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UNITED STATES LIFE TABLES FOR 1969-71

ROBERT J. MYERS

ABSTRACT

This paper presents basic data with regard to the decennial United States life tables for 1969-71, which have been released recently by the federal government. The paper then analyzes these data in comparison with those for previous United States life tables; mortality improvements in the decade between the 1960 and 1970 censuses virtually ceased, especially for males. Finally, analysis is made as between United States mortality and that in Canada, England and Wales, and Sweden.

OFFICIAL population life tables for the United States have been prepared for each decennial census beginning with 1900, based on the population enumerated by the census and on registered deaths during three consecutive years. These decennial life tables have been in the traditional complete life-table form, showing values by single years of age for various race-sex categories. At different times, supplementary life tables have been prepared for geographic regions. Life tables were also prepared in connection with the 1850-90 censuses, on the basis of population and death data obtained from the enumeration, but were usually only for a few states and cities.

Beginning in 1945, a series of abridged life tables has been developed for each calendar year. Before that time, population life tables for intercensal periods had been prepared by the Metropolitan Life Insurance Company. These official abridged life tables are of two forms: (1) provisional ones (beginning with 1958) for only the total population, based on a 10 per cent sample of death certificates, and (2) final ones for various race-sex categories, based on a complete count of all reported deaths. The latest such final abridged life tables relate to 1973.¹ The abridged tables necessarily are based upon postcensal estimates of population, except that, because of the time lag necessarily involved, abridged tables for years around the census year do use the actual data for that year.

¹ "Life Tables," in *Vital Statistics of the United States, 1973*, Vol. II, sec. 5 (Rockville, Md.: National Center for Health Statistics, United States Department of Health, Education, and Welfare, 1975).

For example, the 1969 abridged tables used projected 1960 census data, whereas the 1970 and later abridged tables used 1970 census data and the projections thereof.

The complete population life tables for 1969-71 for the United States as a whole have now been released.² These consist of twelve separate tables—for total persons, white persons, nonwhite persons, and Negro persons, by sex and also for both sexes combined.³ In addition, certain actuarial functions for the national life tables will be published.

In recent years it has been the practice to accompany both the complete and the abridged life tables with a comprehensive exposition of the method used in their preparation. Such an account will also be available for the 1969-71 life tables. These tables have been prepared by Thomas N. E. Greville, F.S.A., Actuarial Adviser, National Center for Health Statistics, Health Resources Administration, United States Department of Health, Education, and Welfare.

This paper will first sketch briefly the methodology involved in the preparation of the national life tables for 1969-71 and will present for reference purposes the basic values of mortality rates and expectations of life by sex and race for all quinquennial ages. Then an analysis will be made of past mortality trends and current mortality differentials by age, sex, and race. Finally, comparisons of mortality rates and of secular changes therein will be made between the United States experience and that of several other countries (Canada; Sweden, which probably has the lowest mortality of any country in the world at present; and England and Wales).⁴

The analyses will, in general, be purely factual, based on the reported data. No attempt will be made to explain why the differences are present as between the sexes or the races, or among countries, or as between the

² "United States Life Tables: 1969-71," in *U.S. Decennial Life Tables for 1969-71*, Vol. I, No. 1 (Rockville, Md.: National Center for Health Statistics, Health Resources Administration, United States Department of Health, Education, and Welfare, May, 1975).

³ Although there may be some question from a technical standpoint as to the significance and usefulness of unisex life tables (for males and females combined), requests for this type of information are often received from the general public. Other life tables are to be released for states, by sex and race. Tables for nonwhites may not be published for some states because of the small size of their population.

⁴ For an extensive comparison of mortality as between countries see P. Giles and A. D. Wilkie, "Recent Mortality Trends: Some International Comparisons," *Transactions of the Faculty of Actuaries*, XXXIII, 375. For a broader, more general comparison of mortality in all regions of the world see "International Trends in Longevity," *Statistical Bulletin* (Metropolitan Life Insurance Company), October, 1974. A somewhat similar analysis to that in this paper was presented for the 1959-61 life tables in Robert J. Myers and Francisco Bayo, "United States Life Tables for 1959-61," *TSA*, XVI, 436.

time periods considered. Some such differences are, of course, readily explainable. Others, however, are not so easily explained, since many counteracting factors are involved and since some elements can be only rationalized and not proved by facts and studies.

METHODOLOGY FOR NATIONAL LIFE TABLES

As in previous decennial national life tables, the principal data involved are the registered deaths in the period of the three calendar years surrounding the census and the number of persons reported in the census. In addition, in order to obtain more reliable mortality rates at the youngest ages, data on births in the years surrounding and immediately preceding the census have been utilized.

In general, it is considered that, for all except extreme old age, the data are sufficiently accurate so that there is need for only a minimum of graduation. The data for the very oldest ages did not seem to be reliable; accordingly, the current life tables were closed off through the use of the mortality experience under the social security program.⁵

The graduation procedure used was selected so as to follow closely the actual experience throughout most of the age range. The full details of the methods of adjusting the data and of graduating them will be contained in a methodological report that will be issued in the near future.

ANALYSIS OF UNITED STATES DATA

In comparing the current population life tables with those of previous years, there are certain elements of basic differences that first should be mentioned. The death registration area was not substantially completed until 1930, so that the life tables for earlier periods are based upon data for only part of the country. Although this might introduce an inconsistency in the trend, it is hardly of sufficient magnitude to vitiate the trend analysis.

Data for the 1969-71 life tables are presented for quinquennial ages for information and reference purposes (and for age 1 as well, because of the significant differences between data for ages 0 and 1). The comparative analyses are made for decennial ages (and age 1) only, since this seems sufficient to bring out the underlying trends.

Although it would be very desirable to make trend analyses by sex for all races combined, life tables for total persons were not prepared for all years before 1939-41. There was a difference in the race classification over the years. Until 1939-41 the tables generally related only to whites and Negroes, while thereafter the classification was whites and nonwhites.

⁵ For an indication of such data see Francisco Bayo and Steven F. McKay, "White vs. Nonwhite Mortality," *The Actuary*, April, 1974.

For 1939-41 only, there were separate tables for whites, Negroes, and other races.⁶ For 1969-71 the tables (separately by sex and for both sexes combined) were prepared for total persons, white persons, nonwhite persons, and the black-persons component of the nonwhite category. In the analyses by race in this paper, the data for 1939-41 and before for blacks will be considered as relating to nonwhites; this will not produce any appreciable error in comparison, since blacks then made up about 93 per cent of the total nonwhite population. Such differential for 1939-41 and before may be about 2 per cent (i.e., nonwhite mortality is about 2 per cent lower than for blacks).

For the reasons indicated above, the analysis in this paper will, in most instances, be made separately by nonwhite and white categories. This separate analysis by race is made because the data are available only in that form for the earlier years, not because it is believed that there is necessarily any significant difference in mortality by race if all factors such as economic and educational conditions are the same.

Such analysis by race over time—and it will take many more years—will give indication of the effect of the trend toward equal treatment in social and economic matters. The author believes that there are no reliable data available as yet to prove whether mortality would be lower, the same, or higher as between blacks and whites if all environmental conditions were (and had been) equal.⁷

The mortality analysis has, as traditionally, been made separately by sex throughout. The author is convinced that in the case of sex, unlike race but similar to age, significant differences in mortality occur. Despite the demand in some quarters that only unisex life tables be used and the assertions that “female liberation” efforts will cause mortality differentials by sex to vanish, one cannot brush away or explain the existing differentials at the very youngest ages (described later).

