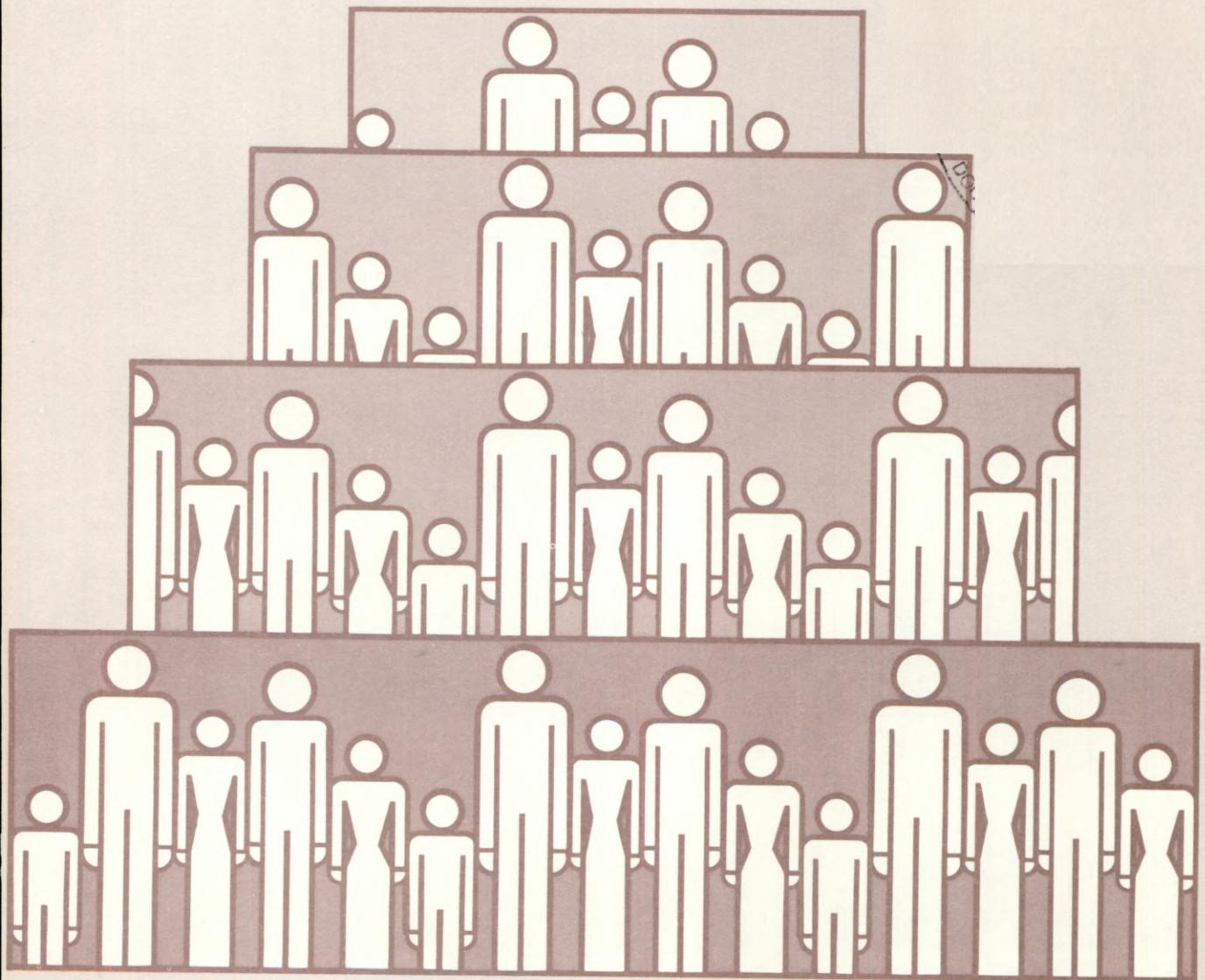


Current Population Reports
Special Studies
P-23, No. 103

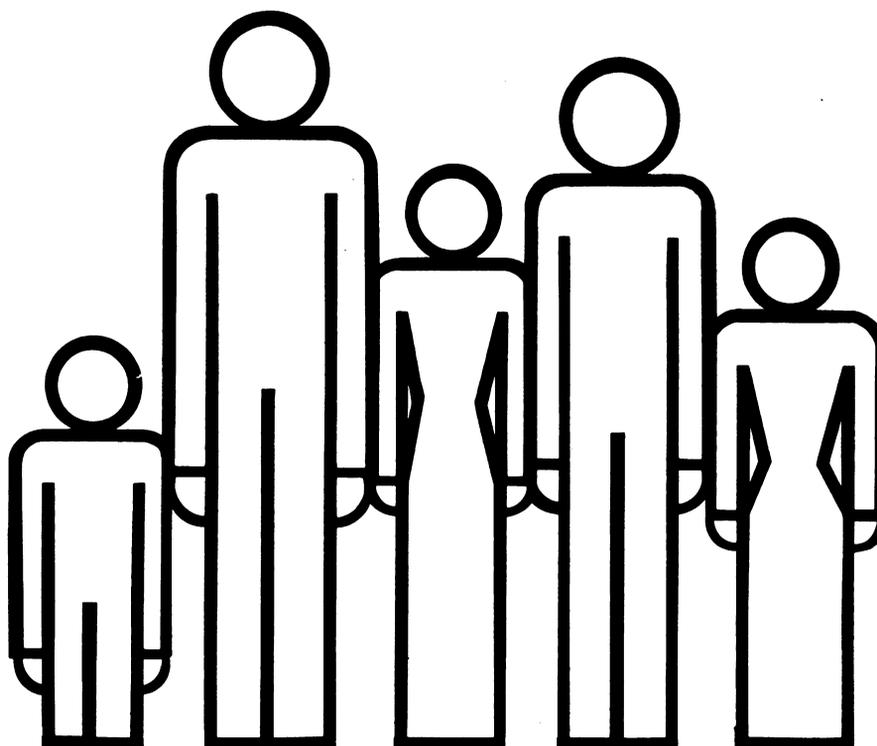
U.S. Department of Commerce
BUREAU OF THE CENSUS

Methodology for Experimental Estimates of the Population of Counties, by Age and Sex: July 1, 1975



Special Studies, Series P-23, No. 103
Issued May 1980

Methodology for Experimental Estimates of the Population of Counties, by Age and Sex: July 1, 1975



U.S. Department of Commerce
Philip M. Klutznick, Secretary
Luther H. Hodges, Jr., Deputy Secretary
Courtenay M. Slater, Chief Economist

BUREAU OF THE CENSUS
Vincent P. Barabba, Director



BUREAU OF THE CENSUS
Vincent P. Barabba, Director
Daniel B. Levine, Deputy Director
George E. Hall, Associate Director
for Demographic Fields

POPULATION DIVISION
Meyer Zitter, Acting Chief

ACKNOWLEDGMENTS

This report was prepared by **Richard Irwin**, Estimates Research Unit. The project was initiated at the request of the National Cancer Institute, which provided major financial support. Statistical assistance was provided by **Bonnie Damon**, **Florence Schwartz**, and **Brenda Vines**. Computer applications and programming were by **Jerome Glynn**, with the assistance of **Jean Fansler**, **Marion Fox**, and **Marie Pees**. Editorial assistance was provided by **Marion Porter**. Professional consultation and review were provided by **Sam Davis III**, **Richard Engels**, **Evie Griffiths**, **Signe Wetrogan**, and **David Word** of the Population Division and **Thomas Mason** of the National Cancer Institute.

SUGGESTED CITATION

U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 103, *Methodology for Experimental Estimates of the Population of Counties, by Age and Sex: July 1, 1975*, U. S. Government Printing Office, Washington, D.C., 1980.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Postage stamps not acceptable; currency submitted at sender's risk. Remittances from foreign countries must be by international money order or by a draft on a U.S. bank. Current Population Reports are sold in two subscription packages: Series P-20, P-23, P-27, and P-60 are available for \$40.00 per year (\$10 additional for foreign mailing); Series P-25, P-26, and P-28 are available for \$70.00 per year (\$17.50 additional for foreign mailing). The single-copy price of this report is \$2.

Contents

	Page
Introduction	1
Methodology	1
General	1
Preparation of basic migration data, 1965-70	2
Birth cohort migration	3
Preliminary approximation of the 1975 population	3
Adjustment for consistency with national estimates	5
Adjustment for consistency with State and county estimates	5
Use of Medicare data for estimating the population aged 65 years and over.	8
Total coverage	8
Age	10
Race	10
Definition of residence in Medicare	10
Medicare data for counties	12
Coding	12
Evaluation and limitations of the estimates.	13
Related reports	16

TEXT TABLES

Table	
A. Computation of preliminary population estimate, by age, for White males, Riley County, Kans.: July 1, 1970 to 1975	4
B. Factors for adjusting the preliminary county population estimates to agree with the national population estimates, by age, sex, and race: July 1, 1975	6
C. Components of change and migration adjustments, by sex and race, for Riley County, Kans.: July 1, 1970 to 1975	7
D. Factors for adjusting the revised county population estimates to agree with the national population estimates, by age, sex, and race: July 1, 1975	9
E. Adjustments to Medicare data and comparison of adjusted data with the Census count, for the United States: April 1, 1970.	9
F. Difference between Medicare enrollment and estimated population, by age and sex, for the United States: July 1, 1970.	11
G. Distribution of counties by percent deviation of Medicare enrollment from Census counts, by sex and race: 1970.	12
H. Summary of average percent errors by age of county estimates from special censuses, by sex: 1974 to 1976	14

APPENDIXES

A. Collapse Procedure for Smoothing Migrant Age Distributions.	17
B. List of Counties Adjusted for Military, College, and Institutional Population	19
C. Major Adjustments to the 1965-70 Migrant Data	24
D. Definitions of Technical Terms	25

APPENDIX TABLE

Table A-1. Comparison of original in-migrant distribution by age and sex with distribution smoothed by collapse procedure, for the White population, Arthur County, Nebr.: July 1, 1965 to 1970.	18
--	----

Methodology for Experimental Estimates of the Population of Counties, by Age and Sex: July 1, 1975

INTRODUCTION

This report describes the methodology used to prepare experimental estimates of the population by age and sex for all counties in the United States on July 1, 1975. Census data on gross outmigration and immigration were used for the first time in developing age estimates for counties, and revised techniques in the treatment of military and college population were introduced. The resulting procedures are generally applicable to other projects of this type.

The estimates are considered experimental because they have not been systematically tested against census data, as is customary with the regular postcensal estimate programs in which the Bureau of the Census is involved. However, tests were conducted with available special census data. The findings of the evaluation work, the general limitations of the age estimates, and special problem areas are discussed in the section titled "Evaluation and Limitations of the Estimates."

Estimates have been prepared for each year 1970 through 1977 using an extension of the methods used in preparing the 1975 estimates. The estimates can be obtained from the Data User Services Division and are for 5-year age groups to 75 years and over, by sex. The estimates are consistent with estimates of the total population of counties published in Current Population Reports, Series P-25 and P-26. They are also generally consistent with estimates of the U.S. resident population, by age and sex, published in Series P-25.

The estimates for all years are for 3,141 counties or county equivalents as delineated by the 1970 census. In Virginia, Nansemond County and Suffolk City were merged to become Suffolk City in 1974. They were calculated separately because of the nature of the basic data, and the estimates are valid only when added together to obtain the total for the area.

The estimates were prepared by carrying forward the 1970 census counts by age cohort using registered births and estimated deaths by age and basing the age-sex detail of migrants on the information provided for the period 1965-70 by the 1970 census. The migrant data used were obtained from a special tabulation, as described in the section on methodology, and were relied upon to establish only the age distribution of migrants, not the levels of migration. The 1970 population data upon which the estimates are based are consistent with those used in the ongoing postcensal estimate programs, and reflect corrections to the census counts made subsequent to the release of the official figures.

METHODOLOGY

General. The cohort-component technique was used to prepare the estimates, making separate estimates of births, deaths, and migration, by age, sex, and race. The population in 1970 was carried forward to 1975, by cohort, using estimates of births and deaths adjusted so as to agree with registered totals. A preliminary approximation of outmigration from 1970 to 1975 was obtained for each county, by cohort, using outmigration rates for the period 1965-70. The outmigrants were summed to form a pool which, after adjustments for immigration and national change in military, college, and institutional population, was distributed back to each county as immigrants, using the proportions of the total pool that each county was observed to have received in 1965-70. The preliminary outmigration and immigration data were then adjusted, sometimes extensively, to bring the 1975 population and 1970-75 migration levels into agreement with independent total population estimates for each county developed for the Federal General Revenue Sharing program. Revised population estimates through the Federal-State Cooperative Program for Local Population Estimates had not been completed for use at the time that the 1975 age estimates were being developed but were used for the 1976 and 1977 estimates.

