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birth rates in
the entire
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1909 - 1948**

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FOREWORD

The following article by P. K. Whelpton is being published to meet the need for a consistent time series of birth data corrected for incompleteness of birth registration and for States not in the birth-registration area prior to 1933. The National Office of Vital Statistics has released estimates of the number of births in the United States corrected for under-registration for each year since 1935, based on relationships determined through the 1940 Test of Birth Registration Completeness. The estimates for earlier years and the adjusted series of age-specific and birth order rates prepared by Mr. Whelpton are of outstanding importance for the interpretation of fertility trends. It is believed that they will be of considerable value to agencies and individuals working with vital statistics published by this Office.

Births And Birth Rates

In The Entire United States, 1909 To 1948

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Only since 1933 has the birth-registration area been Nation-wide. Not until that year was the National Office of Vital Statistics¹ able to collect a copy of each birth certificate filed in the entire United States, and to publish reports based on births in the Nation as a whole. When the birth-registration area was organized in 1915 it included only 10 States (all in the North and East) and the District of Columbia, an area which contained barely 30 percent of the Nation's people and a smaller proportion of their births. One or more States were added in most years from 1916 to 1932, and the forty-eighth State was admitted at the beginning of 1933. Prior to 1915 a few States, mostly in the Northeast, had been registering births and publishing reports based on this material. In some of them the first birth-registration law had been enacted almost a century earlier, and the recording of births had become relatively complete. In others this was a new undertaking, not well established.

In the early years of the registration area, the births in the nonregistration States constituted a large majority of those whose numbers were unknown. With the growth of the area this group was in time outnumbered by the births in the registration States which were not reported to the proper authorities. Prior to 1940 there was little direct information about the numbers and characteristics of these births. In that year, however, tests were conducted in connection with the Census of Population which are believed to show fairly accurately not only the total number of unrecorded births in various States and cities, but their distribution by color, age of mother, and certain other categories.²

During recent years a demand has developed for estimates of the numbers of births and the birth rates in the entire United States prior to the time when the birth-registration area became Nation-wide. In the absence of such information it was often assumed, implicitly if not explicitly, in discussions of national fertility trends that the birth rates for the expanding registration area were typical of those for the entire United States. Unfortunately, this assumption led frequently to erroneous conclusions, for fertility was substantially lower in the birth-registration area than in the remainder of the Nation,

and fertility trends for the area had an upward bias owing to the addition of States. In fact, from 1915 (when the birth-registration area was organized) to 1933 (when it was completed) there was generally a direct relation between the fertility rate of a State and the year when it was admitted to the registration area.

A demand has developed also for estimates of the total number of births—unregistered as well as registered—and for the corresponding birth rate. In attempting to determine the number of children of the age to start school during the next 6 years, for example, it is obviously necessary to compute the number of survivors not only from the babies whose births were registered, but also from those whose births were not registered. Moreover, there has been a widening recognition of the fact that the increase since 1933 in the number of registered births and in the rate based on these births, while resulting mainly from a rise in fertility, reflects an improvement in the completeness of birth registration.

Estimates of the number of births and the crude birth rate, by race, adjusted for incomplete registration, for the entire United States during each year since 1935 have been published previously by the National Office of Vital Statistics.³ The most widely used estimates for earlier years probably are those prepared by the writer and published first in 1933.⁴ They are for (a) total births and white births (and the corresponding crude birth rates) in 1910 and subsequent years, and (b) births to native white, foreign-born white, and nonwhite women beginning with 1920. Because of information which has become available since their preparation (e.g., the results of the 1940 test of registration), these estimates have needed to be improved and brought into line with those for later years mentioned above. This report presents the results of such an undertaking. Revised estimates of the numbers of births in the years from 1909 (or 1917) to 1934 are shown in the right-hand panel of table 1, together with the estimates for later years prepared by the National Office of Vital Statistics. Crude birth rates (i.e., births per 1,000 persons) based on these births are shown in the left-hand panel of the same table. The procedure followed in making the estimates is described in section I of the appendix.

¹The National Office of Vital Statistics was formed in 1946 when the Division of Vital Statistics of the Bureau of the Census was transferred to the Public Health Service.

²Grove, Robert D., "Studies in Completeness of Birth Registration, Part I, Completeness of Birth Registration in the United States, December 1, 1939 to March 31, 1940," Bureau of the Census, Vital Statistics—Special Reports, vol. 17, No. 18, 1943.

³National Office of Vital Statistics, "Vital Statistics of the United States, Part I," 1946, p. XXII, Government Printing Office, Washington, D.C., 1948.

⁴Thompson, Warren S., and Whelpton, P. K., "Population Trends in the United States," p. 266. Recent Social Trends Monographs, McGraw-Hill Book Company, Inc., New York, 1933.

The large decline in the number of births from 1921 to 1933, and the unprecedented increase since the end of World War II, stimulated interest not only in the changes in numbers of births and crude birth rates by race and nativity of mother in the entire United States, but also in the changes in birth rates by age of mother or order of birth of child, e.g., births to native white women aged 20-24 per 1,000 women in this group, or first births per 1,000 native white women aged 15-44. To meet this need, estimates are presented here of the numbers of births in the United States to native white and to nonwhite women by age of mother, together with rates computed from these births.⁵ The series for births to native white women cover the years from 1920 to 1948; those for births to nonwhite women are for 1930 to 1948. The births are shown by age of mother in table 2 and by order of birth of child in table 4; the rates based on these births are shown in tables 3 and 5. A detailed description of the method of estimating is contained in section II of the appendix.

The accuracy of the estimates.—Users of the estimates in tables 1 to 5 should keep in mind the fact that they are approximations to the true numbers and not the true numbers themselves. For each year since 1915, when the birth-registration area was established, the number of births recorded in that area has been known, but it has been necessary to estimate the number not recorded. It is believed that the estimates for 1935 to date, which were made previously by the National Office of Vital Statistics, and those for earlier years, which are shown here for the first time, are as good as any that could be made from the available data. But it is realized that the estimated total number of births in the registration area, adjusted for incomplete reporting, may differ from the true figure by as much as 1 or 2 percent for each year since 1940, and by margins which increase gradually for earlier years and may amount to 5 percent for 1910.

The estimated numbers of white births should be slightly more accurate than those of total births, because the tests for completeness of registration have shown that a larger proportion of white than of nonwhite births have been recorded. The estimates for births to foreign-born white women probably are slightly less accurate relatively than those for births to all women, white women, and native white women, because they were obtained by subtracting the estimates for births to native white women from those for births to all white women. A slightly different procedure was followed in adjusting these two series for incomplete registration in some years, that for all white births ignoring changes in the percentage distribution of births by age of mother, and that for

births to native white women taking account of such changes. (Compare sections I and II of the appendix.) The effect on the results should be small, however, for in no year did the allowance for the age changes raise or lower the over-all percentage of births registered by more than 0.14 percent. Finally, the estimated numbers of nonwhite births during the last few years may be above or below the true figures by as much as 3 to 4 percent; those for the early 1920's may be too high or too low by as much as 8 to 10 percent. The possibility of error is larger for these births than for white births because the proportion not recorded is larger, and the information regarding underregistration presumably is less reliable.

Although the biases in the estimates of the total numbers of births during recent years are believed to be small, two of them should be considered briefly. First, the estimates may be below the true figures because the test of the completeness of birth registration, made in 1940, may have exaggerated slightly the proportion of births recorded. In this test, information obtained by census enumerators concerning infants born between December 1, 1939, and April 1, 1940, was matched against information on birth certificates; the estimated completeness of registration was the percentage of enumerated infants for whom a birth certificate could be found. Indirect evidence indicates that approximately 13.4 percent of the white and 26.4 percent of the nonwhite infants under 1 year of age on the census date were not reported to the enumerators, and that the omissions may have been somewhat larger relatively for the infants under 4 months of age on whom the test was based. There are reasons for believing that the births of the babies who were not reported to the census enumerators were less likely to be registered than those of the babies who were included in the census, which would give an upward bias to the completeness of registration according to the test. Fortunately, statistical analysis indicates that if such a bias exists, it is small for the country as a whole and for most States.⁶

The second possible bias is that the estimates for 1935 to 1939 may be below the true figures and those for years since 1940 above the true figures because too small an allowance was made for the improvement in the completeness of birth registration. It was assumed that the percentage of births recorded varied only because of changes in the proportion of births occurring in institutions (most of which occur in hospitals). In other words, the percentage of the births occurring (a) outside of institutions, and (b) in institutions, which were recorded, was assumed to have been the same in each year since 1935 as it was according to the 1940 test. In consequence, the estimated improvement in the completeness of registration since 1935 results entirely from a rise in the percentage of all births which occur in institutions. It is reasonable to believe that since 1940 there has been some improvement in the completeness of registration of births occurring outside of

⁵A monograph now being prepared by the writer will contain much more detailed information for native white women, including, (a) birth probabilities by single years of age, by parity of women, for each year since 1920, and (b) cumulative birth rates by order of birth of child, up to each year of age reached since 1920, for women grouped by year of birth. Examples of such probabilities and rates are (a) second births during 1947 per 1,000 one-parity women of exact age 25 on January 1, 1947, and (b) third births prior to age 30 per 1,000 women born on January 1, 1900, and living to exact age 30 (on January 1, 1930).

⁶Chandra Sekar, C., and Deming, W. Edwards, "On a Method of Estimating Birth and Death Rates and the Extent of Registration," *Jour. of the Am. Stat. Assn.*, vol. 44, No. 245, p. 101, March 1949.

Shapiro, Sam, "Estimating Birth Registration Completeness," *Jour. of the Am. Stat. Assn.*, vol. 45, No. 250, p. 261, June 1950.

institutions, for during the war years, and a few prewar years as well, there was a very great increase in the number of people who had need for proof of date and place of birth. But since there is no statistical basis for proving that such change occurred, nor for estimating the extent of the change if it did occur, it seemed desirable to follow the procedure described, and call attention to the slight bias which it may have caused in the estimates.

There is less basis for evaluating the possible extent of biases in the estimates for years before 1930 than in those for later years. The preliminary adjustments for unrecorded births in the registration area during 1929 and 1919 and in 10 States in 1909 (explained in the appendix) were based on a method which proved to give too small a number of adjusted births during 1939. In consequence, the preliminary adjustments for these 3 years were revised on the assumption that the ratio between the preliminary and final adjustment was the same for these years as for 1939. Unfortunately, there is no way of testing the validity of this assumption.

It is quite likely that the margin between the true numbers of total, white, or nonwhite births and the estimates in tables 1, 2, and 4 becomes gradually larger for years preceding 1933 not only because of the lack of direct current information regarding the completeness of recording births in the registration area, but also because of the smaller size of the area. That the error due to the latter probably is small is indicated by a comparison between the number of births in the entire Nation during 1930 to 1939 estimated (a) from births in the current registration area, and (b) by the procedure followed in preparing the estimates for 1909 to 1914, i.e., using the numbers of births registered in 10 States and ratios from census data. As shown in section III of the appendix, the differences amount to only 0.1 to 2.7 percent for all births, and to only 0.5 to 2.1 percent for white births. It is believed that the method gives results for 1909 to 1914 which are approximately as reliable as those for 1930 to 1939.