The comparison in Table 1 demonstrates the close agreement between the mortality rates in the decennial tables for 1969-71 and the average of the interpolated rates from the 1969, 1970, and 1971 abridged tables. The differences at the older ages are due primarily to the fact that the 1969 abridged tables were calculated on the basis of estimates for the 1969 populations prepared before the results of the 1970 census were available.

⁶ For an index of the United States life tables that have been prepared see *Guide to United States Life Tables, 1900-59*, PHS Publication No. 1086 (Public Health Service, United States Department of Health, Education, and Welfare).

⁷ For an analysis of the negative correlation between mortality and educational status and between mortality and income see “Socioeconomic Mortality Differentials,” *Statistical Bulletin* (Metropolitan Life Insurance Company), January, 1975.

Table 2 compares nonwhite and black mortality rates for the United States life tables for 1969-71, in order to give an indication of the relative differentials. At most ages, for both sexes, the rates for total nonwhites are about 4 per cent lower than for the black component thereof. The differential is somewhat smaller at the youngest and oldest ages and somewhat larger at the middle ages. This differential is larger than that which prevailed in 1939-41 and earlier, since then blacks constituted about 93 per cent of the nonwhite population, whereas in 1970 the

TABLE 1
COMPARISON OF MORTALITY RATES FOR DECENNIAL LIFE TABLES FOR 1969-71 WITH THOSE FOR ABRIDGED TABLES FOR 1969, 1970, AND 1971

AGE	NONWHITE		WHITE	
	Female	Male	Female	Male
Absolute Excess of Decennial Rates over Average Abridged Rates (Rates per Thousand)				
0.....	0.16	0.06	-0.07	-0.10
1.....	0.00	0.00	-0.02	-0.01
10.....	0.02	0.16	0.01	0.09
20.....	0.01	0.06	0.00	-0.01
30.....	-0.06	0.00	0.01	0.01
40.....	-0.07	-0.12	0.01	0.00
50.....	0.05	-0.12	0.00	0.01
60.....	-0.53	-1.10	-0.01	-0.12
70.....	-7.00	-8.87	-0.40	-0.33
80.....	7.22	4.54	2.43	0.90
Relative Excess of Decennial Rates over Averaged Abridged Rates				
0.....	1%	0%	0%	0%
1.....	0	0	- 2	- 1
10.....	6	50	4	36
20.....	1	2	0	0
30.....	- 3	0	1	0
40.....	- 1	- 1	1	0
50.....	0	- 1	0	0
60.....	- 3	- 3	0	- 1
70.....	-15	-13	- 2	- 1
80.....	12	5	4	1

NOTE.—Although the abridged tables are, in general, for quinquennial age groups, the published reports present data for *L_x* interpolated for single ages. The mortality rates used here are based on such data.

proportion was about 89 per cent. In considerable part this decrease was due to changes in classification of persons of races other than black or white, especially those classified as other than Chinese, Filipino, Indian, and Japanese.

Table 3 presents the mortality rates for the United States life tables for 1969-71 by race and sex, for certain selected ages. These are also shown in Chart I, plotted semilogarithmically for ease in graphing and presentation. As in previous decennial life tables, male mortality is shown to be consistently higher than female mortality and nonwhite mortality to be consistently higher than white mortality (at least until the late seventies). As an interesting, although probably not too meaningful, point, the curves of mortality rates for white males and for nonwhite females

TABLE 2
MORTALITY RATES FOR NONWHITES AS PERCENTAGES
OF THOSE FOR BLACKS, UNITED STATES
LIFE TABLES FOR 1969-71

Age	Females	Males	Age	Females	Males
0.....	95%	95%	50.....	95%	94%
1.....	96	97	60.....	96	95
10.....	97	98	70.....	96	96
20.....	98	96	80.....	96	96
30.....	95	92	90.....	99	97
40.....	93	93			

cross each other three times (the white male mortality being higher from age 7 to age 25 and at ages 54 and over). For all four mortality curves, the customary trough occurs at ages 10-11, following the sharp decline from the high mortality rates at the infant and younger ages.

A very interesting phenomenon that appears frequently in modern life tables for economically well-developed countries shows up in the mortality curve for white males—namely, a peak in the early twenties, followed by a trough in the late twenties, before the inevitable rise that occurs with advancing age. The secondary peak and subsequent trough in the twenties for white males were also noticeable in the 1949-51 and 1959-61 tables. No such phenomenon occurs for the other three categories, although there is a sloping off or plateauing of the mortality curve in the twenties for nonwhite males and white females.

At the extreme of the life span, nonwhite mortality is shown to be lower than white mortality, and by significantly increasing amounts. Whether this is due to faulty reporting of data or to real causes (such as

the theory that persons subject to high mortality at the younger ages, if they are hardy enough to live to the older ages, will have relatively low mortality then) is not certain.⁸

Also of interest is the fact that, above age 90, the mortality rates are shown to increase only very slowly, especially for nonwhites. Whether this is a real trend, or the result of faulty data, or the closing procedure for the life table is a question.

TABLE 3
MORTALITY RATES BY RACE AND SEX, UNITED STATES
LIFE TABLES FOR 1969-71
(Rates per Thousand)

AGE	TOTAL PERSONS		NONWHITE PERSONS		WHITE PERSONS	
	Females	Males	Females	Males	Females	Males
0.....	17.46	22.45	27.65	34.08	15.32	20.06
1.....	1.16	1.33	1.89	2.17	1.01	1.16
5.....	0.43	0.58	0.62	0.82	0.40	0.54
10.....	0.26	0.36	0.33	0.48	0.25	0.34
15.....	0.49	1.14	0.67	1.51	0.46	1.07
20.....	0.72	2.12	1.21	3.57	0.64	1.90
25.....	0.81	2.17	1.64	4.68	0.68	1.84
30.....	1.02	2.10	2.25	5.15	0.84	1.70
35.....	1.52	2.68	3.43	6.57	1.22	2.17
40.....	2.33	4.01	5.07	8.98	1.93	3.40
45.....	3.54	6.23	7.25	12.22	3.08	5.55
50.....	5.23	9.69	10.13	16.83	4.66	8.92
55.....	7.68	15.34	13.92	23.14	6.99	14.52
60.....	11.13	23.39	19.37	31.27	10.27	22.58
65.....	16.78	34.63	27.38	41.71	15.63	33.86
70.....	26.32	49.91	38.63	57.14	25.13	49.16
75.....	43.25	72.64	52.08	76.36	42.55	72.31
80.....	70.97	103.67	66.56	91.60	71.28	104.66
85.....	112.82	147.30	87.47	112.57	114.65	150.33
90.....	172.64	208.39	133.55	156.87	175.70	213.44
95.....	245.84	279.62	182.20	212.70	252.98	290.14
100.....	298.36	328.57	203.55	235.06	317.42	354.79
105.....	333.61	361.57	206.84	249.41	362.89	401.01

Table 4 presents the complete expectations of life by age for the United States life tables for 1969-71 for the several race-sex categories. The expectation of life at birth is 74.6 years for females, as against only 67.0 years for males. For a person at the retirement age of 65, the expectation of life is 16.8 years for females and 13.0 years for males.

Table 5 shows the mortality rates for nonwhite persons for various

⁸ For more details on this question see Francisco Bayo, "Mortality of the Aged," *TSA*, XXIV, 1.

