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NATIONAL CENSUS SURVIVAL RATES, BY COLOR AND SEX, FOR 1950 TO 1960

INTRODUCTION

This report presents two sets of national "census survival rates" designed for use in computing estimates of net migration by age, color, and sex, for various subgroups of the United States population, particularly geographic subdivisions. One set is based on the total population of the United States; the other is based on the native population, excluding the foreign born. The report also presents a set of rates for the Negro population. Rates of this kind have been used widely for the purpose of estimating net migration for States and local areas between censuses[1] because of the advantages they have in this application over reported death statistics by age or over life table survival rates.[2] The sets of rates shown in this report have been prepared and are being made available in response to a number of requests for such figures for use in connection with studies of internal migration. They may be applied in estimating intercensal net migration for 1950 to 1960 for geographic areas (States, counties, cities, etc.), categories of residence (urban and rural, farm and nonfarm), and various other subgroups in the population (e.g., native, and foreign born by national origin; distribution by educational level).

Census survival rates are based on the population as enumerated by age in two successive censuses and represent the ratio of population in a given age group at the second census to the population in the same "cohort"[3] at the earlier census. Such ratios are affected not only by intercensal mortality but also by changes in the census net undercounts[4] for the cohort from the first to the second census. For this reason, the ratios may change irregularly from one age group to the next and may even have a value in excess of unity. The national census survival rates presented here, however, exclude the effect of both internal migration and net immigration. (Ideally, national census survival rates should relate to a completely closed population, that is, one not affected by migration; such a population can only be approximated for the United States, but little error is believed to result from this approximation.) Hence, when they are applied to the population of some local area in 1950, the difference between the expected survivors and the census

[1] See, particularly, Bogue, reference 1; Economic Research Service, U.S. Department of Agriculture, reference 2; Lee and others, reference 8; and Miller, reference 9. References are shown in bibliography on page 7.

[2] See Hamilton and Henderson, reference 5, and Lee and others, reference 8, pp. 25-27.

[3] The term cohort as used here refers to a group of persons born in the same year or group of years (e.g., ages 20-24 in 1950 and ages 30-34 in 1960).

[4] Census net undercounts comprise both net underenumeration and misreporting of age.

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population in 1960 represents net migration alone, since mortality and changing census errors have presumably been allowed for by the census survival rates.

The discussion in this report is concerned solely with the use of national census survival rates for 1950 to 1960 in deriving estimates of amounts of net migration from census data for the 1950-60 decade. It is not concerned as such with the estimation of rates of net migration for this particular decade nor with the estimation of amounts or rates of net migration for use in preparing population projections for local areas. These are special problems requiring special solutions.[5]

APPLICATION

General method.--In the usual application of national census survival rates in the estimation of net migration for a local area, the following computations are made.

1. The population by age as enumerated in the earlier census (P_0) or births during the decade (B) are multiplied by the national census survival rates (r), to obtain the expected population by age at the date of the later census on the assumption that there had been no migration (P_0r or Br).

2. The expected population (P_0r or Br) by age is subtracted from the population by age as enumerated at the later census (P_1), to obtain the estimates of net migration (M) for the particular age cohort.

The formulas for this variation of the national census survival rate method (forward procedure) are as follows, therefore:

$$M = P_1 - P_0r, \text{ or } M = P_1 - Br$$

Such calculations are carried out separately for each age cohort. A positive result indicates net in-migration and a negative result indicates net out-migration.

In the special case of cohorts under 5 years and 5 to 9 years of age in 1960, births for 1955 to 1960 and births for 1950 to 1955 are multiplied by the national census survival rates based on birth statistics. Two sets of survival rates for births, one based on registered births and the other based on births adjusted for underregistration, are given in the present report. They would be applied to the different types of birth statistics which define the particular survival rates--that is, the first type of rate would be applied to registered births; the second type to births adjusted for underregistration.[6]

Illustrative example.--An illustration of how national census survival rates are applied to obtain estimates of net migration by age cohorts is given in table A for Franklin County, Ohio (which includes Columbus). The calculations in table A have been limited to all classes for the sake of brevity, although such estimates are often carried out for specific sex and color groups also.[7] For example, for the age cohort 20 to 24 in 1950 (30 to 34 in 1960), the formula would be solved as follows:

$$50{,}959 - 46{,}644\,(.999510) = 50{,}959 - 46{,}621 = 4{,}338,$$

that is, the method yields a preliminary estimate of net in-migration of 4,338. The estimates by age are then adjusted proportionately by a plus-minus adjustment procedure[8] to the total for all ages derived independently by the "vital statistics" method--4,430. In this method, net migration

