

Centenarians in the United States

1990

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Special Studies

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U.S. Department of Health and
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National Institutes of Health
National Institute on Aging

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Notes About This Report

Findings for this report come primarily from the 1990 Census of Population and Housing. All statistics are subject to sampling variability, as well as survey design flaws, respondent classification errors, and data processing mistakes. The Census Bureau has taken steps to minimize errors, and analytical statements have been tested and meet statistical standards. Because of methodological differences, however, use caution when comparing these statistics with data from other sources.

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Centenarians in the United States

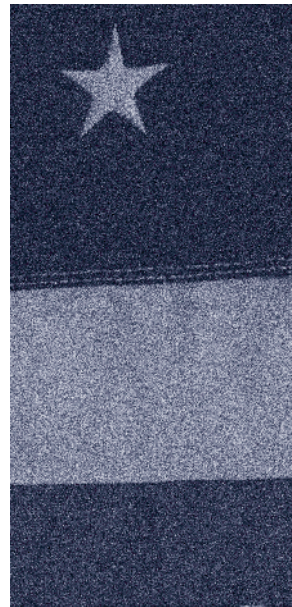
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Centenarians in the United States

Average life expectancy in the United States has increased dramatically over the last century, from just 49 years at the turn of the century to just over 76 years in 1996, the latest year for which such data are available (National Center for Health Statistics, 1997; 1998). While earlier gains in life expectancy may be attributed to reductions in infant mortality and the control of infectious diseases, reductions in mortality at the oldest ages are believed to be the major factor responsible for increased life expectancy in recent decades (Vaupel and Jeune, 1995). This has led to an increasing number of people living to extreme old ages, including those reaching age 100 years or above.

This report focuses on the characteristics of those people identified as centenarians in the 1990 Census of Population and Housing for the United States. While its purpose is not to provide the definitive answer to the number of people aged 100 or above in 1990, this report does give a range of estimates. In 1990, there were 37,306 people identified as centenarians in the census which is most likely an overstatement of the “true” number of centenarians. Estimates of the number of centenarians in the United States by the Census Bureau and the Social Security Administration (SSA) range from around 28,000 in 1990 to 29,131 at the end of 1991, respectively (Das Gupta, 1999; Kestenbaum, 1998). The uncertainty of the numbers is discussed in the section on data quality which addresses these issues and

their effects on both the enumeration and estimation of centenarians in 1990. First, however, we shall examine the characteristics of individuals identified as being aged 100 or above in the 1990 census.

Why Study Centenarians?

Centenarians represent a relatively small proportion of the total U.S. population, with about one out of every 10,000 Americans being aged 100 years or older in 1990. Yet, this segment of the population surviving to extreme old age draws the attention of researchers and the general public alike, as we try to understand and learn from the experience of individuals who beat the odds of environmental and biological obstacles to which most humans fall prey. Observation of centenarians can aid those examining the human life span, mortality at the oldest ages, the issue of racial crossover in mortality at older ages¹, and the trajectory of mortality (Coale and Kisker, 1986, 1990; Elo and Preston, 1994; Horiuchi and Wilmoth, 1998; Kestenbaum, 1998; Manton and Singer, 1994; Wilmoth, Skyttthe, Friou, and Jeune, 1996). Increased longevity also

¹ There is debate over the issue of changes in mortality patterns by race at older ages (Coale and Kisker, 1986, 1990; Elo and Preston, 1994; Manton, Stallard, and Vaupel, 1981; Otten, Teutsch, Williamson, and Marks, 1990.) There is some evidence that at older ages (e.g., mid- to late seventies or early eighties), there exists a crossover to lower mortality among Blacks, a shift from the mortality pattern of lower mortality among Whites. Many attribute this crossover to a “survival of the fittest” argument, while others argue that this apparent phenomenon is actually due to age misreporting and other forms of error and bias in death rates for Blacks at these ages.

has social and economic implications for society as a whole, as we struggle to find the best way to support a growing elderly population. However, we must first determine how many people actually survive to these extreme old ages.

U.S. Centenarians

In 1990, of the 31 million people who were aged 65 and over, 37,306 were classified as being centenarians. This figure most likely exceeds the true number of centenarians in 1990, as we will discuss extensively in the later section on data quality. However, comparisons of various sociodemographic characteristics with those of other groups above age 65 reveal that the traits of this group follow observed age trends. As such, the characteristics for centenarians reported in the 1990 census reasonably capture the experiences and characteristics of the true population aged 100 or above.

As with the elderly population as a whole, women outnumber men in the 100 and above age group. In 1990, four in five centenarians were women (see Table 1). This disproportionate share of women aged 100 and over occurs because death rates are higher for men than women at virtually every age. Although both women and men have experienced dramatic improvements in mortality at the oldest ages over the last few decades, gains for males have typically been smaller than those for females (Vaupel, 1997). The majority of centenarians in 1990 were also non-Hispanic White, accounting for 78 percent of those aged

100 or older. At about 16 percent, Blacks made up the second largest group of centenarians. This compares with 76 percent and 12 percent, respectively, of the total population.

Table 2 presents three series of projections of the size and composition of the centenarian popula-

tion in the future, based on alternative assumptions for fertility, life expectancy, and net immigration. For the elderly population, projections are most sensitive to the differences in assumptions made about life expectancy. Middle series life-expectancy assumptions reflect a slow improvement in life

expectancy, mirroring the 10 year mortality improvements seen from 1980 to 1990, with some additional impact of AIDS included. The low series assumes that current mortality rates will not change, while the high life-expectancy assumption, or rapid improvement series, replicates the

Table 1.
Population Aged 100 and Over in 1990 by Sex, Age, Race, and Hispanic Origin

	Total	White	Black	American Indian, Eskimo and Aleut	Asian and Pacific Islander	Other	Hispanic*	Non-Hispanic	
								White	All Other Races
Both sexes	37,306	30,105	5,874	264	492	571	1,642	29,130	6,534
100 to 104 years	30,947	25,881	4,208	180	357	321	1,051	25,186	4,710
105 years and over	6,359	4,224	1,666	84	135	250	591	3,944	1,824
Males	7,901	5,799	1,587	99	175	241	581	5,490	1,830
100 to 104 years	5,944	4,616	1,025	68	122	113	317	4,421	1,206
105 years and over	1,957	1,183	562	31	53	128	264	1,069	624
Females	29,405	24,306	4,287	165	317	330	1,061	23,640	4,704
100 to 104 years	25,003	21,265	3,183	112	235	208	734	20,765	3,504
105 years and over	4,402	3,041	1,104	53	82	122	327	2,875	1,200

*Persons of Hispanic origin may be of any race.

Source: U.S. Bureau of the Census, 1990 CP-1-1, *1990 Census of Population- General Population Characteristics, United States*, U.S. Government Printing Office, Washington, DC, 1992.

Table 2.
Projected Number of Centenarians in the United States by Sex, Race, and Hispanic Origin: 2000 to 2050¹

Year	Total (lowest series) ²	Total (middle series)	Total (highest series) ³	Percent male ⁴	Percent female	Percent Hispanic ⁵	Percent Non-Hispanic			
							White	Black	American Indian, Eskimo, and Aleut	Asian and Pacific Islander
2000	69,000	72,000	81,000	16.7	83.3	5.6	77.8	12.5	1.4	2.8
2010	106,000	131,000	214,000	15.3	84.7	7.6	72.5	14.5	2.3	2.3
2020	135,000	214,000	515,000	15.4	84.6	9.8	69.2	13.1	2.8	4.7
2030	159,000	324,000	1,074,000	16.4	83.6	14.5	62.3	12.7	2.8	8.0
2040	174,000	447,000	1,902,000	17.4	82.8	17.7	56.2	13.2	2.7	10.5
2050	265,000	834,000	4,218,000	18.0	82.0	19.2	55.4	12.7	2.2	10.6

¹ Projections are based on a July 1, 1994 estimate of the resident population, which is based on the enumerated 1990 census population modified by age and race. As a result of these modifications, the April 1, 1990 population of centenarians is assumed to be 36,000. For a detailed description of the age modification procedures, see publication CPH-L-74, *Age, Sex, and Hispanic Origin Information from the 1990 Census: A Comparison of Census Results with Results Where Age and Race have been Modified*.

² Assumes low fertility, low life expectancy, and low net migration in comparison to the middle series values.