CHART I
MORTALITY RATES OF UNITED STATES
LIFE TABLES FOR 1969-71

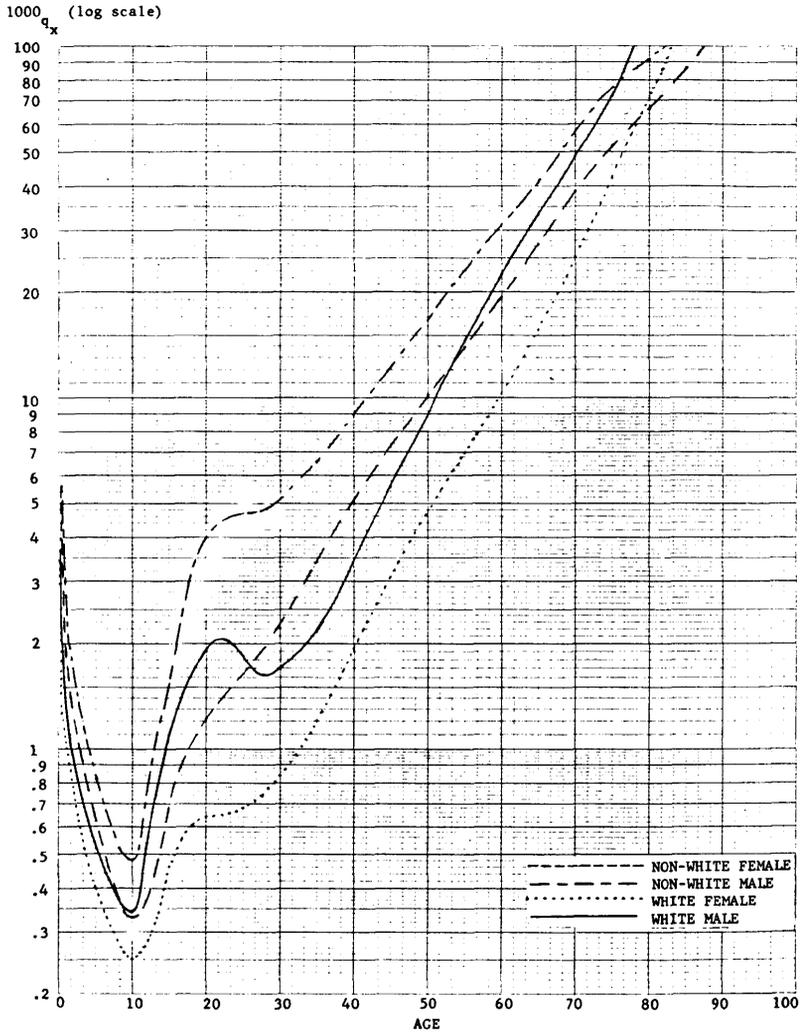


TABLE 4
COMPLETE EXPECTATIONS OF LIFE BY RACE AND SEX
UNITED STATES LIFE TABLES FOR 1969-71

Age	Total Females	Total Males	Nonwhite Females	Nonwhite Males	White Females	White Males
0.....	74.64	67.04	69.05	60.98	75.49	67.94
1.....	74.97	67.58	70.01	62.13	75.66	68.33
5.....	71.19	63.82	66.34	58.48	71.86	64.55
10.....	66.31	58.98	61.49	53.67	66.97	59.69
15.....	61.41	54.12	56.60	48.84	62.07	54.83
20.....	56.59	49.54	51.85	44.37	57.24	50.22
25.....	51.80	45.07	47.19	40.29	52.42	45.70
30.....	47.01	40.51	42.61	36.20	47.60	41.07
35.....	42.28	35.95	38.14	32.16	42.82	36.43
40.....	37.64	31.48	33.87	28.29	38.12	31.87
45.....	33.13	27.18	29.80	24.64	33.54	27.48
50.....	28.77	23.12	25.97	21.24	29.11	23.34
55.....	24.59	19.36	22.37	18.14	24.85	19.51
60.....	20.60	15.99	19.02	15.35	20.79	16.07
65.....	16.83	12.99	15.99	12.87	16.93	13.02
70.....	13.35	10.39	13.30	10.68	13.37	10.38
75.....	10.26	8.13	11.06	8.99	10.21	8.06
80.....	7.68	6.27	9.01	7.57	7.59	6.18
85.....	5.63	4.73	7.07	6.04	5.54	4.63
90.....	4.14	3.60	5.44	4.75	4.05	3.49
95.....	3.18	2.82	4.58	3.92	3.04	2.67
100.....	2.69	2.43	4.20	3.61	2.49	2.20
105.....	2.42	2.21	3.98	3.43	2.18	1.94

TABLE 5
MORTALITY RATES FOR VARIOUS DECENNIAL LIFE TABLES AS
PERCENTAGES OF THOSE FOR 1969-71, NONWHITE PERSONS

Age	1900-1902	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61
Females							
0.....	777%	669%	317%	260%	238%	148%	138%
1.....	3,716	3,113	1,219	760	421	205	153
10.....	2,339	1,570	867	487	315	167	121
20.....	941	888	958	729	440	188	96
30.....	525	535	592	515	325	173	114
40.....	307	345	303	321	233	152	111
50.....	229	252	225	263	215	158	115
60.....	204	235	193	218	179	152	127
70.....	171	184	155	160	127	118	105
80.....	161	180	155	147	122	110	106
Males							
0.....	743%	644%	308%	256%	241%	149%	138%
1.....	3,563	3,080	1,174	764	432	214	155
10.....	1,309	1,046	560	440	288	175	125
20.....	333	335	304	241	153	88	66
30.....	256	291	234	248	169	95	76
40.....	184	234	163	202	152	98	83
50.....	152	187	113	164	151	113	93
60.....	140	163	101	132	125	117	100
70.....	131	147	104	123	102	99	100
80.....	153	144	124	142	117	99	96

ages by sex for the earlier life tables as percentages of those for 1969-71. Similarly, Table 6 relates to white persons. The general and continuous improvement for all ages for each of the race-sex categories is evident up through 1959-61. However, in the next decade significant changes occurred, and in a number of categories the "customary" improving mortality trend came to a grinding halt, and even a reversal occurred in some instances.

TABLE 6
MORTALITY RATES FOR VARIOUS DECENNIAL LIFE TABLES AS PERCENTAGES
OF THOSE FOR 1969-71, WHITE PERSONS

Age	1900-1902	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61
Females							
0.....	722%	668%	417%	324%	247%	154%	128%
1.....	3,084	2,557	1,445	870	428	187	134
10.....	984	824	716	452	280	160	112
20.....	865	656	676	433	227	114	88
30.....	919	717	717	445	262	137	101
40.....	482	416	350	276	191	125	98
50.....	287	270	229	206	163	121	102
60.....	244	251	212	201	167	130	106
70.....	213	226	200	194	168	135	113
80.....	171	176	159	165	152	127	115
Males							
0.....	565%	615%	401%	310%	240%	152%	129%
1.....	2,972	2,432	1,396	856	419	183	132
10.....	805	700	520	432	294	177	124
20.....	828	628	647	414	217	109	84
30.....	833	651	651	404	238	124	92
40.....	312	301	221	200	151	115	98
50.....	172	175	132	143	130	113	107
60.....	127	136	109	117	113	106	101
70.....	120	127	111	118	111	102	99
80.....	127	129	115	124	119	105	103

In all but a few cases the percentages decrease with time up to 1959-61, the principal exceptions being for the middle and older ages between 1919-21 and 1929-31 and between 1900-1902 and 1909-11 (especially for nonwhites). From 1959-61 to 1969-71 mortality continued to improve substantially at the childhood ages, the earlier mortality rates being roughly 20-40 per cent higher than the most recent ones. Female mortality rates at the adult ages for 1969-71 were, on the whole, somewhat

lower than for 1959-61—by about 5-15 per cent, although for white females at ages 20-50 virtually no improvement occurred.