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[5] For example, the selection of the base of migration rates, for combination with alternative estimates of net migration, for various uses, is a matter for separate consideration. With specific regard to population projections, use of local census survival rates has been proposed for this purpose; these allow simultaneously for local variations in mortality, in the pattern of census net undercounts, and in the rate of net migration. See C. Horace Hamilton, "Practical and Mathematical Considerations in the Formulation and Selection of Migration Rates," Demography, Vol. II, 1965; C. Horace Hamilton, "Educational Selectivity of Net Migration from the South," Social Forces, Vol. 38, No. 1, October 1959, pp. 33-42, esp. 40-42; Ralph Thomlinson, "The Determination of a Base Population for Computing Migration Rates," Milbank Memorial Fund Quarterly, Vol. 40, No. 3, July 1962, pp. 355-366; C. Horace Hamilton and Josef Perry, "A Short Method for Projecting Population by Age From One Decennial Census to Another," Social Forces, Vol. 41, No. 2, Dec. 1962, pp. 163-170; Kripalani, reference 6; and Tarver, reference 14.

[6] It is difficult to choose between these alternatives. If the relationship between the extent of net undercount of children under 5 years or 5 to 9 years and of underregistration of births is the same or nearly the same in the geographic area for which estimates of net migration are being prepared, as in the nation as a whole, regardless of the level of the net undercount or underregistration, then the national rates based on registered births would give good results. If the relationship is quite different, it may be advantageous to take account of the estimates of underregistration of births which are available for 1950 for the area or which may be estimated for the later years. The form of the census survival rates at the older ages follows more closely that of the rates for the new-born which do not correct the births for underregistration.

[7] It is desirable to employ the rates for all classes only for areas whose color distribution approximates the national average--10 to 11 percent nonwhite.

[8] See appendix.

is derived by subtracting natural increase (births less deaths) during the decade from total net increase for the decade:

$$M = (P_1 - P_0) - (B - D), \text{ where}$$

P_1 and P_0 refer to the total population at each census, as above, and B and D represent births and deaths, respectively, during the decade. Estimates of total net migration for 1950 to 1960, derived by the vital statistics method, were published for each county in the United States in Current Population Reports, Series P-23, No. 7.

Table A.--ESTIMATING NET MIGRATION BY AGE COHORT, FOR FRANKLIN COUNTY, OHIO, BY USE OF NATIONAL CENSUS SURVIVAL RATES, FOR 1950 TO 1960

(Forward survival procedure)

Age of cohort		Census population, 1950 (age in 1950) (1)	Births (2)	National census survival rates[1] (3)	Expected population, 1960 (age in 1960) (1) or (2) x (3) = (4)	Census population, 1960 (age in 1960) (5)	Net migration	
Age in 1950 (or birth date)	Age in 1960						Preliminary estimate (5) − (4) = (6)	Adjusted estimate (6) adjusted = (7)
Total, all ages.....	Total, all ages....	503,410	(X)	(X)	608,900	682,962	74,062	75,756
Born Apr. 1, 1955 to 1960...	Under 5 years.....	(X)	[2]89,091	[2].947031	84,372	85,464	1,092	1,115
Born Apr. 1, 1950 to 1955...	5 to 9 years.....	(X)	[2]69,628	[2].939721	65,431	69,635	4,204	4,293
Under 5 years.....	10 to 14 years.....	52,007	(X)	1.019725	53,033	58,043	5,010	5,117
5 to 9 years.....	15 to 19 years.....	36,585	(X)	.987918	36,143	47,602	11,459	11,703
10 to 14 years.....	20 to 24 years.....	29,954	(X)	.963345	28,856	52,454	23,598	24,101
15 to 19 years.....	25 to 29 years.....	31,972	(X)	.989183	31,626	50,587	18,961	19,364
20 to 24 years.....	30 to 34 years.....	46,644	(X)	.999510	46,621	50,959	4,338	4,430
25 to 29 years.....	35 to 39 years.....	47,657	(X)	.992511	47,300	49,523	2,223	2,270
30 to 34 years.....	40 to 44 years.....	40,390	(X)	.986082	39,828	42,132	2,304	2,353
35 to 39 years.....	45 to 49 years.....	37,138	(X)	.948344	35,220	37,007	1,787	1,825
40 to 44 years.....	50 to 54 years.....	34,329	(X)	.925976	31,788	33,201	1,413	1,443
45 to 49 years.....	55 to 59 years.....	31,067	(X)	.916818	28,483	28,849	366	374
50 to 54 years.....	60 to 64 years.....	28,138	(X)	.853888	24,027	23,803	-224	-219
55 to 59 years.....	65 to 69 years.....	24,693	(X)	.859476	21,223	19,812	-1,411	-1,381
60 to 64 years.....	70 to 74 years.....	20,467	(X)	.776462	15,892	15,074	-818	-801
65 to 69 years.....	75 to 79 years.....	17,102	(X)	.608023	10,398	10,084	-314	-307
70 to 74 years.....	80 to 84 years.....	11,629	(X)	.461477	5,367	5,456	89	91
75 years and over.....	85 years and over.....	13,638	(X)	.241403	3,292	3,277	-15	-15

X Not applicable.
[1] Based on "total population"; see table 1.
[2] Births adjusted for underregistration or national census survival rates based on adjusted births.

