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United States Life Tables, 2000

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Abstract

This report presents period life tables for the United States based on age-specific death rates in 2000. Data used to prepare these life tables are 2000 final mortality statistics; July 1, 2000, population estimates based on the 1990 decennial census; and data from the Medicare program. Presented are complete life tables by age, race, and sex. In 2000 the overall expectation of life at birth was 76.9 years, representing an increase of 0.2 years from life expectancy in 1999. Between 1999 and 2000, life expectancy increased for both males and females and for both the white and black populations. Life expectancy increased by 0.4 years for black males (from 67.8 to 68.2) and by 0.2 years for white males (from 74.6 to 74.8). It increased by 0.2 years for black females (from 74.7 to 74.9) and by 0.1 year for white females (from 79.9 to 80.0).

Introduction

There are two types of life tables—the cohort (or generation) life table and the period (or current) life table. The cohort life table presents the mortality experience of a particular birth cohort, all persons born in the year 1900, for example, from the moment of birth through consecutive ages in successive calendar years. Based on age-specific death rates observed through consecutive calendar years, the cohort life table reflects the mortality experience of an actual cohort from birth until no lives remain in the group. To prepare just a single complete cohort life table requires data over many years. It is usually not feasible to construct cohort life tables entirely on the basis of observed data for real cohorts due to data unavailability or incompleteness (1). For example, a life table representation of the mortality experience of a cohort of persons born in 1970 would require the use of data projection techniques to estimate deaths into the future (2,3).

Unlike the cohort life table, the period life table does not represent the mortality experience of an actual birth cohort. Rather, the period life table presents what would happen to a hypothetical (or synthetic) cohort if it experienced throughout its entire life the mortality conditions of a particular period in time. Thus, for example, a period life table for 2000 assumes a hypothetical cohort subject throughout its lifetime to the age-specific death rates prevailing for the actual population in 2000. The period life table may thus be characterized as rendering a "snapshot" of current mortality experience, and shows the long-range implications of a set of age-specific death rates that prevailed in a given year. In this report the term "life table" refers only to the period life table and not to the cohort life table.

Keywords: life expectancy • life tables • survival • death rates • race

Data and Methods

The data used to prepare the U.S. life tables for 2000 are final numbers of deaths for the year 2000; postcensal population estimates for the year 2000; and data from the Medicare program prepared by the Health Care Financing Administration. Population estimates are prepared by the U.S. Census Bureau. They are based on the 1990 decennial census because detailed populations from the 2000 census were not available when this report was prepared. A comparison of 1990 census based estimates and summary 2000 census results show differences for some ethnic and race groups. These differences could result in the underestimation or overestimation of life expectancy (see Technical Notes). Once population estimates based on the 2000 census are available, we will publish another report presenting revised life expectancy estimates. Data from the Medicare program are used to calculate probabilities of dying for ages over 85 years (see Technical Notes).

Life tables can be classified in two ways according to the length of the age interval in which data are presented. A complete life table

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contains data for every single year of age. An abridged life table typically contains data by 5- or 10-year age intervals. A complete life table, of course, can be easily aggregated into 5- or 10-year age groups (see Technical Notes for instructions on how to do this). Other than the decennial life tables, U.S. life tables based on data prior to 1997 are abridged life tables constructed by reference to a "standard" table (4). The 2000 U.S. life tables are complete life tables calculated using a method implemented with the 1997 life tables and are similar to the U.S. Decennial Life Tables (5,6). See Technical Notes for more information on the method used to construct the life tables in this report.

Expectation of life—The most frequently used life table statistic is life expectancy (e_x), which is the average number of years of life remaining for persons who have attained a given age (x). Life expectancy and other life table values for each age in 2000 are shown for the total population and by race and sex in tables 1–9. Life expectancy is summarized by age, race, and sex in table A.

Life expectancy at birth (e_0) for 2000 for the total population was 76.9 years. This represents the average number of years that the members of the hypothetical life table cohort may expect to live at the time of birth (table A).