Male mortality rates at the adult ages showed surprising trends for both nonwhites and whites. For almost all ages between 20 and 60, the 1969-71 mortality rates were significantly higher than in 1959-61 and, in some cases for nonwhites, even higher than in 1949-51. The higher mortality for males at the younger adult ages was not due to Vietnam war deaths, because deaths occurring outside the United States are not considered in the construction of the life tables. It is significant to note that mortality rates of females at age 20 in 1969-71 were somewhat higher, too, than in 1959-61. For males, at ages 60 to 80, mortality was at about the same level in 1969-71 as it was ten years earlier.

Considering the fact that female mortality at ages 65 and over improved significantly between 1959-61 and 1969-71—by about 5 per cent for nonwhites and 15 per cent for whites—it might be argued that this occurred because of the effects of the Medicare program (enacted in 1965). However, this seems unlikely because the corresponding male mortality showed no improvement in that period.

Mortality rates at the turn of the century were significantly higher than in the most recent period. The greatest improvement was shown for age 1, where the early mortality rates were about 30-35 times as high as the recent ones. For infants and for older children and young adults the mortality rates of the early 1900's were generally about 5-10 times those currently being experienced. For the older ages the relative improvement has not been as large, although it has been significant. For both white males and nonwhite males aged 50-80, the mortality rates in the early 1900's were about 25-50 per cent higher than those in 1969-71, while for nonwhite females the differential was about 60-130 per cent and for white females somewhat higher.

Table 7 compares the percentage changes in the death rates from one decennial life table to the next for various ages for nonwhite males and females, while Table 8 gives similar data for whites. Once again, the almost steady decrease in mortality rates for all categories until 1959-61 is shown by the large proportion of the figures that indicate decreases. From 1959-61 to 1969-71, decreases in the mortality rates were generally recorded for females (with the exception of age 20), although for white females there were substantially no changes at ages 30-50. On the other hand, sizable increases in mortality rates were shown for males at ages 20-40, especially for nonwhite males, while at the older ages the rates were relatively unchanged.

Despite the unfavorable experience for males at the adult ages in the

last decade, their mortality rates at ages 20 and under improved just about as much as did those for females. In fact, for any particular age the percentage decrease in the mortality rate was virtually the same for each of the four race-sex categories.

The 1929-31 mortality rates at the middle and older adult ages for white males and for nonwhites generally show increases over those for

TABLE 7
PERCENTAGE CHANGES IN MORTALITY RATES FOR GIVEN DECENNIAL LIFE
TABLE AS COMPARED WITH IMMEDIATELY PRECEDING LIFE TABLE,
NONWHITE PERSONS

Age	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71
Females							
0.....	-14%	-53%	-18%	-9%	-38%	-8%	-28%
1.....	-16	-61	-38	-45	-51	-28	-35
10.....	-33	-45	-44	-35	-47	-29	-18
20.....	-6	8	-24	-40	-57	-25	4
30.....	2	11	-13	-37	-47	-21	-12
40.....	12	-12	6	-27	-35	-15	-10
50.....	10	-11	17	-18	-27	-18	-13
60.....	15	-18	13	-18	-15	-15	-21
70.....	8	-16	4	-20	-7	1	-5
80.....	12	-14	-5	-17	-10	-3	-6
Males							
0.....	-13%	-52%	-17%	-6%	-38%	-8%	-27%
1.....	-14	-62	-35	-43	-50	-28	-36
10.....	-20	-46	-22	-35	-39	-29	-20
20.....	1	-9	-21	-37	-42	-25	51
30.....	14	-20	6	-32	-44	-21	32
40.....	27	-31	24	-25	-35	-15	20
50.....	23	-39	44	-8	-25	-18	8
60.....	15	-38	31	-6	-6	-15	0
70.....	11	-30	19	-17	-3	1	0
80.....	-7	-13	14	-17	-15	-3	4

1919-21, which in turn show very sizable decreases over those for 1909-11. It is believed that this rather unusual trend resulted from the fact that the 1918 influenza epidemic removed, somewhat prematurely, a significant number of unhealthy lives who would otherwise have died in the next few years.

Table 9 presents data on the relative mortality differentials between women and men. Female mortality has always been lower than male

mortality at a given age, with only a few exceptions—primarily for nonwhites in 1919-21 but also to some extent for whites then. The differential of female mortality as against male mortality has been as much as 50 per cent in a number of instances in the most recent life tables.

TABLE 8
 PERCENTAGE CHANGES IN MORTALITY RATES FOR GIVEN DECENNIAL LIFE
 TABLE AS COMPARED WITH IMMEDIATELY PRECEDING LIFE TABLE,
 WHITE PERSONS

Age	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71
Females							
0.....	- 8%	-37%	-22%	-24%	-38%	-17%	-22%
1.....	-17	-44	-40	-51	-56	-29	-25
10.....	-16	-13	-37	-38	-43	-30	-11
20.....	-24	3	-36	-48	-50	-23	14
30.....	-22	0	-38	-41	-48	-26	- 1
40.....	-14	-16	-21	-31	-34	-21	2
50.....	- 6	-15	-10	-21	-26	-16	- 1
60.....	3	-16	- 5	-17	-22	-19	- 6
70.....	5	-11	- 3	-13	-19	-17	-11
80.....	4	-10	4	- 8	-16	- 9	-13
Males							
0.....	- 8%	-35%	-22%	-23%	-36%	-16%	-23%
1.....	-18	-43	-29	-51	-56	-28	-24
10.....	-13	-11	-30	-32	-40	-30	-19
20.....	-18	-13	-26	-33	-24	- 2	19
30.....	-17	-13	-28	-32	-35	-14	9
40.....	- 4	-27	- 9	-24	-24	-15	2
50.....	1	-24	9	-10	-12	- 6	- 7
60.....	8	-20	7	- 4	- 7	- 5	- 1
70.....	5	-12	6	- 6	- 8	- 3	1
80.....	2	-12	9	- 4	-12	- 2	- 2

In 1969-71 white female mortality rates were generally about 25 per cent lower than white male rates at the young childhood ages and about 50 per cent lower for the broad age span from the young adult ages up to age 70; at the oldest ages the differential decreases, being about 30 per cent at age 80, 18 per cent at age 90, and 12 per cent at age 100.

Nonwhite females, too, had significantly lower mortality than nonwhite males. Generally, the differentials were larger than they were in the case

of white persons at the younger ages but not at the older ages. In the childhood ages the differential was about 20 per cent, but thereafter, in most instances up to age 70, it was about 50 per cent.