The computations were carried out separately for White and for Black and other races, but county race estimates were not available for use as controls. As an intermediate step, the computations by race were adjusted to be consistent with the 1975 State race estimates, but the county race detail is essentially an extension to 1975 of the 1965-70 migration trends shown by the 1970 census. It is recommended that only the data for all races be used in general analytical applications.

A special adjustment was made for migration caused by significantly large military installations, colleges, and correctional institutions.¹ This special migration was subtracted from total migration, removing it from the usual computation involving rates and proportions. Special immigrants for the 1970-75 period were estimated by adjusting the 1965-70 immigrants for change in the size of the special population

¹ Special migration for correctional institutions had to be estimated independently, whereas military and college migration were provided by the tabulation of 1965-70 migration data from the 1970 census. However, a county selected for a prison adjustment was treated exactly like a college county in the computational procedure.

from 1970 to 1975 as shown by administrative records. The adjustment technique was generally successful in allowing for the impact of changes in the size and age distribution of the military, college, and prison populations. A list of the counties selected for special treatment is given in appendix B. In all, 184 counties received special treatment for military population, 427 for colleges, and 70 for prisons.

For the counties with a special population, the civilian noncollege population² in 1970 was obtained by subtracting the tabulated special migrants from the 1970 census counts. This population was carried forward to 1975 with births, deaths, and civilian noncollege migration. The estimated special inmigrants for the 1970-75 period were added to the 1975 civilian noncollege population to obtain the resident population. It is fundamental to this procedure that the special *population* is based on the number of *migrants* who reported in the census that they were in one of the special categories.

As a final step, estimates of the population aged 65 years and over based on Medicare data were substituted for those obtained by the regular cohort-component procedure.

Preparation of basic migration data, 1965-70. A special tabulation of 1970 census data was prepared showing immigration and outmigration for each county, by age, sex, and race. The original data were obtained by a sample question in the census asking for each person's residence on April 1, 1965, 5 years prior to the census date. The basic census data were adjusted for nonresponse by a special allocation technique, and a summary version of these data was published as Current Population Reports, Series P-25, No. 701.³ The tabulation identified separately the migration of persons in the Armed Forces or attending college in either 1965 or 1970. See appendix D for definitions of migrant types.

In developing the 1965-70 outmigration rates and in-migrant proportions, it was necessary to adjust the migrant data in several ways. The most significant of these was the collapsing procedure used on small counties whereby irregular migrant totals for 5 year age groups were distributed to adjacent age groups, as described in detail in appendix A. This adjustment altered the age detail of migrants in small counties, but did not change the all ages total of outmigrants or inmigrants for any race-sex group. The larger the number of migrants (all ages) the smaller the alteration was of the age distributions. However, for counties with small populations, the age detail of the final migrant distributions is relatively weak.

The collapsing procedure was needed because the original migration data were obtained from the 15-percent sample of the 1970 census. Each sample migrant received a weight of approximately 6, resulting in very irregular age distributions for small numbers of migrants. The census population based

on sample data was not available by race, and in the calculation of migration rates and proportions, complete-count population data were used, thereby complicating the effect of sample variation. The sample weight in the census was assigned according to the following broad age groups: under 5 years, 5 to 13 years, 14 to 24 years, 25 to 44 years, 45 to 64 years, and 65 years and over. As a result, the weighting of a sample case was not necessarily consistent with the complete-count population in a given 5-year age group.

As a preliminary step, the data were checked to see if military inmigrants or college inmigrants were greater than the resident population, and if so, the special migrants were adjusted to be no more than 75 percent of the population in a given age-sex-race cell. This limit was arbitrarily selected based on the idea that about 25 percent of a given cell should be civilian noncollege in order to provide a smoother year-to-year population change. Although the limit affected only a few cells in counties selected for a special adjustment, a more extensive study of the problem is needed. Civilian noncollege population and migrants were next computed by subtracting the special populations from resident data.

To adjust for the irregular age distributions mentioned above, the 5-year civilian noncollege data were collapsed to broader age groups similar to those used to determine sample weights in the census, and the migrants were redistributed to 5-year groups within the broad age groups according to population. Only counties with the smaller population groups (by race) were affected. If the total of male and female migrants for a racial group was 2,000 or more, no collapsing was necessary. The decision to collapse age categories was systematically determined by a statistical score measuring the extent of difference, age by age, between male and female migrants. Based on this score, both male and female distributions were collapsed to the broad age groups 5 to 14 years, 15 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 64 years, and 65 years and over. If the migration distribution for these age groups was still irregular, one more collapse was made to the broad age groups 5 to 24 years, 25 to 44 years, and 45 years and over. A detailed discussion of the collapsing procedure is given in appendix A. Although a more extensive and systematic study of the operation of the collapsing routine is indicated, it smoothed migrant distributions satisfactorily in all observed cases.

In three special instances where extreme difficulties were encountered with the migration tabulations, substantial adjustments were made to the original 1965-70 migrant data. The areas are Chambers County, Ala.; Baltimore City and County, Md.; and New York City. The estimated population distributions by age are believed to have been improved by these adjustments; the total 1975 population is not affected. For more information on each area, see appendix C.

After all adjustments to the migrant data, civilian noncollege outmigration rates, by age, sex, and race, were calculated. For this purpose, a base population for each county was obtained by subtracting all inmigrants from the 1970 resident population, adding all outmigrants, and subtracting military and college outmigrants. This population

² The term "civilian noncollege" as used in this section excludes the migrant population of prisons as well as of military bases and colleges.

³ The tabulation provided data for persons aged 5 years and over. Migration for the youngest cohort, births becoming 0 to 4 years at the end of the period, was estimated by a net migration technique. See section, "Birth cohort migration."

represents the survivors in 1970 of the civilian noncollege population residing in the county in 1965. Civilian noncollege outmigrants were then divided by the base population to obtain an outmigration rate. Excessive rates were frequently encountered where very small populations were involved, and were arbitrarily prevented from exceeding 90 percent.

All outmigrants, when summed for all counties, can be thought of as forming a national pool from which inmigrants are drawn. As a first step in calculating inmigrant proportions for each county, the national sum of civilian noncollege outmigrants was computed for each cohort. This pool was augmented by the sum of all military outmigrants, all college outmigrants, the Armed Forces overseas, and immigrants from abroad; and was diminished by the sum of all military inmigrants and college inmigrants. The civilian noncollege inmigrants for each county were obtained for each age-race-sex category by subtracting military inmigrants and college inmigrants from total inmigrants, and were then taken as a proportion of the national pool. The civilian noncollege inmigrant proportions were then adjusted so as to equal unity for each age-sex-race cell.

Birth cohort migration. The gross migration data from the 1970 census do not provide information for the youngest cohort, that is, the migration of persons born during the 5-year base period, becoming 0 to 4 years at the end of the period. For this group, a rate of net migration was calculated by the formula:

$$r_{nm} = \frac{RP70_{0-4} - (B_{65-70} * NCSR)}{(B_{65-70} * NCSR)}$$

where r_{nm} is the rate of net migration, $RP70_{0-4}$ is the resident population aged 0 to 4 years in the 1970 census, B_{65-70} are births from 1965 to 1970 (April 1), $NCSR$ is a National Census Survival Rate, and $*$ is the symbol for multiplication. These rates were sometimes very high where small numbers were involved, and the net immigration rate was not allowed to exceed 100 percent. Larger areas rarely exceeded this figure. The final estimates for the population 0 to 4 years of age obtained by the method just described are not completely satisfactory. The net migration technique produced too many immigrants for counties with a substantial net immigration for the period 1965-70, and a higher immigration rate for 1970-75. For the extension of the estimates to 1977 an alternative approach resolved the problem by using the cohort-universe technique,⁴ but it was not feasible to correct the 1975 estimates.

Preliminary approximation of the 1975 population. To obtain the preliminary approximation for July 1, 1975, the census population in 1970 was carried forward to 1975 by cohort, by age, sex, and race, making separate estimates for births, deaths, and migration. A preliminary step calculated a new base date population for each county on July 1, 1970,

by a simple interpolation procedure between the April 1, 1970, census total county population and the postcensal estimate on July 1, 1973, as published in Current Population Reports, Series P-25, Nos. 649 through 698. The age-sex-race distribution on April 1, 1970, was adjusted pro rata to agree with this total. For Riley County, Kans., the total population of White males on July 1, 1970, was 30,385 by this calculation (table A, footnote 5).⁵ The census count on April 1, 1970, as adjusted for use in the population estimates program, had been 30,244.

The distribution of deaths by age and sex was obtained by first computing a preliminary estimate of deaths using death rates derived from the United States life table for 1972. The deaths by age-sex cohorts thus obtained were then adjusted pro rata to agree with registered totals, by race, for each county. The national death rates therefore served only to distribute deaths by age and sex. For Riley County, this method estimated 643 deaths for White males, of which 238 are for the cohort becoming 75 years and over in 1975 (table A, col. 2). A coverage adjustment ratio, by age, sex, and race, derived from national estimates of net census undercount, adjusted each cohort for difference in coverage by age as the cohort moved from one age to the next. This had the same effect as the inflation-deflation technique used in preparing the national population estimates, and assumes that the pattern of net census undercount for each county is similar to the pattern for the Nation. This assumption is open to question, and the use of the coverage adjustment ratio should be reexamined when and if more information is available regarding variation of rates of undercount for local areas. For Riley County, the largest adjustment was -253 for the cohort of White males becoming 25 to 29 years old in 1975 (table A, col. 3).

To complete the data preparation for obtaining the preliminary 1975 population, migration was first approximated for each county, by age, sex, and race, using procedures matching the preparation of the basic migration data for the period 1965-70. The rates of civilian noncollege outmigration calculated there (augmented slightly to provide for outmigrants to the Armed Forces overseas in 1975) were multiplied by the "survivors" in 1975 (the 1970 population less deaths and adjusted for coverage) to obtain civilian noncollege outmigrants. This computation was carried out for each county only after subtracting the 1965-70 military inmigrants and college inmigrants, aged 5 years, who now become military outmigrants and college outmigrants for the period 1970-75. It is a fundamental feature of the age estimates procedure that military and college migrants are assumed to be the entire special population. Thus the inmigrants from the 1965-70 period are the special population in 1970, and become the special outmigrants for the 1970-75 period. This assumption functioned very satisfactorily in producing a reasonable age distribution for the special counties in 1975.

⁴ Irwin, Richard. "A Cohort-Universe Net Migration Procedure for Population Estimates and Projections by Age." Paper presented at the annual meeting of the Southern Regional Demographic Group: San Antonio, Texas, October 1978.

⁵ Riley County, Kans., was selected to illustrate the methodological procedures because it was designated as both a military and a college county, and these special populations were a relatively large part of the total population.

Table A. Computation of Preliminary Population Estimate, by Age, for White Males, Riley County, Kans. : July 1, 1970 to 1975

(See text for derivation)

Age in--		Population July 1, 1970	Deaths	Coverage adjustment	Survivors July 1, 1975 ¹	Outmigrants			Inmigrants			Residual ³	Population July 1, 1975 ⁴
1970	1975					Civilian ²	Military	College	Civilian ²	Military	College		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
All ages...	All ages..	532,504	643	-284	31,577	4,951	9,953	5,380	5,247	7,551	6,530	-1,240	30,621
Births, 1970-75	0 to 4 years..	2,119	29	-37	2,053	-	-	-	38	-	-	1	2,091
0 to 4 years...	5 to 9 years..	1,883	4	-2	1,877	1,259	-	-	1,006	-	-	-255	1,624
5 to 9 years...	10 to 14 years	1,769	3	24	1,790	801	-	-	602	-	-	-175	1,591
10 to 14 years..	15 to 19 years	1,664	6	-4	1,654	565	-	-	529	877	2,073	2,910	4,568
15 to 19 years..	20 to 24 years	4,306	27	-52	4,227	497	1,156	1,708	1,030	5,147	3,628	6,392	10,671
20 to 24 years..	25 to 29 years	11,277	72	-253	10,952	402	6,786	2,989	641	737	521	-8,531	2,674
25 to 29 years..	30 to 34 years	2,554	15	20	2,559	508	971	429	375	366	164	-983	1,556
30 to 34 years..	35 to 39 years	1,250	9	-2	1,239	237	482	135	318	217	59	-262	979
35 to 39 years..	40 to 44 years	1,026	11	10	1,025	174	286	49	216	124	44	-115	900
40 to 44 years..	45 to 49 years	867	16	-2	849	108	163	36	93	53	34	-129	722
45 to 49 years..	50 to 54 years	802	24	14	792	117	70	28	127	30	-	-44	734
50 to 54 years..	55 to 59 years	708	33	-2	673	66	39	-	75	-	-	-32	643
55 to 59 years..	60 to 64 years	585	43	-1	541	78	-	-	80	-	-	-	543
60 to 64 years..	65 to 69 years	522	56	12	478	69	-	-	37	-	7	-13	453
65 to 69 years..	70 to 74 years	375	57	-	318	16	-	6	47	-	-	25	343
70 and over....	75 and over...	797	238	-9	550	54	-	-	33	-	-	-30	529

- Represents zero or rounds to zero.