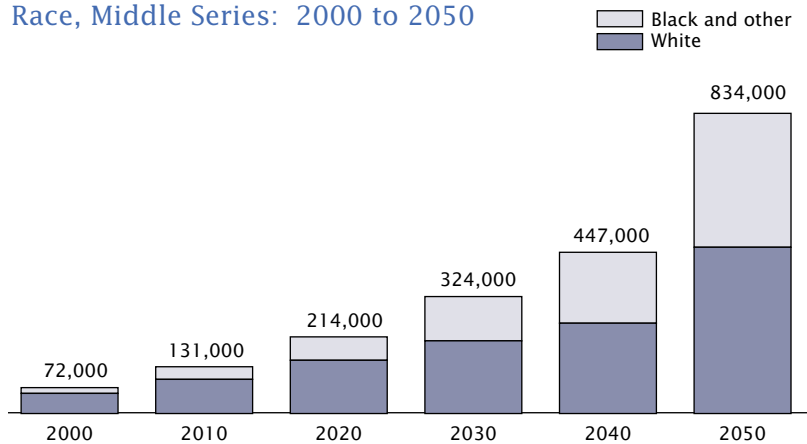
³ Assumes high fertility, high life expectancy, and high net migration in comparison to the middle series values.

⁴ Percentage values are based on middle series projections.

⁵ Persons of Hispanic origin may be of any race.

Source: Day, J. C., 1996, *Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050*, U.S. Bureau of the Census, Current Population Reports, P25-1130, U.S. Government Printing Office, Washington, DC.

Figure 1.
Number of Projected Centenarians by
Race, Middle Series: 2000 to 2050



Source: Day, J. C., 1996, *Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050*, U.S. Bureau of the Census, Current Population Reports, P25-1130, U.S. Government Printing Office, Washington, DC.

mortality patterns found between 1970 and 1980, thus ignoring the estimated impact of AIDS. According to the middle series projections, by the middle of the next century, the United States could have almost 850,000 centenarians. And, if we see even more rapid increases in life expectancy, as assumed in the highest series, the future number of centenarians could be substantially higher than 850,000.

As with other age groups of the elderly population, we expect that centenarians will be a more diverse group in the future. As seen in Table 2, by 2050, non-Hispanic Whites may account for only about 55 percent of the total centenarian population, with the Hispanic and Asian and Pacific Islander populations accounting for a greater share of the population aged 100 years and above.

Table 3.
Cohort Analysis for 1990 Centenarians
Aged 100 to 104: Born 1885 to 1890

Year	Age Range	Population (thousands)			Ratio of Males to females
		Total	Male	Female	
1890	under 5	7,635	3,885	3,750	103.6
1900	10 to 14	8,086	4,086	4,000	102.2
1910	20 to 24	9,117	4,613	4,504	102.4
1920	30 to 34	8,095	4,133	3,962	104.3
1930	40 to 44	8,052	4,166	3,886	107.2
1940	50 to 54	7,281	3,762	3,519	106.9
1950	60 to 64	6,103	3,058	3,045	100.4
1960	70 to 74	4,773	2,197	2,577	85.3
1970	80 to 84	2,312	883	1,429	61.8
1980	90 to 94	557	156	401	38.9
1990	100 to 104	31	6	25	24.0

Source: 1890 data from U.S. Bureau of the Census, *Historical Statistics of the United States-Colonial Times to 1970, Bicentennial Edition, Part I*, Washington, DC, 1975; 1900 to 1950 data from U.S. Bureau of the Census, Current Population Reports, Series P25-311, Washington, DC, July 2, 1965; 1960 data from U.S. Bureau of the Census, Current Population Reports, P25-519; 1970 data from U.S. Bureau of the Census, Current Population Reports, P25-917; 1980 to 1990 data from U.S. Bureau of the Census, Current Population Reports, P25-1095.

Centenarians: One Hundred Years of Life Events

The majority of centenarians living in the United States in 1990 were part of the 1885-1890 birth cohort in which over 7 million babies were born. People of this cohort were in their late 20s during World War I and the 1918 flu epidemic; in their 40s during the Great Depression of the 1930s; and, in their 50s during World War II. In the late 1950s, they joined the 65-plus group, with approximately 5 million people being aged 65 to 69 in 1955. About one-half of these survived to witness the first moon landing in 1969, when they were in their late 70s and early 80s. It is important to note that tracing the survival of this cohort over a period of 100 years is subject to the effects of migration, as well as differences in census procedures and accuracy. For example, such factors are likely to explain why there were over 9 million people aged 20 to 24 in 1910, while there were only just over 8 million aged 10 to 14 in the prior decade.

The median age at first marriage for women in this cohort was between 21 and 22. Ever-married women of this cohort had an average of three children, with a median age at first birth of 23. As of 1940, about 17 percent of women in the 1885 to 1890 birth cohort, then aged 50 to 54 years, remained childless, a lower proportion than that found among subsequent cohorts until the advent of the Baby Boom at mid-century. Approximately one-third of ever-married women had one or two births, over half had three or more, and more than one-quarter bore five or more children (U.S. Bureau of the Census, 1975). In comparison, about one-eighth of ever-married women born between 1950 and 1954, aged 40 to 44 in 1994, remained childless as of 1994. Approximately 56 percent of these had one or two children, and only about 32 percent had three or more children ever born (Bachu, 1995).²

² It is important to note that these women may not have completed their fertility experience, given trends toward delayed childbearing.

