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**UNITED STATES LIFE TABLES FOR 1979-81**

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**ABSTRACT**

This paper presents age-specific mortality rates and expectations of life for the official decennial United States Life Tables for 1979-81. Analysis of these data shows trends and relationships by age, sex, and color. As in the past, mortality rates for males were higher than for females at all ages, especially at the young-adult ages. Mortality rates for other-than-white individuals were significantly higher than for white persons at all ages except the very highest ages, with the differential being the largest in the 30s and 40s.

The paper examines mortality trends since the first decennial life tables were prepared at the beginning of this century. Considerable reductions in mortality are shown for all categories. Until the last decade, the reductions were much larger for the younger and middle-aged persons than for older persons, but in the last decade, all age groups have had about the same relative reductions. Females have always had lower mortality rates than males (with certain minor exceptions at the young-adult ages many years ago), and the relative differential has been steadily increasing. Mortality rates for other-than-white persons have always been significantly higher than those of white persons, except at the very highest ages. However, this differential is decreasing (as is the opposite differential that exists at the highest ages).

The paper briefly compares U.S. mortality with that in selected industrialized countries. Although infant mortality rates in the U.S. decreased significantly (by 37 percent) from 1970 to 1980, the infant mortality rate in the U.S. is still somewhat higher than in most other industrialized countries (it decreased in those countries also). Similarly, the expectation of life at birth in the U.S. is generally at or below (usually by no more than 2-3 percent) the level found in other industrialized countries. U.S. females have a similar life expectancy to women in other industrialized countries, while U.S. males have a slightly lower life expectancy than do other men. However, the expectation of life for males at age 65 is about as high in the U.S. as in any other country, and for females, it is as high or higher than in any other country.

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## I. INTRODUCTION

Official decennial life tables for the United States have been prepared since the beginning of this century. They have been based on the population enumerated during each of the decennial censuses and generally on the deaths registered during the calendar year of the census and the two surrounding years. These sets of tables have included separate tables for each of various color and sex categories, showing values for each exact year of age. The first two sets (1900-1902 and 1909-11) were based on data covering ten states and the District of Columbia (D.C.), while the third set (1919-21) was based on thirty-four states and D.C. Each subsequent set has been based on data covering all the states and D.C. (although, for 1929-31, deaths in Texas were partly estimated).

Sets of abridged life tables (showing values for exact ages 0, 1, and 5, and quinquennial years of age thereafter) have also been developed for intercensal calendar years. These official abridged life tables have been of two types: (1) provisional (beginning in 1958) for the total population only, based on a 10 percent sample of death certificates and (2) final (beginning in 1946) for various color and sex categories, based usually on a complete count of registered deaths.

Because the abridged tables (both provisional and final) are based on postcensal estimates of the population, their accuracy decreases with the increase in time since the last previous census. For example, the 1969 final abridged tables, using the estimated 1969 population (based on a projection of about 9 years from the 1960 census), would be expected to be less accurate than the 1971 abridged tables using the estimated 1971 population (based on a projection of only 15 months from the 1970 census).

## II. METHODOLOGY FOR U.S. LIFE TABLES FOR 1979-81

The official decennial U.S. Life Tables for 1979-81<sup>1</sup> consist of twelve separate tables—for total persons, white persons, other-than-white persons, and black persons, each by sex and also for both sexes combined. As previously, the principal data involved in their preparation were the enumerated population in the latest census (taken on April 1, 1980) and the registered deaths in the three calendar years centered on the census year. In addition, to improve the reliability at the lowest ages, data on births in the years surrounding the census were used.

In general, except for extremely high ages, the data were sufficiently accurate and only a minimum of graduation was needed. This was accom-

<sup>1</sup>*U.S. Decennial Life Tables for 1979-81*, Vol. 1, No. 1. (Hyattsville, Md.: National Center for Health Statistics, Public Health Service, U.S. Department of Health and Human Services).

plished mostly by grouping most data into quinquennial age groups and interpolating the needed values. Minor adjustments were needed at the teenage years to assure that mortality rates for white persons were lower than for other persons. The data for the very highest ages were not considered reliable, and accordingly, the tables were terminated using the mortality experience of the Medicare program. A full description of the methods used in the preparation of the tables will be contained in a report to be issued in the near future.<sup>2</sup>

### III. U.S. LIFE TABLES FOR 1979-81

*Age-Specific Mortality Rates.* Table 1 presents the mortality rates during 1979-81 for each quinquennial year of age from 0 to 105, for each sex separately and for both sexes combined.<sup>3</sup> The rates are very high during the first year of life, decrease significantly until around age 10 and then increase almost exponentially thereafter. Rates for females are substantially lower than the corresponding rates for males at all ages. Female rates are about 20 percent lower at ages 0 to 10, with the differential becoming larger until it is about 67 percent for persons in their 20s. After that, the differential decreases until, for ages 35 to 70, the rates for females are about 50 percent lower. At the highest ages, the differential decreases and is only about 10 percent for centenarians.

*Comparison with Abridged Life Tables.* Table 2 shows that the mortality rates in the national decennial life tables are very close to the rates obtained by averaging the corresponding rates from the annual abridged life tables for the same three years. The only significant exceptions are at the younger childhood ages, with mortality rates so low that minor fluctuations (or even rounding) of the rates can result in sizable percentage differences.

*Mortality Reductions in the 1970s.* A comparison of the mortality rates in the 1979-81 life tables with those in the 1969-71 life tables is shown in table 3. This demonstrates that, during the 1970s, the mortality rates decreased for all ages at about the same rates for males as for females—somewhat over 2 percent per year. It is doubtful that such a substantial rate of decrease can continue during the 1980s. It is also significant that annual reductions substantially higher than 1.5 percent were attained even at the very high ages.

*Mortality Changes by Causes of Death.* Table 4 shows that the high rate of decrease in mortality during the 1970s was mainly due to significant reductions in death rates from heart and cerebrovascular diseases. About 70

<sup>2</sup>U.S. Decennial Life Tables for 1979-81, Vol. I, No. 3.

<sup>3</sup>A table giving age-specific mortality rates for every single age for total persons, total males, total females, and by sex for black persons, other-than-white persons, and white persons (a total of nine sets of rates) is available upon request, from the second co-author.

percent of the absolute decrease in death rates was due to these two principal causes. Death rates from many of the less important causes of death also declined. Relatively small increases occurred, however, in the death rates due to cancer and homicides.

*Life Expectancies.* Expectations of life are often used as summary indicators of the levels of mortality. Such values for the 1979-81 U.S. decennial life tables are presented in table 5 for each quinquennial year of age, for each sex separately, and for both combined. At all ages, the life expectancies are substantially higher for females than for males. The absolute difference is about 7.5 years at birth, and it slowly decreases throughout the life span, but is still present at ages over 100. The excess of female life expectancy is about 10 percent (relatively) at birth, increases gradually to about 30 percent around ages 65 to 75, and then decreases to about 10 percent.

In the past, many demographers have considered life expectancy at age 1 to be more meaningful as an indicator of the level of mortality in a given population than life expectancy at birth. This preference has been justified by the argument that the very high rate of mortality during the first year of life tends to distort the life expectancy at birth. In almost all experiences, the expectation of life has been higher at age 1 than at birth. This is no longer true for the United States. The 1979-81 tables show, for the first time, expectations of life that are higher at birth (although only slightly) than at age 1. The mortality rates at birth have now dropped enough to result in such an increase in life expectancy. However, due to the still high mortality during the first few weeks of life, the expectation of life continues to go up during the first month of life. These increases are so small that the life expectancy at birth can now more acceptably be used as an index of the overall prevailing level of mortality.

#### IV. COMPARISONS WITH EARLIER TABLES

*Life Expectancies.* Table 6 presents, for selected ages, the expectations of life for the U.S. decennial life tables that have been prepared in this century. The life tables for 1900-1902, and 1909-11 are for the registration states of 1900 (Connecticut, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Rhode Island, and Vermont) and the District of Columbia. The tables for 1919-21 are for the registration states of 1920 (in addition to the registration states of 1900, California, Colorado, Delaware, Florida, Illinois, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, Virginia, Washington, and Wisconsin) and the District of Columbia.

For 1929-31, 1939-41, and 1949-51, the life tables are for the contiguous

United States (i.e., the 48 states, excluding Alaska and Hawaii, which became states after 1951, and the District of Columbia). The later life tables are for the 50 states and the District of Columbia.

During this century, life expectancy at birth has increased by 24.64 years (from 49.24 to 73.88), and the increase has been larger for females than for males (26.92 years versus 22.23 years). Much of this increase is due to reductions in mortality at the childhood ages (particularly during the first year of life). Significant increases have occurred at all ages for both sexes, but the increases have been smaller at the higher ages. At age 65, the life expectancies increased by 2.71 years for males, and by 6.22 years for females, or by 4.65 years for both sexes combined. Much of this increase at the higher ages occurred in the 1970s.

Before 1969-71, the excess in life expectancy at birth of females over males increased steadily—from 2.82 years at the turn of the century to 5.49 years in 1949-51, 6.44 years in 1959-61, and 7.60 years 1969-71. However, for 1979-81, this trend reversed, and the excess *dropped* to 7.51 years. Such decrease resulted mostly from the faster decline in mortality for males than females at age 0 (see table 3), as shown by the fact that the excess in life expectancy at age 1 was slightly higher in 1979-81 than in 1969-71 (7.40 versus 7.39). Nonetheless, the 1970s showed a significant reversal in the long-term trend of a widening gap in life expectancy at birth between the sexes.

In the 1970s, the gap in life expectancy between the sexes continued to widen at other ages, but at a much slower pace. As will be discussed later, most of the widening of the gap that occurred in the decade was due to other-than-white persons, since for white persons under age 55 the gap narrowed.

The same general trend for the differential life expectancy by sex at age 20 prevailed before 1969-71 and in the 1970s, but at age 65, the differential continued to increase in the 1970s, although at a slower pace. The following table gives basic data on the excess of female life expectancy over that for males at various ages in the last four decennial life tables:

EXCESS FEMALE LIFE EXPECTANCY OVER  
MALE LIFE EXPECTANCY  
(In years)

Period	Age 0	Age 1	Age 20	Age 65
1949-51	5.49	5.11	4.81	2.21
1959-61	6.44	6.13	5.83	2.85
1969-71	7.60	7.39	7.04	3.84
1979-81	7.51	7.40	7.10	4.23

Because the composition of the population has not been uniform in every

state, any analysis of historical mortality trends should consider that the geographical areas covered by the life tables changed significantly during the early part of this century. Also, the methods used to prepare the tables have varied through time. A small part of the differences noted could be due to methodological changes. This could be the case at the older ages in particular.

*Comparison Under Uniform Methodology.* In the interest of improving the comparability of mortality trends, the Office of the Actuary, Social Security Administration, prepared a set of life tables by sex for each single calendar year in the century, using a uniform methodology throughout. Some of these tables were published in Actuarial Study No. 89, *Life Tables for the United States: 1900-2050*, December 1983. Table 7 presents a comparison of the expectation of life at ages 0, 20, and 65 according to the official decennial tables and as computed by the Office of the Actuary. The differences are minor in every case, except for those for the 1909-11 life tables. These official decennial tables were based on data for the registration states of 1900. But the life tables prepared by the Office of the Actuary were based on data for the registration states of the year for which the tables were prepared. This difference in the geographical areas covered by the two sets of tables results in significant differences in the expectations of life.