Over the years, the favorable mortality differential for women has been widening. Thus, for example, in 1900-1902, female mortality at almost all ages for all races was only about 5-15 per cent lower. In the intervening

TABLE 9
FEMALE MORTALITY RATES AS PERCENTAGES OF MALE MORTALITY RATES
FOR VARIOUS DECENNIAL LIFE TABLES

Age	1900-1902	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71
Nonwhite Persons								
0.....	85%	84%	83%	83%	80%	80%	81%	81%
1.....	91	88	90	87	85	83	86	87
10.....	123	103	106	76	75	65	67	69
20.....	96	90	106	103	98	72	49	34
30.....	90	80	110	91	84	79	66	44
40.....	94	83	105	90	87	88	75	56
50.....	91	81	119	97	86	84	75	60
60.....	90	90	118	102	89	80	78	62
70.....	88	85	101	88	85	81	71	68
80.....	76	91	91	75	76	81	80	73
White Persons								
0.....	83%	83%	80%	80%	79%	77%	76%	76%
1.....	90	92	90	89	89	89	88	87
10.....	90	87	85	77	70	67	67	74
20.....	93	86	101	87	68	45	35	34
30.....	97	91	105	91	79	63	54	49
40.....	88	79	90	78	72	62	57	57
50.....	87	81	91	75	66	55	50	52
60.....	88	84	88	78	67	56	48	45
70.....	91	91	92	84	78	68	58	51
80.....	91	93	95	90	87	82	77	68

years the differential increased gradually and rather steadily, and there seems no reason to predict any reversal of this trend in the near future.

Table 10 compares mortality by race. In this connection it should be recognized that the nonwhite mortality data for the first three decennial life tables of this century are based upon data for only part of the country and, therefore, are not necessarily representative of the country as a whole. For 1969-71, nonwhite male mortality was significantly higher than white male mortality. The differential was as much as 90 per cent

at the very youngest childhood ages and even more at ages 30 and 40. A significant reduction in the differential occurred after age 30, until at age 80 nonwhite mortality is shown to be 12 per cent lower than white mortality. This same relationship occurred at age 80 in most of the earlier life tables.

TABLE 10
NONWHITE MORTALITY RATES AS PERCENTAGES OF WHITE MORTALITY
RATES FOR VARIOUS DECENNIAL LIFE TABLES

Age	1900-1902	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71
Females								
0.....	194%	181%	137%	145%	174%	174%	195%	180%
1.....	225	228	158	163	184	205	214	187
10.....	314	251	160	142	149	138	143	132
20.....	206	256	268	318	367	311	207	189
30.....	153	199	221	310	333	339	301	268
40.....	167	218	227	305	321	318	295	263
50.....	173	203	214	278	287	285	247	217
60.....	158	176	172	205	203	220	226	189
70.....	123	126	119	127	116	134	143	154
80.....	88	95	91	83	75	81	86	93
Males								
0.....	190%	178%	131%	140%	171%	166%	181%	170%
1.....	224	237	157	167	192	220	220	187
10.....	229	211	127	144	138	140	143	141
20.....	200	245	254	270	257	194	148	188
30.....	165	227	210	309	313	270	249	303
40.....	156	206	195	267	265	225	226	264
50.....	166	202	163	215	220	189	164	189
60.....	154	165	129	157	153	154	138	138
70.....	128	135	108	121	106	112	117	116
80.....	105	97	95	100	86	83	82	88

Similarly, current nonwhite female mortality tends to be significantly higher than white female mortality. The differentials are about the same as those for males—ranging from 80 to 160 per cent at most of the ages up to 60 but then gradually reducing until, for age 80, nonwhite female mortality is shown to be 7 per cent lower.

When mortality by race is examined over the entire seventy-year period, no definite overall trend in the differential is apparent. There were decreases in the differential at ages 20 and under, but the reverse tendency generally occurred at the older ages. However, both race categories

showed very significant improvements in mortality during the period, so that, although the relative differences did not change greatly, the absolute differences were significantly decreased. For example, for males aged 1, nonwhite mortality was about twice as high as white mortality in both 1900-1902 and 1969-71, but the absolute differences in the death rates were 42.84 and 1.01 per thousand, respectively. The same situation occurs when the differential ratios are examined for the life tables for the last four decades, that is, generally, no significant trend in the mortality differential by race. Although there seems to be some indication of a reduction in the differential at the young and middle adult ages as far as females are concerned, for males there is, if anything, an increase in the differential at ages 30-50.

Table 11 analyzes the increases in the expectation of life that have

TABLE 11
INCREASES IN COMPLETE EXPECTATION OF LIFE FOR 1969-71
LIFE TABLES OVER THOSE FOR EARLIER LIFE TABLES

Age	1900-1902	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61
Nonwhite Females							
0.....	34.01	31.38	22.13	19.54	13.49	6.35	2.58
20.....	14.96	15.71	14.70	14.63	9.81	5.08	1.78
65.....	4.61	5.17	3.58	3.75	1.96	1.45	0.87
Nonwhite Males							
0.....	28.44	26.93	13.84	13.43	8.72	2.07	- 0.50
20.....	9.26	10.91	6.01	8.42	4.85	0.64	- 1.41
65.....	2.49	3.13	0.80	2.00	0.66	0.12	0.03
White Females							
0.....	24.41	21.87	16.96	12.82	8.20	3.46	1.30
20.....	13.47	12.36	9.78	8.72	5.86	2.68	0.95
65.....	4.70	4.96	4.18	4.12	3.37	1.93	1.05
White Males							
0.....	19.71	17.71	11.60	8.82	5.13	1.63	0.39
20.....	8.03	7.51	4.62	4.20	2.46	0.70	- 0.03
65.....	1.51	1.77	0.81	1.25	0.95	0.27	0.05

occurred over the seventy-year period by indicating, for each race-sex category, for ages 0, 20, and 65, the excess of the value based on 1969-71 mortality over those shown in previous life tables. The expectation of life at birth has shown phenomenal increases since the turn of the century, ranging from a low of 19.7 years for white males to a high of 24.4 years for nonwhite females. The relative increases in the expectation of life at birth from 1900-1902 to 1969-71 have been about 90 per cent for both black males and females but only about 45 per cent for white males and females.

Although the mortality differentials at the various ages between the races have not especially narrowed during this period, the effect of the great decline in mortality rates for all categories has been to produce a larger absolute increase in the expectation of life at birth for nonwhites than for whites. Of course, as would be expected, the more rapid decline in mortality rates for females than for males has produced a greater increase in the expectation of life at birth for women.

The increase since 1900-1902 in the expectation of life for persons entering adulthood has been both relatively and absolutely much less than for age 0. This result would be expected because so much of the increase in the latter was due to declines in mortality at the infant and younger childhood ages.

The expectation of life at age 65 has shown relatively small increases during the seventy-year period, especially for men. The increase was about four and a half years (or 40 per cent) for both nonwhite and white females but only about two and a half years for nonwhite males and one and a half years for white males (or 24 per cent and 13 per cent, respectively).

Most of the increase in the expectation of life occurred in the first half of the seventy-year period. Nonetheless, the last half of the period has shown some improvements. The expectation of life at birth in the 1959-61 life table exceeded that in the 1949-51 table by amounts ranging from about one and a quarter years for white males to three and three-quarters years for nonwhite females. Even for age 65, the expectation of life showed small but significant improvement for all categories during the decade of the 1950's. Such improvements continued in the 1960's for women, although at a much smaller rate. On the other hand, for men there was little change in the expectations of life, and for black males there were even rather sizable decreases at all ages except the oldest ones.

Table 12 compares the expectations of life between the sexes and the races for the several life tables. For both nonwhite and white persons, the expectation of life at all ages for females has had an increasing

differential over that for males, especially in recent decades. For example, for white persons the expectation of life at birth was 2.8 years higher for women than for men in 1900-1902, whereas in 1969-71 the differential was 7.5 years. At age 20 the differential in favor of females in the 1969-71 life tables was almost as large as at birth. Even by age 65, the differential in the 1969-71 life tables is still large—about four years for white females and three years for nonwhite females. On the other hand, at the turn of the century this differential was only about one year.