The Historical Experience of 1990 Centenarians: A Timeline of Events

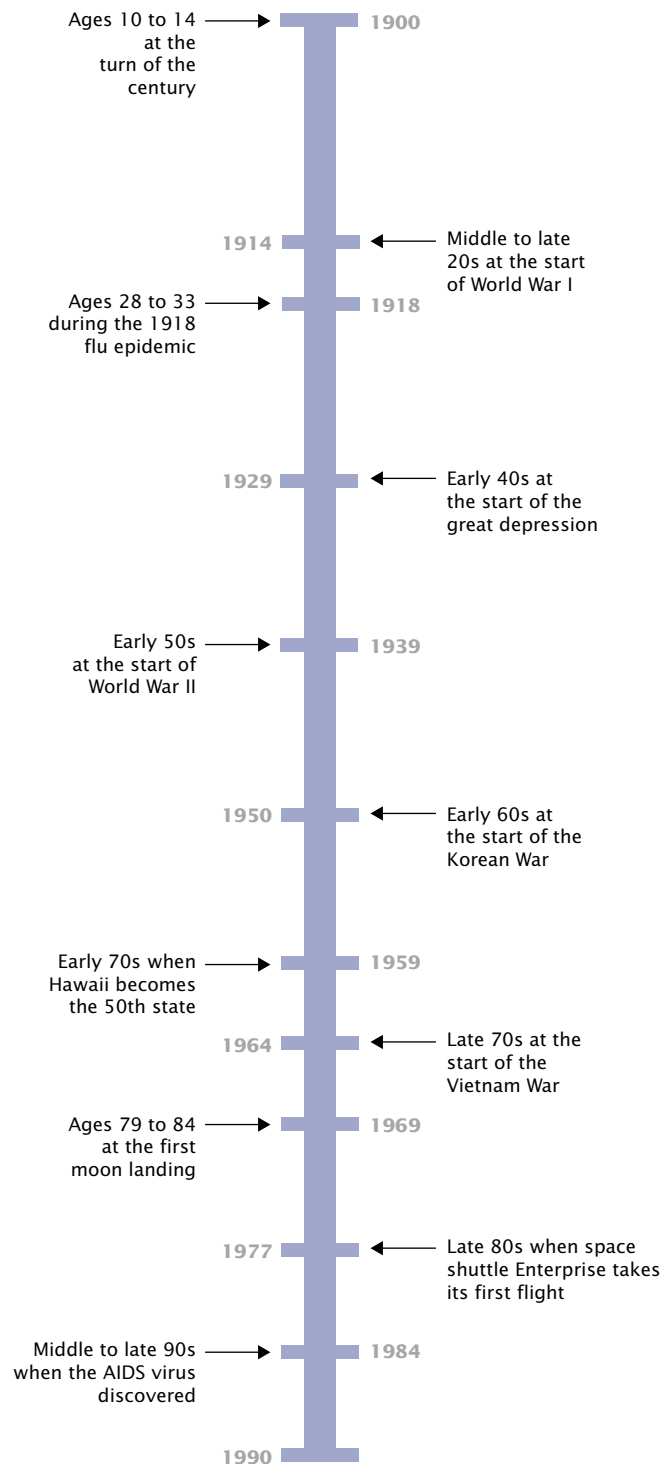
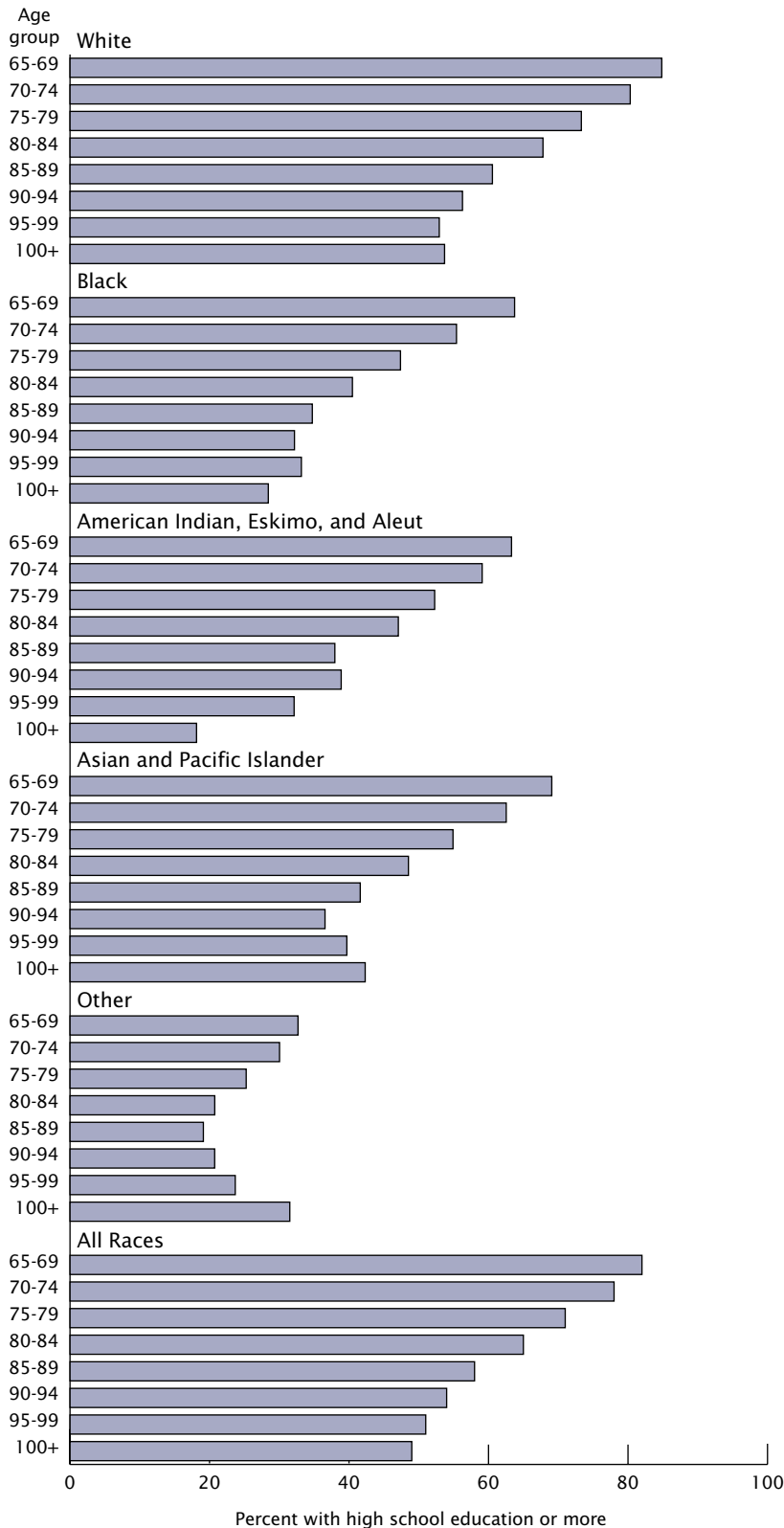


Figure 2.
Percent of Elderly With Some High School Education
or More by Race and Age: 1990



Source: Special tabulations from 1990 Decennial Census sample files.

Socioeconomic Characteristics of Centenarians

Characteristics presented here are based on census sample data and are representative of the 37,306 individuals classified as centenarians in the 1990 Census. As noted earlier, the inclusion in this sample of individuals who might not truly have been 100 years or older in 1990 may skew findings for the various socioeconomic characteristics explored. For example, if racial minorities are indeed more prone to age misreporting, as suggested by some researchers (Elo and Preston, 1994; Preston et al., 1998), the number of centenarians living below poverty may be inflated by an overcount of minority individuals in the sample, who tend to exhibit higher levels of poverty on average. To address this issue, race was entered into the analysis of each variable examined and relevant results are presented where appropriate.

Educational Attainment

Centenarians in 1990 reported significantly lower levels of education compared with other cohorts of the elderly population. This is not unexpected given the trend towards increasing levels of education over time. As seen in Figure 2, about four in five people aged 65 to 69 in 1990 had completed some high school or more, compared with just half of the centenarian group. These findings are consistent across racial groups, except for the Asian and Pacific Islander population. For this group, there is a decline in education with age up to age 100, but reported centenarians then demonstrate higher levels compared with those aged 95 to 99 years.*

* While this comparison is true for the sampled data, the sample size is too small to infer that the results would necessarily hold true for the overall population and may be due to sampling variability, estimation, or other statistical techniques.

Marital Status

Not surprisingly, the majority of centenarians were widowed in 1990 (79 percent). Eighty-four percent of centenarian women were widowed, but only 58 percent of the men were. Even at these advanced ages, nearly 1 in 4 men were currently married, compared with only 1 in 25 women.

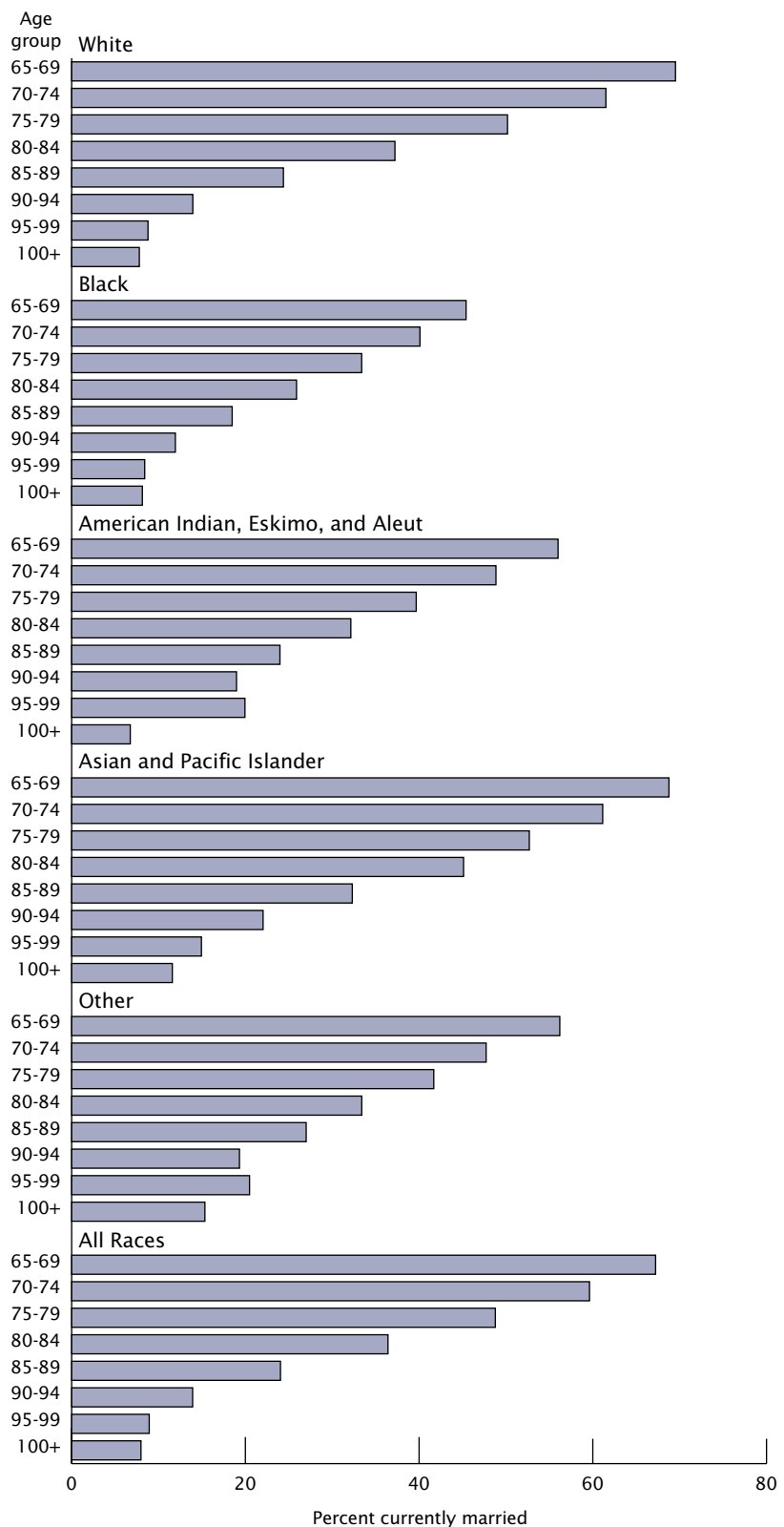
Controlling for race reveals that while a greater percentage of Whites are currently married among the “younger” elderly age groups, the trend is altered at the oldest-old ages, with Blacks, Asian Pacific Islanders, and Others having a higher percentage of centenarians being currently married compared with Whites (Figure 3).