Survivors to specified ages—Another way of assessing the longevity of the synthetic life table cohort is by determining the proportion who survive to specified ages. The l_x column of the life table provides the data for computing the proportion. Table B summarizes the number of survivors by age, race, and sex. To illustrate, 51,037 persons out of the original 2000 synthetic life table cohort of 100,000 (or 51.0 percent) were alive at exact age 80. In other words, the probability that a person will survive from birth to age 80, given 2000 age-specific mortality, is 51 percent. Probabilities of survival can be calculated at any age by simply dividing the number of survivors at the terminal age by the number at the beginning age. For example, to calculate the probability of surviving from age 20 to age 85, one would divide the number of survivors at age 85 (34,959) by the number of survivors at age 20 (98,654), which results in a 35.4 percent probability of survival.

Explanation of the columns of the life table

Column 1—Age (x to x + 1)—This column shows the age interval between the two exact ages indicated. For instance, "20–21" means the 1-year interval between the 20th and 21st birthdays.

Column 2—Probability of dying (q_x)—This column shows the probability of dying between ages x to x+1. For example, for males in the age interval 20–21 years, the probability of dying is .001295 (table 2). The "probability of dying" column forms the basis of the life table; all subsequent columns are derived from it.

Column 3—Number surviving (l_x)—This column shows the number of persons from the original synthetic cohort of 100,000 live births, who survive to the beginning of each age interval. The l_x values are computed from the q_x values, which are successively applied to the remainder of the original 100,000 persons still alive at the beginning of each age interval. Thus out of 100,000 female babies born alive, 99,376 will complete the first year of life and enter the second; 99,189 will reach age 10; 98,909 will reach age 20; and 42,145 will live to age 85 (table 3).

Column 4—Number dying (d_x)—This column shows the number dying in each successive age interval out of the original 100,000 live births. For example, out of 100,000 males born alive, 759 will die in the first year of life; 127 between ages 20 and 21; and 864 will die after reaching age 100 (table 2). Each figure in column 4 is the difference between two successive figures in column 3.

Column 5—Person-years lived (L_x)—This column shows the number of person-years lived by the synthetic life table cohort within an age interval x to x+1. Each figure in column 5 represents the total time (in years) lived between two indicated birthdays by all those reaching the earlier birthday. Thus, the figure 98,349 for males in the age interval 20–21 is the total number of years lived between the 20th and 21st birthdays by the 98,413 (column 3) males who reached their 20th birthday out of 100,000 males born alive (table 2).

Column 6—Total number of person-years lived (T_x)—This column shows the total number of person-years that would be lived after the

Table A. Expectation of life by age, race, and sex: United States, 2000

Age	All races			White			Black		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
0	76.9	74.1	79.5	77.4	74.8	80.0	71.7	68.2	74.9
1	76.4	73.7	79.0	76.9	74.3	79.4	71.7	68.3	74.9
5	72.5	69.8	75.1	73.0	70.3	75.5	67.9	64.4	71.0
10	67.6	64.9	70.1	68.0	65.4	70.5	63.0	59.5	66.1
15	62.6	59.9	65.2	63.1	60.5	65.6	58.1	54.6	61.2
20	57.8	55.2	60.3	58.3	55.7	60.7	53.3	49.9	56.3
25	53.1	50.6	55.4	53.5	51.1	55.8	48.7	45.5	51.5
30	48.3	45.9	50.6	48.7	46.4	50.9	44.1	41.1	46.8
35	43.6	41.3	45.8	44.0	41.7	46.1	39.6	36.6	42.1
40	38.9	36.7	41.0	39.3	37.1	41.3	35.1	32.3	37.5
45	34.4	32.2	36.3	34.7	32.6	36.6	30.8	28.1	33.1
50	30.0	27.9	31.8	30.2	28.2	32.0	26.8	24.2	28.9
55	25.7	23.8	27.4	25.9	24.0	27.5	23.0	20.7	24.9
60	21.6	19.9	23.1	21.8	20.0	23.2	19.4	17.5	21.0
65	17.9	16.3	19.2	17.9	16.3	19.2	16.2	14.5	17.4
70	14.4	13.0	15.5	14.4	13.0	15.5	13.1	11.7	14.1
75	11.3	10.1	12.1	11.3	10.1	12.1	10.5	9.4	11.2
80	8.6	7.6	9.1	8.5	7.6	9.1	8.2	7.3	8.6
85	6.3	5.6	6.7	6.2	5.5	6.6	6.3	5.7	6.5
90	4.7	4.1	4.8	4.5	4.0	4.7	4.8	4.5	4.8
95	3.5	3.1	3.5	3.3	2.9	3.3	3.7	3.6	3.6
100	2.6	2.4	2.7	2.4	2.2	2.4	2.8	2.9	2.7