¹(4) = (1)-(2)+(3).

²Civilian noncollege.

³The "residual" is the sum of all cohort change other than deaths. (11) = (12)-(1)+(2).

⁴(12) = (4)-(5)-(6)-(7)+(8)+(9)+(10).

⁵Including births. Total excluding births is 30,385.

The civilian noncollege outmigrants for each county are summed to begin the formation of the national pool. The national sum of all military outmigrants and college outmigrants are added to the pool where they will be included in the immigrant distribution. The Armed Forces overseas in 1970 are also added to the pool, it being implicitly assumed that all will return to the United States in 1975. Net civilian immigration for the period 1970-75 is also added. Before distributing this pool as civilian noncollege immigrants, subtractions must be made to provide military immigrants and college immigrants in 1975 to all counties, and outmigrants to the Armed Forces overseas in 1975.

The subtractions from the pool for military immigrants and college immigrants in 1975 are the sum of the values for each county, calculated as follows. For the counties having significant military population, station strength, as reported by the statistical services of the Department of Defense, was obtained for July 1, 1970 and 1975. If total military immigrants for the county were less than station strength in 1970, military immigrants in 1975 (all classes) were estimated by multiplying military immigrants in 1970 by the ratio of 1975 to 1970 station strength. If military immigrants were greater than station strength in 1970, and if station strength increased, the amount of the increase was added to the 1970 figure to obtain the 1975 estimate. However, if station strength declined from 1970 to 1975, the ratio computation was used.

For counties with a significant college population, the procedure for obtaining total college immigrants in 1975 was similar to that for military counties. Using full-time enrollment in 1970 and 1975, college immigrants for 1975 were obtained by the same series of calculations just described for obtaining military immigrants from station strength data.

Having obtained figures for 1975 total military immigrants and total college immigrants in this way, college immigrants by age, sex, and race in 1975, were obtained by prorating the 1970 distribution to the new total. For military immigrants, however, an additional step was made to allow for the shift in the composition of the Armed Forces, by sex and race during the period 1970 to 1975. Specifically, the ratios of the 1975 to the 1970 resident Armed Forces, by race and sex, based on data from the national estimates program were: White males, .73; White females, 2.09; Black-and-other-races males, 1.18; and Black-and-other-races females, 3.68. The ratios for women indicate the striking increase in their numbers during the period. The 1970 military immigrant sex-race totals for each military county were multiplied by these ratios and then adjusted pro rata to the 1975 military immigrant total. A special function was included to dampen the effect of the large growth ratios for females in those few training bases where women make up a large proportion of station strength. Having obtained the 1975 military immigrant sex-race totals in this way, the age distribution in 1970 of each group was prorated to the new totals.

After the preliminary 1975 population data were examined, a distortion in age distributions caused by large prisons was noted, especially for Black and other races. This occurred because only a small proportion of the inmates were reported as outmigrants from the county containing the institution in the basic 1965-70 migrant data. For immigrants, however, there was reasonably complete reporting. The migrant data do not provide any special information about inmates of institutions because the 1970 census question on activity in 1965 covered only three categories; membership in the Armed Forces, enrollment in college, and employment. An estimate of migration for the period 1970-75 for

inmates of prisons (males only) was developed by assuming that the excess of male over female immigrants, age by age, in 1965-70 represented the impact of the prison on immigration. An adjustment was made for 70 counties with large prisons, and these counties were treated like college counties in the computational procedure. The prison adjustment alleviated the problem caused by deficient reporting in the original migrant data, but sometimes fell short of the complete adjustment required. The adjustments for military and college population, however, functioned well in general, producing apparently reasonable age distributions.

Comparisons with special censuses were possible for a few counties with significant military and college populations. See "Evaluation and Limitations of the Estimates" and table H. Of the counties in table H, military adjustments were made for Pima, Ariz.; Kings, Calif.; San Bernardino, Calif.; Sarpy, Neb.; and Travis, Tex.; adjustments for colleges were made for Pima, Ariz.; Yolo, Calif.; and Travis, Tex. In the military counties, there was a tendency for the estimates of the age group 25 to 29 years to be low, perhaps due to a shift (not taken into account in the estimating procedure) towards an older age distribution in the Armed Forces.

Table A illustrates the values for military and college migration which were developed for Riley County. Columns 6 and 7 contain military and college outmigrant figures, respectively, for the 1970-75 period. Columns 9 and 10 give military immigrants and college immigrants for 1975 as calculated using the procedures described above. Station strength (all classes) as provided by the Department of Defense declined from 13,144 in 1970 to 11,117 in 1975, while full-time college enrollment increased from 12,943 to 15,711. In table A, the percent decrease from 9,953 (military outmigrants) to 7,551 (military immigrants) for White males is greater than the percent decrease in station strength because of the adjustment for change in the sex-race composition of the Armed Forces. The increase in college immigrants over college outmigrants is 21.4 percent, the same as the increase in enrollment.

In retrospect, it might have been advisable to adjust for the shift in the age structure of the Armed Forces. It was omitted from these experimental estimates because the shift might be specific to certain types of bases leaving others unaffected, and sufficient data for a thorough adjustment are not available.

The sum of military immigrants and college immigrants in 1975 for all counties was subtracted from the immigrant pool, by age, sex, and race, preparatory to distribution as civilian noncollege immigrants. The Armed Forces overseas were also subtracted from the pool, for which provision had been made by augmenting slightly the civilian noncollege outmigration rates for all counties.⁶ This feature was necessary because the basic 1965-70 migration data do not reflect the movement of U.S. residents to the Armed Forces overseas, as the information was tabulated for persons living

in the United States in 1970. Civilian noncollege immigrants were calculated for each county using the immigrant proportions developed for the 1965-70 base period. For the birth cohort, net migration was calculated using the rate previously developed, and the amount of net migration was entered as immigration or outmigration, depending on the sign of the net migration.

The preliminary approximation of the 1975 population was obtained for each cohort by subtracting deaths from the 1970 population, adjusting for coverage, subtracting civilian noncollege outmigrants, adding civilian noncollege immigrants, and adding or subtracting special migrants as appropriate. The cohort 0 to 4 years in 1975 (topmost cohort in table A) was obtained by a similar procedure, but starting with births from 1970 to 1975.

Adjustment for consistency with national estimates. The preliminary 1975 county population estimates were summed for the Nation, were compared with the national estimates by age, sex, and race, and were adjusted pro rata to obtain agreement. For all cells except those for the older Black-and-other-races population, the adjustment factors were small (table B). For Black-and-other-races females aged 75 years and over, a 12.9 percent upward adjustment was required, apparently because the life table death rate was too high relative to other rates for these races, and because the method of correcting for net census undercount does not exactly match the inflation-deflation technique used in preparing the national population estimates. The control to national totals adjusts for these biases to a considerable degree. For Black-and-other-races males in the oldest age group, the adjustment was 4.6 percent. The largest adjustment for Whites was 5.0 percent for females aged 75 years and over. For all of the other 31 age-sex-race cells for White males and females, the adjustment was less than 1 percent.

Adjustment for consistency with State and county estimates. Postcensal estimates for the total population of each county are available, as well as estimates by race for each State; the age detail was controlled to the 1975 estimates. The general procedure was to compare the population produced by the preliminary age approximation to the independent estimates of total population, and to adjust civilian noncollege gross outmigration and immigration, by age, sex, and race, so as to bring the revised total population into agreement with the postcensal estimate and at the same time produce the needed age-sex-race detail. The 1970-75 migration data for the special populations (military immigrants, etc.) were not affected by the adjustments.

The most logical and accurate manner for making such adjustments is a worthwhile subject for future major research. A functional relationship probably exists between (a) the amount of gross outmigration and immigration for a certain time period, (b) the gross migration for a succeeding period given a certain shift in the magnitude and direction of net migration, (c) the demographic characteristics of the migrants, and (d) the social and economic characteristics of the county in question. Other factors may be involved, such as the cost and characteristics of available housing.

⁶ The largest adjustment was for males aged 20 to 24 years in 1975 with an added outmigration rate of 1.9 percent for White and 3.1 percent for Black and other races.

Table B. Factors for Adjusting the Preliminary County Population Estimates to Agree with the National Population Estimates, by Age, Sex, and Race: July 1, 1975

(See text for derivation of factors. A factor of less than 1 indicates that preliminary data are decreased by the adjustment)

Age	White		Black and other races	
	Male	Female	Male	Female
0 to 4 years.....	.994	.992	1.013	1.005
5 to 9 years.....	.996	.996	1.000	.997
10 to 14 years.....	.993	.993	1.003	.998
15 to 19 years.....	.998	.999	1.008	1.003
20 to 24 years.....	1.005	1.004	1.018	1.009
25 to 29 years.....	1.005	1.006	1.009	1.011
30 to 34 years.....	1.004	1.003	1.013	1.007
35 to 39 years.....	1.002	1.001	1.004	1.003
40 to 44 years.....	.993	.993	1.001	.997
45 to 49 years.....	.995	.993	1.009	1.001
50 to 54 years.....	.999	.997	1.015	1.008
55 to 59 years.....	1.001	1.000	1.018	1.010
60 to 64 years.....	1.000	.999	1.007	1.001
65 to 69 years.....	1.000	1.002	1.014	1.018
70 to 74 years.....	.993	.999	.969	.978
75 years and over.....	1.007	1.050	1.046	1.129

Such an analysis was beyond the scope of this project, and in any case, gross migration data are not available for successive 5-year periods for a large group of counties to provide an easily accessible solution. The tabulation of county migration produced for this project was the first which provided complete data for counties. Even for local areas larger than counties, there are few, if any, data for two adjacent 5-year periods. A comparison of 1955-60 and 1965-70 data from the decennial censuses for State economic areas is a possible avenue of research, even though these are not adjacent periods. Data forthcoming after 1980 from the Administrative Records method will make it possible to compare gross migration data for 1970-75 and 1975-80 for local areas, derived from matched Federal income tax returns.⁷

In the absence of such analyses, rather arbitrary decisions were taken in order to provide a practical adjustment procedure in the short run for this project. Specifically, the sex-race totals of gross outmigration and immigration were adjusted in opposite directions by a simple relationship described below, so as to sum to the new desired net migration. Then the age distribution for each sex-race group from the preliminary approximation was adjusted pro rata to agree with the new total.

Perhaps the simplest functional relationship for adjusting the sex-race totals would have been to adjust the two streams in opposite directions by equal amounts to achieve the

desired net total. However, studies by Lowry and others⁸ have indicated that immigration is more responsive to varying economic opportunity than is outmigration. The problem being discussed here lends itself to this hypothesis; a shift in net migration for two successive time periods may be assumed to be related to a shift in economic opportunity, at least for those counties not primarily dependent on an adjacent county for their economic base.

This suggests that immigration should be changed more than outmigration to achieve a desired new net figure. For the solution needed immediately for this project, it was arbitrarily decided to change immigration by two-thirds of the required shift in net migration leaving one-third for outmigration. A comparison of gross migration totals, by race, for States for the period 1970-75 derived from matched income tax returns with 1965-70 migration data from the 1970 census gave some support to this assumption, but the disparate nature of the two data sources weakens the comparison, which in any case is for States, not counties. Nevertheless, the two-thirds, one-third rule appeared to be preferable to the assumption of equal changes or to a plus-minus adjustment, and was adopted for the project.