INTERPRETATION

General assumptions.--The use of national census survival rates involves the following general assumptions:[9]

1. The national census survival rates represent changes in a closed population, that is, a population unaffected by migration.

2. National mortality rates for the decade represent mortality in each area of estimate adequately.

3. The relative change in the percent net undercount for a particular age cohort between the two censuses for the country as a whole adequately reflects the situation in each geographic area for which net migration will be estimated.

4. For the national census survival rates by color and race, the relative change between the two censuses in misclassification by color and race for the country as a whole essentially characterizes each area of estimate separately.

[9] See Zachariah, reference 15, and Price, reference 10.

Other more specific assumptions, relating to the national census survival rates based on the native population, are described below.

A corollary of the definition of national census survival rates employed here is that the resulting estimates of net migration pertain to the balance of all movements into and out of an area, including both international and internal migration, and military and civilian migration. Net movement of college students between their parental homes and college is included because students were counted where they lived while attending college. The application of national census survival rates strictly requires that there be no change in area boundaries between the first and second censuses; in the event of change, the population and births must be secured for a common area. On the other hand, shifts in population due to annexation and reclassification of areas are sometimes treated as a form of migration. The importance of boundary changes and reclassification of areas should not be overlooked, however, in the use of census survival rates.

Some limitations.--The census survival rates for the total population are deficient to the extent that the estimates of net immigration employed in their derivation are in error. It is believed that the error in the immigration estimates is substantial. There is evidence of underreporting of alien immigrants and emigrants, especially of those crossing land borders. After June 1957, the emigrants had to be estimated. Furthermore, the estimates of immigration used in this report were for aliens only. The movement of citizens affiliated with the U.S. Government as members of the Armed Forces, civilian employees of the U.S. Government, or their dependents is allowed for by the coverage of the population on which the rates in tables 1 and 3 are based, but no allowance has been made for the arrival or departure of other citizens.

Census survival rates based solely on the native population have often been used to avoid the error introduced by the immigration component. Thus, by basing the rates in table 2 on the population native to the United States and its outlying areas, including those abroad under U.S. Government auspices, most migration is eliminated as a factor of change. However, the international migration of other natives is a factor that is ignored. The rates are based on the further assumption that the mortality level and pattern of changes in net census undercounts for the native population and the foreign born population are the same. The mortality of the foreign born is probably higher than of the native white population, so that use of native white survival rates for the foreign-born population probably overstates the number of survivors and thus understates the number of in-migrants. Nothing definite can be said about the differences in patterns of net census undercounts of the two nativity groups. The method also assumes that there was no shift in the reporting of nativity between the two censuses. If, in fact, there was a shift in reporting from foreign born in one census to native in the next, the rates based on the native population will encompass such "passing" as one element of census error. These rates will exaggerate the number of foreign-born survivors as they imply a gain through passing; whereas, in fact, there was a loss to the foreign born. They will also exaggerate the number of native survivors in areas where there are few foreign born inasmuch as there can be little passing if the foreign-born population is nearly nonexistant. Consequently, the use of native rates tends to overestimate survivors and, hence, to underestimate in-migration (or overestimate out-migration).

Methodological variations and problems.--The possible errors of estimation arising from the use of national census survival rates computed from the native population recommend the computation of rates based on the total population, less net (alien) immigration, for the decade. Census survival rates based on the total population rather than the native population have the possible advantages of avoiding the assumption that the mortality level and the intercensal change in the pattern of census errors are the same for the native population and the foreign-born population and of eliminating any error arising from any intercensal shift in the reporting of nativity in the censuses. On the other hand, the basic assumptions of the method relating to the similarity of the intercensal change in the pattern of net census undercounts, and of mortality in the local area and in the national area, remain; these assumptions may not apply too well in areas where the proportion of foreign-born persons is quite different from that in the country as a whole. The rates based on the total population, less net immigration, will be in error to the extent that the estimates of immigrants are in error and the basic assumptions do not satisfactorily apply.