*Analysis by Factors Other Than Age.* Many analysts, particularly those with an actuarial background, prefer data which have been grouped into more or less homogeneous categories. For example, they prefer to analyze data for males separately from data for females, rather than for both combined. The rationale is that the difference in mortality by sex are inherent and are so significant that their separation provides additional insight to past experience and possibly future experience.

Some analysts may desire a further breakdown by color, because significant differences in mortality rates have been observed between those for white persons and those for other-than-white persons. It is not at all clear, however, that these differences in mortality by color are inherent. Rather, they may be due to economic and educational factors. The analysis by color is presented here solely in a statistical manner. No inferences are (or should be) drawn as to the reasons for, or the significance of, any differences shown.

This section will present data subdivided by color, but no attempt will be made to further subdivide the other-than-white group. As indicated in the introduction, the 1979-81 U.S. Life Tables include separate tables for black males, black females, and total black persons. These three tables are not discussed because of the lack of historical continuity (and also because the data become less reliable when broken into smaller and smaller subgroups).

As shown by table 8 (in which almost all ratios are below 100 percent), mortality rates for black persons are higher at practically all ages and for

both sexes than for the corresponding total other-than-white group. Although no official decennial life tables have been prepared for nonwhites who are not blacks, it is our understanding that their mortality is usually closer to that of whites than to that of black persons. This has been observed in previous decennial tables with respect to states in which there is a preponderance of nonblacks among the other-than-white group (e.g. Hawaii). According to our calculations for the 1979-81 period, this is the case at almost all ages for both males and females.

*Mortality Rates by Color and Sex.* Tables 9 to 12 present age-specific mortality rates by color and sex, according to the decennial life tables that have been prepared in this century, while tables 13 to 16 show these rates for the various life tables as percentages of those for the 1900-1902 life table. A brief analysis of these tables shows that much of the decrease in mortality in this century has occurred at the lower ages. This has been due primarily to the conquering of many communicable diseases. Much reduction in mortality was attained between 1920 and 1960. There was a considerable slowdown in the 1960s, but the pace resumed again in the 1970s. This pattern is similar for all categories of color and sex.

The reductions in mortality at the higher ages were small during the early decades of this century, but lately (especially in the 1970s), the decreases at these ages have been more significant. Compared with 1900-1902, mortality rates in 1979-81 at ages 65 and over were about 30-35 percent lower for males (both white and other-than-white) and 50-60 percent lower for females (although less at ages 85 and over).

Decreases in mortality at the very high ages continue contrary to what some demographers refer to as the "squaring of the survival curve," but the progress has been relatively slow. Thus, life span is barely increasing.

The reduction in mortality at the youngest ages from 1900-1902 to 1979-81 was indeed phenomenal—generally amounting to about 90 and even to as much as 98 percent at age one. At the young-adult ages, the reductions were generally 75-80 percent for males (both white and other-than-white) and 85-90 percent for females. At ages 40 to 65, the reductions were sizable, tending to decrease somewhat with advancing age.

At the young-adult ages (from about 20 to 35, only minor reductions in the mortality rates for females occurred in the 1950s and 1960s, while for males, some increases occurred. Some of this experience at the young-adult ages will be discussed in more detail later.

*Analysis of Mortality Rates by Sex.* Table 17 presents the ratio of mortality rates for females to rates for males, according to the decennial life tables for white persons. Analogous ratios for other-than-white persons are presented in table 18. In both cases, the ratios have been decreasing, which means that mortality rates for females have been decreasing faster than those

for males. The most significant decline in the ratio has been at the young-adult ages, where several decades ago, mortality rates for females were about the same as those for males (sometimes even higher). Now they are only about a third as high. Through time, the changes in these ratios for other-than-white persons have been similar to those for white persons.

These ratios follow a consistent pattern by age—starting high at the childhood ages, declining significantly to a low point around the twenties, before rising gradually through the end of the life span. For white persons, however, there is a hump in the ratio some years after the low point. Such a hump has been prevalent for most of the century, but it has been drifting upward into higher ages, as have the low points of the troughs on both sides. For example, around the turn of the century, a peak in mortality occurred around age 15, but it moved to about age 25 by 1920, and to about age 30 by 1940. Further movement has brought the peak to around ages 40 to 45. Similar drifting can be observed with respect to the two troughs. However, the movement has been smaller for the first trough, and larger for the second trough, than for the peak. This seems to suggest that, throughout this century, the pattern of mortality by age has expanded on a geometric scale, with the mortality rate at age 20 becoming the rate at age 25, while the rate at age 40 became the rate at age 50.

*Analysis of Mortality Rates by Color.* Table 19 presents the ratio of the mortality rates for other-than-white persons to those for whites, according to the decennial life tables for males. Similar ratios for females are presented in table 20. The patterns of these ratios vary significantly at different times and ages. On the basis of these ratios, it is difficult to conclude whether the mortality rates of other-than-white persons have been decreasing more, less, or about the same as those of white persons. However, analysis of life expectancy does seem to indicate that, for all ages except the very highest ones, the longevity of other-than-white persons has been increasing faster than that of white persons—i.e., the mortality rates of the two categories are slowly converging over time. In comparing the rates for 1979-81 with those for 1969-71, greater reductions for other-than-white persons than for white persons are shown at almost all ages below 50 for males and below 70 for females. Similarly, comparing 1979-81 with 1959-61 indicates larger reductions for other-than-white persons for most ages from birth to age 35 for males and to age 70 for females.

These same ratios exhibit a definite pattern by age. For the 1979-81 life tables, the ratios are relatively high at birth, decline to a low point around the mid-teens, increase to a peak around age 35, and then decline continuously. The trough and the peak have been drifting into higher ages. This suggests, once more, that the present underlying mortality rate is similar to that which prevailed a few decades ago at an age a few years earlier.

The reader should recognize that the ratios of the mortality rates by sex within the same color (tables 17 and 18) and by color within the same sex (tables 19 and 20) are based on the mortality rates presented in tables 9 to 12. If the geographical areas covered by those tables were modified, the calculated ratios would change.

*Life Expectancies by Color and Sex.* Tables 21 to 24 present expectations of life by sex and color, according to the decennial life tables which have been prepared in this century. All four tables show a similar pattern of significant increases in life expectancy. Most of the increases occurred during the first half of the century. A noticeable slowdown in the rate of increase occurred during the 1950s and 1960s, and in some cases (mostly for males and particularly for other-than-white males), decreases occurred in life expectancy. The previous rates of increase resumed in the 1970s, and this time, they were observed for practically all age, sex, and color combinations.

*Analysis of Life Expectancies by Sex.* Table 25 presents the excesses in expectation of life for white females compared to white males for the various life tables of this century. Similar values are presented in table 26 for other-than-white persons. The gap in life expectancy between females and males has been increasing for both white persons and other-than-white persons, at practically all ages. In the case of white persons, the gap narrowed during the 1970s for ages under 55, although it continued to widen for older ages. In the case of other-than-white persons, widening of the gap continued in the 1970s, although at a pace not as great as occurred in the 1950s and 1960s. The gap by sex is now wider for other-than-white persons than for white persons, at ages under 50.

As mortality continues to decrease at a greater rate for females than for males, the probabilities of losing one's spouse to death have been increasing for females and decreasing for males, and the period of widowhood is longer. If the mortality trends observed in the 1970s continue, widowhood will increase more among other-than-white females than among white females.

*Analysis of Life Expectancies by Color.* Table 27 presents the excesses in expectation of life for white males compared to other-than-white males. Similar values are presented in table 28 for females. The color gap in life expectancy has been narrowing at most ages for both sexes. So, although white persons have experienced substantial increases in life expectancy during this century, the increases have been greater for other-than-white persons. For males, a temporary increase in the color gap occurred in the 1960s, but the gap began decreasing again in the 1970s.

At the highest ages, the mortality rates are higher for white persons than for other-than-white persons. These higher rates result in lower life expectancies after certain ages for white persons than for other-than-white persons. This age of cross-over in life expectancy by color has been drifting slowly

into higher ages. For males, it occurred at about age 65 in the 1949-51 life tables and has increased to around age 70 in the latest decennial life tables, while for females the corresponding ages were 67 and 74, respectively. This again suggests that the aged population has had a tendency to experience the mortality of younger individuals.

If mortality rates had been decreasing consistently on a uniform basis, the relationships of the resulting rates and values by age, sex, and color would have remained the same through time, in most instances. The drift of these relationships into higher ages, as has been discussed, suggests that some portion of the reduction in mortality rates, and of the corresponding increases in life expectancy, may be due to changes in the aging process. This could mean that people are living longer partly because they are aging more slowly. It should be kept in mind that comparisons over time, particularly at the older ages, are affected by differences in methodology and by the changing accuracy of the census reports.

*Mortality Rates During Early Adulthood.* The pattern of mortality by age generally starts very high at birth, declines significantly during childhood to a low point around age 10, and then increases almost exponentially through the end of the life span. This is fairly accurate overall, but some localized peculiarities of mortality patterns are not recognized.

As the quantity and quality of mortality data improve, some of the peculiarities that have been observed previously in a particular set of data sometimes begin to acquire a more general character. The analyst views them not as a possible aberration peculiar to the specific data but as a possible underlying pattern of human mortality. For example, Medicare and other data analyzed in the last decade suggest that, at the very high ages (around ages 85 or 90, the usual geometric increases in mortality rates by age begin to decelerate compared to the pattern observed at lower ages. These data have not yet revealed categorically whether the deceleration finally results in another less steep Gompertz pattern, or whether the age-specific mortality rates eventually level off (or even start decreasing with age).

Another localized pattern exists at the young-adult years (ages 15 to 35). In this age range, mortality has not followed a Gompertz pattern for many decades. The life tables prepared since the turn of the century indicate that mortality increases rapidly during adolescence, decreases somewhat in the early adult ages, and increases exponentially after about age 30 or 35. The deceleration may result, in some instances, in an actual dip or decrease in mortality. For example, the 1900-02 life tables showed dips both for black males (from age 27 to age 30 and black females (from age 21 to age 26). This also occurred for white males in the life tables for 1949-51 and later.

To produce this pattern, an abundance of deaths at the late teens and early twenties is necessary. Such abundance could have been originally the result

of increased exposure to the communicable diseases (particularly, tuberculosis). However, with most of the deadly communicable diseases already under control, one would expect the relative abundance to disappear. But it still persists! Its cause is now violent deaths (accidents, suicides, and homicides).

Tables 29 and 30 present the mortality rates by single years at ages 15 to 35 by color and sex, for the last five sets of decennial life tables. All color, sex, and year combinations depart from the smooth geometric progression required by a Gompertz curve. Actual peaks and troughs are shown for white males in the last four decennial tables.

An inspection of table 29 clearly shows that the mortality bulge for white males has become more pronounced. This is not so evident in other color-sex combinations. In order to measure more accurately the movement through time of this bulge in mortality at the young-adult ages, values of the coefficient of determination were computed (see table 31). These values are the squares of the coefficients of correlation obtained from the least-squares lines fitted to the logarithms of the mortality rates for ages 10 to 40. These figures show that white male mortality has been consistently moving away from an exponential curve. This has also been true with respect to white females, although in their case definite peaks and troughs have not yet been reached. The trends in the mortality bulge for other-than-white persons is not clear.

#### V. INTERNATIONAL COMPARISONS

This section presents analyses of several mortality elements for the U.S. as compared to selected industrialized countries throughout the world. This is done for 1970 and 1980 (or for a two or three-year period including those years). The Netherlands, Norway, and Sweden are included because they have traditionally been the countries with the lowest levels of mortality (although in 1980, Japan reached or surpassed them in this respect). Data for the U.S.S.R. are not available after the early 1970s.