The expectation of life at birth for white males in 1900-1902 was about 15.7 years greater than that for nonwhite males, but this differential has been decreased significantly over the years, until for the current life tables it is only 7.0 years. But it is significant to note that there was a reversal of the long-time trend in the 1960's, because the differential actually increased then—from 6.1 years to 7.0 years.

TABLE 12
COMPARISON OF COMPLETE EXPECTATIONS OF LIFE FOR VARIOUS
DECENNIAL LIFE TABLES, BY SEX AND BY RACE

Age	1900-1902	1909-11	1919-21	1929-31	1939-41	1949-51	1959-61	1969-71
Excess of White Females over Nonwhite Females								
0.....	16.04	15.95	11.61	13.16	11.73	9.33	7.72	6.44
20.....	6.88	8.74	9.31	11.30	9.34	7.79	6.22	5.39
65.....	0.85	1.15	0.34	0.57	- 0.37	0.46	0.76	0.94
Excess of White Males over Nonwhite Males								
0.....	15.69	16.18	9.20	11.57	10.55	7.40	6.07	6.96
20.....	7.08	9.25	7.24	10.07	8.24	5.79	4.47	5.85
65.....	1.13	1.51	0.14	0.90	- 0.14	0.00	0.13	0.15
Excess of Nonwhite Females over Nonwhite Males								
0.....	2.50	3.62	- 0.22	1.96	3.30	3.79	4.99	8.07
20.....	1.78	2.68	- 1.21	1.27	2.52	3.04	4.29	7.48
65.....	1.00	1.08	0.34	1.37	1.72	1.79	2.28	3.12
Excess of White Females over White Males								
0.....	2.85	3.39	2.19	3.55	4.48	5.72	6.64	7.55
20.....	1.58	2.17	0.86	2.50	3.62	5.04	6.04	7.02
65.....	0.72	0.72	0.54	1.04	1.49	2.25	2.91	3.91

The differential in the expectation of life at birth for white females as against nonwhite females has been more than halved over the seventy-year period—from 16.0 years according to the 1900-1902 life tables to 6.4 years currently. And in contrast to the situation for males, the narrowing of the gap between nonwhite and white females continued significantly in the 1960's.

The differential in the expectation of life between the races at age 20 has been reduced significantly since 1929-31; before that time the trend was less clear. The expectation of life at age 65 has, in recent years, been about the same for white and nonwhite males, although in the early decades of the century white males showed an excess of somewhat more than one year. For white females, however, the expectation of life at age 65 in the most recent tables has been about one-half year higher than that for nonwhite females, and in the 1969-71 table the difference was almost one year.

COMPARISON OF UNITED STATES DATA WITH THOSE FOR OTHER COUNTRIES

Next, let us consider briefly how United States mortality compares with that in several other countries, both currently and as to trends in the past. The countries selected for analysis are Canada, England (including Wales), and Sweden, for all of which series of official life tables are available. Sweden was selected because it has probably the lowest mortality of any nation, although it is closely followed by the Netherlands and Norway.

Table 13 compares mortality rates by sex for various ages for the United States total population with those of each of the three countries using their life tables which are closest to the United States tables for 1939-41, 1959-61, and 1969-71. As to England, no life table was prepared for the period around 1940 because of World War II, so the first period of comparison is around 1950, and the 1969-71 life tables are not yet available; accordingly, the comparisons will be made for 1949-51 and 1959-61. Table 14 similarly compares expectations of life.

Comparison with Canada

United States mortality was about 15 per cent lower than Canadian mortality at the childhood ages in 1940,⁹ but higher thereafter (especially for males). The differential peaked at about age 50 (at about 25 per cent for females and 40 per cent for males) and then declined to only about 5 per cent at age 80. The higher mortality differential of the United States

⁹ In the subsequent discussion the dates of the various life tables will be referred to by the decennial years included in (or close to) the period to which they relate.

continued at about the same relative amounts in 1960 and 1970 at the middle and oldest ages, but increased for the younger adult ages and the childhood ages, especially between 1940 and 1960. In fact, in 1970, only at age 10 was United States mortality still lower than Canadian.

The expectation of life at birth in Canada has been significantly higher than that in the United States, and the differential has been increasing over time. The comparison is even less favorable for United States males than for United States females, the deficit in 1970 for the former being 2.30 years as against 1.72 years for the latter.

The same trends as between Canada and the United States are present for the expectation of life at age 20. However, at age 65, the differential in favor of Canada has shown no particular trend and has been about one-half to three-quarters of a year for both sexes.

TABLE 13
MORTALITY RATES FOR THE UNITED STATES (TOTAL PERSONS)
AS PERCENTAGES OF THOSE FOR OTHER COUNTRIES

AGE	CANADA			ENGLAND AND WALES		SWEDEN		
	1940-42	1960-62	1970-72	1950-52	1960-62	1941-45	1960-64	1968-72
Females								
0.....	84%	95%	113%	103%	119%	159%	170%	180%
1.....	77	96	102	101	125	157	165	204
10.....	83	103	93	120	125	104	94	130
20.....	106	116	126	111	145	100	164	157
30.....	107	134	132	114	141	121	149	138
40.....	117	132	135	131	128	157	178	150
50.....	125	124	130	126	123	153	149	155
60.....	120	114	120	115	111	140	138	142
70.....	112	106	113	99	94	119	103	112
80.....	105	103	109	86	89	106	91	93
Males								
0.....	84%	95%	112%	102%	119%	153%	167%	169%
1.....	77	98	104	101	115	146	159	185
10.....	86	88	92	121	113	117	113	106
20.....	102	110	119	139	142	83	144	180
30.....	126	121	138	136	157	129	160	149
40.....	139	132	138	152	159	168	172	171
50.....	141	131	127	129	139	174	197	181
60.....	130	118	122	105	103	167	157	167
70.....	115	110	113	90	89	136	124	125
80.....	106	105	107	80	83	113	101	103

Comparison with England

In 1950 United States mortality was significantly higher than English mortality, except at the youngest and oldest ages. At ages 0 and 1 there was little difference, but at ages 70 and over United States mortality was notably lower. The favorable differential for English mortality was greater for males than for females, the excess United States mortality reaching a maximum at age 40 of 52 per cent for males and only 31 per cent for females.

TABLE 14

COMPLETE EXPECTATIONS OF LIFE FOR THE UNITED STATES (TOTAL PERSONS)
COMPARED WITH THOSE FOR OTHER COUNTRIES, DEFICIT
OF UNITED STATES EXPECTATION

AGE	CANADA			ENGLAND AND WALES		SWEDEN		
	1940-42	1960-62	1970-72	1950-52	1960-62	1941-45	1960-64	1968-72
Females								
0.....	0.40	0.93	1.72	0.58	0.76	3.82	2.21	2.32
20.....	0.39	1.05	1.59	0.44	0.35	2.65	1.38	1.55
65.....	0.51	0.27	0.64	-0.62	-0.54	0.76	-0.16	-0.17
Males								
0.....	1.35	1.55	2.30	0.95	1.29	5.46	4.69	4.87
20.....	2.60	1.74	2.17	0.72	0.80	4.32	3.77	4.01
65.....	0.74	0.58	0.73	-1.05	-1.00	1.61	0.90	1.02

The differentials between English and United States mortality remained about the same in 1960 as they were in 1950, except that they generally increased at ages 30 and under. As a result, United States mortality was no longer about the same as English mortality at ages 0 and 1, but rather was about 20 per cent higher.