As mentioned earlier, the assumed net migration total for all ages to which the distribution of preliminary estimates of net migration by age was adjusted was obtained by the vital statistics method. The assumption made is that the estimate of net migration for all ages derived by the vital statistics method is more reliable than the estimate for all ages derived by summing the estimates over the age range secured by the census survival rate method.[10] Whether this is indeed the case is debatable. In the vital statistics method net migration is estimated as a residual, or more specifically as the difference between the 1960 Census count and the population expected in 1960 on the basis of the 1950 count and birth and death statistics for the decade. In this method any increase or decrease in the amount of net census undercount from one census to the next is combined with net migration. If the absolute amount of net underenumeration in a population is the same or nearly the same in two censuses and there is little or no error in the estimate of natural increase, the estimate of net migration tends to be

[10] See Eldridge, reference 3; Hamilton, reference 4; and Tarver, reference 13. Eldridge and Tarver conducted "tests" of the census survival rate method against the vital statistics method by comparing results obtained by the census survival rate method with estimates obtained by the vital statistics method for States, 1950-1960.

accurate. Nationally it appears that this was approximately the case.[11] If, on the other hand, the amount of net undercount in a population decreased substantially between 1950 and 1960, there would be an upward bias in the vital statistics method. (Reasons were cited earlier for suspecting that the census survival rate method has a downward bias.)

Another question is whether the rates should be applied on a forward basis by multiplying the earlier population by the rates (as shown in the example in table A), whether the rates should be applied on a reverse basis by dividing the later population by the rates, or whether an average of these two different methods should be preferred.[12] The forward procedure fails to allow for the deaths of persons who migrated into areas which gained from net in-migration and hence understates net in-migration to these areas. The method also makes excessive allowance for deaths of persons who migrated from areas which lost population from net out-migration and, hence, understates net out-migration from these areas. The reverse procedure has the opposite biases. An average of the forward and reverse procedures has been proposed as a means of reducing the biases noted. In general, however, the error in the estimates by the forward method is small except at the older ages in the areas heavily affected by migration.

In some studies the possibility of adjusting national census survival rates for variations in mortality rates from area to area has been proposed and applied.[13] With the historical convergence of mortality levels among areas, the need for this adjustment has become less. Furthermore, test calculations which have been made suggest that this apparent refinement in the method is not particularly useful. Separate census survival rates have been computed by Eldridge for the population born in each of the nine census geographic divisions on the basis of 1950 and 1960 Census tabulations on the division-of-birth of the population by age.[14]

Residual estimates of net migration calculated by use of national census survival rates are subject to considerable error as a result of the combined effect of the factors previously mentioned. Hence, such estimates should be taken to indicate only approximate magnitudes and small differences between estimates should be disregarded.[15]

SOURCES AND DERIVATION

In general, these 1950-60 national census survival rates were computed by dividing the population of the United States in a given age group in 1950 into the population at the age group 10 years older in 1960. For example, the number of white males 10 to 14 years old in 1950 was divided into the number of white males 20 to 24 years old in 1960. For use in estimating net migration (international and internal combined) at the regional or local level, the national census survival rates themselves should reflect the effect of all factors of change other than migration, specifically mortality and changes in net census undercounts, and exclude the effect of any net immigration as far as practicable. (Net internal migration is of course not a factor at the national level.)

Two modifications were made in the population counts from the censuses to accomplish this. First, estimates of net alien immigration by age cohort, sex, and color from 1950 to 1960 were subtracted from the total population by color in 1960. Similarly, estimates of Negro alien immigrants by age cohort and sex from 1950 to 1960 were subtracted from the Negro population in 1960. Secondly, the population employed in computing the rates was given as broad a coverage as possible. The rates were based on the sum of all population covered by the 1950 and 1960 Censuses except the Trust Territory of the Pacific Islands, small outlying areas, and the category of "other citizens abroad."[16] Thus, the population includes not only the United States as defined in 1960 (50 States and the District of Columbia) but also Puerto Rico, the Virgin Islands, Canal Zone, American Samoa, Guam, U.S. Armed Forces abroad, civilian employees of the U.S. Government abroad, dependents of the last two categories, and crews of merchant vessels. The statistics on Armed Forces abroad employed here are the census counts, not those derivable from Defense Department data.

This broader coverage eliminates from the census survival rates much of the international migration of U.S. natives and of U.S. citizens inasmuch as the population at both ends of the decade is so defined as to include as many American

[11] Conrad Taeuber and Morris H. Hansen, "A Preliminary Evaluation of the 1960 Censuses of Population and Housing," Demography, Vol. I, 1964, pp. 1-14.