*Infant Mortality Rates.* Table 32 presents infant mortality rates by sex for the selected countries. The decrease was about the same for males and females. It amounted to about 37 percent for the U.S. and was about the same for most of the other countries, although slightly more for several of them. As a result, the infant mortality rate in the U.S. continued to be higher than in most of the other countries—in fact, as much as 50 percent higher than for a number of them.

*Expectations of Life at Birth.* Life expectancy at birth increased in all countries during the 1970s (see table 33). The increase for the U.S. was about as large as for any other country, and larger than for most. Whereas almost all of the countries shown had higher life expectancy at birth for

males in 1970 than did the U.S., in 1980, about half had about the same as the U.S. Only the life expectancies for Canada, Japan, the Netherlands, Norway, and Sweden were significantly higher. The same general situation prevailed for females, but the life expectancy for females in the U.S. was somewhat closer to those in other countries than that for males.

*Expectations of Life at Age 65.* Table 34 gives similar data for life expectancy at age 65. The expectations for persons aged 65 in the U.S. are more similar to those for other countries than for life expectancy at birth. For all countries, the life expectancy at age 65 increased more in the 1970s than did the life expectancy at birth, and the increases for the U.S. were among the largest. As a result, only Canada and Japan had significantly higher life expectancies for males at age 65 than did the U.S. (and the differentials were not very large). Only Canada had as high a figure for females.

**TABLE 1**  
**MORTALITY RATES BY SEX.**  
**UNITED STATES 1979-81**

Age	Rates per 100,000			Ratio Female Male
	Total	Male	Female	
0	1,260	1,393	1,120	80%
1	93	101	86	85
5	37	42	31	74
10	20	21	18	86
15	69	96	40	42
20	120	181	58	32
25	132	199	65	33
30	133	191	75	39
35	159	216	104	48
40	232	303	163	54
45	366	476	262	55
50	589	775	416	54
55	902	1,206	627	52
60	1,368	1,846	947	51
65	2,059	2,817	1,427	51
70	3,052	4,207	2,169	52
75	4,507	6,167	3,388	55
80	6,882	9,069	5,622	62
85	10,725	13,419	9,409	70
90	15,868	18,848	14,661	78
95	22,976	26,149	21,823	83
100	29,120	31,869	28,176	88
105	33,539	35,845	32,817	92

**TABLE 2**  
**COMPARISON OF MORTALITY RATES FOR**  
**NATIONAL DECENNIAL LIFE TABLES FOR 1979-81 WITH**  
**AVERAGE OF THOSE FOR ABRIDGED TABLES FOR 1979, 1980, AND 1981**  
**(Percentage Excess of Decennial-Table Rates**  
**Over Averaged Abridged-Table Rates)**

Age	Total	Male	Female
0	0	0	0
1	8	3	16
5	-3	-5	-4
10	-2	-7	2
15	-1	-2	-3
20	-2	-2	-3
25	-1	-1	-1
30	1	1	0
35	0	1	1
40	1	1	1
45	0	0	0
50	0	0	0
55	0	0	0
60	-2	-1	-2
65	0	0	0
70	0	1	0
75	-2	-1	-2
80	-1	-1	0

TABLE 3  
COMPARISON OF NATIONAL DECENNIAL LIFE TABLES FOR  
1969-71 AND 1979-81, BY AGE AND BY SEX

Age	Average Annual Compounded Rate of Decrease in Mortality Rates		
	Total	Male	Female
0 .....	4.5%	4.7%	4.3%
1 .....	2.9	2.7	2.9
5 .....	3.2	3.2	3.2
10 .....	4.3	5.2	3.6
15 .....	1.7	1.7	2.0
20 .....	1.5	1.6	2.1
25 .....	1.1	.9	2.2
30 .....	1.5	.9	3.0
35 .....	2.7	2.1	3.7
40 .....	3.0	2.8	3.5
45 .....	2.8	2.7	3.0
50 .....	2.2	2.2	2.3
55 .....	2.3	2.4	2.0
60 .....	2.1	2.3	1.6
65 .....	1.9	2.0	1.6
70 .....	1.8	1.7	1.9
75 .....	2.1	1.6	2.4
80 .....	2.0	1.3	2.3
85 .....	1.6	.9	1.8
90 .....	1.5	1.0	1.6
95 .....	1.1	.7	1.2

TABLE 4  
CHANGE IN DEATH RATES FROM 1969-71 TO 1979-81,  
FOR SELECTED CAUSES OF DEATH  
(Rates per 100,000)

Cause of Death	Absolute Change in Death Rate*			Average Annual Rate of Change		
	Total	Male	Female	Total	Male	Female
1. Diseases of heart .....	-77.7	-100.4	-58.3	-2.3%	-2.2%	-2.4%
2. Malignant neoplasm .....	7.8	15.0	2.9	.5	.7	.2
3. Cerebrovascular diseases .....	-40.4	-45.8	-36.4	-4.8	-4.9	-4.7
4. Accidents and adverse effects .....	-13.4	-18.6	-8.7	-2.7	-2.5	-3.1
Motor vehicle accidents .....	-5.4	-8.0	-3.1	-2.2	-2.2	-2.4
All other accidents and effects .....	-8.0	-10.6	-5.6	-3.2	-2.9	-3.7
5. Chronic obstructive pulmonary diseases .....	-6.2	-14.5	.6	-2.4	-3.2	.5
6. Pneumonia and influenza .....	-9.6	-11.7	-7.8	-3.9	-3.5	-4.1
7. Diabetes mellitus .....	-5.1	-4.1	-5.9	-3.2	-2.6	-3.6
8. Chronic liver diseases and cirrhosis .....	-2.4	-3.2	-1.8	-1.7	-1.6	-1.9
9. Atherosclerosis .....	-7.4	-8.3	-6.9	-5.1	-5.0	-5.2
10. Suicide .....	-.4	.4	-1.1	-.4	.2	-1.9
11. Homicide .....	1.0	1.5	.6	1.1	1.1	1.6
All causes <sup>2</sup> .....	-167.9	-201.1	-137.8	-1.9%	-1.8%	-2.1%

\*Based on the average age-adjusted death rates for the individual calendar years. Values for 1969-71 are slightly adjusted to obtain comparability with the classification codes used for the 1979-81 values.

<sup>2</sup>Based on the average age-sex-adjusted death rates for the individual calendar years.

<sup>3</sup>Includes all other causes not listed above.

TABLE 5  
 EXPECTATIONS OF LIFE BY SEX,  
 U.S. LIFE TABLES FOR 1979-81

Age	Life Expectancy in Years			Ratio Female:Male
	Total	Male	Female	
0 .....	73.88	70.11	77.62	111%
1 .....	73.82	70.10	77.50	111
5 .....	70.00	66.29	73.67	111
10 .....	65.10	61.41	68.75	112
15 .....	60.19	56.52	63.83	113
20 .....	55.46	51.88	58.98	114
25 .....	50.81	47.37	54.16	114
30 .....	46.12	42.81	49.33	115
35 .....	41.43	38.20	44.53	117
40 .....	36.79	33.64	39.80	118
45 .....	32.27	29.22	35.17	120
50 .....	27.94	25.00	30.69	123
55 .....	23.85	21.08	26.39	125
60 .....	20.02	17.46	22.29	128
65 .....	16.51	14.21	18.44	130
70 .....	13.32	11.35	14.84	131
75 .....	10.48	8.90	11.58	130
80 .....	7.98	6.80	8.69	128
85 .....	5.96	5.13	6.38	124
90 .....	4.43	3.89	4.66	120
95 .....	3.34	2.98	3.48	117
100 .....	2.73	2.49	2.81	113
105 .....	2.38	2.22	2.44	110

TABLE 6  
 EXPECTATIONS OF LIFE FOR U.S. DECENNIAL LIFE TABLES,  
 SELECTED AGES BY SEX  
 (In years)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>c</sup>	1959-61	1969-71	1979-81
	Total								
0 .....	49.24	51.49	56.27*	59.41*	63.62	68.07	69.89	70.75	73.88
1 .....	55.20	57.11	59.84*	62.15*	65.76	69.16	70.75	71.19	73.82
20 .....	42.79	43.53	45.25*	46.11*	48.54	51.20	52.58	53.00	55.46
65 .....	11.86	11.60	12.47*	12.27*	12.80	13.83	14.39	15.00	16.51
	Males								
0 .....	47.88	49.86	55.34*	57.84*	61.60	65.47	66.80	67.04	70.11
1 .....	54.35	55.94	59.38*	60.89*	64.00	66.73	67.80	67.58	70.10
20 .....	42.03	42.48	44.88*	45.01*	46.91	48.92	49.77	49.54	51.88
65 .....	11.50	11.24	12.21*	11.76*	12.07	12.74	12.95	12.99	14.21
	Females								
0 .....	50.70	53.24	57.29*	61.16*	65.89	70.96	73.24	74.64	77.62
1 .....	56.10	58.37	60.34*	63.54*	67.73	71.84	73.93	74.97	77.50
20 .....	43.60	44.66	45.58*	47.33*	50.37	53.73	55.60	56.59	58.98
65 .....	12.22	11.96	12.75*	12.80*	13.57	14.95	15.80	16.83	18.44

\*Values estimated by authors.

<sup>a</sup>For the registration states of 1900.

<sup>b</sup>For the registration states of 1920.

<sup>c</sup>For contiguous United States.

TABLE 7

EXCESS OF EXPECTATIONS OF LIFE FOR DECENNIAL LIFE TABLES AS  
 COMPARED TO AVERAGES FROM THE ANNUAL, UNIFORM-METHODOLOGY LIFE TABLES  
 (In years)

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
	Males								
0 .....	0.12	-1.14	0.02	0.00	0.01	-0.05	-0.04	-0.10	0.02
20 .....	0.10	-0.47	0.02	-0.01	0.01	-0.05	-0.04	-0.09	0.02
65 .....	0.04	-0.24	0.10	0.02	0.03	-0.08	-0.07	-0.11	0.05
	Females								
0 .....	0.07	-1.12	-0.04	0.00	0.02	-0.09	-0.13	-0.20	-0.07
20 .....	0.12	-0.51	0.00	-0.01	0.03	-0.09	-0.14	-0.20	-0.08
65 .....	0.02	-0.26	0.08	0.01	0.03	-0.10	-0.16	-0.22	-0.08

TABLE 8  
MORTALITY RATES FOR OTHER-THAN-WHITE PERSONS.  
AS PERCENTAGES OF THOSE FOR BLACKS.  
U.S. LIFE TABLES FOR 1979-81

Age	Male	Female	Age	Male	Female
0 .....	90%	90%	45 .....	87%	89%
1 .....	94	94	50 .....	89	90
5 .....	92	93	55 .....	90	90
10 .....	91	96	60 .....	91	91
15 .....	99	100	65 .....	92	93
20 .....	96	97	70 .....	92	94
25 .....	92	94	75 .....	93	94
30 .....	87	90	80 .....	95	94
35 .....	86	89	85 .....	96	95
40 .....	86	90	90 .....	99	99

TABLE 9  
MORTALITY RATES FOR U.S. DECENNIAL LIFE TABLES,  
WHITE MALES  
(Rates per 100,000)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>b</sup>	1939-41 <sup>b</sup>	1949-51 <sup>c</sup>	1959-61	1969-71	1979-81
0	13,345	12,326	8,025	6,232	4,812	3,069	2,592	2,006	1,231
1	3,447	2,821	1,619	993	487	212	153	116	92
5	606	471	395	266	138	82	62	54	39
10	274	238	211	147	100	60	42	34	19
15	334	283	291	213	148	105	93	107	96
20	594	489	427	318	212	162	159	190	175
25	704	554	504	371	243	171	156	184	183
30	799	660	573	413	279	182	156	170	166
35	932	852	669	510	363	248	207	217	184
40	1,060	1,022	750	679	513	391	332	340	261
45	1,263	1,264	926	929	766	637	558	555	420
50	1,537	1,553	1,174	1,278	1,155	1,012	955	892	706
55	2,118	2,150	1,653	1,819	1,737	1,587	1,475	1,452	1,125
60	2,859	3,075	2,462	2,644	2,548	2,381	2,271	2,258	1,762
65	4,166	4,379	3,499	3,865	3,685	3,445	3,389	3,386	2,738
70	5,894	6,214	5,463	5,796	5,454	5,027	4,871	4,916	4,148
75	8,843	9,253	8,191	8,526	8,313	7,499	7,066	7,231	6,146
80	13,353	13,575	11,973	12,997	12,471	10,993	10,732	10,466	9,099
85	19,176	19,111	18,232	18,468	18,104	16,304	16,039	15,033	13,507
90	26,278	25,517	23,819	24,550	24,894	22,890	23,601	21,344	19,058

<sup>a</sup>For the registration states of 1900.