The expectation of life at birth for females in England in 1950 was about one-half year higher than in the United States, while the corresponding differential for males was almost one year. These differentials increased to three-quarters and one and a quarter years in 1960. In both years the differential in the expectation of life at age 65 was in the reverse direction, being about one-half year in favor of the United States for females and one year for males.

Comparison with Sweden

The differentials of United States mortality over Swedish mortality in 1940 were very large—about 50–60 per cent for females at ages 0, 1, 40, and 50 and about 50–70 per cent for males at these ages (and at age 60 too). Only for males at age 20 was United States mortality lower. Relatively small differentials in favor of Sweden occurred at age 10 (and at age 20 for females) and at the very oldest ages. As was the case for Canada and England, the male differentials were generally larger than the female ones.

The 1960 and 1970 comparisons of Swedish and United States mortality showed generally widening differentials in favor of Sweden as against the 1940 data. Between 1960 and 1970, however, there was no clear trend as to changes in the differentials.

In 1970 United States mortality at ages 0 and 1 was almost twice as high as Swedish mortality. The differential was relatively small at age 10 but then rose to about 50 per cent at ages 20–60 for females and to about 70 per cent for males at those ages. At the older ages these differentials decreased; in fact, for females at age 80 a reversal occurred.

As would be expected from the foregoing discussion, the expectations of life in Sweden considerably exceed those in the United States. In 1940 the differential at birth was almost four years for females and five and a half years for males. Rather surprisingly, however, these absolute differentials decreased from 1940 to 1960 and then remained about the same from 1960 to 1970. The expectation of life at age 65 in 1940 was about three-quarters of a year higher for Swedish females than for United States females and about one and a half years for males. However, in 1960 and 1970, there was a small favorable differential for United States females, and the unfavorable differential for United States males had declined to about one year.

Table 15 shows the years in the past in which the United States 1969–71 mortality rates were about the same as the Swedish ones. It was assumed that each Swedish life table was centered in the middle year, and then straight-line interpolation could be used to determine the year for which the United States rate would be approximated.

On the basis of this analysis, Sweden was about two decades ahead of the United States mortality-wise for females and about three or more decades ahead for males. However, projecting such a procedure into the future to determine when the United States will be at the current Swedish level of mortality is hardly proper in view of the recent slackening off of mortality decreases in the United States (just as in Sweden).

Finally, it may be of value to have available the Swedish mortality

TABLE 15
YEAR FOR WHICH SWEDISH MORTALITY RATES WERE
THE SAME AS UNITED STATES MORTALITY
RATES FOR 1969-71

Age	Females	Males	Age	Females	Males
0.....	1952	1952	40.....	1949	1940
1.....	1959	1960	50.....	1950	†
10.....	1964	1966	60.....	1953	†
20.....	1948	1946	70.....	1965	†
30.....	1952	1947	80.....	*	*

NOTE.—See text for description of how the “years of equality” were determined.

* Swedish rate never as low as United States rate for 1969-71.

† Swedish rates back to 1921-25 always lower than United States rate for 1969-71.

TABLE 16
MORTALITY RATES FROM VARIOUS SWEDISH LIFE TABLES
(Rates per Thousand)

Age	1941-45	1946-50	1951-55	1956-60	1960-64	1965-69	1968-72
Females							
0.....	26.11	20.53	16.48	14.27	13.30	10.81	9.68
1.....	3.12	1.79	1.55	1.25	0.96	0.67	0.57
10.....	0.72	0.43	0.31	0.26	0.32	0.19	0.20
20.....	1.91	0.99	0.58	0.38	0.39	0.43	0.46
30.....	2.28	1.48	0.95	0.70	0.71	0.68	0.74
40.....	2.88	2.43	1.92	1.58	1.29	1.48	1.55
50.....	5.71	5.56	4.46	3.97	3.62	3.24	3.37
60.....	13.16	12.53	11.23	9.88	8.73	7.93	7.84
70.....	35.92	35.78	33.19	30.55	28.31	24.76	23.59
80.....	100.88	105.69	99.19	95.69	89.43	80.51	76.67
90.....	237.13	257.93	233.31	232.35	224.80	241.90	215.10
Males							
0.....	34.15	26.63	21.59	18.71	17.45	14.34	13.30
1.....	3.78	2.32	1.77	1.49	1.14	0.90	0.72
10.....	0.90	0.51	0.50	0.43	0.39	0.35	0.34
20.....	2.98	1.76	1.30	1.15	1.17	1.20	1.18
30.....	2.55	1.93	1.49	1.34	1.13	1.35	1.41
40.....	3.54	2.80	2.22	2.12	2.17	2.32	2.34
50.....	7.27	6.42	5.60	5.34	5.15	5.05	5.36
60.....	15.85	16.06	15.60	14.94	14.99	14.18	14.04
70.....	40.32	40.88	39.86	39.38	39.90	39.83	39.80
80.....	109.91	114.09	107.76	105.36	104.54	103.92	101.10
90.....	259.50	262.74	260.58	255.28	255.99	243.20	243.99

rates at key ages for the quinquennial life tables since 1940. These are shown in Table 16. Noteworthy are the relatively low mortality rates and their long-term decreasing trends. However, it seems quite significant that, since 1956-60, mortality rates for both sexes at ages 10-50 have shown relatively little change—in some instances, even small increases. For example, the 1968-72 rates are actually *higher* than the 1965-69 ones for females at ages 10-50 and for males at ages 30-50.

SUMMARY AND CONCLUSIONS

In summary, the availability of the official complete United States life tables for 1969-71 confirms that mortality rates have been declining steadily in this country throughout the twentieth century. Although the decline has been slackening off, and in fact plateaued out for white males and even reversed for black males in the 1960's, from a relative standpoint it continues to be significant at all ages. Furthermore, female mortality continues to be decreasing at a somewhat faster rate than male mortality, and accordingly the female differential is continuing to widen. White and nonwhite mortality rates are, on the whole, decreasing at about the same relative rates, so that the unfavorable differential for nonwhites continues at about the same relative magnitude. However, because absolute mortality rates have declined so significantly, the increases in the expectations of life at most ages have been significantly greater (in terms of years) for nonwhites than for whites; correspondingly, the differences in expectations of life at various ages between the two races have generally been narrowing.

In contrast with mortality in Canada, England, and Sweden, that in the United States is relatively higher. This unfavorable differential is even larger for males than for females. In the last decade these relative differentials did not change very much; the long-term trend of decreasing mortality in all these countries then came to a grinding halt.

DISCUSSION OF PRECEDING PAPER

FRANCISCO BAYO:

First, I want to thank Mr. Myers for his excellent paper and for his efforts in bringing this wealth of information in the demographic field to the attention of our members.

Second, I would like to expand on Mr. Myers' brief reference to the peak in mortality in the early twenties. I developed some interest in this subject while helping to prepare the previous decennial United States life tables. Unfortunately I have not been able to do as much work in this area as I would like. However, I want to share some of my observations in the hope that some members will decide to explore this matter further.

Table 1 of this discussion presents the mortality rates by color and sex and by individual years of age from 15 to 35 from the last four decennial United States life tables. It may be observed, as Mr. Myers indicated, that for white males there have been a peak and a subsequent trough in the twenties for the last three decennial tables. In addition, it may be noted that the peak and trough are becoming more pronounced with time and that the range in age between the two is slowly increasing. While the 1939-41 table did not contain a peak and trough, there appeared a precursory bulge around the mid-twenties.

