixture of Negro with any other race is included in the Negro group; other mixed parentage is classified according to the race of the nonwhite parent and mixtures of nonwhite races to the race of the father. The exception refers to a mixture of Hawaiian and any other race, which is classified as Part-Hawaiian. In most tables a less detailed classification is used—"white" and "non-white."

Completeness of birth registration in 1960 is estimated by the Division of Vital Statistics, National Center for Health Statistics, to be 99.3 percent for "white" births and 96.4 percent for "nonwhite" births. The most recent figures for other groups are from the 1950 test which indicated registration completeness at that time to be 85.1 percent for American Indians and 97.4 percent for "other races," chiefly Chinese and Japanese. Both figures are probably higher for 1960, but later data are not available.

A comparison of the race designation in matched sets of birth certificates and infant cards from the 1950 registration completeness test indicates very high agreement for white and Negro infants. There were, however, substantially fewer American Indians recorded on birth records than on census records.<sup>12</sup>

#### Hospital Delivery

Births are classified as occurring "in hospital or institution" on the basis of entries on the birth certificate. The classification is unrelated to the American Hospital Association (AHA) registered hospital listings.

#### Birth Weight

In practically all areas, birth weight is reported in terms of pounds and ounces rather than in grams. However, the metric system has been used in tabulating and presenting the statistics to facilitate comparison with data published by other groups in the United States.

#### Period of Gestation

In 1960, the live birth record forms for the State of Massachusetts and that part of Maryland outside the city of Baltimore did not provide for information on the period of gestation. These areas account for about 60



percent of the records with gestation unspecified. Records with unknown gestations are shown separately and are not distributed in this report.

An examination of the reported information on period of gestation suggests a substantial heaping at the interval "40 weeks and over." This bias probably results from the fact that gestation period is not carefully calculated, and instead the newborn infant of normal size is assumed to have a gestation period of 40 weeks. Such errors in reporting are minimized in areas where the birth certificate asks for the date of onset of last normal menstrual period. Places using this question (California, Baltimore City, the District of Columbia, and New York City) contributed about 14 percent of the live birth records.

### Control of Errors

The coding and punching of birth data for the live birth records for 1960 were performed simultaneously, and the major portion of the work was verified using a partial sequential sample. This procedure was used in verifying the work of employees whose performance (as indicated by complete verification) was such as to produce consistently less than 4-percent error distributed among all the items. For any one item, less than 1-percent error would be expected under these procedures.

A new set of punched cards, using the same procedures, was prepared for infant deaths combining the necessary birth and death information into one card. However, to preserve the consistency of the death information, once the infant death was identified, the coded cause-of-death information from NCHS computer tapes for all deaths was used.

Published data for all live births taken from Volume I of *Vital Statistics of the United States, 1960*, were used. For live birth characteristics of infant deaths, the newly created tapes were used. There are no estimates available of the degree of concordance between these two sources of information. Tabulating, computing, table preparation, and all other operations subsequent to the preparation of punched cards were verified.

### Sampling of Birth Records

In this report, birth data for 1960 have been derived from a 50-percent systematic sample which consists of only even-numbered birth records. Statistics for this year were obtained by multiplying the sample figures by 2.

The sample data represent estimates which differ somewhat from figures that would have been derived by processing all the records. However, the manner in which records are numbered greatly reduces the sampling variability of totals for geographic areas. With few exceptions, records are numbered in the State offices of vital statistics as they are received

from the local offices. The assignment of the last digit in the number is not selective, and the systematic sample of even-numbered records may be assumed to be unbiased.

The extent to which residence figures for States derived from the sample differ from the totals that would have resulted from a complete count depends on the amount of nonresident interchange. (This assumes virtually no error in the figures on a place-of-occurrence basis.) Since there is relatively little nonresident interchange of births among the States, the sampling errors for these geographic units are negligible.

The following table shows percent errors due to sampling in the published birth data by other than geographic characteristics. The chances are about 2 out of 3 that the percent difference due to sampling variability between the published figure based on the 50-percent sample and the result that would be obtained by a complete count is less than the appropriate percent error shown in the table. The chances are about 19 out of 20 that the percent difference is less than twice the percent error.