<sup>b</sup>For the registration states of 1920.

<sup>c</sup>For the contiguous United States.

TABLE 10  
MORTALITY RATES FOR U.S. DECENNIAL LIFE TABLES,  
WHITE FEMALES  
(Rates per 100,000)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>c</sup>	1959-61	1969-71	1979-81
0	11,061	10,226	6,392	4,963	3,789	2,355	1,964	1,532	965
1	3,115	2,583	1,459	879	432	189	135	101	77
5	589	447	349	220	110	60	47	40	28
10	246	206	179	113	70	40	28	25	17
15	339	265	249	164	96	53	41	46	40
20	554	420	433	277	145	73	56	64	56
25	679	522	552	339	182	88	65	68	58
30	772	603	603	374	220	115	85	84	65
35	839	713	642	433	278	161	122	122	90
40	931	803	676	532	368	242	190	193	143
45	1,063	991	814	702	523	373	303	308	231
50	1,337	1,259	1,067	959	762	561	473	466	376
55	1,869	1,793	1,463	1,375	1,128	853	687	699	579
60	2,506	2,583	2,173	2,063	1,714	1,340	1,088	1,027	889
65	3,641	3,786	3,168	3,125	2,643	2,063	1,742	1,563	1,359
70	5,369	5,663	5,023	4,866	4,233	3,409	2,836	2,513	2,092
75	8,039	8,252	7,597	7,460	6,889	5,650	4,742	4,255	3,315
80	12,115	12,579	11,341	11,742	10,819	9,060	8,213	7,128	5,589
85	17,460	17,832	17,044	17,086	16,294	13,965	13,625	11,465	9,463
90	24,532	24,759	23,061	23,151	23,141	20,657	22,560	17,570	14,831

<sup>a</sup>For the registration states of 1900.

<sup>b</sup>For the registration states of 1920.

<sup>c</sup>For the contiguous United States.

TABLE 11  
MORTALITY RATES FOR U.S. LIFE TABLES,  
OTHER-THAN-WHITE MALES  
(Rates per 100,000)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>d</sup>	1959-61	1969-71	1979-81
0	25,326	21,935	10,501	8,732	8,228	5,089	4,699	3,408	2,061
1	7,731	6,682	2,549	1,657	937	466	337	217	139
5	1,087	856	425	295	186	124	87	82	58
10	628	502	269	211	138	84	60	48	30
15	851	787	577	433	274	164	120	151	98
20	1,189	1,196	1,085	858	544	314	236	357	212
25	1,307	1,228	1,174	1,096	733	409	316	468	302
30	1,317	1,496	1,204	1,275	872	492	389	515	356
35	1,505	1,728	1,416	1,484	1,071	646	513	657	436
40	1,658	2,103	1,459	1,813	1,362	879	749	898	595
45	2,185	2,399	1,713	2,240	1,859	1,285	1,038	1,222	877
50	2,553	3,142	1,915	2,750	2,536	1,909	1,565	1,683	1,323
55	3,818	3,950	2,484	3,392	3,248	2,762	2,273	2,314	1,905
60	4,398	5,079	3,172	4,140	3,910	3,676	3,137	3,127	2,619
65	5,418	6,433	3,893	5,072	4,685	4,576	4,365	4,171	3,545
70	7,532	8,398	5,911	7,018	5,799	5,620	5,690	5,714	4,754
75	9,951	11,277	8,197	9,282	7,803	7,108	6,673	7,636	6,356
80	14,053	13,127	11,368	12,991	10,730	9,086	8,836	9,160	8,772
85	18,743	17,982	16,685	17,761	13,783	11,944	12,280	11,257	12,406
90	23,916	20,101	20,724	22,032	17,417	18,255	20,304	15,687	16,621

<sup>a</sup>For blacks only, in the registration states of 1900.

<sup>b</sup>For blacks only, in the registration states of 1920.

<sup>c</sup>For blacks only, in the contiguous United States.

<sup>d</sup>For the contiguous United States.

TABLE 12  
MORTALITY RATES FOR U.S. LIFE TABLES,  
OTHER-THAN-WHITE FEMALES  
(Rates per 100,000)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>d</sup>	1959-61	1969-71	1979-81
0	21,475	18,507	8,749	7,204	6,584	4,087	3,828	2,765	1,739
1	7,024	5,884	2,304	1,437	796	388	289	189	120
5	1,054	847	456	284	175	107	77	62	41
10	772	518	286	161	104	55	40	33	23
15	1,026	949	681	512	307	125	63	67	43
20	1,139	1,074	1,159	882	532	227	116	121	72
25	1,092	999	1,275	1,034	627	303	171	164	102
30	1,180	1,202	1,330	1,159	733	390	256	225	133
35	1,338	1,405	1,461	1,322	924	542	374	343	187
40	1,556	1,750	1,537	1,625	1,181	770	561	507	290
45	2,130	2,125	1,867	2,018	1,602	1,127	769	725	451
50	2,318	2,552	2,279	2,665	2,187	1,599	1,167	1,013	688
55	3,225	3,485	2,878	3,499	2,858	2,239	1,731	1,392	1,001
60	3,951	4,558	3,739	4,220	3,472	2,954	2,459	1,937	1,441
65	5,407	6,037	4,336	4,935	4,090	3,704	3,072	2,738	2,007
70	6,600	7,127	5,957	6,174	4,912	4,553	4,066	3,863	2,875
75	8,686	8,747	7,322	7,341	6,294	5,773	5,127	5,208	4,114
80	10,704	11,968	10,317	9,784	8,127	7,327	7,060	6,656	5,992
85	14,135	16,105	13,687	12,834	10,529	9,270	10,205	8,747	8,685
90	18,780	17,234	18,586	17,203	14,132	15,535	19,137	13,355	12,514

<sup>a</sup>For blacks only, in the registration states of 1900.

<sup>b</sup>For blacks only, in the registration states of 1920.

<sup>c</sup>For blacks only, in the contiguous United States.

<sup>d</sup>For the contiguous United States.

TABLE 13  
MORTALITY RATES FOR VARIOUS DECENNIAL LIFE TABLES,  
AS PERCENTAGES OF THOSE FOR 1900-02, WHITE MALES

Age	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	92%	60%	47%	36%	23%	19%	15%	9%
1	82	47	29	14	6	4	3	3
5	78	65	44	23	14	10	9	6
10	87	77	54	36	22	15	12	7
15	85	87	64	44	31	28	32	29
20	82	72	54	36	27	27	32	29
25	79	72	53	35	24	22	26	26
30	83	72	52	35	23	20	21	21
35	91	72	55	39	27	22	23	20
40	96	71	64	48	37	31	32	25
45	100	73	74	61	50	44	44	33
50	101	76	83	75	66	62	58	46
55	102	78	86	82	75	70	69	53
60	108	86	92	89	83	79	79	62
65	105	84	93	88	83	81	81	66
70	105	93	98	93	85	83	83	70
75	105	93	96	94	85	80	82	70
80	102	90	97	93	82	80	78	68
85	100	95	96	94	85	84	78	70
90	97	91	93	95	87	90	81	73

TABLE 14  
MORTALITY RATES FOR VARIOUS DECENNIAL LIFE TABLES,  
AS PERCENTAGES OF THOSE FOR 1900-02, WHITE FEMALES

Age	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	92%	58%	45%	34%	21%	18%	14%	9%
1	83	47	28	14	6	4	3	2
5	76	59	37	19	19	8	7	5
10	84	73	46	28	16	11	10	7
15	78	73	48	28	16	12	14	12
20	76	78	50	26	13	10	12	10
25	77	81	50	27	13	10	10	9
30	78	78	48	28	15	11	11	8
35	85	77	52	33	19	15	15	11
40	86	73	57	40	26	20	21	15
45	93	77	66	49	35	29	29	22
50	94	80	72	57	42	35	35	28
55	96	78	74	60	46	37	37	31
60	103	87	82	68	53	43	41	35
65	104	87	86	73	57	48	43	37
70	105	94	91	79	63	53	47	39
75	103	95	93	86	70	59	53	41
80	104	94	97	89	75	68	59	46
85	102	98	98	93	80	78	66	54
90	101	94	94	94	84	92	72	60

**TABLE 15**  
**MORTALITY RATES FOR VARIOUS DECENNIAL LIFE TABLES,**  
**AS PERCENTAGES OF THOSE FOR 1900-02, OTHER-THAN-WHITE MALES**

Age	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	87%	41%	34%	32%	20%	19%	13%	8%
1	86	33	21	12	6	4	3	2
5	79	39	27	17	11	8	8	5
10	80	43	34	22	13	10	8	5
15	92	68	51	32	19	14	18	12
20	101	91	72	46	26	20	30	18
25	94	90	84	56	31	24	36	23
30	114	91	97	66	37	30	39	27
35	115	94	99	71	43	34	44	29
40	127	88	109	82	53	45	54	36
45	110	78	103	85	59	48	56	40
50	123	75	108	99	75	61	66	52
55	103	65	89	85	72	60	61	50
60	115	72	94	89	84	71	71	60
65	119	72	94	86	84	81	77	65
70	111	78	93	77	75	76	76	63
75	113	82	93	78	71	67	77	64
80	93	81	92	76	65	63	65	62
85	96	89	95	74	64	66	60	66
90	84	87	92	73	76	85	66	69

**TABLE 16**  
**MORTALITY RATES FOR VARIOUS DECENNIAL LIFE TABLES,**  
**AS PERCENTAGES OF THOSE FOR 1900-02, OTHER-THAN-WHITE FEMALES**

Age	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	86%	41%	34%	31%	19%	18%	13%	8%
1	84	33	20	11	6	4	3	2
5	80	43	27	17	10	7	6	4
10	67	37	21	13	7	5	4	3
15	92	66	50	30	12	6	7	4
20	94	102	77	47	20	10	11	6
25	91	117	95	57	28	16	15	9
30	102	113	98	62	33	22	19	11
35	105	109	99	69	41	28	26	14
40	112	99	104	76	49	36	33	19
45	100	88	95	75	53	36	34	21
50	110	98	115	94	69	50	44	30
55	108	89	108	89	69	54	43	31
60	115	95	107	88	75	62	49	36
65	112	80	91	76	69	57	51	37
70	108	90	94	74	69	62	59	44
75	101	84	85	72	66	59	60	47
80	112	96	91	76	68	66	62	56
85	114	97	91	74	66	72	62	61
90	92	99	92	75	83	102	71	67