The accuracy of the estimates of births by age of mother or order of birth of child is affected not only by the assumptions regarding the completeness of birth registration and the number of births outside the registration area (mentioned above), but also by the assumption regarding the distribution by age or order of the births occurring outside of the area. The latter were tested for births to native white women by (a) estimating the number of such births during 1919-21 by age or order in each of the registration States, using data for other registration States, (b) adding the results to obtain estimates for the entire area, and (c) comparing these estimates with the births in the area, adjusted for incomplete recording. This test shows that the method provides estimates of births by age of mother in the registration area which differ from the estimates based on registered births by less than 2 percent at age groups 20-24 and 25-29, by less than 4 percent at 15-19, 30-34, 35-39, and 40-44, and by less than 8 percent at 45-49.⁷ It is probable that the method provides equally good results for the States outside

the area. Since births in these States constituted less than half of the births in the United States during 1920, it may well be that the 1920 estimates for the United States differ from those obtainable if the registration area had been Nation-wide by percentages which are half as large as the foregoing, namely, by less than 1 percent at age groups 20-24 and 25-29; by less than 2 percent at 15-19, 30-34, 35-39, and 40-44; and by less than 4 percent at 45-49. Estimates for years from 1921 to 1932 should become increasingly accurate because of the expansion of the registration area.

The accuracy of the estimates of births to native white women by order of birth of child in the non-registration States was tested in a similar manner. The method gave totals for the registration area which differ from the figures based on registered births by less than 2 percent for first, second, and third births; by less than 4 percent for fourth and sixth births; by less than 5 percent for fifth births; and by less than 6 percent for seventh births and for eighth and higher order births (combined). (See section IV of the appendix.) In consequence, it may well be that the 1920 estimates for the United States differ from the figures that would be available if every State had been in the registration area by percentages which are less than half as large as the foregoing. Estimates for years after 1920 should be more accurate because of the growth of the registration area.

Two possible biases in the estimates for births by order of birth should be mentioned briefly. First, in the 1940 test of the completeness of birth registration it was not possible to ascertain whether births of one order were recorded more or less accurately than those of another order. In consequence, when the registered births in a given year were adjusted to allow for incomplete reporting, the same factor was used for births of each order to women in each 5-year age group. It is believed that as birth order rises there is a small increase in the proportion of births occurring under conditions which are unfavorable to birth registration. Supporting this belief is the fact that relatively more of the higher order than of the lower order births occur (a) to couples in the lower educational and socioeconomic groups, who are less likely to appreciate the desirability of registration, and (b) in less accessible rural areas where the registration system functions less adequately than in urban areas. On the other hand, registration is likely to be less complete for illegitimate than for legitimate births, and lower order births are relatively more numerous among the former. It is probable that this influence is less important than the other, and that the procedure followed tends to exaggerate slightly the number of lower order births and understate the number of higher order births. It is hoped that the information regarding the completeness of birth registration which it is planned to collect in connection with the 1950 Census of Population will throw light on the differences by order of birth and lead to more accurate estimates by birth order in the future.

A second bias in the estimates of births by order may exist because some women report two first births. This not only would exaggerate the number of such births, but would understate the number of second and subsequent births. Most of such misstatements are believed to occur because a not unimportant proportion of the women whose first child is born out

⁷As explained in section IV of the appendix, the percentages are somewhat smaller on the net basis and somewhat larger on the gross basis. (See appendix table 8.)

of wedlock try to conceal this birth when they marry later, and hence report their second birth as a first birth, their third birth as a second birth, etc. There may also be some tendency for women who marry twice to report the first child by the second husband as a first birth, even though they had one or two children by the first husband. No attempt has been made to reduce or eliminate this bias because little information is available about it, and because it is believed to be relatively small.

The foregoing comments on the accuracy of the estimates should not lead the reader to conclude

that they are not worth using. On the contrary, the picture they give of events in the United States certainly is much more accurate than that given by corresponding figures for the expanding birth-registration area, and very probably is quite close to the truth. Nevertheless, the qualifications should be kept in mind by users of the estimates when evaluating the significance of small changes from year to year in the number of births to, or the birth rate of, native white women (or another group) and small differences between the rates for the various groups. This is especially true for rates by order of birth.

SYMBOLS USED IN SPECIAL REPORTS

Class or item not applicable (three dots)-----	...
Data not available (three dashes)-----	---
Quantity is zero, in frequency tables (one dash)-----	-
Quantity is zero, in rate or percent tables (one cipher)-----	0
If rate or percent is more than 0 but less than 0.05-----	0.0
If both frequency and population base are zero in rate or percent tables (one dash)-----	-

TABLE 1.—ESTIMATED BIRTH RATES AND NUMBERS OF LIVE BIRTHS, BY RACE AND BY NATIVITY OF WHITE MOTHERS:
UNITED STATES, 1909-48

(Adjusted for underregistration, and for births in States not in the birth-registration area. Estimates are rounded to the nearest thousand without being adjusted to totals, which are independently rounded. Rates per 1,000 estimated midyear population)

YEAR	BIRTH RATE ¹			NUMBER OF LIVE BIRTHS				
	All races	White	Nonwhite	All races	White			Nonwhite
					Total	Native mother	Foreign-born mother	
1948-----	25.3	24.3	34.4	3,702	3,173	3,063	110	529
1947-----	27.0	26.3	33.1	3,876	3,377	3,252	125	499
1946-----	24.5	23.8	30.0	3,458	3,013	2,917	96	445
1945-----	20.7	19.9	28.0	2,894	2,487	2,394	92	408
1944-----	21.5	20.7	28.7	2,969	2,558	2,460	98	411
1943-----	22.9	22.2	29.3	3,127	2,713	2,605	108	413
1942-----	22.3	21.6	28.4	3,003	2,610	2,497	113	393
1941-----	20.3	19.5	27.7	2,710	2,332	2,224	108	378
1940-----	19.4	18.6	26.7	2,558	2,199	2,085	114	360
1939-----	18.8	18.0	26.1	2,466	2,117	1,998	120	349
1938-----	19.2	18.4	26.3	2,496	2,148	2,016	132	348
1937-----	18.7	17.9	26.0	2,413	2,071	1,931	141	342
1936-----	18.4	17.6	25.1	2,355	2,027	1,875	152	328
1935-----	18.7	17.9	25.8	2,377	2,042	1,872	170	334
1934-----	19.0	18.1	26.3	2,396	2,058	1,863	195	338
1933-----	18.4	17.6	25.5	2,307	1,982	1,776	205	325
1932-----	19.5	18.7	26.9	2,440	2,099	1,857	242	341
1931-----	20.2	19.5	26.6	2,506	2,170	1,895	275	335
1930-----	21.3	20.6	27.5	2,618	2,274	1,959	314	344
1929-----	21.2	20.5	27.3	2,582	2,244	1,913	331	339
1928-----	22.2	21.5	28.5	2,674	2,325	1,964	361	349
1927-----	23.5	22.7	31.1	2,802	2,425	2,033	391	377
1926-----	24.2	23.1	33.4	2,839	2,441	2,028	412	398
1925-----	25.1	24.1	34.2	2,909	2,506	2,062	443	403
1924-----	26.1	25.1	34.6	2,979	2,577	2,098	479	401
1923-----	26.0	25.2	33.2	2,910	2,531	2,052	478	380
1922-----	26.2	25.4	33.2	2,882	2,507	2,018	489	375
1921-----	28.1	27.3	35.8	3,055	2,657	2,132	525	398
1920-----	27.7	26.9	35.0	2,950	2,566	2,047	520	383
1919-----	26.2	25.5	32.6	2,740	2,387	1,842	545	353
1918-----	28.6	28.0	33.2	2,948	2,588	1,988	601	360
1917-----	28.5	28.0	32.9	2,944	2,587	1,936	651	357
1916-----	29.1	28.5	---	2,964	2,599	---	---	---
1915-----	29.5	28.9	---	2,965	2,594	---	---	---
1914-----	29.9	29.3	---	2,966	2,588	---	---	---
1913-----	29.5	28.8	---	2,869	2,497	---	---	---
1912-----	29.8	29.0	---	2,840	2,467	---	---	---
1911-----	29.9	29.1	---	2,809	2,435	---	---	---
1910-----	30.1	29.2	---	2,777	2,401	---	---	---
1909-----	30.0	29.2	---	2,718	2,344	---	---	---

¹For 1947-48, based on populations excluding armed forces overseas; for 1940-46, based on populations including armed forces overseas.

NOTE.—The estimates for all races, total white, and nonwhite for 1935 to 1948 are from "Vital Statistics of the United States, Part I, 1948," table Y, National Office of Vital Statistics, Government Printing Office, Washington, D. C., 1950. All other estimates were made as described in the text or appendix.

VITAL STATISTICS—SPECIAL REPORTS

TABLE 2.—ESTIMATED NUMBERS OF LIVE BIRTHS, BY AGE OF MOTHER, FOR NATIVE WHITE WOMEN—1920 TO 1948, AND FOR NONWHITE WOMEN—1930 TO 1948: UNITED STATES

(Adjusted for underregistration, and for births in States not in the birth-registration area. Estimates are rounded to the nearest thousand without being adjusted to totals, which are independently rounded)

YEAR	AGE OF MOTHER ¹							
	All ages	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	45-49 years
NATIVE WHITE								
1948-----	3,063	344	1,012	873	520	248	63	4
1947-----	3,252	343	1,078	942	556	264	65	4
1946-----	2,917	256	945	858	534	258	63	5
1945-----	2,394	217	706	688	476	241	61	5
1944-----	2,460	238	776	704	455	225	58	4
1943-----	2,605	277	841	760	454	213	55	4
1942-----	2,497	277	846	723	409	187	50	4
1941-----	2,224	256	732	635	372	175	50	5
1940-----	2,085	245	672	589	354	170	51	5
1939-----	1,998	241	642	555	335	168	51	5
1938-----	2,016	247	659	551	330	169	54	5
1937-----	1,931	238	629	522	314	168	54	6
1936-----	1,875	227	605	504	305	171	57	6
1935-----	1,872	229	594	499	305	179	61	6
1934-----	1,863	224	584	495	311	179	63	6
1933-----	1,776	212	549	470	296	180	63	6
1932-----	1,857	225	577	482	310	191	65	6
1931-----	1,895	233	590	486	317	197	65	7
1930-----	1,959	248	611	494	330	202	67	7
1929-----	1,913	239	593	485	322	201	66	7
1928-----	1,964	245	600	493	340	210	69	7
1927-----	2,033	254	611	512	357	219	73	7
1926-----	2,028	251	601	518	360	217	73	8
1925-----	2,062	250	604	534	367	223	76	8
1924-----	2,098	249	621	544	373	226	77	8
1923-----	2,052	231	602	546	367	224	75	8
1922-----	2,018	224	593	541	357	220	74	9
1921-----	2,132	241	635	568	369	233	78	9
1920-----	2,047	218	620	548	352	223	76	10
NONWHITE								
1948-----	529	117	176	117	67	41	11	1
1947-----	499	110	164	108	64	40	11	1
1946-----	445	92	143	98	61	38	11	1
1945-----	408	89	124	87	59	37	11	2
1944-----	411	91	129	87	58	35	10	1
1943-----	413	99	131	84	54	33	10	1
1942-----	393	97	126	79	50	31	10	1
1941-----	378	94	119	77	48	30	10	1
1940-----	360	88	113	74	45	29	9	1
1939-----	349	87	108	72	43	29	8	1
1938-----	348	85	108	72	43	30	9	2
1937-----	342	81	108	70	42	30	9	2
1936-----	328	75	104	68	41	30	9	2
1935-----	334	75	106	69	42	30	10	2
1934-----	338	75	108	69	45	29	10	2
1933-----	325	71	102	67	44	29	10	2
1932-----	341	74	107	70	45	32	10	2
1931-----	335	74	105	69	45	31	10	2
1930-----	344	76	108	71	45	32	10	2

¹Births to women reported as younger than 15 or older than 49 are combined with those to women aged 15-19 and 45-49, respectively. Births to women of unreported age are distributed proportionally.