Observed racial differences in marital status were not found to be statistically significant.*

However, these observed racial differences in marital status at the oldest ages may provide some evidence for the presence of “false” centenarians among minority groups. Their presence in the numbers classified as centenarians may therefore inflate the numbers in the “currently married” category among the 100 and over population as a whole.

* While this comparison is true for the sampled data, the sample size is too small to infer that the results would necessarily hold true for the overall population and may be due to sampling variability, estimation, or other statistical techniques.

Figure 3.
Percent of Elderly Currently Married
by Race and Age: 1990



Source: Special tabulations from 1990 Decennial Census sample files.

Poverty Status

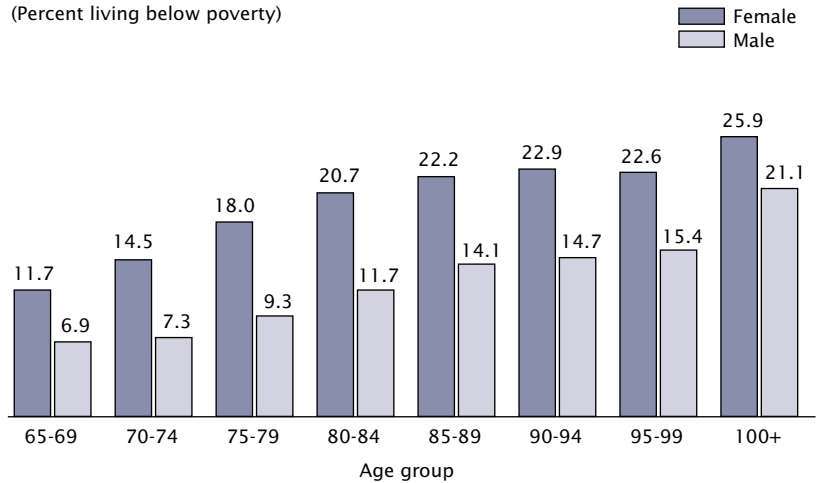
Figure 4 indicates the percent living in poverty for those aged 65 and older among those for whom poverty status was ascertained (information on poverty status was determined for 94.8 percent of the population aged 65 and over; for example, those living in institutions such as nursing homes did not have their status determined). The likelihood of living in poverty appears to increase with age for both men and women, with women more likely to be living below the poverty level at all ages.* Examination of poverty status by race reveals that Whites are less likely to live in poverty compared with other racial groups at almost all ages, with the exception of Asian and Pacific Islanders, who

* While this comparison is true for the sampled data, the sample size is too small to infer that the results would necessarily hold true for the overall population and may be due to sampling variability, estimation, or other statistical techniques.

have levels significantly lower than that for Whites from ages 75 to 89. Differences found above age 90 are not significant (Figure 5). This finding may be due to a lower percentage of Asian and Pacific

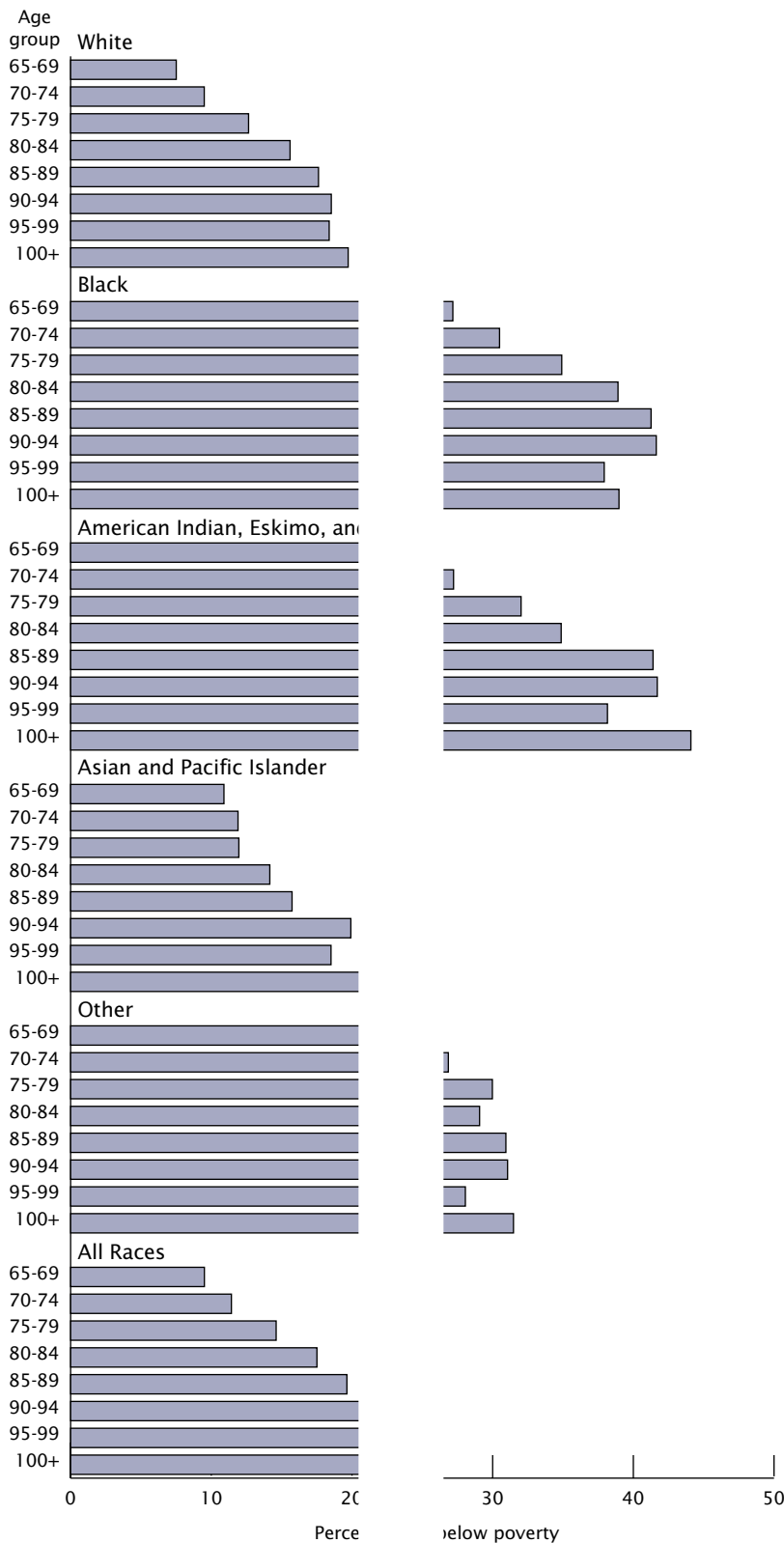
Islanders living alone compared with elderly Whites at all ages, as well as their relatively high education levels compared with other racial minority groups.

Figure 4.
Percent in Poverty by Age and Sex: 1989
 (Percent living below poverty)



Source: Special tabulations from 1990 Census sample files.