TABLE 17

MORTALITY RATES FOR FEMALES, AS PERCENTAGES OF MORTALITY RATES FOR MALES,  
FOR DECENNIAL LIFE TABLES, WHITE PERSONS

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	83%	83%	80%	80%	79%	77%	76%	76%	78%
1	90	92	90	89	89	89	88	87	84
5	97	95	88	83	80	73	76	74	72
10	90	87	85	77	70	67	67	74	89
15	101	94	86	77	65	50	44	43	42
20	93	86	101	87	68	45	35	34	32
25	96	94	110	91	75	51	42	37	32
30	97	91	105	91	79	63	54	49	39
35	90	84	96	85	77	65	59	56	49
40	88	79	90	78	72	62	57	57	55
45	84	78	88	76	68	59	54	55	55
50	87	81	91	75	66	55	50	52	53
55	88	83	89	76	65	54	47	48	51
60	88	84	88	78	67	56	48	45	50
65	87	86	91	81	72	60	51	46	50
70	91	91	92	84	78	68	58	51	50
75	91	89	93	87	83	75	67	59	54
80	91	93	95	90	87	82	77	68	61
85	91	93	93	93	90	86	85	76	70
90	93	97	97	94	93	90	96	82	78

TABLE 18

MORTALITY RATES FOR FEMALES, AS PERCENTAGES OF MORTALITY RATES FOR MALES,  
FOR DECENNIAL LIFE TABLES, OTHER-THAN-WHITE PERSONS

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0 .....	85%	84%	83%	83%	80%	80%	81%	81%	84%
1 .....	91	88	90	87	85	83	86	87	86
5 .....	97	99	107	96	94	86	89	76	71
10 .....	123	103	106	76	75	65	67	69	77
15 .....	121	121	118	118	112	76	52	44	44
20 .....	96	90	107	103	98	72	49	34	34
25 .....	84	81	109	94	86	74	54	35	34
30 .....	90	80	110	91	84	79	66	44	37
35 .....	89	81	103	89	86	84	73	52	43
40 .....	94	83	105	90	87	88	75	56	49
45 .....	97	89	109	90	86	88	74	59	51
50 .....	91	81	119	97	86	84	75	60	52
55 .....	84	88	116	103	88	81	76	60	53
60 .....	90	90	118	102	89	80	78	62	55
65 .....	100	94	111	97	87	81	70	66	55
70 .....	88	85	101	88	85	81	71	68	60
75 .....	87	78	89	79	81	81	77	68	65
80 .....	76	91	91	75	76	81	80	73	68
85 .....	75	90	82	72	76	78	83	78	70
90 .....	79	86	90	78	81	85	94	85	75

TABLE 19

MORTALITY RATES FOR OTHER-THAN-WHITE PERSONS, AS PERCENTAGES OF  
MORTALITY RATES FOR WHITE PERSONS, FOR DECENNIAL LIFE TABLES, MALES

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	190%	178%	131%	140%	171%	166%	181%	170%	167%
1	224	237	157	167	192	220	220	187	151
5	179	182	108	111	135	151	140	152	149
10	229	211	127	144	138	140	143	141	158
15	255	278	198	203	185	156	129	141	102
20	200	245	254	270	257	194	148	188	121
25	186	222	233	295	302	239	203	254	165
30	165	227	210	309	313	270	249	303	214
35	161	203	212	291	295	260	248	303	237
40	156	206	195	267	265	225	226	264	228
45	173	190	185	241	243	202	186	220	209
50	166	202	163	215	220	189	164	189	187
55	180	184	150	186	187	174	154	159	169
60	154	165	129	157	153	154	138	138	149
65	130	147	111	131	127	133	129	123	129
70	128	135	108	121	106	112	117	116	115
75	113	122	100	109	94	95	94	106	103
80	105	97	95	100	86	83	82	88	96
85	98	94	92	96	76	73	77	75	92
90	91	79	87	90	70	80	86	73	87

TABLE 20

MORTALITY RATES FOR OTHER-TAN-WHITE PERSONS, AS PERCENTAGES OF  
MORTALITY RATES FOR WHITE PERSONS, FOR DECENNIAL LIFE TABLES, FEMALES

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	194%	181%	137%	145%	174%	174%	195%	180%	180%
1	225	228	158	163	184	205	214	187	156
5	179	189	131	129	159	178	164	155	146
10	314	251	160	142	149	138	143	132	135
15	303	358	273	312	320	236	154	146	108
20	206	256	268	318	367	311	207	189	129
25	161	191	231	305	344	344	263	241	176
30	153	199	221	310	333	339	301	268	205
35	159	197	228	305	332	337	307	281	208
40	167	218	227	305	321	318	295	263	203
45	200	214	229	287	306	302	254	235	195
50	173	203	214	278	287	285	247	217	183
55	173	194	197	254	253	262	252	199	173
60	158	176	172	205	203	220	226	189	162
65	149	159	137	158	155	180	176	175	148
70	123	126	119	127	116	134	143	154	137
75	108	106	96	98	91	102	108	122	124
80	88	95	91	83	75	81	86	93	107
85	81	90	80	75	65	66	75	76	92
90	77	70	81	74	61	75	85	76	84

TABLE 21  
 EXPECTATIONS OF LIFE FOR U.S. DECENNIAL  
 LIFE TABLES, WHITE MALES  
 (In years)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>c</sup>	1959-61	1969-71	1979-81
0	48.23	50.23	56.34	59.12	62.81	66.31	67.55	67.94	70.82
1	54.61	56.26	60.24	62.04	64.98	67.41	68.34	68.33	70.70
5	54.43	55.37	58.31	59.38	61.68	63.77	64.61	64.55	66.87
10	50.59	51.32	54.15	54.96	57.03	58.98	59.78	59.69	61.98
15	46.25	46.91	49.74	50.39	52.33	54.18	54.93	54.83	57.09
20	42.19	42.71	45.60	46.02	47.76	49.52	50.25	50.22	52.45
25	38.52	38.79	41.60	41.78	43.28	44.93	45.65	45.70	47.92
30	34.88	34.87	37.65	37.54	38.80	40.29	40.97	41.07	43.31
35	31.29	31.08	33.74	33.33	34.36	35.68	36.31	36.43	38.66
40	27.74	27.43	29.86	29.22	30.03	31.17	31.73	31.87	34.04
45	24.21	23.86	26.00	25.28	25.87	26.87	27.34	27.48	29.55
50	20.76	20.39	22.22	21.51	21.96	22.83	23.22	23.34	25.26
55	17.42	17.03	18.59	17.97	18.34	19.11	19.45	19.51	21.25
60	14.35	13.98	15.25	14.72	15.05	15.76	16.01	16.07	17.56
65	11.51	11.25	12.21	11.77	12.07	12.75	12.97	13.02	14.26
70	9.03	8.83	9.51	9.20	9.42	10.07	10.29	10.38	11.35
75	6.84	6.75	7.30	7.02	7.17	7.77	7.92	8.06	8.87
80	5.10	5.09	5.47	5.26	5.38	5.88	5.89	6.18	6.76
85	3.81	3.88	4.06	3.99	4.02	4.35	4.34	4.63	5.09
90	2.85	2.99	3.18	3.03	3.06	3.27	3.16	3.49	3.83

<sup>a</sup>For the registration states of 1900.

<sup>b</sup>For the registration states of 1920.

<sup>c</sup>For the contiguous United States.

TABLE 22  
 EXPECTATIONS OF LIFE FOR U.S. DECENNIAL  
 LIFE TABLES, WHITE FEMALES  
 (In years)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>c</sup>	1959-61	1969-71	1979-81
0	51.08	53.62	58.53	62.67	67.29	72.03	74.19	75.49	78.22
1	56.39	58.69	61.51	64.93	68.93	72.77	74.68	75.66	77.98
5	56.03	57.67	59.43	62.17	65.57	69.09	70.92	71.86	74.13
10	52.15	53.57	55.17	57.65	60.85	64.26	66.05	66.97	69.21
15	47.79	49.12	50.67	53.00	56.07	59.39	61.15	62.07	64.29
20	43.77	44.88	46.46	48.52	51.38	54.56	56.29	57.24	59.44
25	40.05	40.88	42.55	44.25	46.78	49.77	51.45	52.42	54.60
30	36.42	36.96	38.72	39.99	42.21	45.00	46.63	47.60	49.76
35	32.82	33.09	34.86	35.73	37.70	40.28	41.84	42.82	44.93
40	29.17	29.26	30.94	31.52	33.25	35.64	37.13	38.12	40.16
45	25.51	25.45	26.98	27.39	28.90	31.12	32.53	33.54	35.49
50	21.89	21.74	23.12	23.41	24.72	26.76	28.08	29.11	30.96
55	18.43	18.18	19.40	19.60	20.73	22.58	23.81	24.85	26.61
60	15.23	14.92	15.93	16.05	17.00	18.64	19.69	20.79	22.45
65	12.23	11.97	12.75	12.81	13.56	15.00	15.88	16.93	18.55
70	9.59	9.38	9.94	9.98	10.50	11.68	12.38	13.37	14.89
75	7.33	7.20	7.62	7.56	7.92	8.87	9.28	10.21	11.58
80	5.50	5.35	5.70	5.63	5.88	6.59	6.67	7.59	8.65
85	4.10	4.06	4.24	4.24	4.34	4.83	4.66	5.54	6.32
90	3.02	3.00	3.16	3.17	3.24	3.51	3.23	4.05	4.59

<sup>a</sup>For the registration states of 1900.

<sup>b</sup>For the registration states of 1920.

<sup>c</sup>For the contiguous United States.

TABLE 23

EXPECTATIONS OF LIFE FOR U.S. DECENNIAL  
LIFE TABLES, OTHER-THAN-WHITE MALES  
(In years)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>d</sup>	1959-61	1969-71	1979-81
0	32.54	34.05	47.14	47.55	52.26	58.91	61.48	60.98	65.63
1	42.46	42.53	51.63	51.08	55.93	61.06	63.50	62.13	66.01
5	45.06	44.25	50.18	48.69	52.95	57.69	59.98	58.48	62.26
10	41.90	40.65	45.99	44.27	48.34	52.96	55.19	53.67	57.40
15	38.26	36.77	41.75	39.83	43.74	48.23	50.39	48.84	52.52
20	35.11	33.46	38.36	35.95	39.52	43.73	45.78	44.37	47.87
25	32.21	30.44	35.54	32.67	35.72	39.49	41.38	40.29	43.46
30	29.25	27.33	32.51	29.45	32.05	35.31	37.05	36.20	39.13
35	26.16	24.42	29.54	26.39	28.48	31.21	32.81	32.16	34.83
40	23.12	21.57	26.53	23.36	25.06	27.29	28.72	28.29	30.64
45	20.09	18.85	23.55	20.59	21.88	23.59	24.89	24.64	26.63
50	17.34	16.21	20.47	17.92	19.06	20.25	21.28	21.24	22.92
55	14.69	13.82	17.50	15.46	16.60	17.36	18.11	18.14	19.56
60	12.62	11.67	14.74	13.15	14.37	14.91	15.29	15.35	16.54
65	10.38	9.74	12.07	10.87	12.21	12.75	12.84	12.87	13.83
70	8.33	8.00	9.58	8.78	10.11	10.74	10.81	10.68	11.36
75	6.60	6.58	7.61	6.99	8.17	8.83	8.93	8.99	9.20
80	5.12	5.53	5.83	5.42	6.58	7.07	6.87	7.57	7.22
85	4.04	4.48	4.53	4.30	5.34	5.38	5.08	6.04	5.69
90	3.21	4.01	3.60	3.42	4.23	3.78	3.42	4.75	4.48

<sup>a</sup>For blacks only in the registration states of 1900.