The availability of estimates by race for States raised the possibility of strengthening the race detail. Before comparing the preliminary total to the county postcensal estimate, the State totals by race produced by the preliminary approximation were compared to the State estimates, separately for

⁷ For a comprehensive description of the Administrative Records method, see U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 699. *Population and Per Capita Money Income Estimates for Local Areas: Detailed Methodology and Evaluation*. Spring, 1980.

⁸ See also Calvin Beale, *The Relation of Out-migration Rates to In-migration*, paper for the 1969 meeting of the Population Association of America; and Vern Renshaw, *The Relationship of Net Migration to Gross Migration*, paper for the 1977 meeting of the Southwest Economic Association.

White and Black and other races.⁹ The adjustment to net migration needed to achieve consistency was distributed among the counties on the basis of the volume of gross migration, since shifting migration trends were presumably the chief contributor to the disparity. In accord with the two-thirds, one-third concept, each county's share of the total State adjustment was based on the sum of two-thirds of its gross immigrants and one-third of gross outmigrants, in comparison with similarly calculated weights for the other counties of the State.

This is shown as adjustment 1 in table C for Riley County, Kans. The amount of the adjustment was 421 for Whites (col. 2) and -281 for Black and other races (col. 3). The total adjustment is therefore 140, shown in column 1. This adjustment is added to the preliminary 1975 resident population,¹⁰ and the new total of 60,619 is now compared with the independent total population estimate. For Riley County this estimate is 61,093 (shown in the first column, bottom line), and the difference of 474 is shown as

⁹U.S. Bureau of the Census, Current Population Reports, Series P-23 No. 67 *Population Estimates by Race, for States: July 1, 1973 and 1975*, February 1978.

¹⁰This 1975 figure for White males differs from the one given in table A by the amount of adjustment required to obtain consistency with the national population estimates.

adjustment 2. This amount is distributed by race using the weights previously described, and adjustments 1 and 2 are summed to obtain adjustment 3, the total adjustment needed to bring the preliminary approximation into agreement with the independent total population estimate. The race totals for adjustment 3 are now distributed by sex using a similar weighting system. By adding adjustment 3 to the 1975 preliminary population, the sex-race population totals for 1975 are obtained.

To obtain complete age detail, the outmigration and immigrant detail must also be adjusted. Preliminary civilian noncollege outmigrants and immigrants are shown in table C. The difference between these two figures (civilian net migration) differs from preliminary total net migration by (a) the migration of special populations, (b) the adjustment for coverage, and (c) the adjustment producing consistency with the national estimates. The migration of special populations is not changed by the adjustment to State and county controls. Only preliminary civilian noncollege outmigrants and immigrants are adjusted by adding two-thirds of adjustment 3 to immigrants and by subtracting one-third from outmigrants. The final outmigrants and immigrants also are shown in table C. The final resident population for each

**Table C. Components of Change and Migration Adjustments, by Sex and Race, for Riley County, Kans.:
July 1, 1970 to 1975**

(See text for description of procedure)

Item	All classes	Race		Race and sex			
		White	Black and other races	White		Black and other races	
				Male	Female	Male	Female
Resident population, 1970.....	57,052	52,418	4,634	30,385	22,033	3,329	1,305
Births.....	4,486	4,119	367	2,119	2,000	186	181
Deaths.....	1,199	1,157	42	643	514	31	11
Preliminary:							
Net migration.....	140	-645	785	-1,206	561	582	203
Percent ¹	0.2	-1.2	16.9	-4.0	2.5	17.5	15.6
Resident population, 1975.....	60,479	54,735	5,744	30,655	24,080	4,066	1,678
Civilian noncollege immigrants.....	14,550	13,234	1,316	5,247	7,987	484	832
Civilian noncollege outmigrants.....	14,097	13,053	1,044	4,951	8,102	333	711
Civilian noncollege net migrants....	453	181	272	296	-115	151	121
Adjustment 1.....	140	421	-281	(X)	(X)	(X)	(X)
Adjustment 2.....	474	434	40	(X)	(X)	(X)	(X)
Adjustment 3.....	614	855	-241	334	521	-85	-156
Percent ¹	1.1	1.6	-5.2	1.1	2.4	-2.6	-12.0
Final:							
Civilian noncollege immigrants.....	14,959	13,804	1,155	5,470	8,334	427	728
Civilian noncollege outmigrants.....	13,892	12,768	1,124	4,840	7,928	361	763
Net migration.....	754	210	544	-872	1,082	497	47
Percent ¹	1.3	0.4	11.7	-2.9	4.9	14.9	3.6
Resident population, 1975.....	61,093	55,590	5,503	30,989	24,601	3,981	1,522

X Not applicable.

¹Percent of 1970 population.

sex-race group is the 1975 preliminary population plus adjustment 3. The final net migration is the preliminary net migration plus adjustment 3.

While there is no assurance that the population totals by race in 1975 obtained by these procedures do indeed correspond to population levels, the shifts obtained appeared to be reasonable in light of other studies of migration trends. For example, for the White population in counties containing large metropolitan cities in the North and West, these procedures produced continued heavy White net outmigration. The previous net immigration of Blacks to such counties tended to decline or become a net outmigration in the estimates. There was also a tendency for a shift toward more net immigration of Black and other races to counties adjacent to such central counties of metropolitan areas. Although the adjustment procedure would be greatly strengthened by a reliable race estimate for each county, the impact of the State race estimate appeared to be beneficial in distributing the changes needed. Nonetheless, the final estimates by race produced by the project may be problematical, and the analytical use of these data is not encouraged. It is felt that the age estimates were improved by making the detailed computations by race, however. The estimates by age, sex, and race are available on computer tape, and can be obtained by writing to the Data User Services Division of the Bureau of the Census.

The use of the volume of gross migration as the basis for distributing the necessary adjustments had the beneficial result of providing enough migrants to withstand the adjustments required by large shifts in net migration. A number of possibilities were provided for in the computer program should the indicated adjustment exceed the number of migrants. Only one situation materialized in which adjustment was necessary, and only a few counties were affected. In this instance, a large upward adjustment demanded a decrease in outmigrants greater than the original number of outmigrants. In this event, the entire upward adjustment was made by increasing immigrants. Another test was made to assure that civilian noncollege outmigrants did not exceed the base population used to generate the preliminary approximation.

Having obtained new totals for civilian noncollege immigrants and outmigrants, they were distributed by age according to the preliminary migrant age distribution. (This assumption should be reconsidered in future age estimate projects, as a significant bias could be introduced by the simple proportional procedure used.) Revised estimates by age, sex, and race, were then computed for each county. The estimates were summed for all counties and for the second time were adjusted pro rata to agree with the national estimates by age, sex, and race. The adjustment factors were generally very small, the largest adjustment being 3.6 percent for Black-and-other-races males aged 25 to 29 years (table D). Of 64 age-sex-race cells, 55 had adjustments of less than 1 percent.

Use of Medicare data for estimating the population aged 65 years and over. Medicare enrollment statistics are available by county and are now being used to estimate change in the

total population aged 65 years and over for States and counties. For use in this special project, Medicare statistics by age, sex, and race, were provided by the Health Care Finance Administration, and the final population estimates in this age range were developed from these data. The general procedure was to adjust the age-sex-race detail of the 1970 census by the change in Medicare enrollment between 1970 and 1975, age by age. Since Medicare enrollment includes nearly all persons 65 and over, it was not expected that there would be any serious problems with this segment of the project. Medicare statistics have already been used extensively by the Bureau of the Census in its current estimates program and in the evaluation of census coverage in 1970 for the Nation¹¹ and for States.¹²

However, in using the Medicare enrollment data for these age-sex county estimates, a number of problems were encountered, some of which are still unresolved. The problems do not promise a simple solution; the census counts and Medicare enrollment are fundamentally inconsistent with each other in several ways, although the national totals for the two sources are nearly equal.

Total coverage. At the national level, the differences in total coverage are small. Some categories of persons are excluded from Medicare, and enrollment is not complete for some segments of the population eligible for the program. The largest exclusion from Medicare is aliens who have resided in the country for less than 5 years. Certain small groups of noncitizens are also excluded. Federal employees covered under the Federal Employees Health Benefit Act were originally excluded from Part A (hospital insurance), and although now permitted to enroll, they are not completely registered for Medicare. The total number in all of these categories was estimated to be 216,000 on April 1, 1970, as shown in a Census Bureau report.¹³ Table E compares Medicare enrollment after various adjustments to the Medicare total (as given in the report) to the 1970 census. In addition to the exclusions already cited, omissions of other persons was estimated to be 181,000 (low estimate). The estimate was obtained by assuming that registration for White males (after the adjustments in items 2a and 2b) was complete, and developing estimated omissions for the other sex-race groups by demographic analysis. The highest omission rate was for Black-and-other-races females. The subtraction of 119,000 in table E due to the method of age determination in Medicare is discussed in the next section.¹⁴

¹¹ U.S. Bureau of the Census, Census of Population and Housing: 1970, Evaluation and Research Program, PHC(E)-4, *Estimates of Coverage of Population by Sex, Race, and Age: Demographic Analysis*, February 1974.

¹² U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 65, *Developmental Estimates of the Coverage of the Population of States in the 1970 Census: Demographic Analysis*. Washington, D.C.: Government Printing Office, December 1977.

¹³ U.S. Bureau of the Census, Census of Population and Housing: 1970, op. cit., footnote 11.

¹⁴ For a more detailed discussion than given here of these and other related issues, see Richard Irwin, "Aggregate Medicare Enrollment by Age, Sex, and Race as a resource in Analyzing Demographic Change for Local Areas". *Proceedings of the Workshop on Policy Analysis with Social Security Research files*. SSA-ORS Research Report No. 52: Washington, D.C., 1978.

**Table D. Factors for Adjusting the Revised County Population Estimates to Agree With the National Population Estimates, by Age, Sex, and Race:
July 1, 1975**

(See text for derivation of factors. A factor of less than 1 indicates that preliminary data are decreased by the adjustment)

Age	White		Black and other races	
	Male	Female	Male	Female
0 to 4 years.....	.998	.997	1.004	1.004
5 to 9 years.....	.994	.994	1.008	1.008
10 to 14 years.....	.994	.994	1.003	1.004
15 to 19 years.....	.995	.995	1.005	1.004
20 to 24 years.....	1.004	1.001	1.024	1.019
25 to 29 years.....	1.012	1.006	1.036	1.024
30 to 34 years.....	1.004	1.000	1.023	1.015
35 to 39 years.....	1.001	.999	1.017	1.010
40 to 44 years.....	.999	.998	1.010	1.006
45 to 49 years.....	.999	.998	1.009	1.007
50 to 54 years.....	.998	.998	1.004	1.006
55 to 59 years.....	.997	.997	1.002	1.004
60 to 64 years.....	.994	.995	1.001	1.004
65 to 69 years.....	.991	.995	1.001	1.003
70 to 74 years.....	.993	.997	1.000	1.002
75 years and over.....	.994	.998	1.001	1.003

Table E. Adjustments to Medicare Data and Comparison of Adjusted Data With the Census Count, for the United States: April 1, 1970

(Census is U.S. resident population aged 65 years of age and over. Figures in thousands. Due to individual rounding, the data do not sum exactly to the final estimate)

1. Medicare Enrollment, April 1, 1970 ¹	20,051
2. Adjustments for:	
a. Method of age determination in Medicare.....	-119
b. Aliens and Federal Employees not included in Medicare....	+216
c. Other persons not registered for Medicare.....	+181
3. Estimated Resident Population.....	20,328
4. Census Count.....	19,972
5. Estimated Net Census Undercount.....	356
Percent.....	1.3

¹Average of January 1, 1970 and July 1, 1970 data.

Source:

Census of Population and Housing: 1970.

Evaluation and Research Program, PHC (E)-4.

"Estimates of Coverage of Population by Sex, Race, and Age: Demographic Analysis." Table D, p. 17.

Federal employees are somewhat concentrated in the Washington, D.C., area and retirees not enrolled in Medicare could affect the estimates for the surrounding counties. Immigrants who arrived recently are also not evenly dispersed geographically and may have an impact on local estimates, although only about 65,000 aliens over age 65 were residents of the United States in 1970.¹⁵

The adjustments shown in table E usually cannot be made with precision for counties, and in this project, no attempt was made to adjust the Medicare data for the categories shown in the table. The tabulated Medicare total without adjustments was only 0.4 percent above the 1970 census count. For some individual counties, however, the impact of the excluded categories can be more significant.