NOTE.—The procedure followed in making these estimates is described in section II of the appendix.

TABLE 3.—ESTIMATED BIRTH RATES, BY AGE OF MOTHER, FOR NATIVE WHITE WOMEN—1920 TO 1948, AND FOR NONWHITE WOMEN—1930 TO 1948: UNITED STATES

(Based on births in table 2. Rates per 1,000 estimated numbers of women of specified age, at midyear)

YEAR	AGE OF MOTHER							
	15-44 years ¹	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	45-49 years
NATIVE WHITE								
1948-----	107	73	195	169	103	55	16	1
1947-----	115	71	206	182	112	60	17	1
1946-----	103	52	179	167	109	60	17	1
1945-----	85	43	133	135	100	57	17	1
1944-----	89	47	147	139	98	55	16	1
1943-----	95	53	162	149	100	53	16	1
1942-----	91	53	163	144	92	48	14	1
1941-----	82	48	142	129	85	46	15	1
1940-----	78	46	131	122	83	46	15	2
1939-----	76	45	125	118	80	46	15	2
1938-----	78	47	128	119	81	47	16	2
1937-----	75	45	124	115	80	47	16	2
1936-----	74	44	121	114	79	49	18	2
1935-----	75	44	121	115	81	51	19	2
1934-----	76	43	122	117	85	52	20	2
1933-----	74	41	118	114	82	53	21	3
1932-----	79	44	126	120	86	57	22	3
1931-----	82	46	131	125	89	59	23	3
1930-----	86	50	139	130	93	62	24	3
1929-----	86	50	138	130	91	63	25	3
1928-----	90	52	143	133	97	68	26	3
1927-----	95	55	150	139	103	73	28	3
1926-----	96	55	151	142	106	75	29	4
1925-----	100	56	156	147	110	79	30	4
1924-----	104	57	163	151	114	82	31	4
1923-----	103	54	160	153	116	83	31	4
1922-----	104	54	158	154	116	83	32	4
1921-----	112	60	170	163	124	88	35	5
1920-----	109	55	167	160	122	86	35	5
NONWHITE								
1948-----	141	172	255	173	105	71	22	3
1947-----	134	161	238	163	102	73	22	3
1946-----	120	134	207	149	97	72	22	4
1945-----	111	128	179	133	95	72	22	4
1944-----	112	131	188	133	95	68	21	3
1943-----	114	142	192	130	93	64	21	3
1942-----	110	138	185	122	88	58	20	3
1941-----	106	133	177	119	87	56	21	3
1940-----	102	125	169	116	83	54	21	4
1939-----	100	124	161	115	81	55	19	4
1938-----	101	121	161	115	81	57	21	5
1937-----	99	116	161	113	80	58	22	5
1936-----	96	108	155	111	79	57	23	5
1935-----	99	109	159	113	84	59	24	5
1934-----	100	108	162	113	91	59	26	6
1933-----	97	103	153	111	89	59	26	6
1932-----	103	109	160	118	94	64	27	7
1931-----	102	108	157	116	94	64	27	6
1930-----	106	111	161	120	97	68	28	7

¹Rates for age group 15-44 years computed by relating total births, regardless of age of mother, to female population age 15-44 years.

VITAL STATISTICS—SPECIAL REPORTS

TABLE 4.—ESTIMATED NUMBERS OF LIVE BIRTHS, BY ORDER OF BIRTH OF CHILD, FOR NATIVE WHITE WOMEN—1920 TO 1948, AND FOR NONWHITE WOMEN—1930 TO 1948: UNITED STATES

(Adjusted for underregistration, and for births in States not in the birth-registration area. Estimates are rounded to the nearest thousand without being adjusted to totals, which are independently rounded)

YEAR	ORDER OF BIRTH ¹							
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth and higher
NATIVE WHITE								
1948-----	1,182	914	460	216	113	65	40	72
1947-----	1,391	896	448	216	115	67	42	77
1946-----	1,156	832	418	212	114	67	42	77
1945-----	846	672	379	199	110	67	43	80
1944-----	881	692	385	200	110	67	43	80
1943-----	1,007	732	373	193	109	67	44	82
1942-----	1,089	650	319	167	96	60	40	77
1941-----	914	575	295	161	95	62	41	81
1940-----	813	545	284	157	95	63	43	85
1939-----	785	506	266	152	95	64	43	86
1938-----	793	496	265	155	100	68	47	93
1937-----	746	463	254	155	100	69	48	96
1936-----	704	442	251	157	103	71	48	99
1935-----	687	427	255	163	107	75	53	105
1934-----	645	430	264	170	112	78	55	108
1933-----	588	413	257	167	111	78	55	108
1932-----	614	430	268	174	117	83	58	113
1931-----	632	437	272	177	119	84	58	116
1930-----	653	447	282	185	125	88	61	118
1929-----	620	437	279	183	125	87	61	121
1928-----	626	443	289	192	130	91	65	128
1927-----	638	456	299	203	136	98	68	135
1926-----	628	459	301	203	136	98	69	134
1925-----	637	460	311	206	140	100	70	139
1924-----	646	467	315	208	144	103	73	143
1923-----	611	474	302	206	143	103	72	141
1922-----	615	460	292	204	139	100	71	138
1921-----	689	444	310	217	147	106	75	144
1920-----	657	439	299	205	140	100	72	135
NONWHITE								
1948-----	154	120	78	51	36	26	19	44
1947-----	156	105	68	47	34	25	19	44
1946-----	123	93	63	46	33	25	19	43
1945-----	110	79	57	43	33	24	18	44
1944-----	111	81	59	44	32	24	18	42
1943-----	118	84	58	42	31	23	17	41
1942-----	116	78	55	39	29	21	16	38
1941-----	110	75	52	38	28	21	16	38
1940-----	103	70	50	37	27	20	15	38
1939-----	104	67	47	34	26	20	15	36
1938-----	105	65	47	34	25	20	15	37
1937-----	102	65	45	33	26	19	15	37
1936-----	96	62	43	33	25	19	14	36
1935-----	99	61	44	34	25	19	15	37
1934-----	98	60	45	34	26	20	15	40
1933-----	92	59	43	33	25	20	15	38
1932-----	98	62	44	34	26	21	16	40
1931-----	96	60	43	34	26	21	16	39
1930-----	102	61	44	34	27	21	16	40

¹Births of unreported order are distributed.

NOTE.—The procedure followed in making these estimates is described in section II of the appendix.

TABLE 5.—ESTIMATED BIRTH RATES, BY ORDER OF BIRTH OF CHILD, FOR NATIVE WHITE WOMEN—1920 TO 1948, AND FOR NONWHITE WOMEN—1930 TO 1948: UNITED STATES

(Based on births in table 4. Rates per 1,000 estimated numbers of women aged 15-44, at midyear)

YEAR	ORDER OF BIRTH							
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth and higher
NATIVE WHITE								
1948-----	41	32	16	8	4	2	1	3
1947-----	49	32	16	8	4	2	1	3
1946-----	41	29	15	7	4	2	1	3
1945-----	30	24	14	7	4	2	2	3
1944-----	32	25	14	7	4	2	2	3
1943-----	37	27	14	7	4	2	2	3
1942-----	40	24	12	6	4	2	1	3
1941-----	34	21	11	6	4	2	2	3
1940-----	30	20	11	6	4	2	2	3
1939-----	30	19	10	6	4	2	2	3
1938-----	31	19	10	6	4	3	2	4
1937-----	29	18	10	6	4	3	2	4
1936-----	28	18	10	6	4	3	2	4
1935-----	28	17	10	7	4	3	2	4
1934-----	26	18	11	7	5	3	2	4
1933-----	24	17	11	7	5	3	2	4
1932-----	26	18	11	7	5	4	2	5
1931-----	27	19	12	8	5	4	3	5
1930-----	29	20	12	8	6	4	3	5
1929-----	28	20	13	8	6	4	3	5
1928-----	29	20	13	9	6	4	3	6
1927-----	30	21	14	9	6	5	3	6
1926-----	30	22	14	10	6	5	3	6
1925-----	31	22	15	10	7	5	3	7
1924-----	32	23	16	10	7	5	4	7
1923-----	31	24	15	10	7	5	4	7
1922-----	32	24	15	10	7	5	4	7
1921-----	36	23	16	11	8	6	4	8
1920-----	35	23	16	11	7	5	4	7
NONWHITE								
1948-----	41	32	21	14	10	7	5	12
1947-----	42	28	18	13	9	7	5	12
1946-----	33	25	17	12	9	7	5	12
1945-----	30	21	15	12	9	7	5	12
1944-----	30	22	16	12	9	7	5	11
1943-----	33	23	16	12	8	6	5	11
1942-----	32	22	15	11	8	6	4	11
1941-----	31	21	15	11	8	6	4	11
1940-----	29	20	14	10	8	6	4	11
1939-----	30	19	13	10	7	6	4	10
1938-----	30	19	13	10	7	6	4	11
1937-----	30	19	13	10	7	6	4	11
1936-----	28	18	13	10	7	6	4	11
1935-----	29	18	13	10	7	6	4	11
1934-----	29	18	13	10	8	6	5	12
1933-----	27	18	13	10	8	6	5	11
1932-----	30	19	13	10	8	6	5	12
1931-----	29	18	13	10	8	6	5	12
1930-----	31	19	14	10	8	6	5	12

APPENDIX

1. Estimating the Total Annual Numbers of All Births and White Births in the United States From 1909 to 1948, and Births to Native White Women, Foreign-Born White Women, and Nonwhite Women From 1917 to 1948

A. 1935 to 1948

The birth-registration area was Nation-wide; the completeness of birth registration was estimated by the National Office of Vital Statistics.

1. The numbers of registered white and nonwhite births were adjusted for incomplete recording, using the estimates of underregistration in 1935 to 1948 prepared by the National Office of Vital Statistics.
2. Adding the estimated numbers of white and nonwhite births obtained in 1 gave the estimated numbers of total births.
3. The numbers of registered births to native white women were adjusted for incomplete recording, using percentages obtained as explained in section II. (See appendix table 1, columns B, E, and F.)
4. Estimates of the numbers of births to foreign-born white women were obtained by subtracting those for births to native white women from those for all white births.

B. 1920 to 1934

The birth-registration area increased from 23 States and the District of Columbia in 1920 to the entire United States in 1933; the completeness of recording births in the registration area was not estimated by the National Office of Vital Statistics—in those years the Division of Vital Statistics of the Bureau of the Census. The procedure for estimating the numbers of births to white, native white, and nonwhite women is described in 1 and 2. Estimates for births to foreign-born white women were obtained by subtracting those for native white women from those for all white women.