Table B. Number of survivors by age, out of 100,000 born alive, by race and sex: United States, 2000

Age	All races			White			Black		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
1	99,307	99,241	99,376	99,430	99,376	99,487	98,586	98,444	98,733
5	99,177	99,096	99,261	99,315	99,247	99,386	98,368	98,206	98,535
10	99,095	99,006	99,189	99,240	99,163	99,320	98,247	98,071	98,430
15	98,992	98,882	99,107	99,142	99,046	99,243	98,110	97,905	98,321
20	98,654	98,413	98,909	98,819	98,604	99,046	97,672	97,259	98,100
25	98,181	97,716	98,671	98,391	97,977	98,831	96,913	96,107	97,730
30	97,696	97,025	98,392	97,960	97,363	98,586	96,065	94,886	97,232
35	97,132	96,266	98,021	97,456	96,675	98,268	95,040	93,531	96,506
40	96,349	95,264	97,460	96,747	95,755	97,777	93,680	91,827	95,462
45	95,210	93,826	96,623	95,719	94,441	97,044	91,660	89,333	93,879
50	93,522	91,674	95,398	94,195	92,474	95,970	88,583	85,464	91,509
55	91,113	88,687	93,561	91,977	89,731	94,283	84,351	80,033	88,329
60	87,498	84,286	90,716	88,559	85,586	91,590	78,737	72,884	84,046
65	82,131	77,897	86,344	83,379	79,419	87,385	71,389	64,048	77,996
70	74,561	69,055	79,983	75,912	70,657	81,163	62,448	54,082	70,040
75	64,244	57,321	70,983	65,615	58,874	72,254	51,081	42,101	59,333
80	51,037	43,192	58,563	52,286	44,521	59,792	38,083	29,317	46,210
85	34,959	27,265	42,145	35,852	28,100	43,112	24,655	17,354	31,410
90	18,839	13,045	23,936	19,244	13,335	24,439	12,913	8,212	17,112
95	7,252	4,268	9,669	7,219	4,217	9,638	5,113	2,941	6,892
100	1,781	864	2,479	1,618	773	2,244	1,388	754	1,831

beginning of the age interval x to x+1 by the synthetic life table cohort. For example, the figure 5,434,563 is the total number of years lived after attaining age 20 by the 98,413 males reaching that age (table 2).

Column 7—Expectation of life (e_x)—The expectation of life at any given age is the average number of years remaining to be lived by those surviving to that age on the basis of a given set of age-specific rates of dying. It is derived by dividing the total person-years that would be lived above age x by the number of persons who survived to that age interval (T_x/l_x). Thus, the average remaining lifetime for males who reach age 20 is 55.2 years (5,434,563 divided by 98,413) (table 2).

Results

Life expectancy in the United States

Tables 1–9 show complete life tables by race (white and black) and sex for 2000. Tables A and B summarize life expectancy and survival by age, race, and sex. Life expectancy at birth for 2000 represents the average number of years that a group of infants would live if the infants were to experience throughout life the age-specific death rates prevailing in 2000. In 2000 life expectancy at birth was 76.9 years, increasing by 0.2 years from 76.7 years in 1999. This increase is typical of the average yearly changes that occurred during the last 25 years in the United States. Throughout the 20th century, the trend in U.S. life expectancy was one of gradual improvement (7).