Age. There are substantial differences by age between the two sets of data. The age determinations in Medicare are quite accurate, since the determination of the date of birth of a person applying for Social Security retirement benefits or for Medicare coverage is determined by a relatively rigorous procedure. A study conducted by the Social Security Administration in 1967 showed that the net error in the determination of age at the time a new application for retirement benefits is made (usually very close to the 65th birthday) is very small.¹⁶ In the early years of the program, persons presumed to be well over age 65 may have been added to the Medicare universe with a less rigorous procedure for determining age.

The accuracy of age data in a census depends on the precision with which the respondents report their age. The 1960 and 1970 U.S. census effected a substantial improvement over earlier censuses in age reporting by asking each respondent to report date of birth. There are still some problems in the age data for the elderly, however, especially at or near age 65.

A comparison of July 1, 1970, Medicare data, by age and sex, with national population estimates (based on the April 1, 1970, census count) shows the estimates to be higher than Medicare for the age group 65 to 69 years, lower for ages 75 to 84 years, and about the same for the groups 70 to 74 years and 85 years and over (table F). For the all ages total, the difference is small for both males and females. The differences in table F are largely due to the net effect of census under-enumeration and net misreporting of age, but omissions in the Medicare data also contribute to the deviations shown.

One peculiarity of Medicare data by age probably does not cause much error in local population estimates. Due to administrative requirements, Medicare data as of any specified date include persons who attain age 65 during the month following the reference date. Thus the total universe always includes a few persons who are still 64 years of age by census definition. This also affects subgroupings by age, in that for

any defined age range a tabulation of Medicare enrollees will include persons up to 1 month younger than the defined lower limit and at the older end of the age range will exclude persons up to 1 month younger than the upper limit. On April 1, 1970, the number of persons included in the Medicare tabulation but not yet 65 years of age was estimated to be 119,000, as shown in table E. Since this feature is common to all local areas, no appreciable error to the county estimates is involved.

Race. There are a number of problems in using race data from the Medicare file in conjunction with census data for persons over 65 years of age. Only the age and sex estimates are recommended for general use, and they are only very slightly affected by these problems. The basic computations were carried out by race, however, and persons with race not specified in the Medicare data were excluded from the computation of the 1975 estimates.¹⁷ In 1970, 2.1 percent of all males and 3.3 percent of females are shown as unknown race in Medicare tabulations. In 1975, the figures changed only slightly to 2.3 and 3.0 percent. The exclusion of unknown race from the calculation did not affect the general level of the estimates for the age group 65 years and over, because the detailed calculations were adjusted to agree with a computation for the group as a whole, taking into account all persons enrolled for Medicare. For the 1976 and 1977 estimates, an improved procedure was adopted which distributed the "race unknown" category.

Definition of residence in Medicare. Tabulations of Medicare data for local areas are developed using codes for State and county of residence contained on each record of the basic computer file. These codes are assigned from responses to a residence question on the application form for Medicare entitlement. In case of nonresponse, a coding guide is used to assign the State and county residence code on the basis of the residential address in the file. Although many Social Security beneficiaries have their monthly benefit transmitted directly to a bank, the Medicare file carries an additional residential address for these persons.

Tabulations of Medicare enrollment are regularly prepared for States and counties as of July 1 of each year. With over 22 million records, however, considerable time is needed to update the file for a given reference date, especially since late applications by persons just reaching retirement age are not unusual. As a result, a definitive tabulation is prepared approximately 9 months after the reference date. For example, a tabulation showing enrollment as of July 1, 1970, will actually be run on the computer on or about April 1, 1971. The addition of new beneficiaries reaching age 65 and the deletion of deceased persons are not allowed to affect the totals as of the reference date, but address changes during the 9 month period are reflected in this tabulation. As a result, the reference date with respect to place of residence may be closer to April 1, 1971, than to the stated reference date of July 1, 1970.

¹⁵ Unpublished estimate developed for the estimates of census coverage in U.S. Bureau of the Census, *Census of Population and Housing, 1970*, op. cit., footnote 11.

¹⁶ Social Security Administration, Office of Research and Statistics, *Report on Policies and Procedures for Establishing Initial Entitlement to OASI Benefits*. April 1967.

¹⁷ For a discussion of the race classification in the Medicare data, see Richard Irwin, op. cit.

Table F. Difference Between Medicare Enrollment and Estimated Population, by Age and Sex, for the United States: July 1, 1970

(Population and Medicare enrollment in thousands. Age data may not sum to column totals due to individual rounding)

Age and sex	Estimated population ¹	Medicare enrollment	Difference	
			Number (3)=(2)-(1)	Percent (4)=(3)÷(1)
BOTH SEXES				
65 and over.....	20,087	20,135	48	0.2
65 to 69.....	7,023	6,777	-246	-3.5
70 to 74.....	5,465	5,453	-12	-0.2
75 to 79.....	3,859	4,071	212	5.4
80 to 84.....	2,309	2,393	84	3.6
85 and over.....	1,432	1,441	9	0.6
MALE				
65 and over.....	8,407	8,376	-31	-0.4
65 to 69.....	3,137	3,059	-78	-2.5
70 to 74.....	2,322	2,306	-16	-0.7
75 to 79.....	1,568	1,624	56	3.6
80 to 84.....	882	899	17	1.9
85 and over.....	497	488	-9	-1.8
FEMALE				
65 and over.....	11,681	11,759	78	0.7
65 to 69.....	3,885	3,718	-167	-4.3
70 to 74.....	3,143	3,147	4	0.1
75 to 79.....	2,290	2,447	157	6.8
80 to 84.....	1,427	1,493	67	4.7
85 and over.....	935	953	18	1.9

¹The April 1, 1970, census count carried forward 3 months by the national estimates procedure.

Source: Unpublished tabulation of Medicare enrollment for July 1, 1970. Census data are from U.S. Bureau of the Census, Current Population Reports, Series P-25 No. 614.

There is no way to resolve this situation completely. However, retired persons who move to a new area may not have their address in the Social Security file changed immediately. To the extent that there is a delay in the address change, the error in assignment of residence caused by the 9-month lag would be reduced. Furthermore, the rate of net migration is not high for elderly people, even at or near the usual retirement age of 65 years. In March 1976, 2.1 percent of the population aged 65 and over had been living in a different county 1 year earlier.¹⁸ The situation remains a problem, however.

Another problem in using Medicare data in conjunction with census data is caused by persons with dual residence. If a retired person from a northern State spends the winter in a southern State, but retains a residential address in the original State, this person might well be enumerated as a

resident of the southern State in the census, while the Medicare file still carries the address in the northern State. Whatever the reason, Medicare data for the White population are decidedly below the census levels in the retirement States of Florida and Arizona.¹⁹ In a number of States with cold climates (Michigan, the Dakotas, northern New England), Medicare for Whites is higher than the census count.

For Black and other races the pattern is different, and in northern States, Medicare is substantially below census. The net overstatement of age mentioned earlier in the census for age 65 could in part account for these differences. In contrast, the southern States have relatively higher Medicare enrollments for Black and other races, especially for females. The chief elements which would produce such differentials are (a) unknown race, (b) underenumeration and/or net overstatement of age in the census, (c) inconsistency between

¹⁸U.S. Bureau of the Census, Current Population Reports, Series P-20, No. 305. *Geographical Mobility: March 1975 to March 1976*, January 1977, p. 46.

¹⁹U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 65. *Developmental Estimates of Coverage of the Population of States in the 1970 Census: Demographic Analysis*, December 1977, p. 76. See also Richard Irwin, op. cit.

the census definition of residence and the Medicare address, and (d) inconsistency between the race designations in the two data sources. The data for Whites are presumably influenced by the same considerations, but to a smaller relative degree.

Medicare data for counties. The preceding material gives an idea of the source and extent of differences between census and Medicare data at the national and State level. The county level introduces a new element in that there may be substantial variation among counties in completeness of coverage in the Medicare program and the census, and in the impact of the various other sources of difference between the two data sets. It is possible that differences are concentrated in a relatively few counties, while in a majority of counties correspondence between the two sets is excellent.

To examine this hypothesis, a distribution of counties by percent difference between the census counts and Medicare enrollment was tabulated by sex and race (table G).²⁰ For White males, the difference was less than 5 percent in 1,743 counties. These amount to 56 percent of all U.S. counties with at least 30 Medicare enrollment; in 91 percent of the counties, the difference was less than 15 percent. The

²⁰The Medicare data used to prepare table G include only those persons for whom race and county or residence is specified, and on the average Medicare would be about 2 percent low for males and 3 percent low for females.

percent difference was over 25 in 100 counties. For White females there is a stronger correspondence between the census and Medicare figures.

The distribution for Black and other races is not as encouraging. In only 28 percent of the counties (with 30 or more Medicare enrollment) was Medicare for males within 5 percent of the census count. For females, the figure is a little higher at 31 percent, but for both males and females, there are differences of over 25 percent in a substantial number of counties. The downward bias of Medicare statistics for Black and other races is widespread. For males, in 53 percent of U.S. counties the Medicare data are 5 percent or more below the census figures, as compared to only 19 percent for which Medicare statistics are 5 percent or more above the census count.

Coding. In addition to the sources of differences between census counts and Medicare enrollment already mentioned, at the county level the geographic coding in the Medicare system is an important factor.

Persons actually residing in a ring county of a metropolitan area, but near the county line separating them from the central county, may be improperly coded as being residents of the central county. This type of "cross-over" coding error was found in a number of counties in comparing 1970 Medicare and census data.²¹

²¹Irwin, Richard, op. cit.

Table G. Distribution of Counties by Percent Deviation of Medicare Enrollment From Census Counts, by Sex and Race: 1970

(Census counts are base of percent deviations; a minus deviation indicates Medicare is less than census. Percents may not sum to total due to independent rounding)

Race and sex	Counties with 30 or more Medicare enrollment							
	Total	Percent deviation of Medicare from Census						
		-25 and over	-15 to -24.99	-5 to -14.99	Less than 5	+5 to +14.99	+15 to +24.99	+25 and over
NUMBER								
White:								
Male.....	3,109	66	129	601	1,743	470	66	34
Female.....	3,109	49	88	556	1,841	467	62	46
Black and other races:								
Male.....	1,466	152	190	434	412	164	36	78
Female.....	1,481	145	215	367	458	195	53	48
PERCENT DISTRIBUTION								
White:								
Male.....	100	2	4	19	56	15	2	1
Female.....	100	2	3	18	59	15	2	1
Black and other races:								
Male.....	100	10	13	30	28	11	2	5
Female.....	100	10	15	25	31	13	4	3

Source: Unpublished tabulation comparing Medicare data for July 1, 1970, (excluding unknown race or county) with the census count as of April 1.

In a systematic review of counties with differences of 25 percent or more between the 1970 census and Medicare enrollment, 69 of these counties were found to have an apparent cross-over with an adjacent county. Of the 69 counties, 25 are in Virginia, the State with the most serious errors. However, the problem is widespread; the remaining 44 counties are located in 18 different States. Most of these counties are adjacent to a county containing a relatively large city, and do not have large populations.

The impact of this phenomenon varies greatly and may cause a serious error in estimating population, even when only the change in Medicare is used to update the 1970 population count. In order to mitigate the impact of improper coding and the other inconsistencies between Medicare and census data, the formula for estimating population was modified from that used in the ongoing current estimates program for county population. For the current estimates, the population aged 65 and over is estimated by *adding* change in Medicare to the 1970 census count. For these estimates by age, sex, and race, this was done only when Medicare in 1970 was less than the census count. If Medicare was larger than census, the *rate* of change in Medicare was multiplied by the census population in 1970 to obtain change in population. These two procedures select the minimum change in population obtained by the two alternative methods. However, some of the impact of this new procedure was lost when the age-sex-race estimates were controlled to the independent estimate of county population, and the coding problems still produced apparently erroneous estimates in a number of counties. Interestingly enough, the estimated population over age 65 was not always biased by such discrepancies; in many cases the *change* in Medicare appeared to be about the same as would be developed from more precisely coded Medicare data. However, there were still obvious errors in the 1975 estimates for a number of areas. For 1976 and subsequent years an alternative procedure was introduced for the areas most seriously affected, and the estimates for the aged population developed by the cohort-component procedure were retained for the following counties:

Georgia - Baker, Crawford, Jones, Oglethorpe

Mississippi - Rankin

North Carolina - Edgecombe, Nash

Ohio - Holmes

Virginia - Alleghany, Bedford, Fairfax, Henry, James City, Nansemond, Roanoke, Rockingham, Spotsylvania, Stafford

Virginia (Independent Cities) - Bedford, Covington, Fairfax, Falls Church, Fredericksburg, Galax, Harrisonburg, Martinsville, Roanoke, Suffolk, Williamsburg

Nansemond and Suffolk are included in this list because of problems with the basic data series, and Williamsburg and James City were added because the Medicare data used in

preparing the total population estimate for the Federal-State Cooperative Program for Population Estimates (FSCP) were specially adjusted. The rest of the counties were selected by the following criteria:

1. The county is part of a group of two to four adjacent counties, at least one of which showed a deviation in 1970 of 25 percent or more between the census count of persons aged 65 years and over and Medicare enrollment.
2. There were opposite deviations of approximately equal size observed in adjacent counties, suggesting a coding problem in the Medicare data.
3. Substituting the cohort-component calculation for the suspect Medicare-based estimate caused a change of 10 percent or more in the estimated population aged 65 years and over.