[12] See Siegel and Hamilton, reference 12; Lee and Bowles, reference 7; and Tarver, reference 13.

[13] See Lee and Bowles, reference 7; Price, reference 11; Lee and others, reference 8; Tarver, reference 14.

[14] See Eldridge, reference 3.

[15] See Price, reference 10, and Kripalani, reference 6.

[16] These categories were omitted only because most of the necessary data were not available.

natives and citizens as possible wherever they are to be found throughout the world. The Censuses of 1950 and 1960 classified as native those born in the United States, Puerto Rico, and other outlying areas, as well as those born abroad of American parents.

For certain population groups the cross-classification of age, color, and sex had to be estimated. Color by age and sex was recorded for all categories except Puerto Rico and Armed Forces abroad in 1960, and Armed Forces and civilian citizens abroad in 1950. For Puerto Rico in 1960, it was assumed that each age-sex group had the same percent nonwhite as in 1950. Armed Forces abroad in 1950 and 1960 and civilian citizens abroad in 1950 were reported by (1) color and sex and (2) age and sex, but these distributions were not cross-classified. The cross-classification for the Armed Forces was estimated from information on the age, sex, and color composition of each of the armed services obtained from the Department of Defense. For civilian citizens abroad in 1950, the age distributions of the white and the nonwhite populations were assumed to be the same as for the two combined.

Nativity by age, sex, and color was reported only for the United States (including Alaska and Hawaii) in 1950 and 1960, and that was on a sample basis except for complete counts for Alaska and Hawaii in 1950. The sample counts were adjusted to a complete-count basis by applying to each group, by age, sex, and color, the ratio of the complete count to the sample count for the sum of the native and foreign-born populations for that group. For Puerto Rico in 1960, nativity was also reported by age and sex (but not color) on a sample basis. The native population of Puerto Rico was adjusted to a complete-count basis in the same way as was the United States population and then distributed by color in proportion to the distribution by color in 1950.

For the other outlying areas in 1960, and for Puerto Rico and the other outlying areas as well as the Armed Forces and civilian citizens abroad in 1950, nativity was reported by sex and color only. Each sex-color group for the native and foreign-born populations separately was assumed to have the same age distribution as the sum of the native and foreign-born populations for that group. When the census survival rates for the native population were prepared, not all the 1960 Census tabulations for the U.S. civilian population abroad were yet available.[17] The tabulations that were available were in the same detail as for 1950, and the adjustments were made in the same manner. As a consequence, the estimated color distribution for the native population is not entirely consistent with that for the total population, estimated later.

The Negro population was tabulated by age and sex in 1950 and 1960 on a complete count basis only for the Virgin Islands and on a sample basis for the United States (excluding Alaska and Hawaii in 1950), although the total number by sex is available from the complete counts.[18] The distributions were adjusted to a complete-count basis in the same way as were the distributions of the native population. The ratio of the complete count to the sample count for the nonwhite population was applied to each age-sex group in the Negro population, and the resulting figures were adjusted pro rata to the complete count total for each sex.

The Negro population was reported by sex, but not by age, for Puerto Rico, Hawaii, and the Armed Forces abroad in 1950 and for U.S. civilians abroad in 1950 and 1960. The Negroes in Hawaii in 1950 were assigned the same age distribution as they had in 1960. For the other categories, the Negro population was assumed to have the same age distribution as the nonwhite population. The Negro population of Puerto Rico and Negro Armed Forces abroad in 1960 were assumed to comprise the same proportion of the nonwhite population as in 1950.[19]

The estimates of net alien immigration by age cohort, color, and sex, from 1950 to 1960 used in calculating the survival rates for the total pop-

[17] Tabulations of the U.S. population abroad in 1960 by (1) color and sex and (2) age and sex were first published in 1960 Census of Population, General Population Characteristics, United States Summary, Final Report PC(1)-1B, 1961, tables 43 and 45, and by (3) nativity and color in ibid., General Social and Economic Characteristics, United States Summary, Final Report PC(1)-1C, 1962, table 67; tabulations of U.S. civilians abroad by (4) age, color, and sex (5) race and sex, and (6) nativity, age, and sex were published in ibid., Selected Area Reports, Americans Overseas, Final Report PC(3)-1C, 1964, tables 1, 2, 4, 9, and 11. Items (1), (2), and (3) are now also available in ibid., Vol. I, Characteristics of the Population, Part 1, United States Summary, 1964.

[18] In each census, age distributions from more than one sample were published. The distribution chosen for 1950 was the one published in 1960 Census of Population, Vol. I, Characteristics of the Population, Part 1, United States Summary, 1964, table 158; that for 1960 was the one published in ibid., Subject Reports, Nonwhite Population by Race, Final Report PC(2)-1C, 1963, table 1.