1. Allowing for births in States not in the birth-registration area. Steps a and b were carried out separately for births to, and native-born children of, all white, native white, and nonwhite women.
 - a. The ratio between the number of children under 1 year of age in the United States and in the birth-registration area of 1932 was calculated as of April 1, 1930, and 1940, from data in the censuses of 1930 and 1940. Similar calculations were made for the birth-registration area of each year from 1920 to 1931, using the 1920 and 1930 census data for the areas of 1920 to 1929. Straight line interpolation between the appropriate 1920, 1930, and 1940 ratios gave the ratio as of December 31, 1920, for the 1920 birth-registration area; as of December 31, 1921, for the 1921 area; etc. (For native white women, the ratios were based on registered births to native white women in 1933, and on children under 5 with native white mothers in 1920 and 1930 because children under 1 with such mothers were not tabulated in the censuses of 1920, 1930, or 1940.) The ratios are shown in appendix table 1, column C.
 - b. Multiplying the number of recorded births in the registration area during a given year by the appropriate ratio obtained in a gave an estimate of the number of "registered" births in the United States during that year.³ (See appendix table 1, column D.)
2. Adjusting for underregistration. The estimated numbers of "registered" births to all white, native white, and nonwhite women in the United States during each year from 1920 to 1934 (obtained in 1) were adjusted for incomplete recording, using estimates of underregistration obtained as described below.

³For a discussion of the accuracy of this procedure, see section III of the appendix. The estimated number of "registered" births in the United States is a working figure only and should not be taken as an estimate of the total number of births registered in all States.

- a. Preliminary estimates were made of the percentage of the white and nonwhite births occurring in the 1929 registration area during the year ending on March 31, 1930, which were recorded, based on the relationship in each birth-registration State between (1) the number of children under 1 year of age enumerated in the 1930 census, adjusted for underenumeration, and (2) the number of births during the year ending on March 31, 1930, minus the number of infants born and dying during that year.⁹ The preliminary estimates were that 93.5 percent of the white births and 88.1 percent of the nonwhite births occurring in the 1929 registration area during the year ending on March 31, 1930, were recorded.
- b. Similar preliminary estimates were made for births in the registration area during 1919, primarily from data in the "United States Abridged Life Tables, 1919-1920," pp. 58 and 60, by Elbertie Foudray, Bureau of the Census, Government Printing Office, Washington, D. C., 1923. The estimates for the area were that 92.7 percent of the white births and 75.1 percent of the nonwhite births were recorded.
- c. The preliminary 1929 percentages in a were decreased from 93.5 to 91.32 for white births and from 88.1 to 78.00 for nonwhite births, and the preliminary 1919 percentage for white births in b was reduced from 92.7 to 90.56 to take account of biases which were found when estimates of the underregistration of births occurring during the year ending March 31, 1940, obtained by the same method, were compared with the results of the Nation-wide birth registration test conducted in connection with the 1940 Census of Population. The percentage for nonwhite births in 1919 was rounded to 75.0.¹⁰ These changes are equivalent to multiplying the preliminary percentages for white births by 0.977 and those for nonwhite births in 1929 by 0.885 and in 1919 by 0.999.
- d. Estimates of the completeness of registration for 1930 to 1934 were obtained by interpolations between the percentages for 1929 in c and those of the National Office of Vital Statistics for 1935 (mentioned in A1). The percentages for births to total white and native white women were adjusted slightly (by 0.03 to 0.11 percent) to allow for the effect of changes in the distribution of births by age of mother, as explained in section IIA1 of the appendix. The results are shown in appendix table 1, column E.¹¹
- e. Estimates for 1920 to 1928 were made by interpolating between the 1919 and 1929 percentages in c and making slight adjustments (0.12 to 0.14 percent) for age changes as in d. (See appendix table 1, column E.)

C. 1917 to 1919

The birth-registration area consisted of 20 States and the District of Columbia in 1917 and 1918; 3 States were added and 1 was dropped in 1919. The estimates of births to foreign-born white women were obtained by subtracting those for births to native white women from those for total white births.

1. The numbers of "registered" births in the United States to white, native white, and nonwhite mothers were estimated from the numbers in the registration area according to the procedure described in B1a and B1b, using data from the censuses of 1910 and 1920.
2. Adjusting for underregistration.
 - a. The percentages of births registered in 1919 obtained in B2c (i.e., 90.56 for white and 75.0 for nonwhite births) were used for these groups in 1919. The percentage for births to native white women was assumed to be the same as that for white births.
 - b. The percentage of nonwhite births registered was assumed to be the same in 1918 and 1917 as in 1919.
 - c. Preliminary estimates were made of the percentage of the white births occurring in each registration State during 1919 which were recorded, based primarily on data in the report by Elbertie Foudray, *loc. cit.* These were multiplied by 0.977 to allow for the bias mentioned in B2c. The final estimates are shown in appendix table 2.

⁹For a more detailed discussion of the procedure followed, see "The Completeness of Birth Registration in the United States," by P. K. Whelpton, Jour. of the Am. Stat. Assn., vol. 29 No. 186, p. 125, June 1934.

¹⁰The percentage for nonwhite births in 1919 was changed so little (from 75.1 to 75.0) because a large allowance for incomplete registration had been made by Miss Foudray.

¹¹In estimating births by age of mother (see section II), it was advisable to allow for the variations in the completeness of the registration of births to women in different age groups. The results were applied to the estimates of births at all ages for the sake of uniformity even though the effect on the total is small.

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APPENDIX TABLE 1.—NUMBERS OF BIRTHS RECORDED IN THE REGISTRATION AREA, AND ESTIMATED NUMBERS OF "REGISTERED" AND TOTAL BIRTHS IN THE UNITED STATES, FOR ALL WHITE BIRTHS IN 1909 TO 1934, FOR BIRTHS TO NATIVE WHITE WOMEN IN 1917 TO 1948, AND FOR BIRTHS TO NONWHITE WOMEN IN 1917 TO 1934

YEAR	Number of States in the birth-registration area ¹	Number of births registered in area ² (thousands)	Estimated ratio of "registered" births in the United States to those in the birth-registration area	Estimated number of "registered" births in the United States (B x C) (thousands)	Estimated percentage of births registered ³	Estimated number of births in the United States ($\frac{D \text{ (or B)}}{E} \times 100$) (thousands)
	A	B	C	D	E	F
BIRTHS TO ALL WHITE WOMEN						
1934--	49	1,898.5	...	...	92.25	2,058.0
1933--	49	1,823.5	...	...	92.01	1,981.9
1932--	48	1,822.4	1.0573	1,926.9	91.80	2,099.0
1931--	47	1,867.2	1.0648	1,988.2	91.61	2,170.3
1930--	47	1,953.2	1.0648	2,079.8	91.48	2,273.5
1929--	47	1,924.5	1.0647	2,049.0	91.32	2,243.7
1928--	45	1,982.2	1.0704	2,121.7	91.24	2,325.4
1927--	41	1,925.6	1.1480	2,210.5	91.16	2,424.8
1926--	36	1,707.0	1.3025	2,223.4	91.09	2,440.9
1925--	34	1,731.7	1.3169	2,280.4	91.01	2,505.6
1924--	34	1,762.9	1.3294	2,343.6	90.94	2,577.1
1923--	31	1,644.0	1.3990	2,300.1	90.88	2,530.9
1922--	31	1,629.4	1.3971	2,276.4	90.80	2,507.1
1921--	28	1,565.4	1.5398	2,410.5	90.73	2,656.8
1920--	24	1,395.5	1.6671	2,326.5	90.65	2,566.5
1919--	23	1,269.4	1.7031	2,161.8	90.56	2,387.0
1918--	21	1,288.7	1.8178	2,342.6	90.51	2,588.3
1917--	21	1,280.3	1.8206	2,330.8	90.10	2,586.9
1916--	12	799.8	2.9884	2,390.2	91.97	2,598.9
1915--	11	763.9	3.1076	2,373.9	91.52	2,593.8
1914--	10	751.1	3.1372	2,356.2	91.03	2,588.4
1913--	10	719.4	3.1443	2,261.9	90.57	2,497.4
1912--	10	705.4	3.1515	2,223.1	90.13	2,466.6
1911--	10	690.9	3.1586	2,182.4	89.64	2,434.6
1910--	10	676.0	3.1658	2,140.0	89.13	2,400.9
1909--	10	654.8	3.1729	2,077.7	88.63	2,344.2
BIRTHS TO NATIVE WHITE WOMEN						
1948--	49	2,974.2	...	...	97.10	3,062.9
1947--	49	3,157.1	...	...	97.08	3,252.1
1946--	49	2,817.1	...	...	96.57	2,917.3
1945--	49	2,308.8	...	...	96.43	2,394.4
1944--	49	2,363.8	...	...	96.10	2,459.7
1943--	49	2,491.4	...	...	95.63	2,605.2
1942--	49	2,382.3	...	...	95.40	2,497.1
1941--	49	2,103.7	...	...	94.58	2,224.3
1940--	49	1,962.8	...	...	94.15	2,084.8
1939--	49	1,872.3	...	...	93.73	1,997.6
1938--	49	1,883.5	...	...	93.41	2,016.4
1937--	49	1,797.0	...	...	93.07	1,930.8
1936--	49	1,740.3	...	...	92.82	1,874.9
1935--	49	1,731.4	...	...	92.47	1,872.4
1934--	49	1,718.7	...	...	92.25	1,863.1
1933--	49	1,634.5	...	...	92.01	1,776.4
1932--	48	1,618.1	1.0538	1,705.2	91.80	1,857.5
1931--	47	1,633.3	1.0630	1,736.2	91.61	1,895.2
1930--	47	1,684.1	1.0643	1,792.5	91.48	1,959.4

APPENDIX TABLE 1.—NUMBERS OF BIRTHS RECORDED IN THE REGISTRATION AREA, AND ESTIMATED NUMBERS OF "REGISTERED" AND TOTAL BIRTHS IN THE UNITED STATES, FOR ALL WHITE BIRTHS IN 1909 TO 1934, FOR BIRTHS TO NATIVE WHITE WOMEN IN 1917 TO 1948, AND FOR BIRTHS TO NONWHITE WOMEN IN 1917 TO 1934—Continued

YEAR	Number of States in the birth-registration area ¹	Number of births registered in area ² (thousands)	Estimated ratio of "registered" births in the United States to those in the birth-registration area	Estimated number of "registered" births in the United States (B x C) (thousands)	Estimated percentage of births registered ³	Estimated number of births in the United States ($\frac{D \text{ (or B)}}{E} \times 100$) (thousands)
	A	B	C	D	E	F
BIRTHS TO NATIVE WHITE WOMEN—Continued						
1929--	47	1,639.2	1.0656	1,746.8	91.32	1,912.8
1928--	45	1,672.0	1.0719	1,792.3	91.24	1,964.4
1927--	41	1,592.8	1.1638	1,853.7	91.16	2,033.4
1926--	36	1,362.1	1.3565	1,847.7	91.09	2,028.4
1925--	34	1,364.6	1.3754	1,876.8	91.01	2,062.2
1924--	34	1,368.6	1.3943	1,908.2	90.94	2,098.3
1923--	31	1,254.5	1.4869	1,865.3	90.88	2,052.5
1922--	31	1,229.8	1.4901	1,832.6	90.80	2,018.3
1921--	28	1,172.8	1.6495	1,934.5	90.73	2,132.2
1920--	24	1,047.6	1.7709	1,855.3	90.65	2,046.6
1919--	23	914.0	1.8249	1,667.9	90.56	1,841.7
1918--	21	910.0	1.9770	1,799.1	90.51	1,987.7
1917--	21	879.6	1.9828	1,744.1	90.10	1,935.6
BIRTHS TO NONWHITE WOMEN						
1934--	49	269.1	...	...	79.80	338.1
1933--	49	257.7	...	...	79.30	325.0
1932--	48	251.6	1.0710	269.5	79.00	341.1
1931--	47	245.5	1.0749	263.9	78.67	335.5
1930--	47	250.8	1.0756	269.7	78.33	344.4
1929--	47	245.4	1.0760	264.1	78.00	338.6
1928--	45	250.9	1.0805	271.1	77.67	349.0
1927--	41	212.3	1.3729	291.4	77.33	376.8
1926--	36	149.0	2.0564	306.5	77.00	398.0
1925--	34	147.2	2.0984	308.9	76.67	402.9
1924--	34	167.7	1.8266	306.4	76.33	401.4
1923--	31	148.6	1.9413	288.5	76.00	379.6
1922--	31	145.5	1.9476	283.4	75.67	374.6
1921--	28	148.8	2.0145	299.8	75.33	398.0
1920--	24	113.4	2.5366	287.5	75.00	383.4
1919--	23	104.1	2.5445	264.8	75.00	353.1
1918--	21	74.9	3.6016	269.9	75.00	359.9
1917--	21	73.5	3.6400	267.6	75.00	356.7

¹The District of Columbia is counted as a State. The 10 States used as an unofficial registration area during 1909 to 1914 are Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Michigan, and Minnesota. These States and the District of Columbia formed the birth-registration area in 1915.