In using the 1975 age estimates for all of the counties listed, it is advisable to combine them with one or more adjacent counties to mitigate the effect of the coding problems.

Another problem occurred in utilizing the Medicare data that required adjustment. The first county of each State tended to have a much larger Medicare count for unknown race in 1975 than in 1970. The data processing programs incorrectly assigned new enrollees with incomplete information to the first county in the State. This situation has been corrected, but it was not possible to recreate the tabulations for previous years, and the 1975 estimates are affected by the problem. For the age estimates in 1976 and subsequent years, the original cohort-component estimates were retained for those first counties where the Medicare-based estimates required an adjustment of 10 percent or more. The counties involved are: Appling, Ga.; Adams, Ind.; Allen, Kans.; Adair, Ky.; Adair, Mo.; Adams, Ohio; Adams, Pa.; Anderson, Tex.; Beaver, Utah; Adams, Wash.; Barbour, W. Va.; and Adams, Wis.

After calculation of the population estimates in 1975 for all age-sex-race cells over age 65, the estimates for each county were adjusted pro rata to agree with the independent estimates for ages 65 years and over as a group, and the detailed estimates were substituted for those calculated by the cohort-component procedure. The difference between the cohort-component estimate and the Medicare-derived estimate for each sex-race group was distributed pro rata to the population under 65 years, in order to maintain the agreement of the total of the age detail with the independent estimate of total population.

EVALUATION AND LIMITATIONS OF THE ESTIMATES

The 1975 county age estimates are considered experimental because they involve the application of new techniques, and because it has not yet been possible to compare the estimates systematically with decennial census data. Comparisons have been made with special census data, as available (table H), but except in California, relatively few complete counties conducted special censuses during the

1970-75 period. For some special censuses conducted by the U.S. Bureau of the Census, age distributions could not be obtained; the age detail is published only for areas with 50,000 or more inhabitants. The table gives comparisons for 14 federally conducted censuses, 8 conducted by the State of California, and 1 by the State of Washington.

The State-conducted censuses are of high quality, and are accepted by the Bureau of the Census for official purposes. For some California counties, however, age detail was not obtained for military bases and large institutions, and the published age data show these as age unknown. All California counties shown in the official State report for July 1975²² for which complete age detail was provided are included in table H.

The table shows the average errors for 15 age groups (5-year age groups to age 65 years, continuing with 65 to 74 years, and 75 years and over), by sex. Also shown are the number of age groups with errors of less than 5 percent, 5 to 9.9 percent, and 10 percent and over. The average error for all 23 counties was 6.5 percent for males and 5.9 percent for females. The two smallest counties (Logan and Arthur counties, Nebraska) have large percent errors, however, and if

these two counties are excluded, the average error for the 21 largest counties drops to 5.0 percent for males and 4.4 for females. For these 21 counties, 187 age groups for males out of the total of 314 (60 percent) show errors of less than 5 percent. The corresponding figure for females is 65 percent. The large average errors for the two smallest counties are not unexpected, as the number of persons in each age group is very small. For such small counties it is advisable to combine the detailed data into broader categories.

Even excluding the two smallest counties, however, table H shows a tendency for the smaller counties to have somewhat larger average percent errors. Pasco County, Fla., is an exception to this rule, having large average errors (8.3 and 5.7 for males and females, respectively), yet its special census population was over 100,000. A contributing factor to these errors is the very rapid population growth of the county since 1970. The county had a net immigration rate of 50 percent for the period April 1, 1970, to July 1, 1973.²³

The errors shown in table H implicitly assume that the postcensal estimate of total population is consistent with the special census count. For the comparisons in the table, this

²² California State Department of Finance. *Census Report*. Sacramento, California, July 1976.

²³ U.S. Bureau of the Census, Current Population Reports, Series P-26, No. 90. *Estimates of the Population of Florida Counties and Metropolitan Areas: July 1, 1972 and 1973, October 1974.*

Table H. Summary of Average Percent Errors by Age of County Estimates From Special Censuses, by Sex: 1974 to 1976

(Data relate to 15 age groups (5-year age groups to age 65 years, continuing with 65 to 74 years, and 75 years and over), except for Santa Clara County, Calif. (5-year age groups to age 65 years, then 65 years and over))

State and county	Special census		Males				Females			
	Date	Population	Average error ¹ (%)	Number of errors ¹			Average error ¹ (%)	Number of errors ¹		
				Under 5%	5% to 9.9%	10% and over		Under 5%	5% to 9.9%	10% and over
Santa Clara, Calif.....	4/1/75	1,169,006	3.8	10	4	-	3.9	8	6	-
San Bernardino, Calif.....	4/1/75	696,094	3.4	11	3	1	2.6	14	-	1
Contra Costa, Calif.....	4/7/75	582,722	4.4	11	2	2	4.6	9	4	2
Pima, Ariz.....	10/20/75	449,544	4.1	9	5	1	4.5	7	8	-
Fresno, Calif.....	9/1/74	440,467	4.0	10	4	1	3.4	13	1	1
Travis, Tex.....	4/20/76	373,275	3.9	12	2	1	3.4	10	4	1
San Joaquin, Calif.....	10/6/75	299,831	3.8	10	4	1	3.8	14	-	1
Pasco, Fla.....	3/21/73	108,865	8.3	4	8	3	5.7	7	6	2
Yolo, Calif.....	4/7/75	100,778	4.9	6	8	1	4.5	9	5	1
Placer, Calif.....	7/10/75	90,975	6.0	6	7	2	5.3	7	8	-
Wayne, N.Y.....	4/22/75	82,194	2.9	14	-	1	1.8	13	2	-
Sarpy, Nebr.....	7/15/74	73,479	7.9	5	6	4	5.2	10	3	2
Eau Claire, Wis.....	3/31/75	72,237	2.4	14	1	-	3.1	13	2	-
Cowlitz, Wash.....	9/13/73	70,384	3.3	11	4	-	2.3	14	-	1
Putnam, N.Y.....	4/14/75	68,765	5.9	9	3	3	5.6	7	6	2
Kings, Calif.....	10/4/74	67,993	6.3	6	6	3	4.4	10	3	2
El Dorado, Calif.....	7/10/75	59,219	4.6	10	4	1	7.2	7	4	4
Bonneville, Idaho.....	11/5/75	58,499	4.8	8	6	1	2.9	13	2	-
Sutter, Calif.....	6/10/75	46,003	4.6	8	6	1	5.6	9	4	2
Nevada, Calif.....	7/10/75	33,949	8.4	5	3	7	6.6	4	10	1
Dakota, Nebr.....	5/13/76	16,282	6.7	8	3	4	6.6	6	7	2
Logan, Nebr.....	8/14/75	1,031	17.2	-	4	11	16.4	1	4	10
Arthur, Nebr.....	8/21/75	565	27.9	2	1	12	26.8	4	-	11
Total (23 counties).....	(X)	(X)	6.5	189	94	61	5.9	209	89	46
Total (21 largest counties)..	(X)	(X)	5.0	187	89	38	4.4	204	85	25

- Represents zero.
X Not applicable.

¹Without regard to sign.

could not be avoided, because the age estimates are automatically adjusted to agree with a computer file containing the regular postcensal estimate, and this estimate has already been adjusted to agree with special census results. The agreement between the total of the age estimates and the special census total tends to minimize the error of the individual age cells. The minimizing effect is not as great as might be expected, because a shift in the overall level of one of the distributions increases the deviations for some age groups and decreases others. Nonetheless, the errors of the age detail for a county without a special census would tend to be larger than those shown in the table. The errors shown do, however, measure the degree to which the relative distribution by age and sex of the estimate differs from the distribution shown by the special census.

The comparisons in table H are not necessarily indicative of the accuracy of the entire set of county estimates. Most of the censuses were ordered and paid for by the county itself in the expectation of showing an increase in population over the 1970 census.²⁴ The errors shown in table H therefore cannot be assumed to be valid for counties with little or no population growth.

Probably the major factor affecting the accuracy of the age estimates is the implicit assumption that the age pattern of county gross outmigration and immigration for the period 1965-70 as shown by the 1970 census is representative of the pattern for 1970-75, after adjustment for change in the level of net migration. For very small counties, sample variation of the migrant data is also a source of error. Other factors are the estimates of deaths by age and net census undercount. The coverage adjustment procedure used for the age estimates assumes that the pattern of net census undercount for each county, by age, sex, and race, is similar to the national pattern. Taking all of these factors into consideration, the average error shown by the comparisons in table H is not excessive. If a subsequent full test against the 1980 census confirms this general level of accuracy for counties with medium to large population, the basic procedure adopted for the age estimates can be assumed to be sound.

A number of special situations should be noted. The estimates for Alaska and Hawaii are weaker than those for other States due to special problems relating to geography, identification of race, and military population. Problems were also encountered in counties with small populations, but these tended to be associated with the race detail, usually for Black and other races. The errors are almost always small, and do not seriously distort the data for all races combined as presented in this report, except in a few cases. In Angoon, Alaska, there is an overestimate of the female population of Black and other races which is easily observable in the combined data. This was caused by an uneven sample distribution of migrants, by sex, in the original census data, magnified by a very sharp upturn in population growth in the 1970-75 period.

²⁴The special census for Travis County, Tex., was conducted by the Bureau of the Census as a pretest of 1980 decennial census procedures.

A similar sampling accident affected one age group for Black and other races in Val Verde County, Tex. This county contains a military base and was designated a military county. An uneven sample distribution of military immigrants resulted in a sharp drop in the resident male population of Black and other races aged 25 to 29 years between 1970 and 1975. This error is hardly observable in the data for all races since the Black-and-other-races population is a small proportion of total population in this county. In general the collapsing procedure took care of such problems but military counties were excepted, as discussed in appendix A.

A problem of a different type affects the estimates for the counties of Sebastian, Ark., San Diego, Calif., Okaloosa, Fla., and Lebanon, Pa. In 1975, these counties contained sizeable relocation centers for Vietnamese refugees, who were included in the estimate of total population to which the age data were controlled. The data needed to make a special adjustment were not available, and the counties were handled with standard procedures. As a result, the race distribution of the 1975 estimates does not reflect the race of the Vietnamese refugees, and the age distribution in 1975 may be affected as well.

The estimates for Richmond City and Chesterfield County in Virginia are affected by a large annexation which added about 47,000 persons to the city shortly before the 1970 census. This situation caused an overstatement of outmigration from Chesterfield County in the 1970 census tabulations, because persons who had migrated out of the annexed area to other parts of the Nation naturally tended to report in 1970 that in 1965 they had lived in Chesterfield County. For analytical purposes, these persons should have been considered to be outmigrants from Richmond City, and the migrant data as tabulated show an incorrect level of net migration for both the city and county. In preparing the age estimates, this bias resulted in large adjustments to the preliminary approximations of the 1975 population. The Chesterfield County adjustment of 25 percent of total population was particularly prejudicial to the final estimates of the age detail of migrants. It is advisable to combine the estimates for these two counties.

This type of error will occur wherever the geographical boundaries of a county or county equivalent are changed during the period covered by the census migration question. The Richmond-Chesterfield situation is by far the largest which affected the 1965-70 data, but other areas, especially in Virginia, were similarly involved.