Life expectancy was 74.1 years for males, increasing by 0.2 years from 73.9 years in 1999. Life expectancy for females in 2000 was 79.5 years, increasing by 0.1 year from 79.4 years in 1999. The increase in life expectancy between 1999 and 2000 for females was primarily the result of decreases in mortality due to diseases of the heart, cancer, perinatal conditions, and chronic lower respiratory diseases. Increases in life expectancy took place despite increases in mortality due to Alzheimer's disease, kidney disease, and pneumonitis due to solids and liquids. For males, life expectancy increased as a result of decreases in mortality from heart disease, stroke, cancer, and lower respiratory diseases, which were partly offset by increases in mortality due to kidney disease, Alzheimer's disease, viral hepatitis, and pneumonitis due to solids and liquids.

The difference in life expectancy between the sexes was 5.4 years in 2000, a slight narrowing from the difference (5.5) in the previous year. From 1900 to 1975, the difference in life expectancy between the sexes increased from 2.8 years to 7.8 years. The increasing gap during these years is attributed to increases in male mortality due to ischemic heart disease and lung cancer, both of which increased largely as the result of men's early and widespread adoption of cigarette smoking (7,8). Since 1979, the difference in life expectancy between the sexes has narrowed from 7.8 years to 5.4 years, reflecting proportionately greater increases in lung cancer mortality for women than for men and proportionately larger decreases in heart disease mortality among men (7,8).

Between 1999 and 2000, life expectancy for the black population rose 0.3 years to 71.7 years. For the white population life expectancy rose by 0.1 year to 77.4 years. The difference in life expectancy between the white and black populations was 5.7 years in 2000, returning to its record low level first observed in 1982. The white-black difference in life expectancy narrowed from 15.8 years in 1900 to 5.7 years in 1982, but increased to 7.1 years in 1993 before declining from 1994 (7.0 years) to 2000 (5.7 years). The increase in the gap from 1983 to 1993 was largely the result of increases in mortality among the black male population due to HIV infection and homicide (7,9).

Among the four race-sex groups (figure 1), white females continued to have the highest life expectancy at birth (80.0 years), followed by black females (74.9 years), white males (74.8 years), and black males (68.2 years). Between 1999 and 2000, life expectancy increased 0.4 years for black males (from 67.8 in 1999 to 68.2 in 2000). Black males experienced an unprecedented decline in life expectancy every year for 1984–89 (8), but annual increases in 1990–92 and 1994–2000. From 1999 to 2000, life expectancy for black females increased from

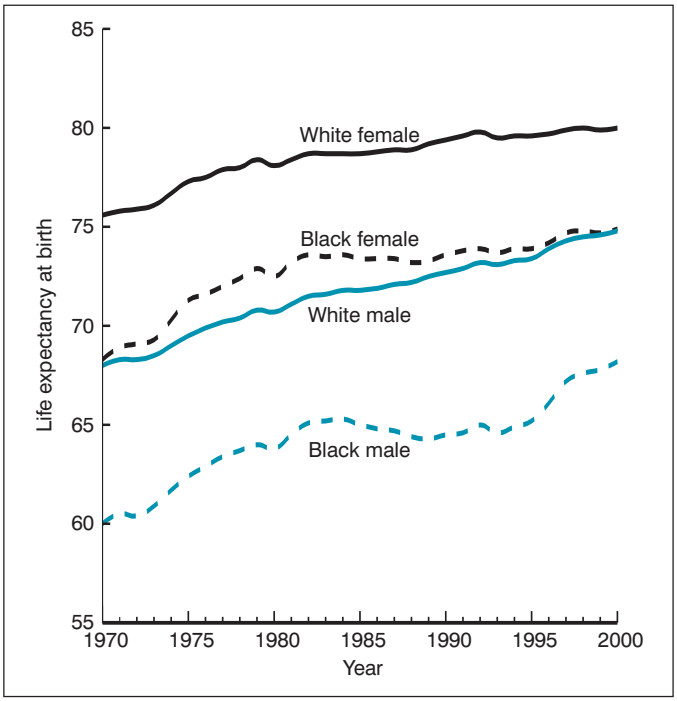

Figure 1. Life expectancy at birth by race and sex: 1970–2000

74.7 years to 74.9 years, an increase of 0.2 years. Life expectancy for white males rose 0.2 years, from 74.6 years in 1999 to 74.8 years in 2000. White female life expectancy increased during the same period by 0.1 year from 79.9 to 80.0 years. Overall, gains in life expectancy between 1980 and 2000 were 4.4 years for black males, 4.1 years for white males, 2.4 years for black females, and 1.9 years for white females (table 12).