²For 1937 to 1948 from annual reports, "Vital Statistics of the United States"; for 1922 to 1936 from annual reports, "Birth, Stillbirth, and Infant Mortality Statistics"; for 1915 to 1921 from annual reports, "Birth Statistics for the Birth Registration Area of the United States"; and for 1909 to 1914 from annual reports issued by the individual States.

³The method of estimating is described in sections I and II of the appendix.

VITAL STATISTICS—SPECIAL REPORTS

APPENDIX TABLE 2.—ESTIMATED COMPLETENESS OF REGISTRATION OF THE WHITE BIRTHS OCCURRING IN THE BIRTH-REGISTRATION STATES DURING 1919, AND IN A SIX-STATE AREA DURING 1919 AND THE YEAR ENDING ON APRIL 15, 1910 (THE CENSUS DATE)

YEAR AND STATE	Percentage of births registered
1919: ¹	
Maine-----	92.82
New Hampshire-----	92.82
Vermont-----	88.91
Massachusetts-----	98.41
Rhode Island-----	93.79
Connecticut-----	94.86
 New York-----	 98.13
Pennsylvania-----	88.59
Ohio-----	85.25
Indiana-----	90.90
Michigan-----	91.56
Wisconsin-----	87.69
Minnesota-----	90.46
Kansas-----	85.91
 District of Columbia-----	 100.54
Maryland-----	92.95
Virginia-----	90.00
North Carolina-----	87.17
South Carolina-----	81.61
Kentucky-----	84.49
 Utah-----	 91.84
Washington-----	86.55
Oregon-----	85.90
California-----	87.61
Six States ² -----	93.37
April 15, 1909 to April 15, 1910:	
Six States ² -----	88.65

¹Preliminary percentages for 1919 for all States except Maine, New Hampshire, Vermont, and Rhode Island were computed from data in the report by Elbertie Foudray, *op. cit.* These were multiplied by 0.977 for the reason mentioned in IB2c. The 1919 percentages for the four States mentioned above, and the 1909-10 percentage for the six-State area, were estimated by the writer according to a similar procedure.

²The six States are Massachusetts, Connecticut, New York, Pennsylvania, Michigan, and Minnesota; they are the only original registration States for which the numbers of births during 1919, corrected for underregistration, were estimated in the Foudray report.

- d. Dividing the numbers of recorded white births during 1918 (or 1917) in the various registration States by the 1918 (or 1917) percentages obtained in c, adding the quotients, and dividing the number of recorded white births in the entire registration area by the sum of the quotients, gave preliminary estimates of the percentage of white births registered in the area as a whole during 1918 (or 1917).
- e. The preliminary estimate for 1918 was reduced by slightly less than 0.5 and that for 1917 by approximately 0.9 to allow for the improvement in the completeness of birth registration in the area; the resulting percentages are shown in appendix table 1, column E. The amount of improvement was estimated from a comparison of the completeness of registration of the births occurring during 1919 and during the year ending on April 15, 1910 (the census date), in a

six-State area (i.e., those original birth-registration States for which the number of births during 1919, corrected for underregistration, was estimated in the Foudray report). The 1909-10 percentage was obtained as follows:

- (1) The number of native white children under 1, enumerated in the 1910 census, was multiplied by 1.09 to allow for underenumeration,¹² and by 1.0876 to allow for the infants born and dying during the year ending on the census date.¹³
- (2) The number of white births registered in the year ending on April 15, 1910 (the census date), was assumed to be 7/24 of the number for 1910 plus 17/24 of that for 1909.
- (3) Dividing the estimate in (1) by that in (2) and multiplying by 0.977 (as before) gave the estimate of the percent registered, namely, 88.65.
- (4) Subtracting the estimate in (3) from that for 1919 gave an increase of 4.72 in 9.71 years, or slightly less than 0.5 per year.

D. 1909 to 1916

The birth-registration area began in 1915 with 10 States and the District of Columbia; 1 State was added in 1916. These States contained too small a proportion of the nonwhite population to permit the making of worth-while estimates of nonwhite births. Estimates for 1909 to 1914 were based on tabulations made by each of the 10 original registration States.¹⁴ Since births to white women were not classified by nativity of mother in most of these tabulations, it was not practicable to estimate the numbers of births to native white women. The estimates for white births are shown in appendix table 1, column F and those for all births in appendix table 3, column C. (Caution: The differences between the estimates of total births and those of white births should not be used as estimates of nonwhite births, for reasons given in section III of the appendix.)

APPENDIX TABLE 3.—ESTIMATED NUMBERS OF ALL BIRTHS IN THE UNITED STATES, BASED ON ESTIMATES FOR WHITE BIRTHS, 1909 TO 1916

YEAR	Estimated number of white births ¹ (thousands)	Estimated percentage of births that were white ²	Estimated number of all births (A + B) (thousands)
	A	B	C
1916-----	2,598.9	87.68	2,964.1
1915-----	2,593.8	87.47	2,965.3
1914-----	2,588.4	87.27	2,966.0
1913-----	2,497.4	87.06	2,868.5
1912-----	2,466.6	86.86	2,839.8
1911-----	2,434.6	86.66	2,809.4
1910-----	2,400.9	86.45	2,777.3
1909-----	2,344.2	86.25	2,717.9

¹From appendix table 1.

²The method of estimating is described in section ID4 of the appendix.

1. Estimating the numbers of registered white births in the 10 States. Because the births recorded during the years from 1909 to 1914 were not classified by race in the State reports, it was assumed that white births constituted the same percentage of all births registered in these States during 1909 to 1914 as during 1915.¹⁵

¹²The corresponding underenumeration factors for the 1920 and 1930 censuses are 1.099 and 1.085, respectively, according to page 9 of Foudray's "United States Abridged Life Tables, 1919-1920," and page 128 of Whelpton's "The Completeness of Birth Registration in the United States." The ratio 1.09 was used for the 1910 census because there are indications that it ranks between the 1920 and 1930 censuses in accuracy.

¹³The allowance for infant deaths was based on the 1910 United States life tables for white persons.

¹⁴These States are Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Michigan, and Minnesota.

¹⁵The 1915 percentage was 98.68 for the 10-State area; it varied from 99.92 percent in Vermont to 98.14 percent in Pennsylvania.

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2. Allowing for white births in States not in the registration area. The numbers of births obtained in 1 were multiplied by ratios obtained as in B1a, and shown in appendix table 1, column C.¹⁸
3. The births in 2 were adjusted for underregistration according to the procedure described in C2d and e. (See appendix table 1, columns E and F.)
4. Estimating the total numbers of births from the numbers of white births. The numbers of white births obtained in 3 were divided by estimates of the percentage of births that were white, shown in appendix table 3, column B, and made as follows:
 - a. The percentage of the births that were white in the United States during 1917, computed from the estimates of births by race obtained in C, was 87.88.
 - b. The percentage for the year ending on April 15, 1910 (the census date), estimated as shown below, was 86.25.
 - (1) The numbers of native white and nonwhite children under 1 enumerated in the 1910 census were multiplied by 1.09 and 1.22, respectively, to allow for incomplete enumeration. (These factors are weighted averages of those for 1920 and 1930, the former having a weight of one and the latter a weight of two. (See C2g(1).)
 - (2) The estimate for nonwhite children obtained in (1) was multiplied by 1.06 to allow for the higher mortality of nonwhite than of white infants shown in the 1910 life tables.
 - (3) The figure for white children obtained in (1) was divided by the sum of this figure and that for nonwhite children obtained in (2).
 - c. Percentages for 1910 to 1916 were computed by straight line interpolation between those in a and b; they are shown in appendix table 3, column B.

II. Estimating the Annual Numbers of Births in the United States by 5-year Age Period of Mother and by Order of Birth of Child, for Births to Native White Women From 1920 to 1948, and for Births to Nonwhite Women From 1930 to 1948

Births to women whose age at confinement was reported as less than 15 years or as 50 or more years were combined with those to women aged 15-19 and 45-49, respectively.

A. 1948

1. White births.

- a. Distributing "unknowns." White births with nativity of mother not reported, and births to native white women with age of mother and/or order of birth of child not reported, were distributed as follows:
 - (1) Because the Massachusetts birth certificate has not contained a question regarding order of birth, births to native white women by single years of age in Massachusetts were distributed by order of birth in the proportions found for Connecticut. (In this step births to women whose age was not reported were treated as a separate category.) These estimates of births by order in Massachusetts were deducted from the births of unknown order to native white women of each age in the United States and added to those of known order.
 - (2) White births in the United States, in each age-order group, to women whose nativity was not reported, were divided between native and foreign-born white women in the same proportions as births with nativity of mother reported. (Unknown age and/or unknown order were treated as separate categories.)
 - (3) Births of each order to native white women whose age was not reported (obtained in (2)) were prorated among the births for which age of mother was reported. (Unknown order was treated as a separate category.)
 - (4) Births to native white women of each age with order of birth not reported (obtained in (3)) were prorated among those with order reported.
- b. Adjusting births to native white women for underregistration.
 - (1) The test of the completeness of birth registration which was made in connection with

¹⁸For a discussion of the accuracy of this procedure see section III of the appendix.

the 1940 census indicated that 94.0 percent of all the white births were registered in 1940, but that the percentages were 98.6 for the white births occurring in institutions (mostly hospitals) and 88.2 for those occurring outside of institutions. The percentages of white births registered in the years from 1935 to 1939 and 1941 to 1948 were estimated by the National Office of Vital Statistics by assuming that the foregoing percentages for institutional and noninstitutional births applied not only to the test period, but also to each year since 1935.¹⁷ In consequence, the increase in the proportion of registered white births occurring in institutions, from 39.6 percent in 1935 to 90.4 percent in 1948 caused the estimates of the percentage of all white births registered to rise from 92.44 in 1935 to 97.08 in 1948.