The very large number of data cells for the entire set of 3,141 counties has made it impossible in a practical sense to review the data thoroughly for every county, and there may be as yet undetected questionable results. A substantial number of counties have been reviewed, however, and a special consistency check has been made for *all* counties for selected age groups, by sex and race. The consistency check compared the 1970-75 estimated change in population with the 1950-60 and 1960-70 intercensal change, and identified outliers.²⁵ The outliers were almost always found to result

²⁵This consistency check was carried out by the National Cancer Institute, which provided major funding for the county age estimates project.

from real changes in trend rather than weaknesses in the methodology. The number of outliers was not excessive, except in the group 0 to 4 years. The consistency check revealed that the estimates for this age group were on the high side in about 10 percent of U.S. counties. Subsequent study revealed that the use of net migration rather than gross migration for the birth cohort caused a high estimate for counties with a high net immigration for the period 1965-70 and a continued or accelerated rate for the 1970-75 period. The other age groups checked did not reveal any similar large-scale biases. The age groups covered in this check were 0 to 4 years, 15 to 19 years, 20 to 24 years, 55 to 59 years, 60 to 64 years, 65 to 69 years, and 85 years and over; each age group was run separately for the four sex-race categories.

As a result of the various reviews, it is not believed that any pervasive biases not already identified are inherent in the data. The exact degree of overall error is, however, unknown; and there are undoubtedly many specific situations where a particular age cell is significantly in error. Users are cautioned from placing too much reliance on results for specific age categories, even though the general level of error may be acceptable for use of the figures in trend and pattern analyses.

RELATED REPORTS

The 1970 census gross migration data used to obtain migration rates and proportions for preparing the county age estimates were developed by a special project. See U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 701. *Gross Migration by County: 1965 to 1970*.

The estimates of county, State, and national population to which the 1975 estimates were controlled are as follows:

- (County) Current Population Reports, Series P-25, Nos. 649 through 698. *1973 (revised) and 1975 Population Estimates and 1972 (revised) and 1974 Per Capita Income Estimates for Counties and Incorporated Places*.
- (State) Current Population Reports, Series P-23, No. 67. *Population Estimates by Race, for States: July 1, 1973 and 1975*.
- (Nation) Current Population Reports, Series P-25, No. 721. *Estimates of the Population of the United States by Age, Sex, and Race: 1970 to 1977*.

Appendix A. Collapse Procedure for Smoothing Migrant Age Distributions

The basic migration data used in the county age estimates project were obtained from a question in the 1970 census on residence 5 years prior to the census date. This question was part of the 15-percent sample. Each person in the sample was assigned a sample weight of approximately six, and the sample migrant data were inflated by these weights to provide an estimate of the total number of migrants. For large counties, only a few problems were encountered in using the resulting migration data. For small populations, however, the age distributions were very irregular. For example, a county with only 2 sample migrants for a sex-race category would have a total of about 12 migrants, but they would be concentrated in only two of the 5-year age groups, with zero migrants in all other age groups. If it had been possible to use the sample *population* to compute migration rates, the problem may have been less pronounced, as the sample population would have tended to have the same weight as the migrants. The sample population could not be used, however, as it was never tabulated from the basic census records for counties by race.

In order to smooth the irregular age distributions of migrants for small populations, the 5-year age data for both population and migrants were collapsed to broader age groups. Within each broad group, the migrants were distributed back to 5-year age groups according to population. The implicit assumption is that the 5-year age groups all have the migration rate of the broader group.

The decisions to collapse age categories were systematically based on a sex ratio score (SRS) which provided an index of the degree to which male and female migrants differ, age by age, for the entire distribution. This criterion takes advantage of the strong tendency for migrants to be about evenly divided between the sexes, age by age, in most situations. Because some types of military installations give rise to a sharp exception to this rule, data for counties designated as military were not collapsed.

The assumption that male migrants should be approximately equal to female migrants seemed preferable to curve-fitting criteria which would attempt to classify the age distribution itself as being satisfactorily smooth. Many situations produce skewed age distributions of migrants in various patterns, making it a complex problem to establish criteria for identifying age distributions which are to be smoothed. The bimodal character of many county migrant age distributions, with a peak in the twenties or thirties and

another peak for very young children, makes it more difficult to decide whether a given age distribution should be smoothed. The notion that male and female migrants ought to be approximately equal provided a simpler basis for deciding whether to collapse to broader age groups. Although more study is needed on the impact of the collapsing routine on the various county age distributions, in all observed cases the smoothed distributions were an improvement over the original data.

The SRS was calculated separately for White and Black and other races by the formula:

$$SRS = \left[\sum_1^n \frac{(M * F)}{(M + F)} \right] * 4 \div \sum_1^n (M + F)$$

where n is the number of age groups in the distribution, M and F are male and female migrants in each age group, and * is the symbol for multiplication. The SRS varies from 1 (male migrants exactly equal to female migrants in all age groups) to zero (no age group has both male and female migrants.)¹

If the SRS was less than .90, the distribution was collapsed to the age groups 5 to 14 years, 15 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 64 years and 65 years and over. Where very few sample migrants were involved, it was necessary to collapse the age distribution to even broader age groups, that is 5 to 24 years, 25 to 44 years, and 45 years and over. This procedure was used if the SRS after the first collapse was less than .87. The collapse decisions were subject to the following conditions:

1. The SRS for inmigrants determined the collapse for both outmigrants and inmigrants.
2. If the sum of male and female migrants (separately by race) was less than 200, the distributions were collapsed once, regardless of SRS.
3. If the sum of male and female migrants was 2,000 or more (separately for each race), no collapsing was permitted.
4. If a county was designated as military, no collapsing was permitted.

As an example of the effect of the collapsing procedure on actual data, table A-1 shows the inmigrant age distri-

¹ This score was developed at the Bureau of the Census specifically for this project. An initial formula was developed by Sam Davis, III, and Beverly Causey suggested the final version which weights the calculation by the number of migrants in each age category.

bution for Whites in Arthur County, Nebr., one of the counties for which comparisons with special censuses are shown in table H. The original distribution is quite irregular, with a total of 112 migrants (both sexes), concentrated in 13 of the 30 age cells.

The SRS score for the original distribution is .73. After the first collapse it is .88 for the 6 broad age groups, and since this satisfied the tolerance limits, the migrant data were redistributed at this level. The age distributions after collapsing appear to be more reasonable than the original distribution. They are, however, the result of a statistical manipulation and do not represent actuality.

The impact of the collapsing procedure on the accuracy of the age estimates is not precisely known. For the two smallest counties shown in table H (Arthur and Logan Counties, Nebr.), a simulated procedure using the original migrant age distribution without collapsing was tested. For males, the average error for the simulated age estimates was 32 percent for Logan County and 40 percent for Arthur as compared to 17 and 28 percent, the figures shown in table H for the regular estimates. These results suggest that the collapsing procedure did improve the accuracy of the estimates for small counties, but a much more extensive test will be needed to evaluate the effectiveness of the procedure.

Table A-1. Comparison of Original Immigrant Distribution by Age and Sex With Distribution Smoothed by Collapse Procedure, for the White Population, Arthur County, Nebr.: July 1, 1965 to 1970

(See text for explanation of methodology)

Age in 1970	Immigrants				1970 population (April 1)	
	Male		Female		Male	Female
	Original	Revised	Original	Revised		
5 to 9 years.....	7	7	-	3	28	31
10 to 14 years.....	12	12	6	3	45	38
15 to 19 years.....	8	10	6	11	28	24
20 to 24 years.....	8	6	13	8	16	16
25 to 29 years.....	-	-	-	-	18	15
30 to 34 years.....	-	-	-	-	15	22
35 to 39 years.....	7	6	14	9	16	23
40 to 44 years.....	7	8	-	5	23	12
45 to 49 years.....	10	4	-	1	18	15
50 to 54 years.....	-	5	-	2	19	20
55 to 59 years.....	8	5	6	2	23	15
60 to 64 years.....	-	4	-	1	15	13
65 to 69 years.....	-	-	-	-	10	8
70 to 74 years.....	-	-	-	-	1	6
75 years and over.....	-	-	-	-	14	15

- Represents zero.

Appendix B. List of Counties Adjusted for Military, College, and Institutional Population

(Counties with at least 1 percent of total population and not less than 500 in military barracks or college dormitories, plus selected counties with large institutions. M denotes military, C denotes college, and I denotes institutional)

SELECTED COUNTIES

ALABAMA

Calhoun – M C	Madison – M C
Coffee – M	Montgomery – M
Dale – M	Perry – C
Dallas – M	Pike – C
Elmore – I	Russell – M
Escambia – I	Shelby – C
Lauderdale – C	Sumter – C
Lee – C	Tuscaloosa – C
Macon – C	

ALASKA

Aleutian Islands – M	Kodiak – M
Anchorage – M	S.E. Fairbanks – M
Fairbanks – M C	Yukon-Koyokuk – M

ARIZONA

Cochise – M	Pima – M C
Coconino – C	Yuma – M

ARKANSAS

Clark – C	Lincoln – I
Columbia – C	Mississippi – M
Craighead – C	Pope – C
Drew – C	Pulaski – M
Faulkner – C	Washington – C
Jefferson – C	White – C

CALIFORNIA

Alameda – M	Sacramento – M
Amador – I	San Bernardino – M
Butte – C	San Diego – M
Humboldt – C	San Francisco – M
Kern – M	San Luis Obispo – I
Kings – M	Santa Barbara – M C
Lassen – I	Santa Cruz – C
Marin – I	Solano – M
Merced – M	Tuolumne – I
Monterey – M	Ventura – M
Napa – C	Yolo – C
Orange – M	Yuba – M
Riverside – M	

COLORADO

Adams – M	El Paso – M
Alamosa – C	Gunnison – C
Arapahoe – M	La Plata – C
Boulder – C	Larimer – C
Chaffee – I	Weld – C
Denver – M	

CONNECTICUT

New London – M	Tolland – I
----------------	-------------

DELAWARE

Kent – M C	New Castle – C
------------	----------------

DISTRICT OF COLUMBIA

Washington – M

FLORIDA

Alachua – C
 Bay – M
 Bradford – I
 Brevard – M
 Clay – M
 Duval – M
 Escambia – M
 Hillsborough – M
 Jackson – I
 Leon – C
 Monroe – M
 Okaloosa – M
 Orange – M
 Santa Rosa – M
 Sumter – I
 Union – I
 Volusia – C

GEORGIA

Baldwin – C
 Bleckley – C
 Butts – I
 Carroll – C
 Chatham – M
 Chattahoochee – M
 Clarke – C
 Columbia – M
 Dougherty – M
 Floyd – C
 Fulton – C
 Glynn – M
 Habersham – I
 Houston – M
 Liberty – M
 Lowndes – M C
 Lumpkin – C
 Muscogee – M
 Peach – C
 Richmond – M
 Sumter – C
 Tattall – I
 Tift – C

HAWAII

Honolulu – M

IDAHO

Bannock – C
 Bonneville – M
 Canyon – C
 Elmore – M
 Latah – C
 Madison – C

ILLINOIS

Adams – C
 Champaign – M C
 Coles – C
 De Kalb – C
 Jackson – C
 Jersey – C
 Kankakee – C
 Knox – C
 Lake – M
 Livingston – I
 Logan – C
 McDonough – C
 McLean – C
 Morgan – C
 Peoria – C
 Randolph – I
 St. Clair – M
 Warren – C
 Will – I

INDIANA

Delaware – C
 Grant – C
 Jasper – C
 Jefferson – C
 Johnson – I
 Knox – C
 La Porte – I
 Madison – I
 Miami – M
 Monroe – C
 Montgomery – C
 Porter – C
 Putnam – C
 St. Joseph – C
 Steuben – C
 Tippecanoe – C
 Vigo – C
 Wabash – C

IOWA

Black Hawk – C
 Bremer – C
 Decatur – C
 Dubuque – C
 Fayette – C
 Jefferson – C
 Johnson – C
 Jones – I
 Linn – C
 Mahaska – C
 Marion – C
 Plymouth – C
 Poweshiek – C
 Sioux – C
 Story – C
 Warren – C
 Winneshiek – C
 Woodbury – C

KANSAS

Atchison – C
 Cowley – C
 Crawford – C
 Douglas – C
 Ellis – C
 Franklin – C
 Geary – M
 Harvey – C
 Leavenworth – M I
 Lyon – C
 McPherson – C
 Reno – I
 Riley – M C
 Saline – C
 Sedgwick – M
 Shawnee – M

KENTUCKY

Calloway – C
 Christian – M
 Fayette – C
 Franklin – C
 Hardin – M
 Jessamine – C
 Lyon – I
 Madison – C
 Meade – M
 Oldham – I
 Rowan – C
 Scott – C
 Union – I
 Warren – C
 Whitley – C