Number of births with a specified characteristic	Total births in area or to residents of area <sup>1</sup>							
	250	500	1,000	2,000	5,000	10,000	50,000	500,000
30-----	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3
50-----	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
100-----	7.7	8.9	9.5	9.7	9.9	9.9	10.0	10.0
250-----	0.0	4.5	5.5	5.9	6.2	6.2	6.3	6.3
500-----	...	0.0	3.2	3.9	4.2	4.4	4.4	4.5
1,000-----	...	...	0.0	2.2	2.8	3.0	3.1	3.2
2,000-----	...	...	...	0.0	1.7	2.0	2.2	2.2
5,000-----	...	...	...	...	0.0	1.0	1.3	1.4
10,000-----	...	...	...	...	...	0.0	0.9	1.0
20,000-----	...	...	...	...	...	...	0.5	0.7
50,000-----	...	...	...	...	...	...	0.0	0.4

<sup>1</sup>An "area" is the smallest geographic unit to which the figure under consideration pertains. If the area is a city or county of residence where appreciable nonresident interchange occurs, the sampling error will be slightly larger.

### Registration Completeness

Although every State has adopted a law requiring the registration of births, deaths, and fetal deaths, these laws are not uniformly observed. In most areas practically all births and deaths are registered. For some areas, however, there is enough underregistration to affect the use of the statistics for certain purposes.

Nationwide tests of completeness of birth registration were made in both 1940 and 1950.<sup>4,5</sup> For the United States as a whole, these tests indicated that birth registration was, respectively, 92.5 and 97.9 percent complete. A detailed discussion of the results of these tests was given in chapter 6, Volume I, *Vital Statistics of the United States, 1950*. On the basis of results of the 1950 test, it is estimated by the Division of Vital Statistics that in 1960 birth registration completeness was 98.9 percent for the country as a whole—99.3 for the white and 96.4 for the nonwhite groups, respectively.

APPENDIX II

STANDARD CERTIFICATE OF LIVE BIRTH

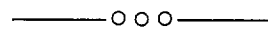
Form approved  
Budget Bureau No. 85-R374.2

**CERTIFICATE OF LIVE BIRTH**

STATE OF \_\_\_\_\_ BIRTH NO. \_\_\_\_\_

<b>1. PLACE OF BIRTH</b> a. COUNTY		<b>2. USUAL RESIDENCE OF MOTHER</b> (Where does mother live?) a. STATE	
b. CITY, TOWN, OR LOCATION		c. CITY, TOWN, OR LOCATION	
c. NAME OF HOSPITAL OR INSTITUTION (If not in hospital, give street address)		d. STREET ADDRESS	
d. IS PLACE OF BIRTH INSIDE CITY LIMITS? YES <input type="checkbox"/> NO <input type="checkbox"/>		e. IS RESIDENCE INSIDE CITY LIMITS? YES <input type="checkbox"/> NO <input type="checkbox"/>	f. IS RESIDENCE ON A FARM? YES <input type="checkbox"/> NO <input type="checkbox"/>
<b>3. NAME</b> (Type or print) First Middle Last			
<b>4. SEX</b> SINGLE <input type="checkbox"/> TWIN <input type="checkbox"/> TRIPLET <input type="checkbox"/>		<b>5. IF TWIN OR TRIPLET, WAS CHILD BORN</b> 1st <input type="checkbox"/> 2d <input type="checkbox"/> 3d <input type="checkbox"/>	
<b>6. DATE OF BIRTH</b> Month Day Year			
<b>7. NAME</b> (Type or print) First Middle Last		<b>8. COLOR OR RACE</b>	
<b>9. AGE</b> (At time of this birth) YEARS	<b>10. BIRTHPLACE</b> (State or foreign country)	<b>11a. USUAL OCCUPATION</b>	<b>11b. KIND OF BUSINESS OR INDUSTRY</b>
<b>12. MAIDEN NAME</b> (Type or print) First Middle Last		<b>13. COLOR OR RACE</b>	
<b>14. AGE</b> (At time of this birth) YEARS	<b>15. BIRTHPLACE</b> (State or foreign country)	<b>16. PREVIOUS DELIVERIES TO MOTHER</b> (Do NOT include this birth) a. How many OTHER children are now living? b. How many OTHER children were born alive but are now dead? c. How many fetal deaths (fetuses born dead at ANY time after conception)?	
<b>17. INFORMANT</b>			
<b>18. MOTHER'S MAILING ADDRESS</b>			
I hereby certify that this child was born alive on the date stated above.		<b>18a. SIGNATURE</b>	
		<b>18b. ATTENDANT AT BIRTH</b> M. D. <input type="checkbox"/> D. O. <input type="checkbox"/> MIDWIFE <input type="checkbox"/> OTHER (Specify)	
<b>18c. ADDRESS</b>		<b>18d. DATE SIGNED</b>	
<b>19. DATE RECD. BY LOCAL REG.</b>	<b>20. REGISTRAR'S SIGNATURE</b>	<b>21. DATE ON WHICH GIVEN NAME ADDED</b>	
BY _____ (Registrar)			
<b>FOR MEDICAL AND HEALTH USE ONLY</b> (This section MUST be filled out)			
<b>22a. LENGTH OF PREGNANCY</b> COMPLETED WEEKS	<b>22b. WEIGHT AT BIRTH</b> LB. OZ.	<b>23. LEGITIMATE</b> YES <input type="checkbox"/> NO <input type="checkbox"/>	
(SPACE FOR ADDITION OF MEDICAL AND HEALTH ITEMS BY INDIVIDUAL STATES)			