- (2) The test also showed that the percentages of white births registered, by age of mother, were: 15-19, 93.1; 20-24, 94.3; 25-29, 94.7; 30-34, 94.3; 35-39, 92.5; 40-44, 91.5; and 45-49, 82.5.
- (3) Although the procedure mentioned in (1) may be the best to follow in estimating total white (or nonwhite) births, it was believed that in estimating births by age of mother use should be made of the information in (2) on differentials by age. Accordingly, it was assumed that in 1948 there were variations by age like those in (2). For example, the percentage of all white births which were not registered was 6.0 in 1940 and 2.9 in 1948, and the percentage of white births to women aged 15-19 which were not registered was 6.9 in 1940. The latter percentage for 1948 was computed by multiplying 2.9 by $\frac{6.9}{6.0}$, the result being 3.3. Subtracting from 100 gave the percentage of births registered, namely 96.7. Percentages for other ages in 1948, obtained in a similar manner, are: 20-24, 97.2; 25-29, 97.4; 30-34, 97.2; 35-39, 96.4; 40-44, 95.9; and 45-49, 91.5. In the absence of information as to variations in completeness of registration by order of birth of child or within a 5-year age group, the estimated percentage for a given 5-year age group in a given year was assumed to apply to births of each order to women of each age in that age group.
- (4) Dividing the numbers of registered births by order to native white women of a given age in 1948 by the appropriate percentages in (3) gave the adjusted numbers of births by order to women of that age. The results for the various 5-year age periods are shown in text table 2; the adjusted numbers by order of birth are shown in text table 4.
- (5) Adding the estimated numbers of births for the various ages gave the estimated total number of births to native white women in 1948 shown in appendix table 1, column F. Dividing this adjusted number by the number of registered births (in column D) gave the estimated percentage of births registered for native white women of all ages (in column E).

2. Nonwhite births.

- a. Nonwhite births in 1948 to women whose age was not reported were prorated among those to women with age reported. Within each age group births with order of birth not reported were prorated among those with order reported.
- b. The births in a were adjusted for incomplete registration, using percentages obtained by a procedure like that described in 1b. These percentages, by age, are: 15-19, 87.6; 20-24, 86.4; 25-29, 86.4; 30-34, 85.7; 35-39, 83.9; 40-44, 81.8; and 45-49, 69.8. The resulting estimates by age were adjusted proportionally so that their sum equaled the estimate for all nonwhite births in 1948 obtained in 1A. The final estimates by age are shown in text table 2; those by order of birth are shown in text table 4.

B. 1935 to 1947

The procedure followed for births to native white women will be described, but not that for nonwhite births. The latter was the same as in 1948.

1. Distributing "unknowns." White births with nativity of mother not reported, and births to native white women with age of mother and/or order of birth not reported, were distributed according to the procedure described in 1A₂, or one resembling it closely. The deviations occurred in 1940 to 1944, because part of the data needed to carry out the procedure described in 1A₂ was not available when the estimates were being prepared. The largest difference in procedure occurred in connection with the births for 1942. Tables published for that year showed the number of births to native white women by age of mother and the number of births to all white women by age of mother by order of birth

¹⁷These percentages are published in "Births by Person in Attendance: United States, Each Division and State, 1948," National Office of Vital Statistics, Vital Statistics—Special Reports, vol. 35, No. 7, 1950.

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of child. It was assumed that the percentage distribution by birth order of the births to women in each 5-year age period was the same for births to native white women as for births to all white women. The results are shown below on the first line. A tabulation of 1942 births to native white women by age of mother and birth order of child, made especially for this report, yielded the results on the second line. The percentages by which the former departed from the latter are shown on the third line. The numbers of registered births to native white women, by order of birth, in 1942 (in thousands) follow:

	<u>First</u>	<u>Second</u>	<u>Third</u>	<u>Fourth</u>	<u>Fifth</u>	<u>Sixth</u>	<u>Seventh</u>	<u>Eighth and higher</u>
Estimated-----	1,037.9	620.3	304.3	159.2	91.1	57.1	37.8	72.6
Tabulated-----	1,034.8	618.0	304.5	160.2	92.2	58.0	38.6	74.0
Percent error----	+0.30	+0.37	-0.07	-0.62	-1.19	-1.55	-2.07	-1.89

In view of the small differences for 1942 the original estimates were used for all years.

2. Adjusting for underregistration.

- a. The registered births by age and order in 1 were divided by percentages obtained by the procedure described in Alb. The estimated numbers of births to women by 5-year age periods are shown in text table 2; those by order of birth are shown in text table 4.
- b. Adding the estimates by age for each year in a gave the estimated total number of births to native white women shown in appendix table 1, column F. Dividing this adjusted number of births by the number of registered births (in column D) gave the percentage of births registered for native white women of all ages (in column E).

C. 1933 and 1934

The procedure was the same as in A except that (1) because the published tables of the Division of Vital Statistics showed the number of births to native white women in Colorado and New Hampshire in 1933 and in New Hampshire in 1934 by age of mother and (separately) by order of birth of child, but not by age by order, it was necessary to estimate the joint distribution, and that (2) the estimates of the completeness of registration of white and nonwhite births by age of mother were based on the author's estimates of the percentages for births to women of all ages, discussed in IB2.

D. 1931 and 1932

Texas was the only State not in the birth-registration area in 1932; Texas and South Dakota were the only States not in the area in 1931.

1. Distributing "unknowns" and adjusting for underregistration. The procedures for the United States described in A and C were followed for the birth-registration area in order to obtain estimates of births in that area to native white women and to nonwhite women by age of mother and order of birth of child.
2. Allowing for the births in Texas and South Dakota. Ratios were computed for 1933 between the number of births to women in each 5-year age period in the United States and in the United States excluding Texas. It was assumed that these ratios applied also to 1932. Multiplying the number of births to women of a given age in the 1932 birth-registration area by the appropriate ratio gave the estimated number for the United States. It was assumed that the percentage distribution by birth order of the births in 1932 to native white women of each age period was the same for the United States as for the birth-registration area. The estimates for each age and order group were adjusted proportionally (but slightly) so that their sum equaled the estimate for all births to native white women obtained in IB2. The same procedure was followed for births to nonwhite women. A similar procedure was followed for 1931. The estimates by 5-year age period of mother are shown in text table 2; those by order of birth are shown in text table 4.

E. 1929 and 1930

South Dakota and Texas were the only States not in the birth-registration area. The procedure for nonwhite births in 1930 is the same as that for 1931 and 1932, described in D. That for births to native white women is described below.

1. Distributing "unknowns." White births during 1929 and 1930 to women whose nativity was not reported, and births to native white women with age of mother and/or order of birth not reported were prorated as in A and B. This was done for the registration area as a whole, excluding five

States (Colorado, Maine, Massachusetts, New Hampshire, and Rhode Island), and also for North Dakota, Nebraska, Louisiana, and Oklahoma.

2. The distribution by age of mother and by order of birth for registered births in Colorado, Maine, Massachusetts, New Hampshire, and Rhode Island during 1929 and 1930 was estimated for the reason given in C.
3. Estimates of "registered" births in South Dakota to native white women during 1929-31 (combined) by age of mother and order of birth of child were made as follows:
 - a. The total number of "registered" births during 1929-31 was estimated on the assumption that the ratio of these births to the children under 1, enumerated in the 1930 census, was the same for South Dakota as for North Dakota and Nebraska combined.
 - b. Births by 5-year age periods of mother were estimated by multiplying the number of South Dakota women in a given age period by the 1929-31 birth rate at those ages for North Dakota and Nebraska combined, and repeating the process for the other age periods. The products thus obtained were adjusted proportionately so that their sum equaled the estimated total in a.
 - c. Births by order of birth of child were estimated on the assumption that the births to women in each 5-year age period were distributed by order of birth in the same proportions in South Dakota as in the guide States (North Dakota and Nebraska).
4. Estimates of "registered" births in Texas were made in the same way as for South Dakota, except that Louisiana and Oklahoma were used as guide States.
5. 1929-31 ratios of "registered" births in the United States to those in the registration area, excluding Colorado, Maine, Massachusetts, New Hampshire, and Rhode Island, were computed for each age-order class by dividing (a) the births in the latter area (in 1) plus the estimates for the five States (in 2), for South Dakota (in 3), and for Texas (in 4), by (b) the births in the birth-registration area, excluding the five States.
6. Estimates of "registered" births in the United States in 1929 and 1930. The ratios for the 3-year period (in 5) were applied to the births in the registration area (excluding the five States) in 1929 and 1930 (in 1) to obtain preliminary estimates for the United States for each year and each age-order class. These were adjusted proportionally (but slightly) so that their sum equaled the estimates of the total number of births to native white women (not adjusted for underregistration) in 1931.
7. Adjusting for underregistration. The births obtained in 6 were divided by percentages obtained like those in Alb. The results are shown in text tables 2 and 4.

F. 1920

This year will be considered before the years from 1921 to 1928 because ratios like those used for 1920 were used for these years. In 1920 the birth-registration area consisted of 23 States and the District of Columbia.

1. "Unknowns" in 1919, 1920, and 1921 were distributed as in Ala for each registration State except Maine (which did not report age of mother) and Massachusetts (which did not report order of birth of child).
2. "Registered" births during 1919-21 (combined) in each nonregistration State to native white women by age of mother and order of birth of child were estimated as shown below.
 - a. Total births
 - (1) A guide State (or group of States) in the 1919 birth-registration area was selected for each State not in the area at that time, as shown in appendix table 4. The pairings were made on the basis of similarity of 1929-31 birth rates by age of mother and order of birth of child.
 - (2) For each guide State the ratio was computed between (a) the number of children under 1 enumerated in the 1920 census and (b) the number of births registered during 1919-21.
 - (3) Applying the appropriate ratio in (2) to the number of children under 1 in a nonregistration State gave the estimated number of "registered" births in that State during 1919-21. For States added to the area in 1920 (or 1921) the estimates were made only for 1919 (or 1919-20) and the registered births were used for 1920-21 (or 1920).

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b. Births by age of mother

- (1) Birth rates by 5-year age periods were computed for each 1919 registration State (except Maine) during 1919-21 and for each State during 1929-31. The population enumerated in the censuses of 1920 and 1930 was used as a base.
- (2) Ratios were computed between the 1919-21 and 1929-31 age-specific birth rates for each guide State in appendix table 4. (New Hampshire and Vermont were used as guide States for Maine.)
- (3) Applying the appropriate ratios in (2) to the 1929-31 age-specific rates for a State not in the 1919 registration area gave first estimates of the 1919-21 rates for that State.
- (4) Applying the estimated age-specific rates for each State obtained in (3) to the native white women enumerated in that State in the 1920 census gave first estimates of the number of births to women of each age in that State during 1919-21. The estimates for the various age groups for a State were adjusted proportionally so that their sum equaled the State estimate in a. (The number of registered births was used for Maine.)

c. Births by order of birth of child

- (1) For each guide State in appendix table 4, the ratio was computed between the number of births of each order to women of each 5-year age period during 1919-21 and during 1929-31. (In this step Connecticut was used as a guide for Massachusetts and Rhode Island, because births in Massachusetts and Rhode Island were not tabulated by order of birth.)