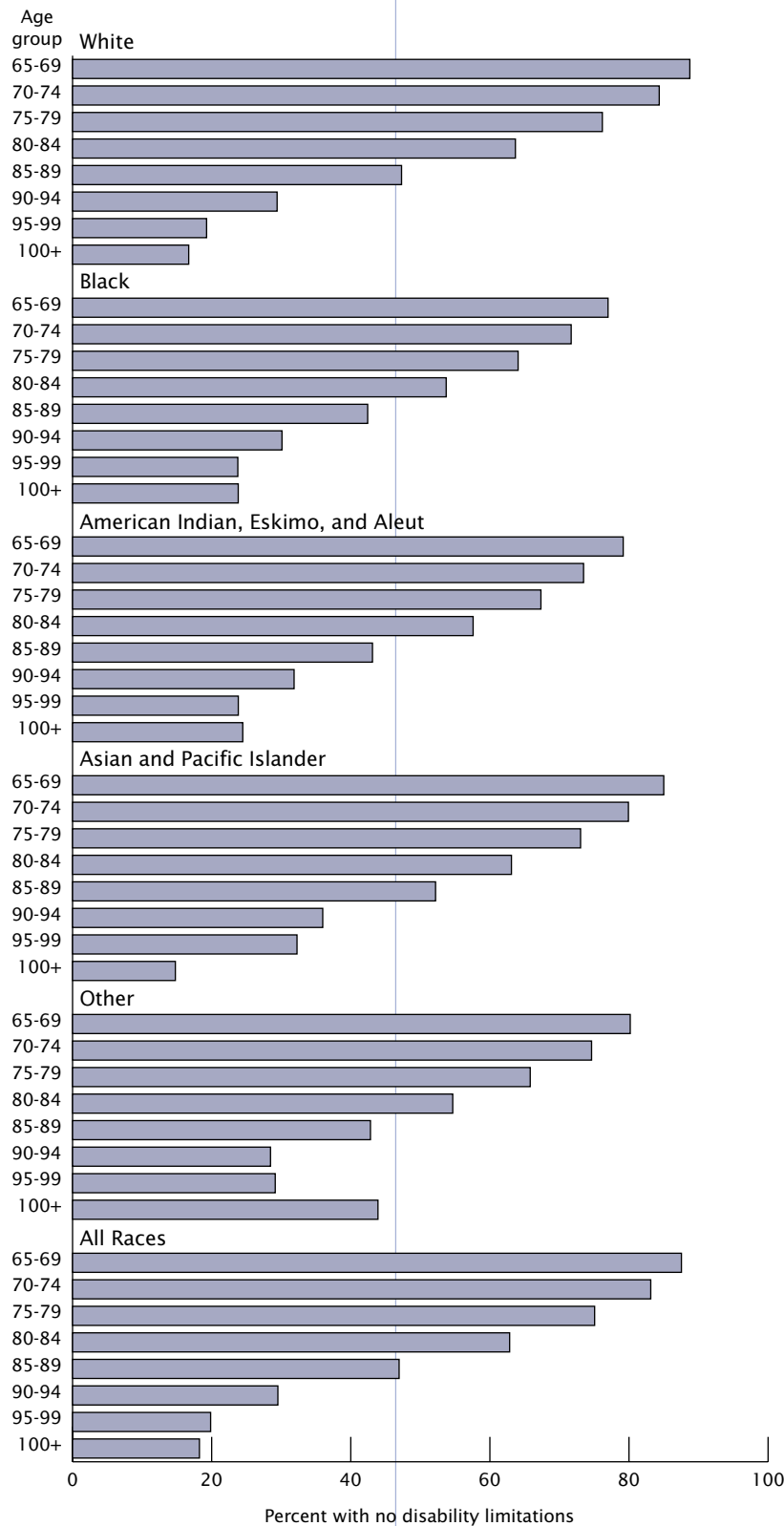
Figure 5.
Percent in Poverty by Race and Age: 1989*



*Figures show the percent in each group in poverty status was ascertained.
Source: Special tabulations from 1990 Dec

Percent in poverty among those for whom poverty status was ascertained.
Source: Census Bureau's sample files.

Figure 6.
Percent With No Self-Care or Mobility Limitations
by Race and Age: 1990



Source: Special tabulations from 1990 Decennial Census sample files.

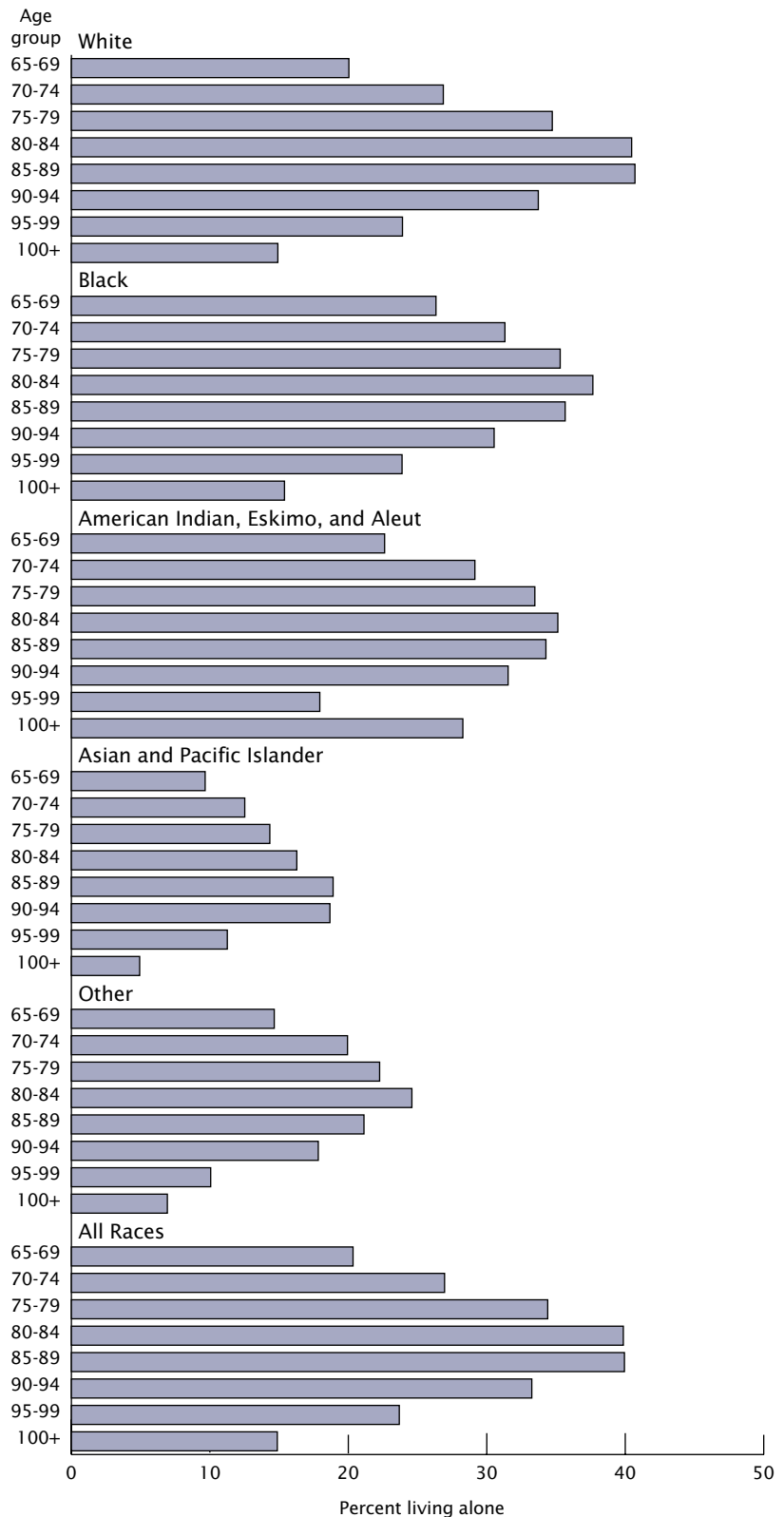
Disability Status and Living Arrangements

The long form of the 1990 Census included questions regarding mobility and self-care limitations. Examination of these factors shows that the percent of elderly people having no such limitations decreases with age. Racial comparisons in Figure 6 reveal that while Whites appear to have lower disability levels at the younger-old ages, this was not the case among those aged 80 and above.

The living arrangements of the elderly may be influenced by their disability status and need for assistance. Consistent with disability trends, centenarians in all racial categories except American Indian, Eskimo, and Aleut were found to be less likely to be living alone compared with their younger counterparts (Figure 7). The higher percent of American Indians found to be living alone was not found to be statistically significant. In relation to this finding, the likelihood of living in a nursing home was found to increase with age for all races, with the exception of the American Indian and Other race categories (Figure 8).^{*} Findings for disability and living arrangements for these racial minorities are most likely due to data quality issues, wherein individuals in these groups are not truly aged 100 years or older.