<sup>b</sup>For blacks only in the registration states of 1920.

<sup>c</sup>For blacks only in the contiguous United States.

<sup>d</sup>For the contiguous United States.

TABLE 24  
 EXPECTATIONS OF LIFE FOR U.S. DECENNIAL  
 LIFE TABLES, OTHER-THAN-WHITE FEMALES  
 (In years)

Age	1900-02 <sup>a</sup>	1909-11 <sup>a</sup>	1919-21 <sup>b</sup>	1929-31 <sup>c</sup>	1939-41 <sup>c</sup>	1949-51 <sup>d</sup>	1959-61	1969-71	1979-81
0	35.04	37.67	46.92	49.51	55.56	62.70	66.47	69.05	74.00
1	43.54	45.15	50.39	52.33	58.46	64.37	68.10	70.01	74.31
5	46.04	46.42	48.70	49.81	55.40	60.93	64.54	66.34	70.53
10	43.02	42.84	44.54	45.33	50.75	56.17	59.72	61.49	65.64
15	39.79	39.18	40.36	40.87	46.13	51.36	54.85	56.60	60.73
20	36.89	36.14	37.15	37.22	42.04	46.77	50.07	51.85	55.88
25	33.90	32.97	34.35	33.93	38.20	42.35	45.40	47.19	51.11
30	30.70	29.61	31.48	30.67	34.40	38.02	40.83	42.61	46.39
35	27.52	26.44	28.58	27.47	30.71	33.82	36.41	38.14	41.72
40	24.37	23.34	25.60	24.30	27.19	29.82	32.16	33.87	37.16
45	21.36	20.43	22.61	21.39	23.89	26.07	28.14	29.80	32.77
50	18.67	17.65	19.76	18.60	20.95	22.67	24.31	25.97	28.59
55	15.88	14.98	17.09	16.27	18.38	19.62	20.89	22.37	24.66
60	13.60	12.78	14.69	14.22	16.10	16.95	17.83	19.02	20.99
65	11.38	10.82	12.41	12.24	13.93	14.54	15.12	15.99	17.60
70	9.62	9.22	10.25	10.38	11.82	12.29	12.46	13.30	14.44
75	7.90	7.55	8.37	8.62	9.81	10.15	10.10	11.06	11.68
80	6.48	6.05	6.58	6.90	8.02	8.15	7.66	9.01	9.17
85	5.10	5.09	5.22	5.48	6.41	6.15	5.44	7.07	7.19
90	4.01	4.50	4.07	4.20	4.96	4.13	3.52	5.44	5.49

<sup>a</sup>For blacks only in the registration states of 1900.

<sup>b</sup>For blacks only in the registration states of 1920.

<sup>c</sup>For blacks only in the contiguous United States.

<sup>d</sup>For the contiguous United States.

TABLE 25  
 EXCESS OF EXPECTATIONS OF LIFE FOR DECENNIAL  
 LIFE TABLES, WHITE FEMALES OVER WHITE MALES  
 (In years)

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	2.85	3.39	2.19	3.55	4.48	5.72	6.64	7.55	7.40
1	1.78	2.43	1.27	2.89	3.95	5.36	6.34	7.33	7.28
5	1.60	2.30	1.12	2.79	3.89	5.32	6.31	7.31	7.26
10	1.56	2.25	1.02	2.69	3.82	5.28	6.27	7.28	7.23
15	1.54	2.21	.93	2.61	3.74	5.21	6.22	7.24	7.20
20	1.58	2.17	.86	2.50	3.62	5.04	6.04	7.02	6.99
25	1.53	2.09	.95	2.47	3.50	4.84	5.80	6.72	6.68
30	1.54	2.09	1.07	2.45	3.41	4.71	5.66	6.53	6.45
35	1.53	2.01	1.12	2.40	3.34	4.60	5.53	6.39	6.27
40	1.43	1.83	1.08	2.30	3.22	4.47	5.40	6.25	6.12
45	1.30	1.59	.98	2.11	3.03	4.25	5.19	6.06	5.94
50	1.13	1.35	.90	1.90	2.76	3.93	4.86	5.77	5.70
55	1.01	1.15	.81	1.63	2.39	3.47	4.36	5.34	5.36
60	.88	.94	.68	1.33	1.95	2.88	3.68	4.72	4.89
65	.72	.72	.54	1.04	1.49	2.25	2.91	3.91	4.29
70	.56	.55	.43	.78	1.08	1.61	2.09	2.99	3.54
75	.49	.45	.32	.54	.75	1.10	1.36	2.15	2.71
80	.40	.26	.23	.37	.50	.71	.78	1.41	1.89
85	.29	.18	.18	.25	.32	.48	.32	.91	1.23
90	.17	.01	-.02	.14	.18	.24	.07	.56	.76

TABLE 26

EXCESS OF EXPECTATIONS OF LIFE FOR DECENNIAL  
LIFE TABLES, OTHER-THAN-WHITE FEMALES OVER OTHER-THAN-WHITE MALES  
(In years)

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	2.50	3.62	-0.22	1.96	3.30	3.79	4.99	8.07	8.37
1	1.08	2.62	-1.24	1.25	2.53	3.31	4.60	7.88	8.30
5	.98	2.17	-1.48	1.12	2.45	3.24	4.56	7.86	8.27
10	1.12	2.19	-1.45	1.06	2.41	3.21	4.53	7.82	8.24
15	1.53	2.41	-1.39	1.04	2.39	3.13	4.46	7.76	8.21
20	1.78	2.68	-1.21	1.27	2.52	3.04	4.29	7.48	8.01
25	1.69	2.53	-1.19	1.26	2.48	2.86	4.02	6.90	7.65
30	1.45	2.28	-1.03	1.22	2.35	2.71	3.78	6.41	7.26
35	1.36	2.02	-.96	1.08	2.23	2.61	3.60	5.98	6.89
40	1.25	1.77	-.93	.94	2.13	2.53	3.44	5.58	6.52
45	1.27	1.58	-.94	.80	2.01	2.48	3.25	5.16	6.14
50	1.33	1.44	-.71	.68	1.89	2.42	3.03	4.73	5.67
55	1.19	1.16	-.41	.81	1.78	2.26	2.78	4.23	5.10
60	.98	1.11	-.05	1.07	1.73	2.04	2.54	3.67	4.45
65	1.00	1.08	.34	1.37	1.72	1.79	2.28	3.12	3.77
70	1.29	1.22	.67	1.60	1.71	1.55	1.65	2.62	3.08
75	1.30	.97	.76	1.63	1.64	1.32	1.17	2.07	2.48
80	1.36	.52	.75	1.48	1.44	1.08	.79	1.44	1.95
85	1.06	.61	.69	1.18	1.07	.77	.36	1.03	1.50
90	.80	.49	.47	.78	.73	.35	.10	.69	1.01

TABLE 27  
 EXCESS OF EXPECTATIONS OF LIFE FOR DECENNIAL  
 LIFE TABLES, WHITE MALES OVER OTHER-THAN-WHITE MALES  
 (In years)

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	15.69	16.18	9.20	11.57	10.55	7.40	6.07	6.96	5.19
1	12.15	13.73	8.61	10.96	9.05	6.35	4.84	6.20	4.69
5	9.37	11.12	8.13	10.69	8.73	6.08	4.63	6.07	4.61
10	8.69	10.67	8.16	10.69	8.69	6.02	4.59	6.02	4.58
15	7.99	10.14	7.99	10.56	8.59	5.95	4.54	5.99	4.57
20	7.08	9.25	7.24	10.07	8.24	5.79	4.47	5.85	4.58
25	6.31	8.35	6.06	9.11	7.56	5.44	4.27	5.41	4.46
30	5.63	7.54	5.14	8.09	6.75	4.98	3.92	4.87	4.18
35	5.13	6.66	4.20	6.94	5.88	4.47	3.50	4.27	3.83
40	4.62	5.86	3.33	5.86	4.97	3.88	3.01	3.58	3.40
45	4.12	5.01	2.45	4.69	3.99	3.28	2.45	2.84	2.92
50	3.42	4.18	1.75	3.59	2.90	2.58	1.94	2.10	2.34
55	2.73	3.21	1.09	2.51	1.74	1.75	1.34	1.37	1.69
60	1.73	2.31	.51	1.57	.68	.85	.72	.72	1.02
65	1.13	1.51	.14	.90	-.14	.00	.13	.15	.43
70	.70	.83	-.07	.42	-.69	-.67	-.52	-.30	-.01
75	.24	.17	-.31	.03	-1.00	-1.06	-1.01	-.93	-.33
80	-.02	-.44	-.36	-.16	-1.20	-1.19	-.98	-1.39	-.46
85	-.23	-.60	-.47	-.31	-1.32	-1.03	-.74	-1.41	-.60
90	-.36	-1.02	-.42	-.39	-1.17	-.51	-.26	-1.26	-.65

TABLE 28  
 EXCESS OF EXPECTATIONS OF LIFE FOR DECENNIAL  
 LIFE TABLES, WHITE FEMALES OVER OTHER-THAN-WHITE FEMALES  
 (In years)

Age	1900-02	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71	1979-81
0	16.04	15.95	11.61	13.16	11.73	9.33	7.72	6.44	4.22
1	12.85	13.54	11.12	12.60	10.47	8.40	6.58	5.65	3.67
5	9.99	11.25	10.73	12.36	10.17	8.16	6.38	5.52	3.60
10	9.13	10.73	10.63	12.32	10.10	8.09	6.33	5.48	3.57
15	8.00	9.94	10.31	12.13	9.94	8.03	6.30	5.47	3.56
20	6.88	8.74	9.31	11.30	9.34	7.79	6.22	5.39	3.56
25	6.15	7.91	8.20	10.32	8.58	7.42	6.05	5.23	3.49
30	5.72	7.35	7.24	9.32	7.81	6.98	5.80	4.99	3.37
35	5.30	6.65	6.28	8.26	6.99	6.46	5.43	4.68	3.21
40	4.80	5.92	5.34	7.22	6.06	5.82	4.97	4.25	3.00
45	4.15	5.02	4.37	6.00	5.01	5.05	4.39	3.74	2.72
50	3.22	4.09	3.36	4.81	3.77	4.09	3.77	3.14	2.37
55	2.55	3.20	2.31	3.33	2.35	2.96	2.92	2.48	1.95
60	1.63	2.14	1.24	1.83	.90	1.69	1.86	1.77	1.46
65	.85	1.15	.34	.57	—	.46	.76	.94	.95
70	— .03	.16	— .31	— .40	— 1.32	— .61	— .08	.07	.45
75	— .57	— .35	— .75	— 1.06	— 1.89	— 1.28	— .82	— .85	— .10
80	— .98	— .70	— .88	— 1.27	— 2.14	— 1.56	— .99	— 1.42	— .52
85	— 1.00	— 1.03	— .98	— 1.24	— 2.07	— 1.32	— .78	— 1.53	— .87
90	— .99	— 1.50	— .91	— 1.03	— 1.72	— .62	— .29	— 1.39	— .90

TABLE 29  
MORTALITY RATES FOR WHITE PERSONS BY SEX FOR AGES 15-35.  
U.S. LIFE TABLES FOR 1939-41 TO 1979-81  
(Rates per 100,000)