APPENDIX TABLE 4.—GUIDE STATES USED IN ESTIMATING TOTAL BIRTHS IN EACH NONREGISTRATION STATE, 1919 TO 1921

Nonregistration States	Guide States ¹
Rhode Island (1919 and 1920)	Connecticut and Massachusetts
New Jersey	New York
Illinois	Ohio
Iowa	Minnesota
Missouri	Kansas
North Dakota	Minnesota
South Dakota	Minnesota
Nebraska (1919)	Kansas
Delaware	Maryland
West Virginia	Kentucky
Georgia	South Carolina
Florida	South Carolina
Tennessee	Kentucky
Alabama	South Carolina
Mississippi	South Carolina
Arkansas	North Carolina
Louisiana	North Carolina
Oklahoma	Kansas
Texas	Kansas, North Carolina, and South Carolina
Montana	Minnesota and Utah
Idaho	Minnesota and Utah
Wyoming	Minnesota and Utah
Colorado	Kansas and Utah
New Mexico	Utah
Arizona	Utah
Nevada	California and Utah

¹Sums (not averages) of State data were used when two or more States were selected as guides.

- (2) Applying the ratios in (1) for a guide State to the births by age by order during 1929-31 in the appropriate State not in the registration area in 1919-21 gave first estimates of births by age by order in this State during 1919-21. These estimates by order within each 5-year age group were adjusted proportionally so that their sum equaled the total for that age group obtained in b.
3. 1919-1921 ratios between "registered" births in the registration and nonregistration areas. The estimates by States in 1 and 2 were added so as to obtain for each age-order class estimates of the numbers of births during 1919-21 in the 1920 registration area (except Maine, Massachusetts, and Nebraska), and also in the remainder of the Nation. Ratios were computed between each estimate for the former area and the corresponding estimate for the latter area. For example, the ratio was computed between the number of third births to women aged 30-34 in the 1920 registration area excluding Maine, Massachusetts, and Nebraska, and the corresponding number for the nonregistration area plus these three States.
4. Estimated numbers of "registered" births by age of mother by birth order of child in the nonregistration area plus Maine, Massachusetts, and Nebraska. It was assumed that the 1919-21 ratios in 3 applied to 1920. For example, multiplying the number of registered third births to women aged 30-34 in the 1920 registration area (excluding Maine, Massachusetts, and Nebraska) during 1920 by the appropriate ratio in 3 gave a preliminary estimate of the number of such births during 1920 in the remainder of the United States. Repeating the process gave estimates for births of each other age-order class.
5. Estimates of "registered" births in the United States were made by adjusting proportionally (but slightly) the estimates in 4 so that when added to the births in the registration area the sum of all the age-order groups equaled the preliminary estimate of "registered" births to native white women in that year obtained in IBl.
6. Estimates of total births to native white women in the United States were obtained by adjusting the estimates in 5 for underregistration, using percentages obtained as explained in Alb. The results are shown in text tables 2 and 4.

G. 1921 to 1923

The registration area included 27 States and the District of Columbia in 1921; Illinois, Montana, and Wyoming were added in 1922. The procedure outlined in F was followed except for differences in area. For 1921 the ratios like those described in F3 were between births in the 1921 registration area excluding Maine, Massachusetts, Rhode Island, and Mississippi, and in the remainder of the Nation. For 1922 and 1923 the ratios were between the 1922 registration area, excluding Maine, Massachusetts, Rhode Island, and Delaware, and the remainder of the Nation.¹⁸

H. 1924 to 1928

The procedure outlined in F was followed, except that in steps 3 and 4 simple averages of ratios for 1919-21 and 1929-31 were used for 1924, 1925, and 1926, and ratios for 1929-31 were used for 1927 and 1928. For 1924, 1925, and 1926 the ratios were between the States in the 1924 registration area, excluding Delaware, Massachusetts, Maine, New Hampshire, Rhode Island, and South Carolina, and the remainder of the Nation. For 1927 and 1928 the ratios were between the States in the current registration area (excluding Delaware, Massachusetts, Maine, New Hampshire, and Rhode Island in 1927, and Colorado, Massachusetts, Maine, New Hampshire, and Rhode Island in 1928) and the remainder of the Nation.

¹⁸The States mentioned were treated in this manner because the published tables showed births by age of mother and/or by order of birth of child but not by age by order.

It might be thought that weighted averages of the 1919-21 and 1929-31 ratios should have been used for 1921, 1922, and 1923. (For 1923, for example, the 1919-21 ratios would have had a weight of 7 and the 1929-31 ratios a weight of 3.) A comparison between the 1919-21 and 1929-31 ratios showed changes in 10 years of less than 10 percent for over 90 percent of the ratios for age-order classes with more than 1,000 births, and changes of less than 5 percent for 72 percent of these ratios. In consequence, if weighted averages had been used for 1923, they would have differed from the 1919-21 ratios by less than 3 percent for over 90 percent of the age-order classes with more than 1,000 births, and by less than 1.5 percent for 72 percent of these classes. The increase in accuracy which might have resulted from using such weighted averages was believed to be too small to justify the additional work involved. Such a conclusion has even more justification for 1921 and 1922.

III. The Accuracy of the Estimated Total Numbers of All Births and White Births in the United States During the Years From 1909 to 1948

The accuracy of the estimates of the numbers of births during years since 1933 (when the birth-registration area became Nation-wide) depends on the accuracy of the estimates of underregistration. This was discussed in the text, and will not be considered further here.

The estimates of the numbers of births during previous years are affected not only by the allowance for underregistration, but also by the procedure used in estimating the births occurring outside of the birth-registration area of a given year from (a) those occurring within the registration area during that year, and (b) the children under 1 in, and outside of, the birth-registration area of that year according to the census enumerations of 1910, 1920, and 1930. The magnitude of the error arising in this connection would be expected to vary inversely with the number of States in the registration area, and directly with the length of the interval to the closest census date.

In order to evaluate the accuracy of the estimated numbers of births in the United States before the birth-registration area included all States, the numbers of all births and white births in the United States during each year from 1930 to 1939 were estimated according to the procedure followed in making the estimates for 1909 to 1914 (described in section ID). The 1909-14 procedure was chosen because births in only 10 states were utilized in making the estimates for the United States during these years. The basic data needed for the test were (a) the numbers of white births recorded in the 10 original birth-registration States during 1929 to 1939, and (b) the numbers of native white and nonwhite children under 1 enumerated in this area and in the United States in the 1930 and 1940 censuses. The procedure is described below.

A. White births

1. Ratios between the number of native white children under 1 in the United States and in the 10-State area were computed for 1930 and 1940 from census data. Ratios for intermediate years were obtained by straight line interpolation.
2. Multiplying the number of registered white births in the 10-State area during each year from 1930 to 1939 by the appropriate ratio in 1 gave preliminary estimates of the number of "registered" white births in the United States during each of these years.¹⁸

APPENDIX TABLE 5.—ESTIMATED COMPLETENESS OF REGISTRATION OF THE WHITE BIRTHS OCCURRING IN THE 10 ORIGINAL REGISTRATION STATES, 1929 AND 1939

STATE	PERCENTAGE OF BIRTHS REGISTERED	
	1929	1939
Maine-----	96.03	95.5
New Hampshire-----	95.78	97.1
Vermont-----	91.70	97.7
Massachusetts-----	100.00	100.0
Rhode Island-----	97.12	97.5
Connecticut-----	97.88	97.3
New York-----	100.00	100.0
Pennsylvania-----	98.63	99.4
Michigan-----	98.46	95.5
Minnesota-----	95.27	93.2

NOTE.—The percentages for 1929 are from "The Completeness of Birth Registration in the United States," table I, column C, by P. K. Whelpton. Those for 1939 were computed in a similar way.

¹⁸The numbers of registered white births, rather than total births, were used throughout the test, even though a percentage of the numbers of all registered births were used in making the estimates for 1909 to 1914. This was done because the proportion of births which were nonwhite was substantially higher in the 10-State area during the 1930's than during 1910-14, e.g., 3.6 percent in 1930 as against 1.3 percent in 1915.

3. The estimates for 1939 in 2 were adjusted for underregistration, using a weighted average of the 1939 percentages in appendix table 5. Percentages for years from 1930 to 1938 were obtained by straight line interpolation between the 1939 percentage and one computed in the same way for 1929. These percentages were multiplied by 0.977 to allow for the biases in the method of estimating the percentage of white births registered, discussed in IB2c. The results are shown in column A of the upper deck of appendix table 6.

B. Total births

- The numbers of native white children under 1 in the United States according to the 1930 and 1940 censuses were multiplied by 1.085, and the numbers of nonwhite children by 1.168, to allow for underenumeration. The products were multiplied by 1.046 and 1.073, respectively, for 1930, and by 1.038 and 1.064 for 1940, to allow for infant mortality, in order to obtain estimates of births during the years ending on the census dates. Dividing (a) the results for white births by (b) the sum of those for white and nonwhite births gave the percentage white for these 2 years. Percentages for calendar years from 1930 to 1938 were obtained by straight line interpolation.
- Dividing the estimated numbers of white births in A3 by the appropriate percentages in 1 gave the estimated numbers of all births. (See column A of the lower deck of appendix table 6.)

APPENDIX TABLE 6.—TOTAL NUMBERS OF WHITE BIRTHS AND ALL BIRTHS IN THE UNITED STATES, ESTIMATED FROM BIRTHS RECORDED IN 10 STATES AND IN THE CURRENT BIRTH-REGISTRATION AREA, 1930 TO 1939

YEAR	ESTIMATED FROM BIRTHS IN--		Numerical difference (A-B) (thousands)	Percentage difference (C ÷ B × 100)
	10 States (thousands)	Current birth-registration area ¹ (thousands)		
	A	B	C	D
WHITE BIRTHS				
1939-----	2,162.0	2,117.4	44.6	2.1
1938-----	2,177.1	2,148.4	28.7	1.3
1937-----	2,103.8	2,071.3	32.5	1.6
1936-----	2,062.7	2,027.3	35.4	1.7
1935-----	2,057.9	2,042.2	15.7	0.8
1934-----	2,037.0	2,058.0	-21.0	-1.0
1933-----	1,994.3	1,981.9	12.4	0.6
1932-----	2,108.8	2,099.0	9.8	0.5
1931-----	2,182.7	2,170.3	12.4	0.6
1930-----	2,292.6	2,273.5	19.1	0.8
ALL BIRTHS				
1939-----	2,486.8	2,466.5	20.3	0.8
1938-----	2,501.8	2,496.4	5.4	0.2
1937-----	2,415.4	2,413.3	2.1	0.1
1936-----	2,366.0	2,355.2	10.8	0.5
1935-----	2,358.4	2,376.7	-18.3	-0.8
1934-----	2,332.3	2,396.1	-63.8	-2.7
1933-----	2,281.0	2,306.9	-25.9	-1.1
1932-----	2,409.8	2,440.1	-30.3	-1.2
1931-----	2,491.9	2,505.7	-13.8	-0.6
1930-----	2,615.1	2,617.9	-2.8	-0.1

¹The birth-registration area included all States in 1933 to 1939 all except Texas in 1932, and all except South Dakota and Texas in 1930 and 1931.

NOTE.—The 10 States are Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Michigan, and Minnesota.

The estimates of white births during 1930-39, obtained as just described, are less than 1 percent above the estimates based on births in the current area for 5 of the 10 years, 1.0 percent too low for 1 year, 1.0 to 1.9 percent too high for 3 years, and 2.1 percent too high for 1 year. (See appendix table 6, column D.) The estimates of all births are about as accurate, differing by less than 1 percent for 7 years, by 1.0 to 1.9 percent for 2 years, and by 2.7 percent for the remaining year. These estimates, unlike those for white births, do not have a consistent upward bias, the figures for 1930 to 1935 being too low, and those for 1936 to 1939 being too high.