The 2000 life table may be used to compare life expectancy at any age from birth onward. On the basis of mortality experienced in 2000, a person aged 65 years could expect to live an average of 17.9 more years for a total of 82.9 years, and a person age 100 years could expect to live an additional 2.6 years on average (table A). Life expectancy at 100 years of age, particularly for the black population, should be interpreted with caution as these figures may be affected somewhat by age misreporting (5,10,11).

Survivorship in the United States

Table B summarizes the number of survivors out of 100,000 persons born alive (l_x) by age, race, and sex. Table 10 shows trends in survivorship from 1900 to 2000. In 2000, 99.3 percent of all infants born in the United States survived the first year of life. In contrast, only 87.6 percent of infants born in 1900 survived the first year. Fifty-one percent of the 2000 synthetic life table cohort survived to age 80, and about 1.8 percent survived to age 100. In 1900 the median age at death was 58 and only 0.03 percent survived to age 100.

Among the four race-sex groups (figure 2, table B), white females have the highest median age at death with 50 percent surviving to age 83. Of the original hypothetical cohort of 100,000 infant white females, 99.0 percent survive to age 20, 87.4 percent survive to age 65, and 43.1 percent survive to age 85. For white males and black females, the pattern of survival by age is similar. These groups have approximately the same median age at death of 78 years. However, white males have slightly higher survival rates than black females at the younger ages with 98.6 percent surviving to age 20 and 79.4 percent surviving to age 65 compared with 98.1 percent and 78.0 percent, respectively, for black females. At the older ages, in contrast, black female survival surpasses white male survival. At age 85, white male survival is 28.1 percent compared with 31.4 percent for black females. This crossover, which occurs at about age 72, is clearly shown in figure 2. The median age at death for black males is 72 years, 11 years less than that for white females; 97.3 percent of black males survive to age 20, 64.0 percent to age 65, and 17.4 percent to age 85. By age 100, there is very little difference between the white and black populations in terms of survival. Somewhat less than 1 percent of white and black males and about 2 percent of white and black females survive to age 100.

Plotting the percent surviving by age for the periods 1900–1902, 1949–51, and 2000 shows an increasingly "rectangular" survival curve (figure 3). That is, the survival curve has become increasingly flat in response to progressively lower mortality, particularly at the younger ages, and increasingly vertical at the older ages. The survival curve for 1900–1902 shows a rapid decline in survival in the first few years of life and a relatively steady decline thereafter. In contrast, the survival curve for 2000 is nearly flat until about age 50 after which the decline in survival becomes more rapid. Improvements in survival between 1900–1902 and 1949–51 occurred at all ages, although the largest improvements were among the younger population. Between 1949–51 and 2000, improvements occurred primarily for the older population.