1956 REVISION OF STANDARD CERTIFICATE  
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE—PUBLIC HEALTH SERVICE  
PHS-708 REV. 11-54



# APPENDIX III

## STANDARD CERTIFICATE OF DEATH

### CERTIFICATE OF DEATH

Form approved.  
Budget Bureau No. 68-R375.2.

BIRTH NO.		STATE OF		STATE FILE NO.	
1. PLACE OF DEATH a. COUNTY			2. USUAL RESIDENCE (Where deceased lived. If institution: Residence before admission) a. STATE		
b. CITY, TOWN, OR LOCATION		c. LENGTH OF STAY IN 10	c. CITY, TOWN, OR LOCATION		
d. NAME OF HOSPITAL OR INSTITUTION <i>(If not in hospital, give street address)</i>			d. STREET ADDRESS		
e. IS PLACE OF DEATH INSIDE CITY LIMITS? YES <input type="checkbox"/> NO <input type="checkbox"/>		e. IS RESIDENCE INSIDE CITY LIMITS? YES <input type="checkbox"/> NO <input type="checkbox"/>	f. IS RESIDENCE ON A FARM? YES <input type="checkbox"/> NO <input type="checkbox"/>		
3. NAME OF DECEASED <i>(Type or print)</i> First Middle Last			4. DATE OF DEATH Month Day Year		
5. SEX	6. COLOR OR RACE	7. MARRIED <input type="checkbox"/> NEVER MARRIED <input type="checkbox"/> WIDOWED <input type="checkbox"/> DIVORCED <input type="checkbox"/>	8. DATE OF BIRTH	9. AGE (In years last birthday)	IF UNDER 1 YEAR Months Days Hours Mins.
10a. USUAL OCCUPATION <i>(Give kind of work done during most of working life, even if retired)</i>		10b. KIND OF BUSINESS OR INDUSTRY	11. BIRTHPLACE <i>(State or foreign country)</i>		12. CITIZEN OF WHAT COUNTRY?
13. FATHER'S NAME			14. MOTHER'S MAIDEN NAME		
15. WAS DECEASED EVER IN U. S. ARMED FORCES? <i>(If yes, no, or unknown) (If yes, give year or dates of service)</i>		16. SOCIAL SECURITY NO.	17. INFORMANT Address		
18. CAUSE OF DEATH <i>[Enter only one cause per line for (a), (b), and (c).]</i>					INTERVAL BETWEEN ONSET AND DEATH
PART I. DEATH WAS CAUSED BY: IMMEDIATE CAUSE (a) _____					
Conditions, if any, which gave rise to above cause (a), stating the underlying cause last.					
DUE TO (b) _____					
DUE TO (c) _____					
PART II. OTHER SIGNIFICANT CONDITIONS CONTRIBUTING TO DEATH BUT NOT RELATED TO THE TERMINAL DISEASE CONDITION GIVEN IN PART I (a)					19. WAS AUTOPSY PERFORMED? YES <input type="checkbox"/> NO <input type="checkbox"/>
20a. ACCIDENT <input type="checkbox"/>	SUICIDE <input type="checkbox"/>	HOMICIDE <input type="checkbox"/>	20b. DESCRIBE HOW INJURY OCCURRED. <i>(Enter nature of injury in Part I or Part II of item 18.)</i>		
20c. TIME OF INJURY Hour Month, Day, Year a. m.					
20d. INJURY OCCURRED WHILE AT WORK <input type="checkbox"/> NOT WHILE AT WORK <input type="checkbox"/>	20e. PLACE OF INJURY <i>(e. g., in or about home, farm, factory, street, office bldg., etc.)</i>		20f. CITY, TOWN, OR LOCATION	COUNTY	STATE
21. I attended the deceased from _____, to _____ and last saw her alive on _____ Death occurred at _____ m on the date stated above; and to the best of my knowledge, from the causes stated.					
22a. SIGNATURE <i>(Degree or title)</i>			22b. ADDRESS		22c. DATE SIGNED
23a. BURIAL, CREMATION, REMOVAL <i>(Specify)</i>	23b. DATE	23c. NAME OF CEMETERY OR CREMATORY		23d. LOCATION <i>(City, town, or county)</i> <i>(State)</i>	
24. FUNERAL DIRECTOR ADDRESS		25. DATE RECD. BY LOCAL REG.	26. REGISTRAR'S SIGNATURE		