[19] Mixed and other races in the Virgin Islands, all nonwhites in the Canal Zone, and other races in Guam were counted as Negro. It was assumed that there were no Negroes in Alaska in 1950 or in American Samoa in 1950 or 1960.

ulation were those published in Current Population Reports, Series P-25, No. 310. That report should be consulted for an explanation of the derivation of those estimates. The estimates of alien Negro immigration by cohort for the decade are the sums of annual statistics of Negro immigrants by age, sex, and year of entry, as shown in the Annual Report of the Immigration and Naturalization Service.

For cohorts born between 1950 and 1960 (and under 10 in 1960), the tables show two sets of census survival rates differing as to coverage, as follows:

1. Births in the United States (including Alaska and Hawaii), Puerto Rico, and the Virgin Islands, as tabulated by the National Center for Health Statistics; births in the Canal Zone, American Samoa, and Guam, as reported by the Territorial governments; and births to Americans abroad as registered at American embassies, legations, and consulates.

2. Births as above plus estimates of unregistered births in the United States, Alaska, and Puerto Rico.

Where a cross-classification by color and sex for births was missing, as for the outlying areas and for Americans abroad, it was estimated on the basis of census counts of children under 5 and other information.

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Table 1.—CENSUS SURVIVAL RATES FOR THE TOTAL POPULATION OF THE UNITED STATES, BY COLOR AND SEX, FOR 1950 TO 1960

(Based on the entire population covered by the 1950 and 1960 Censuses, except Trust Territory of the Pacific Islands and "other citizens abroad." For detailed definition, see text)

Age of cohort		All classes			White			Nonwhite		
Age in 1950 (or birth date)	Age in 1960	Total	Male	Female	Total	Male	Female	Total	Male	Female
Born Apr. 1, 1955 to 1960:	Under 5 years:									
Based on registered births	.....	.959013	.951560	.966841	.966232	.959315	.973529	.919307	.908305	.930587
Based on total births[1]...	.....	.947031	.939746	.954682	.958971	.952103	.966218	.883440	.872999	.894142
Born Apr. 1, 1950 to 1955:	5 to 9 years:									
Based on registered births	.....	.956436	.948639	.964639	.958989	.951341	.967075	.941278	.932310	.950430
Based on total births[1]...	.....	.939721	.932151	.947683	.948269	.940709	.956262	.891124	.882639	.899783
Under 5 years.....	10 to 14 years.....	1.019725	1.017020	1.022534	1.016919	1.014319	1.019633	1.038837	1.035744	1.041954
5 to 9 years.....	15 to 19 years.....	.987918	.981170	.994903	.990763	.983584	.998235	.968416	.964285	.972542
10 to 14 years.....	20 to 24 years.....	.963345	.945864	.981480	.972266	.957979	.987143	.905633	.866405	.945358
15 to 19 years.....	25 to 29 years.....	.989183	.975662	1.002895	.993015	.981871	1.004402	.962747	.931495	.992806
20 to 24 years.....	30 to 34 years.....	.999510	.995916	1.003023	1.001859	.998133	1.005546	.981971	.978462	.985104
25 to 29 years.....	35 to 39 years.....	.992511	.989180	.995711	.994439	.990874	.997886	.977164	.975287	.978876
30 to 34 years.....	40 to 44 years.....	.986082	.985370	.986768	.986923	.985196	.988600	.978865	.980928	.976612
35 to 39 years.....	45 to 49 years.....	.948344	.949550	.947175	.955102	.954463	.955725	.893155	.908115	.879436
40 to 44 years.....	50 to 54 years.....	.925976	.917160	.934728	.931692	.922057	.941273	.875837	.873873	.877760
45 to 49 years.....	55 to 59 years.....	.916818	.898858	.934782	.922354	.902771	.941949	.868257	.864461	.872039
50 to 54 years.....	60 to 64 years.....	.853888	.816504	.891239	.860909	.823171	.898496	.784426	.751665	.818195
55 to 59 years.....	65 to 69 years.....	.859476	.802412	.917063	.852807	.797119	.908701	.939464	.863734	1.021041
60 to 64 years.....	70 to 74 years.....	.776462	.714280	.839136	.772650	.709896	.835640	.827126	.770880	.887013
65 to 69 years.....	75 to 79 years.....	.608023	.558779	.654403	.616660	.563585	.666642	.515722	.507453	.523519
70 to 74 years.....	80 to 84 years.....	.461477	.406858	.511466	.464349	.408377	.515176	.423245	.387755	.459286
75 years and over.....	85 years and over.....	.241403	.208035	.268988	.238194	.204158	.266080	.286192	.258423	.312197
65 years and over.....	75 years and over.....	.452019	.410550	.489214	.453990	.410846	.492475	.427821	.407048	.447748
70 years and over.....	80 years and over.....	.344658	.304017	.379902	.344120	.302623	.379801	.352001	.321850	.381358

[1] Births adjusted for underregistration.