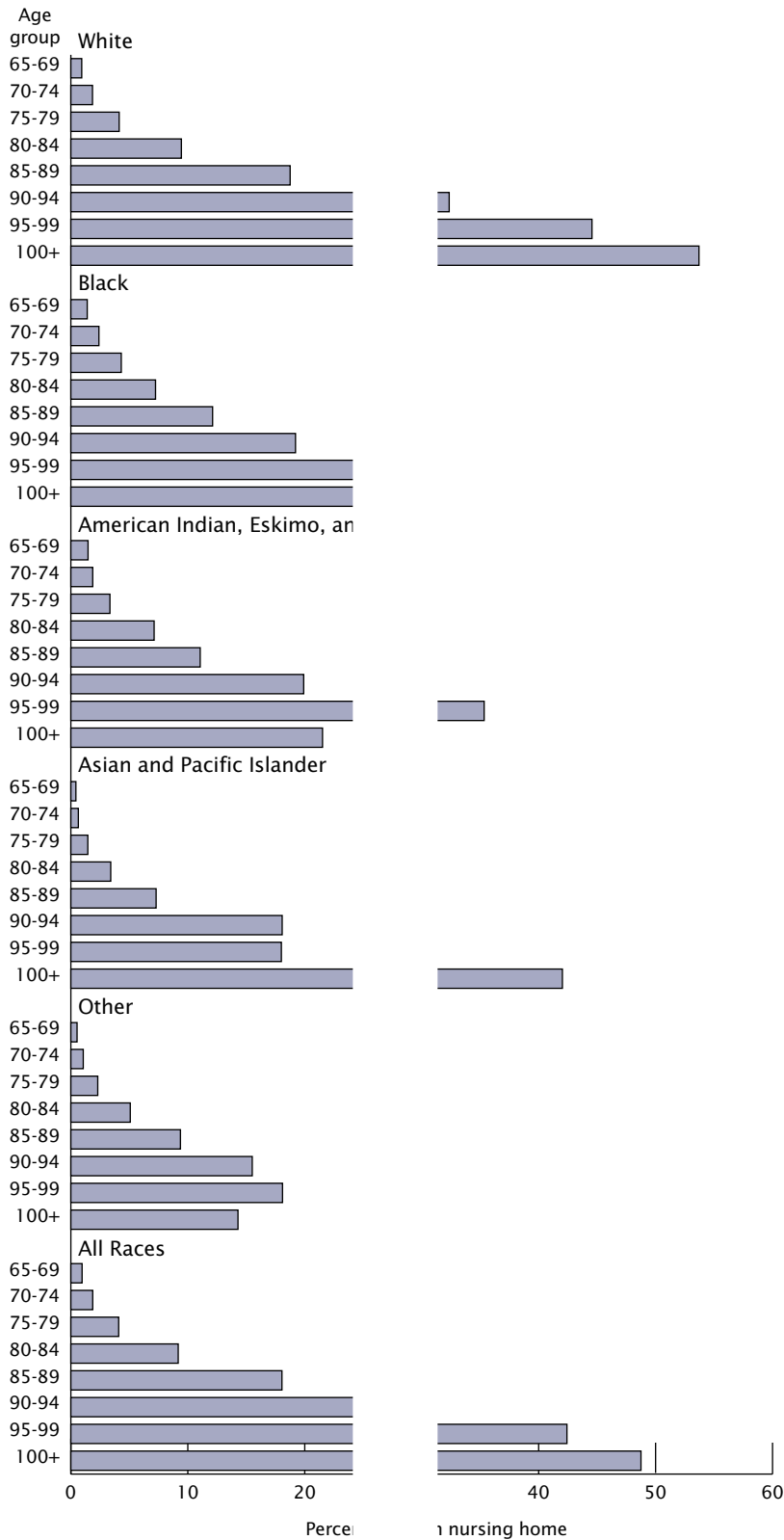
^{*} While this comparison is true for the sampled data, the sample size is too small to infer that the results would necessarily hold true for the overall population and may be due to sampling variability, estimation, or other statistical techniques.

Figure 7.
Percent Living Alone by Race and Age: 1990



Source: Special tabulations from 1990 Decennial Census sample files.

Figure 8.
Percent Living in Nursing Homes
by Race and Age: 1990



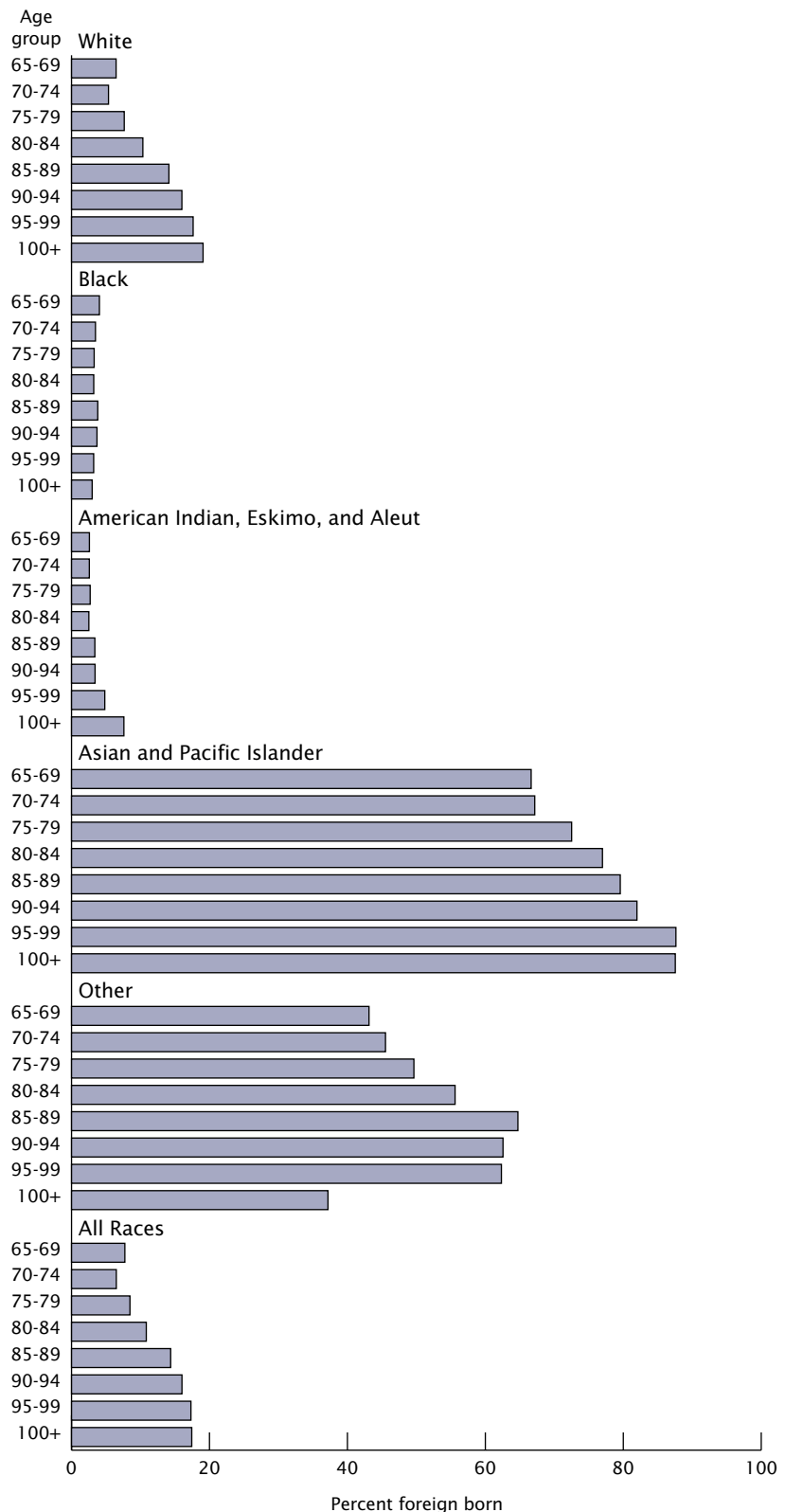
Source: Special tabulations from 1990 Decennial Census sample files.

Nativity Status

While most centenarians in the 1990 Census were born in the United States, about 17 percent were born in a foreign country. This age group had a higher proportion foreign born than is the case among the younger elderly, those aged 65 to 89 years. Differences from those aged 90 to 99 years were not statistically significant. For example, only 8 percent of those aged 65 to 69 were born in a foreign country. The majority of foreign-born centenarians (83 percent) entered the U.S. before 1950, probably around 1910 when they were teens or in their early 20s. Most of them (82 percent) became naturalized citizens. Among centenarians, the percent foreign born is highest for Asian and Pacific Islanders and those in the Other race category, who are mostly of Hispanic origin (U.S. Bureau of the Census, 1991). Whites have a higher level of foreign born compared with Blacks (Figure 9).