It is believed that the method gives estimates of all births and white births during 1910 to 1914 which are about as accurate as those for 1930 to 1939, at least within the limits of our knowledge of the completeness of birth registration. The latter qualification is made because the biases in the method used to estimate underregistration in each year can be determined accurately only for the months immediately preceding the 1940 census. It is assumed that the relative size of the biases is the same in prior years, but this may or may not be true.

As was pointed out at the beginning of section ID, the test shows that the differences between the estimated numbers of all births and white births obtained by the procedure in question do not give reliable estimates for nonwhite births. The figures for nonwhite births during 1930-39 computed by subtraction are between 6 and 13 percent below the estimates in appendix table 1 based on the numbers of nonwhite births recorded in the registration area during these years, which should be much more accurate. The magnitude of the differences is not surprising, for the procedure followed in estimating the numbers of all births and white births during 1910 to 1914 (and tested here) was not designed to provide accurate estimates for nonwhite births.

IV. The Accuracy of the Estimated Numbers of Births to Native White Women, by Age of Mother and Order of Birth of Child, in Nonregistration States, 1920 to 1933

In section II births to native white and nonwhite women, by age of mother and order of birth of child, were estimated for nonregistration States on the basis of (a) similar data for selected States in the registration area, and (b) the census count of children under 1 year of age. In order to evaluate the accuracy of estimates made by this procedure, it was applied to the States in the 1919 registration area and the resulting numbers of births to native white women during 1919-21 were compared with the recorded data. The process followed is outlined below.

APPENDIX TABLE 7.—GUIDE STATES USED IN TESTING ACCURACY OF ESTIMATES OF BIRTHS BY AGE OF MOTHER AND ORDER OF BIRTH OF CHILD, 1919 TO 1921

States assumed to be outside the registration area	Guide States
New Hampshire	Connecticut
Vermont	New Hampshire
Connecticut	New York
New York	Connecticut
Pennsylvania	Ohio
Ohio	Indiana
Indiana	Michigan
Michigan	Indiana
Wisconsin	Minnesota
Minnesota	Kansas
Kansas	Minnesota
Maryland	Ohio
District of Columbia	New York
Virginia	North Carolina
North Carolina	South Carolina
South Carolina	North Carolina
Kentucky	South Carolina
Utah	Kentucky
Washington	Oregon
Oregon	Washington
California	New York

- A. It was assumed that no birth statistics for 1919-21 were available for one of the States in the registration area during these years. A "guide State" was selected for this State on the basis of similarity of birth rates by age of mother and order of birth of child in 1929-31. The procedure was repeated for the other States in the 1919 registration area, as shown in appendix table 7. (Maine and Massachusetts were omitted from the test, because births in Maine were not tabulated by age of mother, nor those in Massachusetts by order of birth of child.)
- B. The number of births during 1919-21 to native white women by age of mother by order of birth of child was estimated for each State assumed to be outside the 1919 registration area, following exactly the procedure described in IIF2. Adjustments for underregistration were made on the basis of the percentages in appendix table 2.
- C. The differences were computed for each State between the estimates in B for births during 1919-21 to native white women by age of mother and order of birth of child, and the registered births adjusted for underregistration as above. The amounts by which the former exceeded or fell below the latter were added in two ways: (a) net—keeping plus and minus signs unchanged, and (b) gross—changing all plus signs to minus.²⁰ The net and gross differences for the area as a whole were expressed as percentages adjusted for underregistration of the registered births.

The estimates of births by age of mother in the 20-State area as a whole are too low on the net basis by amounts which vary from 21 at ages 45-49 to 2,493 at ages 20-24, and by percentages which vary from 0.6 at ages 45-49 to 2.4 at ages 40-44. (See appendix table 8.) On the gross basis the deficits are substantially larger, the amounts varying from -379 at ages 45-49 to -7,468 at ages 25-29, and the percentages from -2.1 at ages 20-24 to -10.0 at ages 45-49.²¹ It should be noted that an important part of each difference arises because of the underestimate of total births rather than because of failure to distribute births correctly by age of mother. Had the estimates of the total been correct, the percentage differences on the net basis for the age groups from 15-19 to 45-49 would have been 0.0, 0.3, 0.3, -0.1, -0.6, -1.3, and 0.5, respectively, and those on the gross basis -2.7, 0.1, -0.4, -1.2, -2.5, -2.0, and -7.8, respectively.

The estimates of births by order of birth for the 20-State area are too low on the net basis by amounts which vary from 250 for seventh births to 2,429 for second births and by percentages which vary from 0.4 for first births to 2.0 for fourth births. (See appendix table 9.) On the gross basis the numerical deficits vary from 2,774 for seventh births to 9,847 for first births, and the percentage deficits from 2.5 for third births to 8.0 for eighth and higher order births as a group. Here, as above, the differences on the net basis occur in important degree because of the underestimate of the total number of births rather than the incorrect distribution of births by order of birth. If the total had been

APPENDIX TABLE 8.—AVERAGE ANNUAL NUMBER OF BIRTHS TO NATIVE WHITE WOMEN, BY AGE OF MOTHER, IN THE 1919 BIRTH-REGISTRATION AREA DURING 1919-21, AND EXCESS OR DEFICIT OF ESTIMATES BASED ON BIRTHS IN "GUIDE" STATES

AGE OF MOTHER	Number of births in area ¹	EXCESS OR DEFICIT OF ESTIMATES			
		Net ²		Gross ³	
		Number	Percent	Number	Percent
ALL AGES-----	1,030,404	-10,868	-1.1	-23,144	-2.2
15-19 years ⁴ -----	101,243	-1,080	-1.1	-5,004	-4.9
20-24 years-----	307,201	-2,493	-0.8	-6,517	-2.1
25-29 years-----	284,073	-2,262	-0.8	-7,468	-2.6
30-34 years-----	184,748	-2,194	-1.2	-6,276	-3.4
35-39 years-----	111,795	-1,920	-1.7	-5,230	-4.7
40-44 years-----	37,572	-898	-2.4	-1,588	-4.2
45-49 years ⁵ -----	3,772	-21	-0.6	-379	-10.0

¹Births to women whose age was not reported are distributed proportionally.

²Excesses for some States are partially canceled by deficits for others, and vice versa.

³Excesses are treated as deficits.

⁴Includes births to women younger than 15.

⁵Includes births to women 50 or older.

NOTE.—Births are adjusted for underregistration. Those in Maine (which were not tabulated by age of mother) and in Massachusetts (which were not tabulated by order of birth) are excluded.

²⁰Plus signs were changed to minus rather than the reverse because the net totals had minus signs.

²¹All excesses are counted as deficits on the gross basis.

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estimated correctly, the percentage differences on the net basis for first to eighth (and later) births would have been 0.7, 0.0, 0.0, -0.9, -0.8, -0.5, 0.4, and -0.5, respectively, and those on the gross basis -0.9, -0.8, -0.3, -2.2, -4.5, -3.5, -5.7, and -5.8, respectively.

The net basis exaggerates the accuracy of the estimates, because of 5 "pairings" in the choice of "guide" States. For example, using Indiana as a "guide" for Michigan gives results which are too low for Michigan in most cases, while using Michigan as a "guide" for Indiana gives results which are too high for Indiana in most cases. These differences tend to balance when the two States have similar numbers of births (as with Indiana and Michigan), but to only partially offset each other when one State has many more births than the other (as with Connecticut and New York). Such "pairings," with the resulting tendency toward compensation, could not occur in making estimates for the States which actually were outside the registration area.

The gross basis understates the accuracy of the estimates because it eliminates the possibility of excesses offsetting deficits (or the reverse) in the case of States which were not paired when "guides" were chosen. It is practically certain that a tendency toward compensation occurred in the estimates made for States actually outside the registration area, as was the case with unpaired States in the test.

Allowing roughly, but conservatively, for the foregoing biases indicates that the estimates by age of mother probably are too low by less than 2 percent at ages 20-24 and 25-29, by less than 4 percent at ages 15-19, 30-34, 35-39, and 40-44, and by less than 8 percent at ages 45-49. Those by order of births probably are too low by less than 2 percent for first, second, and third births, by less than 4 percent for fourth and sixth births, by less than 5 percent for fifth births, and by less than 6 percent for seventh births and for eighth and higher order births combined. It seems reasonable to believe that the estimates for the States outside the registration area, obtained in IIF, G and H, are about as accurate as the foregoing. But it is not believed worth while to use these percentages as correction factors for the estimates in the text tables.

The estimated numbers of births by age and order in the nonregistration States were combined with the corresponding numbers of births in the registration States to obtain national totals in IIF, G and H; hence, the accuracy of the latter depends not only on the accuracy of the estimates for the nonregistration area, but also on the ratio between the numbers of births in and out of the registration area. The available evidence indicates that the former exceeded the latter by about 30 percent in 1920, and by increasing percentages in subsequent years as additional States were added to the area. In consequence, the estimates of births by age of mother and order of birth of child in the United States in 1920 should differ from the figures which would be available if the registration area had been Nation-wide by percentages which are somewhat less than half as large as those stated above. In other words, if the adjustment for underregistration is correct, the error in the estimates may well be (a) less than 1 percent for births to women 20-24 and 25-29, and for first, second, and third births, (b) less than 2 percent for births to women 15-19, 30-34, 35-39, and 40-44, and for fourth and sixth births, (c) less than 3 percent for fifth, seventh, and eighth and higher order births (combined), and (d) less than 4 percent for births to women 45-49. The estimates for 1921 to 1932 obtained in IID, E, and G should be progressively more accurate because of the growth of the registration area.

APPENDIX TABLE 9.—AVERAGE ANNUAL NUMBER OF BIRTHS TO NATIVE WHITE WOMEN, BY ORDER OF BIRTH OF CHILD, IN THE 1919 BIRTH-REGISTRATION AREA DURING 1919-21, AND EXCESS OR DEFICIT OF ESTIMATES BASED ON BIRTHS IN "GUIDE" STATES

ORDER OF BIRTH	Number of births in area ¹	EXCESS OR DEFICIT OF ESTIMATES			
		Net ²		Gross ³	
		Number	Percent	Number	Percent
ALL ORDERS-----	1,030,404	-10,868	-1.1	-23,144	-2.2
First-----	319,136	-1,155	-0.4	-9,847	-3.1
Second-----	228,897	-2,429	-1.1	-6,837	-3.0
Third-----	155,698	-1,724	-1.1	-3,968	-2.5
Fourth-----	105,325	-2,091	-2.0	-4,595	-4.4
Fifth-----	71,178	-1,370	-1.9	-4,752	-6.7
Sixth-----	49,766	-794	-1.6	-2,830	-5.7
Seventh-----	35,066	-250	-0.7	-2,774	-7.9
Eighth and higher-----	65,338	-1,055	-1.6	-5,251	-8.0

¹Births with order not reported are distributed proportionally.

²Excesses for some States are partially canceled by deficits for others, and vice versa.

³Excesses are treated as deficits.

NOTE.—Births are adjusted for underregistration. Those in Maine (which were not tabulated by age of mother) and in Massachusetts (which were not tabulated by order of birth) are excluded.