Table 2.—CENSUS SURVIVAL RATES FOR THE NATIVE POPULATION OF THE UNITED STATES, BY COLOR AND SEX, FOR 1950 TO 1960

(Based on the entire population covered by the 1950 and 1960 Censuses, except Trust Territory of the Pacific Islands and "other citizens abroad." For detailed definition, see text)

Age of cohort		All classes			White			Nonwhite		
Age in 1950 (or birth date)	Age in 1960	Total	Male	Female	Total	Male	Female	Total	Male	Female
Born Apr. 1, 1955 to 1960:	Under 5 years:									
Based on registered births	.....	.956296	.948931	.964033	.963699	.956939	.970832	.915578	.904265	.927177
Based on total births[1]...	.....	.944349	.937150	.951909	.956458	.949744	.963541	.879856	.869116	.890865
Born Apr. 1, 1950 to 1955:	5 to 9 years:									
Based on registered births	.....	.955473	.947654	.963697	.956469	.950876	.966497	.937680	.928186	.947367
Based on total births[1]...	.....	.938775	.931183	.946759	.947755	.940250	.955691	.887718	.878735	.896884
Under 5 years.....	10 to 14 years.....	1.020131	1.017443	1.022923	1.017659	1.015046	1.020387	1.036938	1.034043	1.039851
5 to 9 years.....	15 to 19 years.....	.988343	.981087	.995855	.991585	.983957	.999525	.966175	.961046	.971293
10 to 14 years.....	20 to 24 years.....	.961666	.940790	.983312	.972161	.954888	.990142	.893872	.848364	.939852
15 to 19 years.....	25 to 29 years.....	.991261	.974366	1.008372	.997443	.983693	1.011482	.948743	.908123	.987647
20 to 24 years.....	30 to 34 years.....	1.004158	.999938	1.008300	1.007835	1.004066	1.011585	.976871	.967367	.985273
25 to 29 years.....	35 to 39 years.....	.996325	.993039	.999496	.999315	.996207	1.002341	.972916	.967246	.978030
30 to 34 years.....	40 to 44 years.....	.989116	.988498	.989712	.990846	.989334	.992319	.974510	.981098	.968648
35 to 39 years.....	45 to 49 years.....	.950431	.951017	.949861	.958505	.957672	.959323	.886704	.896155	.878176
40 to 44 years.....	50 to 54 years.....	.929420	.919698	.939066	.936810	.926786	.946802	.868430	.859920	.876560
45 to 49 years.....	55 to 59 years.....	.921889	.901548	.942070	.929917	.908087	.951627	.858259	.849159	.867119
50 to 54 years.....	60 to 64 years.....	.859396	.821552	.896663	.869310	.831232	.906709	.773583	.738825	.808596
55 to 59 years.....	65 to 69 years.....	.871109	.810744	.930080	.864663	.805722	.921791	.935895	.859080	1.017121
60 to 64 years.....	70 to 74 years.....	.790008	.722713	.854147	.787361	.719278	.851780	.818364	.757957	.880599
65 to 69 years.....	75 to 79 years.....	.623372	.568959	.672037	.637394	.578121	.690237	.505678	.493253	.517091
70 to 74 years.....	80 to 84 years.....	.473904	.414745	.526001	.479691	.418877	.532656	.412862	.373951	.451355
75 years and over.....	85 years and over.....	.251096	.215187	.279796	.248208	.211582	.277083	.283014	.251655	.312150
65 years and over.....	75 years and over.....	.464289	.418188	.503915	.468918	.420770	.509926	.419414	.394420	.442891
70 years and over.....	80 years and over.....	.355500	.311319	.392457	.356449	.311327	.393722	.345243	.311243	.377798

[1] Births adjusted for underregistration.