Investigation into the socioeconomic and demographic characteristics of reported centenarians in 1990 reveals that, in general, those aged 100 or older tend to follow the patterns exhibited by subsequent cohorts of elderly individuals. As would be expected, centenarians are more likely to be disabled and impoverished, to be widowed, and to have lower educational attainment when compared with younger elderly. Although it is likely that there are “false” centenarians among the 37,306 classified as such in 1990, for the most part, this group does fit the patterns that would be expected given age-related social and economic characteristics.

Figure 9.
Percent Foreign Born by Race and Age: 1990



Source: Special tabulations from 1990 Decennial Census sample files.

Geographical Distribution of U.S. Centenarians

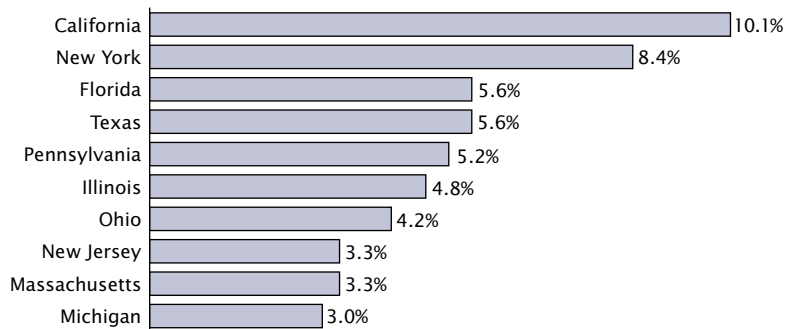
The most populous states in the United States also tend to be those with the greatest number of centenarians. In 1990, the ten states with the highest percentage of the total U.S. centenarian population were California, New York,

Florida, Texas, Pennsylvania, Illinois, Ohio, New Jersey, Massachusetts, and Michigan. These ten states accounted for slightly over half of the total population aged 100 and over (Figure 10).

Figure 11 shows that the top ten states with the greatest proportion of their own population comprised of centenarians differed from those with the greatest

number, with the exception of Massachusetts.³ For example, California had the greatest number of centenarians (3,774), accounting for 10 percent of the total U.S. population aged 100 and over, while it ranked 37th among the states in the proportion of its population aged 100 and over. The two states with the highest percentage of their population comprised of centenarians were Iowa, with 724 centenarians, and South Dakota, with 178 centenarians, making up 0.026 percent of their populations. The ten states with the highest percentage of their own populations aged 100 and over accounted for only about 14.5 percent of the total U.S. centenarian population. In 1990, Alaska had both the lowest number and smallest proportion of its population aged 100 or above (18 and .003 percent, respectively). Surprisingly, Florida, the state with the highest share of those aged 65 or older, ranked 24th in proportion of state population aged 100 and over. It has been suggested that while Florida may receive a substantial influx of the relatively healthier “young old”, the less healthier “older old” may return to their origin state to be cared for by family (Rogers, 1990; U.S. Bureau of the Census, 1996).

Figure 10.
Ten States With the Highest Percentage of the Total U.S. Centenarian Population: 1990¹



¹These ten states account for 19,939 (53 percent) of the total U.S. centenarian population as enumerated in the 1990 Census.
Source: U.S. Bureau of the Census, 1990 Census of Population, Summary Tape File 1.

Figure 11.
Ten States With the Highest Percentage of Total State Population Aged 100 or Over: 1990¹



¹Ten states with the highest percentage of their own population aged 100 or over compared to other U.S. states account for only 5,423 (14.5%) of U.S. centenarians enumerated in the 1990 Decennial Census.
Source: U.S. Bureau of the Census, 1990 Census of Population, Summary Tape File 1.

³ The states in Figure 11 may be differentially affected by the data reliability issues that are discussed on page 14 under the section on Data Quality Issues.

International Comparisons

Information about the number of centenarians living in other countries of the world is limited mainly to developed countries that are more likely to have a population registration system or census. Kannisto (1990) estimated the number of centenarians in several developed countries based on the assumption that the ratio of people aged 100 and over to the population aged 75 and over observed in some countries is the same for all countries. He calculated that in 1985, there were only 30,000 centenarians worldwide, with about 5,000 in the United States. This number is obviously inconsistent with the number of people aged 100 and above enumerated in the 1990 Census of Population, an issue addressed in the later section on data quality.

Some aspects of the 100-plus populations in the United States and other countries are similar. For example, there were 27 men for every 100 women aged 100 and over in the United States in 1990. Both Sweden and Japan have similar sex ratios (27 and 25 respectively). Finland's sex ratio is somewhat lower, with only 21 men per 100 women aged 100 and over.

Historical analysis of 11 developed countries, not including the U.S., indicate significant increases in the number of people reaching age 100 between 1885 and 1950, with this population doubling each decade since 1950. Researchers attribute about two-thirds of these increases to improved survival from ages 80 to 100 (Jeune and Vaupel, 1995). Revised estimates of the U.S. centenarian populations

for 1970 through 1980 are somewhat consistent with this doubling trend. The annual rates of growth for the centenarian populations in the United States and other developed countries have been similar. From 1980 to 1990, the growth rate for American centenarians was around 9 percent per year based on a revised 1980 estimate of 15,000 and the 1990 census count of 37,306. Using the revised estimate of 28,000 for 1990 (to be presented in the section on data quality below) yields an annual growth rate of over 6 percent. Finland and Japan had slightly higher annual growth rates (11 percent and 12 percent respectively for the same period). Sweden's centenarian population grew slower, at only 6 percent per year. Note that in all cases, these are high growth rates compared with other age groups. However, their meaning should not be overstated: the numbers are small and so any growth appears large.

Centenarians do make up a high proportion of the U.S. population aged 85 and above compared with other countries with good quality data. For example, there are approximately 120 centenarians per 10,000 persons aged 85 and over in the United States. The comparable number of centenarians per 10,000 population aged 85 and over in Finland was about 30; in Japan, about 29; and in Sweden, about 41. It does not appear that differences in data quality alone could account for such significant differences in the proportion of the extreme aged between the United States and other nations. A higher proportion of centenarians is not the only evidence supporting the comparative advantage of the U.S. in survival at

older ages. Manton and Vaupel (1995) found that life expectancies at age 80 were significantly higher in the United States than in England, France, Japan, and Sweden.

Data Quality Issues When Measuring Populations at Extreme Ages

Generating a count of people at older ages is hounded by problems that may result in imperfect estimates of the very old population. Data reliability problems escalate with age, with the most serious problems found among reported ages of 95 to 99 and 100 and over (Kestenbaum, 1992). Lack of birth records, which makes it difficult to confirm or disconfirm a reported age, and low literacy levels have both been identified as contributing to the lack of data quality at the highest ages, especially for Blacks (Bowerman, 1939; Elo and Preston, 1994; Elo, Preston, Rosenwaike, Hill and Cheney, 1996). Functional and/or cognitive disability make it impossible for some elderly to report their own age, making it necessary to rely on the knowledge of others. In addition, there are individuals who deliberately misreport their age for a variety of reasons, as well as those who mistakenly report an incorrect age in surveys. The census, like any data collection system that involves measuring the elderly population, can potentially be affected by all of these problems. Examination of the count of centenarians in past censuses may shed some light on the problems encountered in 1990.

Problems With Past Census Counts

Census counts prior to 1990 are marked by large error for those aged 100 and older. Figure 12 indicates the count of centenarians for each of the decennial censuses since 1950, as well as figures believed to more accurately reflect the true number of centenarians. The gross overstatement of centenarians in 1970, the first primarily self-enumerated census, is attributed mainly to a misunderstanding on the part of some respondents about properly completing the census form (Siegel and Passel, 1976).