Age	1939-41	1949-51	1959-61	1969-71	1979-81
	Males				
15 .....	143	105	93	107	96
16 .....	158	120	111	134	118
17 .....	172	133	126	156	137
18 .....	186	143	139	172	151
19 .....	199	153	149	181	163
20 .....	212	162	159	190	175
21 .....	223	169	169	201	186
22 .....	232	174	174	205	193
23 .....	238	176	172	203	193
24 .....	241	174	165	195	189
25 .....	243	171	156	184	183
26 .....	245	168	149	173	177
27 .....	251	169	145	165	172
28 .....	259	172	145	162	168
29 .....	268	176	149	165	167
30 .....	279	182	156	170	166
31 .....	291	190	163	176	165
32 .....	306	201	171	183	166
33 .....	323	214	181	192	169
34 .....	342	230	193	203	175
35 .....	363	248	207	217	184
	Females				
15 .....	96	53	41	46	40
16 .....	107	59	47	55	47
17 .....	117	63	51	61	52
18 .....	126	67	54	64	54
19 .....	136	70	55	64	55
20 .....	145	73	56	64	56
21 .....	154	76	58	65	57
22 .....	162	79	60	65	57
23 .....	170	82	62	66	58
24 .....	176	85	63	67	58
25 .....	182	88	65	68	58
26 .....	188	92	68	70	58
27 .....	195	96	71	72	59
28 .....	203	102	74	75	60
29 .....	211	108	79	79	63
30 .....	220	115	85	84	65
31 .....	230	122	91	90	68
32 .....	240	131	97	97	72
33 .....	252	140	105	104	77
34 .....	264	150	113	113	83
35 .....	278	161	122	122	90

TABLE 30  
MORTALITY RATES FOR OTHER-THAN-WHITE PERSONS BY SEX  
FOR AGES 15-35, U.S. LIFE TABLES FOR 1939-41 TO 1979-81  
(Rates per 100,000)

Age	1939-41*	1949-51	1959-61	1969-71	1979-81
	Males				
15 .....	274	164	120	151	98
16 .....	320	192	140	190	119
17 .....	369	220	162	230	140
18 .....	422	249	186	270	162
19 .....	483	282	210	309	186
20 .....	544	314	236	357	212
21 .....	602	344	262	410	239
22 .....	650	369	283	452	262
23 .....	685	387	298	473	279
24 .....	711	399	307	475	291
25 .....	733	409	316	468	302
26 .....	754	420	327	464	314
27 .....	780	435	339	464	325
28 .....	810	452	353	474	335
29 .....	840	471	370	494	346
30 .....	872	492	389	515	356
31 .....	906	515	409	535	367
32 .....	943	543	431	558	379
33 .....	983	574	455	587	395
34 .....	1,025	608	483	621	413
35 .....	1,071	646	513	657	436
	Females				
15 .....	307	125	63	67	43
16 .....	371	150	73	80	49
17 .....	424	173	84	93	55
18 .....	465	192	94	103	60
19 .....	501	210	104	111	66
20 .....	532	227	116	121	72
21 .....	559	244	128	132	78
22 .....	583	261	140	141	84
23 .....	603	276	150	150	90
24 .....	616	290	160	157	96
25 .....	627	303	171	164	102
26 .....	640	318	182	173	109
27 .....	657	334	197	183	115
28 .....	680	352	214	195	121
29 .....	705	370	234	210	127
30 .....	733	390	256	225	133
31 .....	764	413	279	242	140
32 .....	799	439	303	262	148
33 .....	837	470	326	286	159
34 .....	880	504	350	313	172
35 .....	924	542	374	343	187

\*Mortality rates for 1939-41 based on the black population only.

**TABLE 31**  
**COEFFICIENT OF DETERMINATION ( $R^2$ ),**  
**U.S. LIFE TABLES FOR 1939-41 TO 1979-81\***

Color and Sex	1939-41	1949-51	1959-61	1969-71	1979-81
White males . . . . .	0.961	0.893	0.776	0.648	0.564
White females . . . . .	0.975	0.988	0.974	0.920	0.848
Other-than-white males . . .	0.904†	0.927	0.934	0.814	0.848
Other-than-white females	0.840†	0.937	0.987	0.966	0.975

\*See text for a description of the coefficient.

†Based on the black population only.

**TABLE 32**  
**INFANT MORTALITY RATES IN SELECTED COUNTRIES**

Country	Rate per 100,000		Decrease from 1970 to 1980	As Percentage of Rate for U.S.	
	Circa 1970	Circa 1980		Circa 1970	Circa 1980
	Males				
United States . . . . .	2,245	1,393	38%	100	100
Canada . . . . .	2,130	1,260	41	95	90
France . . . . .	1,760	1,230	30	78	88
Germany, West . . . . .	2,630	1,450	45	117	104
Italy . . . . .	3,340	1,900	43	149	136
Japan . . . . .	1,500	840	44	67	60
Netherlands . . . . .	1,380	1,000	28	61	72
Norway . . . . .	1,650	900	45	73	65
Sweden . . . . .	1,330	810	39	59	58
Switzerland . . . . .	1,800	1,030	43	80	74
United Kingdom . . . . .	2,050	1,365	33	91	98
U.S.S.R. . . . .	2,690	*	*	120	*
	Females				
United States . . . . .	1,746	1,120	36%	100	100
Canada . . . . .	1,630	980	40	93	88
France . . . . .	1,350	900	33	77	80
Germany, West . . . . .	2,000	1,150	42	115	103
Italy . . . . .	2,680	1,470	45	153	131
Japan . . . . .	1,170	660	44	67	59
Netherlands . . . . .	1,010	740	27	58	66
Norway . . . . .	1,140	710	38	65	63
Sweden . . . . .	960	570	41	55	51
Switzerland . . . . .	1,320	770	42	76	69
United Kingdom . . . . .	1,560	1,098	30	89	98
U.S.S.R. . . . .	2,160	*	*	124	*

\*Not available.

Source: Various issues of *United Nations Demographic Yearbook*.

**TABLE 33**  
**EXPECTATION OF LIFE AT BIRTH IN SELECTED COUNTRIES**

Country	Expectation of Life (In years)		Increase from 1970 to 1980	As Percentage of Life Expectancy for U.S.	
	Circa 1970	Circa 1980		Circa 1970	Circa 1980
	Males				
United States . . . . .	67.04	70.11	4.6%	100	100
Canada . . . . .	69.34	71.88	3.7	103	103
France . . . . .	68.40	70.05	2.4	102	100
Germany, West . . . . .	67.25	69.60	3.5	100	99
Italy . . . . .	68.97	70.41	2.1	103	100
Japan . . . . .	69.60	73.32	5.3	104	105
Netherlands . . . . .	71.00	72.40	2.0	106	103
Norway . . . . .	71.20	72.25	1.5	106	103
Sweden . . . . .	71.95	72.76	1.1	107	104
Switzerland . . . . .	70.15	*	*	105	*
United Kingdom . . . . .	67.10	70.20	4.6	100	100
U.S.S.R. . . . .	64.00	*	*	95	*
	Females				
United States . . . . .	74.64	77.62	4.0%	100	100
Canada . . . . .	76.36	78.98	3.4	102	102
France . . . . .	76.00	78.20	2.9	102	101
Germany, West . . . . .	73.56	76.36	3.8	99	98
Italy . . . . .	74.88	76.94	2.8	100	99
Japan . . . . .	74.97	78.83	5.1	100	102
Netherlands . . . . .	76.70	78.90	2.9	103	102
Norway . . . . .	77.30	79.00	2.2	104	102
Sweden . . . . .	77.00	78.81	2.4	103	102
Switzerland . . . . .	76.17	*	*	102	*
United Kingdom . . . . .	73.36	76.23	3.9	98	98
U.S.S.R. . . . .	74.00	*	*	99	*

\*Not available.

Source: Various issues of *United Nations Demographic Yearbook* and Canadian and U.K. government officials.

**TABLE 34**  
**EXPECTATION OF LIFE AT AGE 65 IN SELECTED COUNTRIES**

Country	Expectation of Life (In years)		Increase from 1970 to 1980	As Percentage of Life Expectancy for U.S.	
	Circa 1970	Circa 1980		Circa 1970	Circa 1980
	Males				
United States . . . . .	12.99	14.21	9.4%	100	100
Canada . . . . .	13.72	14.57	6.2	106	103
France . . . . .	13.00	13.81	6.2	100	97
Germany, West . . . . .	11.92	12.90	8.2	92	91
Italy . . . . .	13.30	13.44	1.1	102	95
Japan . . . . .	12.69	14.50	14.2	98	102
Netherlands . . . . .	13.60	14.00	2.9	105	99
Norway . . . . .	13.90	14.24	2.4	107	100
Sweden . . . . .	14.02	14.30	2.0	108	101
Switzerland . . . . .	13.31	*	*	102	*
United Kingdom . . . . .	12.00	12.60	5.0	92	89
U. S. S. R. . . . .	*	*	*	*	*
	Females				
United States . . . . .	16.83	18.44	9.6%	100	100
Canada . . . . .	17.47	18.85	7.9	104	102
France . . . . .	16.80	18.07	7.6	100	98
Germany, West . . . . .	15.00	16.55	10.3	89	90
Italy . . . . .	16.15	16.71	3.5	96	91
Japan . . . . .	15.54	17.74	14.2	92	96
Netherlands . . . . .	16.60	18.20	9.6	99	99
Norway . . . . .	16.80	17.91	6.6	100	97
Sweden . . . . .	16.70	17.92	7.3	99	97
Switzerland . . . . .	16.30	*	*	97	*
United Kingdom . . . . .	16.00	16.58	3.6	95	91
U. S. S. R. . . . .	*	*	*	*	*

\*Not available.

Source: Various issues of *United Nations Demographic Yearbook* and Canadian and U.K. government officials.

## DISCUSSION OF PRECEDING PAPER

ROBERT J. JOHANSEN:

The authors are to be thanked for making available various mortality rates from the new 1979–81 U.S. Life Tables and for comparing these with earlier decennial tables. Their analyses dramatically illustrate the long-term improvement in mortality which has recently extended to the very high ages. They have also drawn attention to the problem of obtaining sufficient, reliable information at the very high ages. Because of the volume of data, population mortality rates should provide reliable comparisons from one period to the next, between male and female, and so on.

Nevertheless, some caution must be exercised when interpreting comparisons and trends. For example, during the period of the expanding number of death registration states, mortality improvement rates might have been affected by the increased proportion of experience in the less developed areas of the country. This may explain the apparent lack of mortality improvement among nonwhites, in particular, during this period when progress in public health was a factor.

Similarly, white versus nonwhite mortality comparisons reflect differences in average economic circumstances and associated ways of life. Further, the improvement in economic circumstances and access to health care for nonwhites may explain their greater rate of improvement in mortality. A like situation was observed some years ago when the mortality of industrial life insurance policyholders improved at a faster rate than that of the general population. (Cf. L.I. Dublin and M. Spiegelman, "Health Progress among Industrial Policyholders, 1946 to 1950," *TSA* III (1951), 294.)

As an example of the usefulness of population statistics, we might consider the following test, keeping in mind, however, that we should expect the mortality of the population to improve at a faster rate than that of annuitants who, as a group, are probably in better economic circumstances than the population as a whole.

About a year ago, the use of population mortality improvement rates was suggested to the National Association of Insurance Commissioners Life and Health Technical Task Force, as one of two tests to check on the adequacy of the 1983 Table *A* individual annuity mortality table as a valuation standard. One of those tests was based on the mortality improvement from the 1969–71 to the 1979–81 life tables for white males and white females. The other test requires the availability of the Society's next compilation of individual annuity experience, which will not be published until at least 1987.