Table 3.—CENSUS SURVIVAL RATES FOR THE TOTAL NEGRO POPULATION OF THE UNITED STATES, BY SEX, FOR 1950 TO 1960

(Based on the entire population covered by the 1950 and 1960 Censuses, except Trust Territory of the Pacific Islands and "other citizens abroad." For detailed definition, see text)

Age of cohort		Total	Male	Female
Age in 1950 (or birth date)	Age in 1960			
Born April 1, 1955 to 1960:	Under 5 years:			
Based on registered births		.920256	.908953	.931817
Based on total births[1]		.883736	.872884	.894835
Born April 1, 1950 to 1955:	5 to 9 years:			
Based on registered births		.939931	.930085	.949968
Based on total births[1]		.888854	.879550	.898338
Under 5 years	10 to 14 years	1.038908	1.035789	1.042041
5 to 9 years	15 to 19 years	.965374	.958866	.971848
10 to 14 years	20 to 24 years	.897133	.852201	.942238
15 to 19 years	25 to 29 years	.954922	.915437	.992543
20 to 24 years	30 to 34 years	.978255	.970716	.984831
25 to 29 years	35 to 39 years	.969990	.966925	.972722
30 to 34 years	40 to 44 years	.974148	.981092	.968036
35 to 39 years	45 to 49 years	.886500	.902055	.872744
40 to 44 years	50 to 54 years	.866678	.863539	.869616
45 to 49 years	55 to 59 years	.845566	.843140	.847883
50 to 54 years	60 to 64 years	.778023	.743304	.812735
55 to 59 years	65 to 69 years	.943938	.866617	1.025506
60 to 64 years	70 to 74 years	.831374	.774597	.888993
65 to 69 years	75 to 79 years	.510000	.499198	.519775
70 to 74 years	80 to 84 years	.420576	.383565	.456572
75 years and over	85 years and over	.285243	.256123	.311515
65 years and over	75 years and over	.424484	.401755	.445418
70 years and over	80 years and over	.350065	.318401	.379680

[1] Births adjusted for underregistration.

Appendix

ADJUSTMENT TO ASSIGNED TOTAL

This note explains the procedure employed in the illustrative example (table A) to adjust the preliminary estimates of net migration by age to an independent, assigned total for all ages. In this case, the preliminary distribution was obtained by the census survival rate method and the assigned total by the vital statistics method. If it appears that the vital statistics method gives a better estimate of net migration for the total of all ages than does the sum of the estimates for the separate age groups, then the estimates for each age group should be improved by adjusting the distribution by age to sum to the independent total.

Commonly, with demographic data, the adjustment is made by distributing the difference between the assigned total and the sum of the initial distribution in proportion to the original figures. If, however, the initial distribution has both negative and positive items, a single pro rata adjustment of this kind will be larger than required and may distort the original data. If the net adjustment is positive, a pro rata adjustment will increase both the positive and the negative items (i.e., inflate them). The adjustment of the negative items will be in the wrong direction, merely offsetting some of the adjustment in the positive items, which had been given an excessively large adjustment.

There are several alternatives to a pro rata adjustment of this kind. If the data were available, the difference between the assigned total and the sum of the items in the initial distribution could be distributed in proportion to the age distribution of the population of the estimate area at either the beginning or end of the estimate period, or to the estimate of the age distribution of gross migration for some other area, as for example, the entire United States.

A simple mathematical alternative has been employed in the illustrative example. This method may be termed the "plus-minus adjustment procedure."

Let:

T be the independent total

P be the sum of the positive items in the distribution

N be the sum of the negative items in the distribution, with sign omitted.

Then, P-N is the algebraic sum of the preliminary distribution and P+N is its absolute sum without regard to sign.

Compute an adjustment factor F such that:

$$F = \frac{T - (P - N)}{P + N}$$

The adjustment factor for each positive item is 1.0+ F; the adjustment factor for each negative item is 1.0 − F. The sum of the adjusted items will add to T, the independent total. The amount of adjustment is a type of minimal adjustment to achieve the required total.

In the illustrative example:

T is 75,756
P is 76,844
N is 2,782

$$\text{Therefore, } F = \frac{75{,}756 - (76{,}844 - 2{,}782)}{76{,}844 + 2{,}782} =$$

$$\frac{75{,}756 - 74{,}062}{79{,}626} = 0.021274$$

Hence, the adjustment factor for the positive items is 1.021274, and the adjustment factor for the negative items is 0.978726.

There are several limitations to this method. One is that the amount of adjustment depends on the class interval chosen. If the data had initially been grouped in 10-year intervals rather than 5-year intervals, the final estimates for 10-year age groups would have been different from those indicated for these groups in table A.

Another limitation is that in the highly unlikely case that the required adjustment in the total exceeds the sum of the preliminary estimates without regard to sign, the procedure described gives untenable results. Apart from the question raised with respect to the adequacy of the distribution or the assigned total, this situation may be handled satisfactorily by an arithmetic translation of the numbers in the initial distribution (e.g., adding a selected constant to each value) and then applying the plus-minus adjustment procedure.

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