LOUISIANA

Bossier – M
 East Baton Rouge – C
 Lafayette – C
 Lafourche – C
 Lincoln – C
 Natchitoches – C
 Ouachita – C
 Rapides – M
 Tangipahoa – C
 Vernon – M
 West Feliciana – I

MAINE

Androscoggin – C
 Aroostook – M C
 Cumberland – M C
 Franklin – C
 Kennebec – C
 Penobscot – C
 York – M C

MARYLAND

Allegany – C
 Anne Arundel – M
 Carroll – C
 Cecil – M
 Charles – M
 Frederick – C
 Harford – M
 Kent – C
 Montgomery – M
 Prince Georges – M C
 St. Marys – M
 Washington – I
 Wicomico – C

MASSACHUSETTS

Barnstable – M
 Berkshire – C
 Hampden – M
 Hampshire – C
 Middlesex – C
 Suffolk – C
 Worcester – M C

MICHIGAN

Calhoun – C
 Chippewa – M
 Gratiot – C
 Hillsdale – C
 Houghton – C
 Ingham – C
 Ionia – I
 Iosco – M
 Isabella – C
 Jackson – I
 Kalamazoo – C
 Lenawee – C
 Livingston – I
 Marquette – M C
 Mecosta – C
 Ottawa – C
 Washtenaw – C

MINNESOTA

Beltrami – C
 Blue Earth – C
 Clay – C
 Lyon – C
 Nicollet – C
 Ramsey – C
 Rice – C
 St. Louis – M
 Sherburne – I
 Stearns – C
 Stevens – C
 Winona – C

MISSISSIPPI

Bolivar – C
 Forrest – C
 Harrison – M
 Hinds – C
 Jackson – M
 Lafayette – C
 Lauderdale – M
 Leflore – C
 Lowndes – M C
 Oktibbeha – C
 Sunflower – I
 Tate – C

MISSOURI

Adair – C
 Boone – C
 Callaway – C
 Cape Girardeau – C
 Cass – M
 Cole – I
 Greene – C
 Howard – C
 Johnson – M C
 Lewis – C
 Nodaway – C
 Phelps – C
 Polk – C
 Pulaski – M
 Randolph – I
 Saline – C
 Taney – C

MONTANA

Cascade – M
 Gallatin – C
 Lewis and Clark – C
 Missoula – C
 Yellowstone – C

NEBRASKA

Adams – C
 Buffalo – C
 Dawes – C
 Lancaster – C
 Nemaha – C
 Sarpy – M
 Scotts Bluff – C
 Seward – C
 Washington – C
 Wayne – C

NEVADA

Churchill – M
 Clark – M
 Washoe – C

NEW HAMPSHIRE

Cheshire – C
 Grafton – C
 Merrimack – C
 Rockingham – M
 Strafford – C

NEW JERSEY

Burlington – M
 Cape May – M
 Hunterdon – I
 Mercer – C
 Middlesex – C
 Monmouth – M
 Ocean – M

NEW MEXICO

Bernalillo – M
 Curry – M
 Dona Ana – M C
 Otero – M
 Roosevelt – C
 San Miguel – C
 Santa Fe – C

NEW YORK

Albany – C
 Allegany – C
 Broome – C
 Cattaraugus – C
 Cayuga – I
 Chautauqua – C
 Chemung – I
 Clinton – M I
 Cortland – C
 Delaware – C
 Dutchess – C
 Franklin – C
 Livingston – C
 Madison – C
 Monroe – C
 Oneida – M
 Onondaga – C
 Ontario – C
 Orange – M
 Oswego – C
 Otsego – C
 Rensselaer – C
 St. Lawrence – C
 Saratoga – C
 Schoharie – C
 Sullivan – I
 Tompkins – C
 Ulster – C
 Washington – I
 Wyoming – I
 Yates – C

NORTH CAROLINA

Avery – C
 Carteret – M
 Cleveland – C
 Craven – M
 Cumberland – M
 Durham – C
 Forsyth – C
 Franklin – C
 Guilford – C
 Harnett – M C
 Hertford – C
 Jackson – C
 Onslow – M
 Orange – C
 Pasquotank – C
 Pitt – C
 Rowan – C
 Scotland – C
 Stanly – C
 Union – C
 Wake – C
 Watauga – C
 Wayne – M
 Wilson – C

NORTH DAKOTA

Barnes – C
 Cass – C
 Grand Forks – M C
 Richland – C
 Stark – C
 Ward – M C

OHIO

Ashland – C
 Athens – C
 Butler – C
 Clark – C
 Defiance – C
 Delaware – C
 Fairfield – I
 Franklin – C
 Green – M C
 Hardin – C
 Knox – C
 Licking – C

Madison – I
 Marion – I
 Muskingum – C
 Portage – C
 Richland – I
 Ross – I
 Seneca – C
 Warren – I
 Washington – C
 Wayne – C
 Wood – C

OKLAHOMA

Canadian – I
 Cherokee – C
 Cleveland – C
 Comanche – M
 Custer – C
 Garfield – M
 Greer – I
 Jackson – M
 Latimer – C

Logan – I
 Okmulgee – C
 Ottawa – C
 Payne – C
 Pittsburg – I
 Pontotoc – C
 Pottawatomie – C
 Woods – C

OREGON

Benton – C
 Clatsop – I
 Jackson – C
 Klamath – M

Lane – C
 Marion – I
 Polk – C
 Yamhill – C

PENNSYLVANIA

Adams – C
 Berks – C
 Butler – C
 Cambria – C
 Centre – C
 Chester – C
 Clarion – C
 Clinton – C
 Columbia – C
 Crawford – C
 Cumberland – C
 Erie – C
 Franklin – C
 Greene – C

Huntingdon – C
 Indiana – C
 Lancaster – C
 Lawrence – C
 Luzerne – I
 Lycoming – C
 Mercer – C
 Monroe – C
 Northampton – C
 Snyder – C
 Tioga – C
 Union – I
 Washington – C

RHODE ISLAND

Bristol – C
 Newport – M

Providence – C
 Washington – M C

SOUTH CAROLINA

Abbeville – C
 Bamberg – C
 Beaufort – M
 Berkeley – M
 Charleston – M C
 Dorchester – M
 Greenville – C
 Horry – M

Laurens – C
 Newberry – C
 Orangeburg – C
 Pickens – C
 Richland – M C
 Spartanburg – C
 Sumter – M
 York – C

SOUTH DAKOTA

Brookings – C
 Brown – C
 Clay – C
 Lake – C
 Lawrence – C

Meade – M
 Minnehaha – C
 Pennington – M C
 Yankton – C

TENNESSEE

Chester – C
 Davidson – C
 Franklin – C
 Jefferson – C
 Knox – C
 Madison – C
 Montgomery – M

Putnam – C
 Rutherford – C
 Shelby – M
 Tipton – M
 Washington – C
 Weakley – C

TEXAS

Bee – M
 Bell – M
 Bexar – M
 Brazoria – I
 Brazos – C
 Brewster – C
 Brown – C
 Caldwell – I
 Coryell – M
 Denton – C
 Eastland – C
 El Paso – M
 Erath – C
 Grayson – M C
 Guadalupe – C
 Hays – C
 Howard – M
 Hunt – C
 Kleberg – M C

Lubbock – M C
 McLennan – C
 Madison – I
 Nacogdoches – C
 Nueces – M
 Palo Pinto – M
 Parker – M
 Randall – C
 Taylor – M C
 Tom Green – M C
 Travis – M C
 Val Verde – M
 Walker – C
 Waller – C
 Washington – C
 Webb – M
 Wichita – M
 Williamson – C

UTAH

Cache – C
 Davis – M I

Utah – C

VERMONT

Addison — C Washington — C
 Chittenden — C Windham — C
 Rutland — C

VIRGINIA

Albemarle — C	Independent Cities
Amherst — C	Alexandria — M
Arlington — M	Bristol — C
Chesterfield — C	Chesapeake — M
Fairfax — M I	Danville — C
Fauquier — M	Fredericksburg — C
Franklin — C	Hampton — M C
Hanover — C	Harrisonburg — C
Montgomery — C	Lexington — C
Powhatan — I	Lynchburg — C
Prince Edward — C	Newport News — M
Prince George — M	Norfolk — M
Prince William — M	Petersburg — M
Roanoke — C	Portsmouth — M
Rockingham — C	Radford — C
Southampton — I	Richmond — C
Stafford — M	Salem — C
Washington — C	Staunton — C
York — M	Virginia Beach — M
	Williamsburg — C

WASHINGTON

Island — M	Spokane — M C
Kitsap — M	Walla Walla — I
Kittitas — C	Whatcom — C
Mason — I	Whitman — C
Pierce — M	

WEST VIRGINIA

Barbour — C	Mercer — C
Cabell — C	Monongalia — C
Fayette — C	Ohio — C
Gilmer — C	Randolph — C
Jefferson — C	Upshur — C
Marion — C	

WISCONSIN

Brown — I	Grant — C
Dane — C	Jefferson — C
Dodge — I	La Crosse — C
Douglas — C	Pierce — C
Dunn — C	Portage — C
Eau Claire — C	Walworth — C
Fond du Lac — C	Winnebago — C

WYOMING

Albany — C	Laramie — M
------------	-------------

Appendix C. Major Adjustments to the 1965-70 Migrant Data

In three local situations, substantial adjustments were made to the 1965-70 data as tabulated and presented in Current Population Reports, Series P-25, No. 701. In Chambers County, Ala., the allocation procedure which assigned place of origin to migrants for whom origin was not provided by the census data resulted in a very large number of White male outmigrants in the age groups 15 to 19 and 20 to 24. This occurred as a result of a problem involving military personnel enumerated in barracks in 1970. For purposes of this age estimate project, the outmigrants for Chambers County for these two cells were decreased by the amount of the allocation. This change produced a more reasonable age-sex-race distribution for the final population estimate.

Another major change involved Baltimore City and County, Md. In this case, an unreasonable number of Black-and-other-races outmigrants were reported for Baltimore County in the original census data. This was the result of incorrect or ambiguous responses of outmigrants from Baltimore City resulting in their being coded as outmigrants from the County. There did not seem to be a serious problem with the age distribution of migrants, but the incorrect heavy net outmigration indicated for Baltimore County had a serious impact on the subsequent adjustment of migrants for all counties in Maryland in the program

which produced consistency with the independent postcensal estimate of total population. To prevent this, outmigrants were decreased for the county so as to obtain zero net migration, all ages, while retaining the proportions, by age, of the original data. The amount of change, age by age, was added to Black-and-other-races outmigrants for Baltimore City.

The third adjustment did not involve any change in the numbers as reported, but a sizable assignment of place of residence for outmigrants from New York City was required. Persons residing outside of New York City in 1970 who reported in the census that they had lived in New York City in 1965 received a special code which did not specify borough of former residence. It was possible to calculate the number for each borough by sex and race, but not by age. These will be called Type 1 outmigrants. Persons living in New York City in 1970 who said they had lived in another borough in 1965, but did not identify it, also received this special code, and it was possible to reconstruct data for these persons by sex and race for broad age groups. These are Type 2 outmigrants. Detailed age groups were estimated for Type 2 outmigrants; and Type 1 outmigrants were assigned these age distributions, specific by sex and race. The sum of Type 1 and Type 2 outmigrants was added to the original census data, which did not include movers with the special code.

Appendix D. Definitions of Technical Terms

[All definitions relate to the period 1965 to 1970]

Military outmigrants. Outmigrants who were in the Armed Forces in 1965, and in any category in 1970.¹

Military immigrants. Immigrants who were in the Armed Forces in 1970 and in any category in 1965.¹

College outmigrants. Outmigrants (excluding those in the Armed Forces in 1965) who were attending college in 1965 and in any category in 1970.²

¹ For 184 counties with a resident military population of at least 500 in 1970. (Counties listed in appendix B.)

² For 427 counties with relatively large colleges or universities having a dormitory population of at least 500 in 1970. (Counties listed in appendix B.)

College immigrants. Immigrants (excluding those in the Armed Forces in 1970) who were attending college in 1970 and in any category in 1965.²

Civilian noncollege outmigrants. Outmigrants who were not in the Armed Forces or attending college in 1965, and in any category in 1970.³

Civilian noncollege immigrants. Immigrants who were not in the Armed Forces or attending college in 1970, and in any category in 1965.³

³ Also excludes estimated migration for correctional institutions in 70 counties, as described in section on methodology. (Counties listed in appendix B.)