Use of the white population experience reduces, but does not eliminate, the greater effect of socioeconomic improvement among the general population than among annuitants. *A priori*, we would expect the population improvement rates to be somewhat higher than those of annuitants, reflecting several factors: the increase in the numbers of retired people receiving pensions and higher payments (including Social Security payments); employer-provided health care insurance; Medicare; improved employment environment prior to retirement; and improved average standard of living of the elderly.

The first step in the test is to obtain, by age group, annual rates of mortality improvement among the U.S. white population over the ten-year period. The second step is to compare these rates with the annual improvement rates used to derive the 1983 Basic Table from the 1973 Experience Table. The 1973 Table was based on the Society's published experience on individual annuities from 1971 to 1976 contract anniversaries. The latter improvement rates appear in *TSA XXXIII*, page 692. The following table compares the two sets of improvement rates, separately for males and females. It is interesting to note that the authors of the paper remarked on the similarity of improvement rates of males and females over the period; the Committee which produced the 1983 table had made a similar observation and chose to use the same improvement rates for both male and female annuitants.

The table indicates that the male improvement rates are fairly close for the two groups, with margins in favor of the annuitant tables. Female annuitant improvement rates were somewhat higher than the population rates in the 60s, and somewhat lower in the late 70s and early 80s. A 1 percent difference in improvement rates over a period of years is not insignificant. For example, a 1.5 percent annual improvement rate over ten years yields a total improvement of 14 percent; a 2.5 percent rate over the same period yields a 22 percent improvement—half again larger.

COMPARISON OF ANNUAL MORTALITY IMPROVEMENT RATES

AGE	MALES			FEMALES		
	1969/71 to 1979/81	1973 to 1983	Pop.-Ann.	1969/71 to 1979/81	1973 to 1983	Pop.-Ann.
50 . . . .	2.31%	2.50%	-0.19	2.12%	2.50%	-0.38
55 . . . .	2.52	2.50	0.02	1.87	2.50	-0.63
60 . . . .	2.45	2.50	-0.05	1.43	2.50	-1.07
65 . . . .	2.10	2.50	-0.40	1.39	2.50	-1.11
70 . . . .	1.68	2.50	-0.82	1.82	2.50	-0.68
75 . . . .	1.61	1.85	-0.24	2.47	1.85	0.62
80 . . . .	1.39	1.60	-0.21	2.40	1.60	0.80
85 . . . .	1.06	1.50	-0.44	1.90	1.50	0.40
90 . . . .	1.13	1.50	-0.37	1.68	1.50	0.18

The population improvement rates of males and females seem to present quite different patterns: the male rates decrease steadily from the 50s while those of females increase from the 60s to the 70s and then remain at a higher level than those of males. (Note that the improvement rates in Table 3 of the paper are for total males and total females.)

Based on our table and considering that we expect the general population to experience higher improvement rates than annuitants, the 1983 Table *a* is adequate for males and is probably adequate for females.

ROBERT L. BROWN:

This paper will prove to be a valuable addition to the actuarial literature, as would be anticipated given the authors. Two points which were raised somewhat tangentially in the paper deserve further comment.

In section III of the paper, the authors comment on the significant reduction in mortality during the 1970s. They go on to say that "it is doubtful that such a substantial rate of decrease can continue during the 1980s."

In a paper entitled "The Deviant Dynamics of Death in Heterogeneous Populations," J.W. Vaupal and A.I. Yashin seem to indicate otherwise. In this paper, Vaupal and Yashin argue that the observed rate of progress in reducing the *population* death rate at any age  $x$  will be less than, but will approach over time, the rate of progress in reducing *individual* death rates at age  $x$ .

As United States death rates at younger ages have improved, more frail individuals have survived to older ages where they die relatively easily, thus raising the population mortality rates at older ages even while individual mortality rates improve. That is, reductions in mortality rates at younger ages have served as a brake or counter-current on observed reductions in population mortality rates at the older ages. The heterogeneity of the population masked the true rate of progress in reducing mortality rates in the 1960s.

As improvements in mortality at younger ages have become less significant (nearing their lower bound), the older population takes on a more consistent profile with time (becoming more homogeneous over time), and the long-term true rate of individual improvement in mortality now reveals itself for the first time in the population statistics.

I think Vaupal and Yashin would argue that the rapid rates of mortality improvement during the 1970s were there for individuals in the 1960s but were masked by the heterogeneity of the population. That being true, we may want to rethink our projected rate of possible mortality improvement.

The second point of discussion is not related to the first. In table 31, the authors calculate a number of coefficients of determination ( $R^2$ ) and then

conclude that “these figures show that white male mortality has been consistently moving away from an exponential curve.” I wonder if the authors are giving the  $R^2$  statistics too much power, as other authors have done.

Suppose that a straight line (any other function could be used) has been fitted to some data. Let  $d_1, d_2, \dots, d_n$  represent the vertical deviations of the  $n$  observed points from the fitted line (called residuals). Let  $D_1, D_2, \dots, D_n$  represent the vertical deviations of the  $n$  points from their arithmetic mean. (See figure 1). Then the coefficient of determination is:

$$R^2 = 1 - \frac{d_1^2 + d_2^2 + \dots + d_n^2}{D_1^2 + D_2^2 + \dots + D_n^2} \quad 0 \leq R^2 \leq 1.$$

A large value of  $R^2$  (near 1) can come either from small  $d$ 's or from large  $D$ 's.

For another example, see figure 2. Here, trend lines have been fitted to two data sets. The residuals,  $d_i$ , are exactly the same in both cases. The two

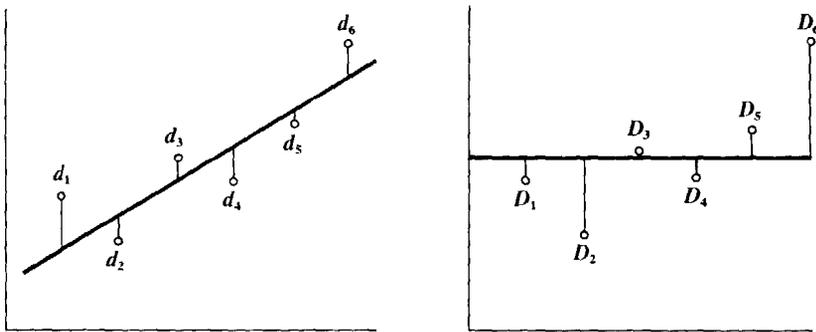


FIG. 1—Definition of the coefficient of determination  $R^2 = 1 - \frac{d_1^2 + d_2^2 + \dots + d_n^2}{D_1^2 + D_2^2 + \dots + D_n^2}$

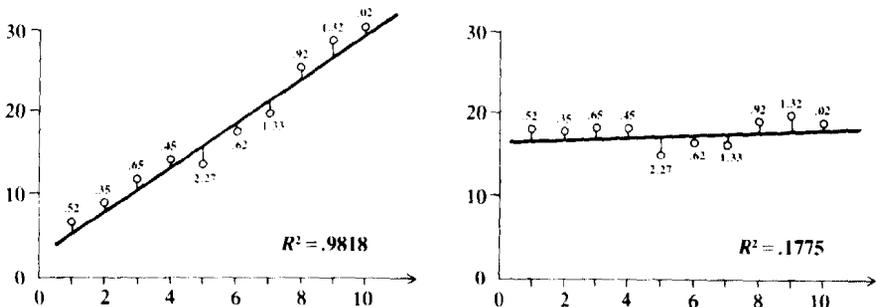


FIG. 2—Example of two trend lines with the same residuals but different  $R^2$  values

trend lines give an equally good fit and should be considered equally reliable. However, the first line has  $R^2 = 0.9818$ , while the second line has  $R^2 = 0.1775$ . (My thanks to Professor Jim Kalbfleisch for this nice example.)

In conclusion, the coefficient of determination cannot be used to draw the conclusions drawn by the authors. One could just as easily explain the  $R^2$  factor by saying that  $\beta$  (the slope estimate) is decreasing or total variability  $\sum (y_i - y)^2$  is increasing, or a straight line fits less well and so on. A graph of the data and fitted line might be examined in order to help with the interpretation of  $R^2$ .

These comments are of only tangential consequence and should not detract from the overall excellence of the presentation. I thank the authors for their paper.

(AUTHORS' REVIEW OF DISCUSSION)

ROBERT J. MYERS AND FRANCISCO R. BAYO:

We thank Messrs. Johansen and Brown for their kind words about our paper. We agree with Mr. Johansen's comments about the caution that must be exercised when interpreting comparisons and trends and about the usefulness of the observed population rates in developing annuitant tables. Regarding Mr. Brown's comments, we have some disagreement, and we would like to reply to the two points raised in his discussion.

The first point refers to the effect that earlier significant improvements at the younger ages have on the observed overall population mortality rates at the older ages. We find the argument presented to be very appealing. Intellectually, we could easily assent to that argument. However, long years of work in this area lead us to believe that patterns of mortality experience are rather more complex than we would prefer and that it is possible to jump to conclusions on the basis of an unproven hypothesis.

One difficulty with Mr. Brown's argument is that it is hard to postulate it as a hypothesis. The scientific tests necessary to elevate such a hypothesis into theory would be almost impossible to accomplish. To consider such a hypothesis as a law of mortality and to proceed to base our projection on it would not be acceptable.

Because a large proportion of the mortality improvement at the younger ages came as a result of the conquering of infectious and communicable diseases, we have difficulty in conceptualizing as "frail" those individuals who were spared a bout with communicable diseases, due to better sanitation, or whose diseases were diagnosed at an early stage and properly treated while they were young.

Mr. Brown's argument, however, goes further. It requires that we assume

that those who survived the early communicable diseases then would die "relatively easily" from totally unrelated degenerative diseases.

We prefer to stay within the historical context presented in the paper, from which it is obvious that an annual rate of decline in mortality of 2 percent in the 1970s is significantly above the norm.

Provisional mortality statistics show that, in the first four years of the 1980s, the rate of decline in the age-and-sex-adjusted death rate has slowed to about 1 percent per year. This is about half the rate of decline experienced in the 1970s.

With respect to Mr. Brown's second point, we would like to retain our original interpretation. It is true, as Mr. Brown states, that a large value of  $R^2$  can come from either small  $d$ 's or large  $D$ 's. But that is the way it should be. Whether a bulge or a trough is large or small depends on the values surrounding them. A good measure of their size should refer to the general pattern and level of mortality in the specific table and not to the absolute size of the bulge or trough. This is fairly well captured by the coefficient of determination,  $R^2$ .

In case this theoretical discussion has not been sufficiently persuasive regarding the validity of our conclusion about white male mortality, we computed the following table using Mr. Brown's terminology of  $d$ 's and  $D$ 's:

Item	1939-41	1949-51	1959-61	1969-71	1979-81
Sum of $d$ 's	0.046	0.140	0.352	0.724	1.188
Sum of $D$ 's	1.182	1.306	1.574	2.059	2.727
$R^2$	.961	.893	.776	.648	.564

These values are based on the same logarithm of the single-year mortality rates for white males from ages 10 to 40 used to compute the coefficient of determination presented in the paper. They show that the  $R^2$  is not decreasing with time because of a decreasing sum of  $D$ 's, as Mr. Brown fears. The sum of  $D$ 's are instead increasing. What has happened, however, is that the sum of  $d$ 's have been increasing even faster. This means that, when the data are analyzed in terms of the  $D$ 's and  $d$ 's, as Mr. Brown would prefer, a stronger case can be made for our observation that white male mortality at the young adult ages has been consistently moving away from an exponential curve.