The count of 32,194 centenarians in 1980 is believed to contain only about 15,000 true centenarians (Spencer, 1986). This estimate was derived from an analysis of a 10 percent random sample (621 cases) of centenarians from the Census Sample Detail File, representing 2 percent of the total centenarian population. The original long form for each of these cases was examined for consistency

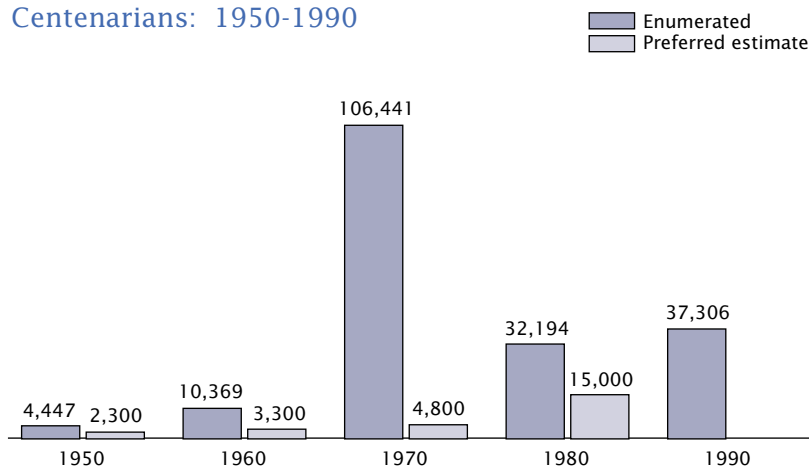
between machine-coded and written age entries in order to assign an age to each individual. Thirty-six of these cases were removed from the study because their forms were either incompletely photocopied or did not contain any age information.

Of the 585 cases in the census file, only 46 percent (271) were identified as centenarians according to their original forms. Application of this percentage to the count of 32,194 in the census yields an estimate of about 15,000, a number that is similar to that found in the Social Security Administration (SSA) files in 1980. It should be noted that the relationship between the census count and the number of centenarians found on the original forms deteriorates at higher ages. That is, the number aged 100 and over in the census sample is about twice the number found on the original forms, while for those aged 105 and over, the sample contains about 12 times the number found on the original forms.

The overcount of centenarians in 1980 resulted primarily from two sources of error (Spencer, 1987). First, mistakes were made by some respondents in completing the age portion of the census questionnaire. Age could be ascertained in three ways from the census form: written age, written year of birth, and coded year of birth (i.e., filling in circles). Computer technology makes the coded year of birth the optimal way to assign age, but this is also the method most prone to mistakes on the part of respondents. For example, there were cases where entire families were coded as being born in the 19th century, thus making them all over age 100. Editing procedures did not allow anyone over the age of 112, so most of these misreported centenarians were discarded. Only children under age 13 coded in the wrong century (i.e., coded as aged 100 to 112) were falsely identified as centenarians.

The second source of error involved the allocation of unreasonable ages to incomplete or inconsistent records during editing procedures. For incomplete records, householders filling out the census questionnaire may have mistakenly begun giving responses for a nonexistent person. Instead of deleting these incomplete records, the missing data for that record would be allocated based on the information that was provided. In many cases, these people were assigned the relationship of parent or other relative. Depending on the age of the householder, it was possible for these records to be assigned an unreasonably old age. Inconsistent records occurred when the ages of household members could not logically be true given the identified relationship

Figure 12.
Counts and Preferred Estimates of Centenarians: 1950-1990



Source: Enumerated figures and preferred estimates for 1950 through 1970: Siegel and Passel, 1976. Enumerated 1980 figure: U.S. Bureau of the Census, *1980 Census of Population, Volume 1: Characteristics of the Population*. United States Summary, PC80-1-B1, Tables 41 and 42, U.S. Government Printing Office, Washington, DC. Preferred 1980 estimate: Spencer, 1986. Enumerated 1990 figure: U.S. Bureau of the Census, *1990 Census of Population: General Population Characteristics-United States*. 1990 CP-1-1, Table 13, U.S. Department of Commerce, Economics and Statistics Administration, Washington, DC.

between them. For example, householders filling out the census questionnaire may have mistakenly identified their child by the relationship from the child's perspective, i.e., a father would identify his son as "father." As parents must be older than their children, this "father" would then be reassigned an age greater than that of the householder, which in some cases could be greater than age 100. In response to this problem of "elderly children," editing procedures for 1990 did not allow for any children or grandchildren over the age of 90. With these changes, it is expected that the centenarian population reported in 1990 is less likely to contain these false centenarians.

How Many Centenarians Were There in 1990?

Attempts to determine the true number of centenarians in the United States by the Census Bureau and the Social Security Administration (Kestenbaum, 1998) have generated estimates ranging from about 28,000 in 1990 to 29,131 at the end of 1991, respectively. There are others who believe that the true number of centenarians in the United States could be much lower than estimates falling within this range on the assumption of even greater age misreporting than previously discussed (Kannisto, 1990; 1994; Vaupel and Jeune, 1995).

Several alternative sources of data have been used to estimate the size of the population at older ages, including SSA records, Medicare enrollment files, and death registration records from the National Center for Health Statistics.

Methods for estimating the number of elderly at the oldest ages include the method of extinct generations⁴, surviving younger age cohorts from prior censuses, and the vital statistics method. The accuracy of all three methods is dependent on the availability and reliability of mortality data, while the latter two are also dependent on the reliability of the initial census counts used as the base for calculations. With respect to death registration records, Preston and his colleagues (1998) maintain that age reporting on death certificates is often problematic at older ages, resulting in underestimation of mortality at ages 85 and above. As a result, when the methods discussed above are applied, the count of people surviving to extreme old ages is likely to be inflated. Research by Kestenbaum (1998) tends to confirm the contention of net understatement of age on death certificates.

An alternative method for estimating the number of centenarians is to tabulate Medicare records. Examination of the Master Beneficiary Record File for Medicare at the end of 1987 resulted in an estimate of 22,000 to 23,000 centenarians (Kestenbaum, 1992). More recent work in this area using the now simpler and more complete Medicare enrollment files compiled by the Health Care Financing Administration concludes that

⁴ This method uses death registration data to reconstruct the population of a specified age group at any given time. First, it identifies each death with a particular birth cohort. The population at a certain age for a particular date is then equal to the sum of all the deaths that occur at or after that age within the same cohort up to its extinction. To estimate the number of centenarians in 1990, the deaths for all age cohorts 100 and over in 1990 are summed in each subsequent year until all the age cohorts have been reduced to zero. Available death registration data and deaths based on projected mortality for years where such data are not available are used for these calculations.

there were 29,131 centenarians enrolled in Medicare Part B at the end of 1991 (Kestenbaum, 1998). In order to test the accuracy of this estimate, centenarians found in the enrollment files were compared with those from a sample of death certificates from the 1993 National Mortality Followback Survey (NMFS) that had viable social security numbers. For the population aged 100 and over, age reported in the SSA administrative files was found to be in exact agreement with the age recorded on the death certificate for 84 percent of the matched cases. In addition, 93.8 percent of the individuals identified as centenarians on death certificates were also centenarians according to SSA records, while another 2.5 percent were age 99. Consistent with the findings of Preston and his colleagues, when the age from the two records was not in exact agreement, the age reported on the death certificate was likely to be younger. Exact age agreement was less likely for Blacks than for Whites. Overall, the matching case study provides strong support for the accuracy of age information in the SSA records, and therefore supports the reliability of the estimate of 29,131 centenarians for 1991.

Of these 29,131 centenarians, 93 percent are ages 100 to 104, 16 percent are male, and 10 percent are Black. In comparison, only 83 percent of the 37,306 Census centenarians were between the ages of 100 and 104, 21 percent were male, and 16 percent were Black. According to census data, 9 percent of Census centenarians were aged 105 to 109 years and 7 percent were aged 110 years or older.

Examination of socioeconomic characteristics of the 1990 Census sample of centenarians provides evidence that individuals enumerated as aged 110 or over were not truly centenarians. For example, of the 1,505 Whites reported as aged 110 or older, 68 percent reported having no mobility or personal care limitations. It is very doubtful that this large a proportion could reach such an advanced age without any functional or mental limitations. In addition, among Whites, nearly 30 percent of those aged 110 and over claimed to live alone and over 41 percent claimed to be married, both of which are unlikely scenarios for people of such advanced age.

All of the above mentioned estimates of the centenarian population are potentially biased by the incidence and prevalence of age misreporting, be it intentional or mistaken. As such, caution should be used when viewing any demographic profile of the extreme aged in our population. As Siegel and Passel aptly concluded in 1976, "until a complete population register or vital registration system has been in existence in a country for at least 100 years, it is unlikely that the true number of centenarians can be known" (p. 566).

Data Sources

The 1990 census data included in the report are from Summary Tape File 1, Subject Summary Tape File 19: The Older Population of the United States, and special tabulations of the detailed 1990 census file. For more information about the publication program for the 1990 Census of Population and Housing and the Census Bureau's wide range of data products, contact Customer Services, U.S. Bureau of the Census, Washington,

DC 20233 (Phone: 301-457-4100) or visit our website at www.census.gov. Data for Finland, Japan, and Sweden are from country censuses and administrative records.

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