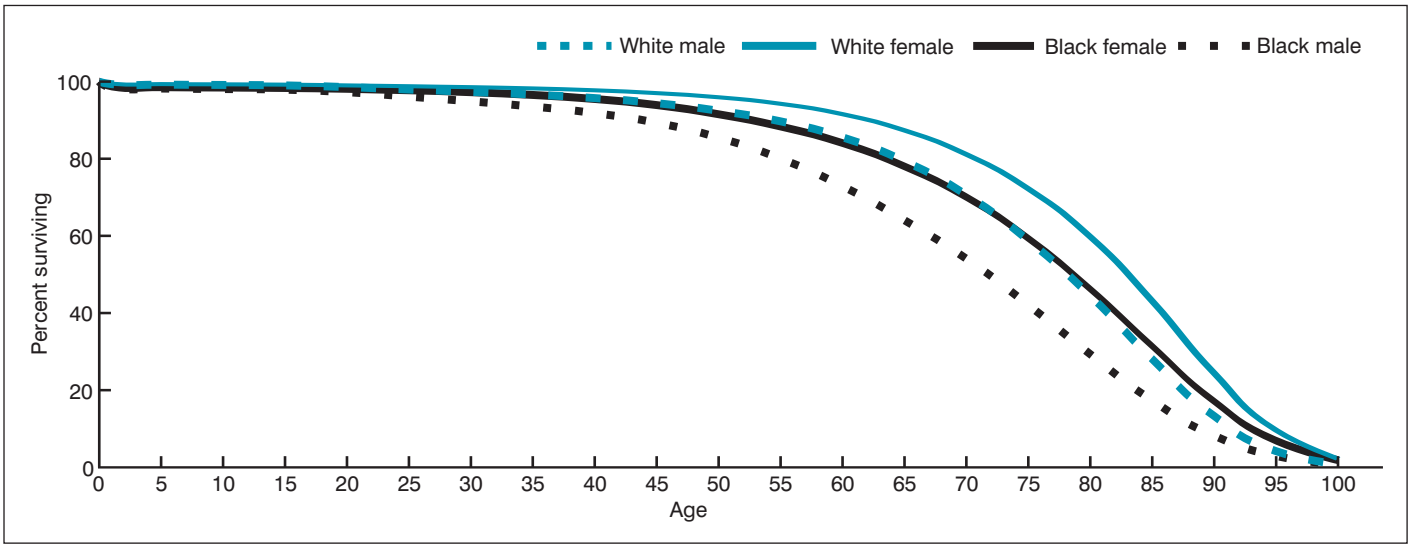

Figure 2. Percent surviving by age, race, and sex: United States, 2000

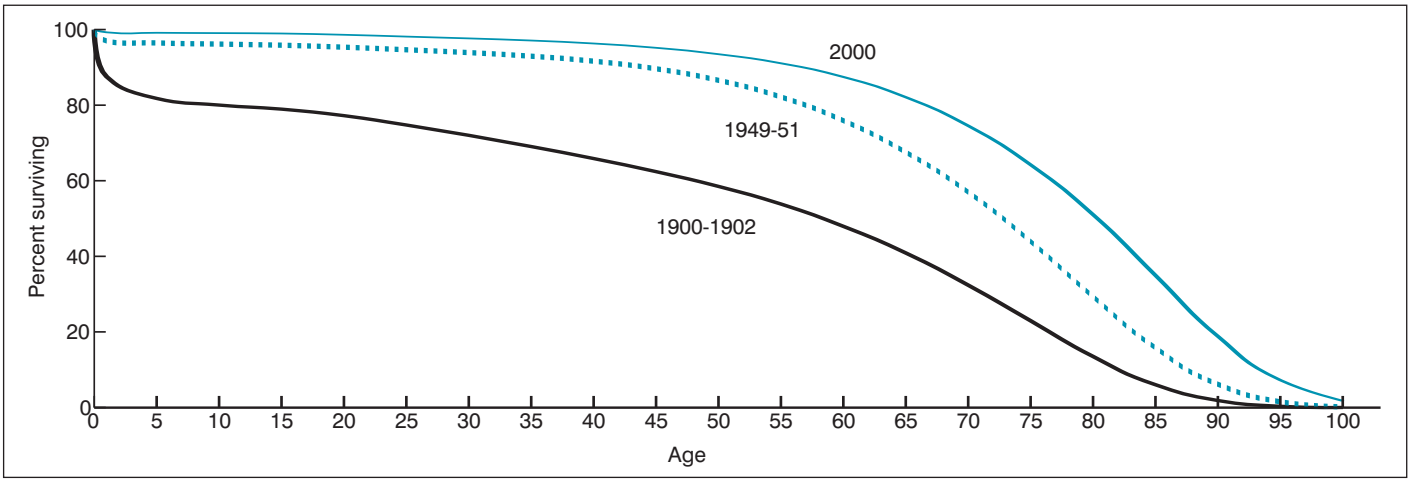

Figure 3. Percent surviving by age: Death-registration States, 1900–1902, and United States, 1949–51 and 2000

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List of Detailed Tables