1956 REVISION OF STANDARD CERTIFICATE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE—PUBLIC HEALTH SERVICE

MEDICAL CERTIFICATION

## OUTLINE OF REPORT SERIES FOR VITAL AND HEALTH STATISTICS

Public Health Service Publication No. 1000

- Series 1. Programs and collection procedures.*—Reports which describe the general programs of the National Center for Health Statistics and its offices and divisions, data collection methods used, definitions, and other material necessary for understanding the data.
- Series 2. Data evaluation and methods research.*—Studies of new statistical methodology including: experimental tests of new survey methods, studies of vital statistics collection methods, new analytical techniques, objective evaluations of reliability of collected data, contributions to statistical theory.
- Series 3. Analytical studies.*—Reports presenting analytical or interpretive studies based on vital and health statistics, carrying the analysis further than the expository types of reports in the other series.
- Series 4. Documents and committee reports.*—Final reports of major committees concerned with vital and health statistics, and documents such as recommended model vital registration laws and revised birth and death certificates.
- Series 10. Data from the Health Interview Survey.*—Statistics on illness, accidental injuries, disability, use of hospital, medical, dental, and other services, and other health-related topics, based on data collected in a continuing national household interview survey.
- Series 11. Data from the Health Examination Survey.*—Data from direct examination, testing, and measurement of national samples of the population provide the basis for two types of reports: (1) estimates of the medically defined prevalence of specific diseases in the United States and the distributions of the population with respect to physical, physiological, and psychological characteristics; and (2) analysis of relationships among the various measurements without reference to an explicit finite universe of persons.
- Series 12. Data from the Institutional Population Surveys.*—Statistics relating to the health characteristics of persons in institutions, and on medical, nursing, and personal care received, based on national samples of establishments providing these services and samples of the residents or patients.
- Series 13. Data from the Hospital Discharge Survey.*—Statistics relating to discharged patients in short-stay hospitals, based on a sample of patient records in a national sample of hospitals.
- Series 14. Data on health resources: manpower and facilities.*—Statistics on the numbers, geographic distribution, and characteristics of health resources including physicians, dentists, nurses, other health manpower occupations, hospitals, nursing homes, and outpatient and other inpatient facilities.
- Series 20. Data on mortality.*—Various statistics on mortality other than as included in annual or monthly reports—special analyses by cause of death, age, and other demographic variables, also geographic and time series analyses.
- Series 21. Data on natality, marriage, and divorce.*—Various statistics on natality, marriage, and divorce other than as included in annual or monthly reports—special analyses by demographic variables, also geographic and time series analyses, studies of fertility.
- Series 22. Data from the National Natality and Mortality Surveys.*—Statistics on characteristics of births and deaths not available from the vital records, based on sample surveys stemming from these records, including such topics as mortality by socioeconomic class, medical experience in the last year of life, characteristics of pregnancy, etc.

For a list of titles of reports published in these series, write to: Office of Information  
National Center for Health Statistics  
U.S. Public Health Service  
Washington, D.C. 20201