For white females there are no peaks and troughs, but there is a bulge that generally occurs about the early twenties, that is, a few years of age earlier than for white males. Since the bulge is becoming more pronounced with time, it would be of interest to find out whether it is precursory to a peak and trough in the next decennial tables.

For nonwhite males the bulge around the mid-twenties in the earlier tables became a peak and trough in the last decennial table. This is not the case for nonwhite females, for which the bulge has been decreasing and may still not be precursory.

It may also be noted that in almost all cases the peak or bulge shows a tendency to move slowly into younger ages.

It would be of interest to find a measure of the intensity of the bulge (or of the peak and trough) for all these mortality curves, in order to be able to conclude categorically whether or not it is becoming more or less pronounced with time. As a first attempt, I decided to measure the departure of the life table mortality rates from the rates that would be

TABLE 1
MORTALITY RATES BY RACE AND SEX, UNITED STATES
LIFE TABLES FOR 1939-41 TO 1969-71
(Rates per Hundred Thousand)

Age	1939-41	1949-51	1959-61	1969-71	1939-41	1949-51	1959-61	1969-71
	White Males				White Females			
15.....	143	105	93	107	96	53	41	46
16.....	158	120	111	134	107	59	47	55
17.....	172	133	126	156	117	63	51	61
18.....	186	143	139	172	126	67	54	64
19.....	199	153	149	181	136	70	55	64
20.....	212	162	159	190	145	73	56	64
21.....	223	169	169	201	154	76	58	65
22.....	232	174	174	205	162	79	60	65
23.....	238	176	172	203	170	82	62	66
24.....	241	174	165	195	176	85	63	67
25.....	243	171	156	184	182	88	65	68
26.....	245	168	149	173	188	92	68	70
27.....	251	169	145	165	195	96	71	72
28.....	259	172	145	162	203	102	74	75
29.....	268	176	149	165	211	108	79	79
30.....	279	182	156	170	220	115	85	84
31.....	291	190	163	176	230	122	91	90
32.....	306	201	171	183	240	131	97	97
33.....	323	214	181	192	252	140	105	104
34.....	342	230	193	203	264	150	113	113
35.....	363	248	207	217	278	161	122	122
	Nonwhite Males*				Nonwhite Females*			
15.....	274	164	120	151	307	125	63	67
16.....	320	192	140	190	371	150	73	80
17.....	369	220	162	230	424	173	84	93
18.....	422	249	186	270	465	192	94	103
19.....	483	282	210	309	501	210	104	111
20.....	544	314	236	357	532	227	116	121
21.....	602	344	262	410	559	244	128	132
22.....	650	369	283	452	583	261	140	141
23.....	685	387	298	473	603	276	150	150
24.....	711	399	307	475	616	290	160	157
25.....	733	409	316	468	627	303	171	164
26.....	754	420	327	464	640	318	182	173
27.....	780	435	339	464	657	334	197	183
28.....	810	452	353	474	680	352	214	195
29.....	840	471	370	494	705	370	234	210
30.....	872	492	389	515	733	390	256	225
31.....	906	515	409	535	764	413	279	242
32.....	943	543	431	558	799	439	303	262
33.....	983	574	455	587	837	470	326	286
34.....	1,025	608	483	621	880	504	350	313
35.....	1,071	646	513	657	924	542	374	343

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

obtained if a least-squares line were fitted to the logarithms of the mortality rates. One of my assistants, Mr. Richard S. Foster, suggested that these departures be measured in terms of what statisticians refer to as the "coefficient of determination," that is, the square of the coefficient of correlation. (The higher the coefficient of determination, the more closely the actual mortality rates follow the fitted line and the less pronounced would be the bulge or the peak and trough.)

Table 2 of this discussion presents the coefficients of determination that we computed for the last four decennial tables, based on natural logarithms of the mortality rates for ages 10-40. The table shows that, according to this measure, the bulge (or the peak-and-trough pattern) for white males has been becoming more pronounced. This is also the

TABLE 2
COEFFICIENT OF DETERMINATION (R^2) FOR UNITED STATES
LIFE TABLES FOR 1939-41 TO 1969-71*

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

* See text of discussion for a description of the coefficient.

† Based on the black population only.

case for white females, except that there was a decrease in the bulge from the 1939-41 table to the 1949-51 table. However, for nonwhite persons, both males and females, the reverse occurred; that is, the bulge had a tendency to decrease until the 1959-61 tables. For all color-sex combinations there was a decrease in the bulge from the 1959-61 tables to the 1969-71 tables.

It is believed that the movement in the bulge is to a large extent due to changes in the effect of violent causes of death. These are principally motor vehicle accidents but could include all other accidents and even homicides and suicides.

One possible test of this hypothesis would be to recalculate the mortality rates under the assumption that these causes of death were eliminated and to determine whether or not the bulge would be eliminated. Table 3 shows what the mortality rates would be for the period 1969-71 if motor vehicle accidents were eliminated and if all violent causes were eliminated. For visual comparison, these rates are shown in graphical form in Figures 1-4.

TABLE 3
MORTALITY RATES BY RACE AND SEX, UNITED STATES LIFE TABLES FOR
1969-71 ALL CAUSES COMBINED, ELIMINATING MOTOR VEHICLE
ACCIDENTS (MVA), AND ELIMINATING ALL VIOLENCE*
(Rates per Hundred Thousand)

Age	All Causes	Eliminating MVA	Eliminating All Violence	All Causes	Eliminating MVA	Eliminating All Violence
	White Males			White Females		
15.....	107	62	28	46	28	19
16.....	134	72	32	55	32	22
17.....	156	83	36	61	34	22
18.....	172	91	39	64	36	25
19.....	181	98	41	64	38	25
20.....	190	104	43	64	40	28
21.....	201	112	46	65	43	29
22.....	205	116	48	65	45	32
23.....	203	116	49	66	47	32
24.....	195	116	48	67	50	35
25.....	184	114	48	68	52	37
26.....	173	114	50	70	55	38
27.....	165	114	51	72	59	42
28.....	162	118	56	75	63	45
29.....	165	121	59	79	67	49
30.....	170	127	65	84	72	53
31.....	176	134	72	90	77	59
32.....	183	142	81	97	84	65
33.....	192	153	91	104	92	73
34.....	203	167	103	113	101	80
35.....	217	182	118	122	111	90
	Nonwhite Males			Nonwhite Females		
15.....	151	120	45	67	56	38
16.....	190	150	53	80	66	44
17.....	230	181	62	93	77	52
18.....	270	215	73	103	85	57
19.....	309	253	83	111	94	61
20.....	357	291	95	121	103	66
21.....	410	329	107	132	111	71
22.....	452	358	117	141	122	79
23.....	473	373	126	150	129	85
24.....	475	379	133	157	138	92
25.....	468	381	141	164	147	101
26.....	464	388	151	173	156	110
27.....	464	396	164	183	168	122
28.....	474	411	180	195	180	135
29.....	494	428	199	210	195	148
30.....	515	447	220	225	210	164
31.....	535	469	243	242	226	182
32.....	558	492	271	262	246	203
33.....	587	525	304	286	271	226
34.....	621	559	341	313	297	253
35.....	657	598	382	343	327	281

* "All violence" refers to the combination of all accidents, homicides, and suicide.

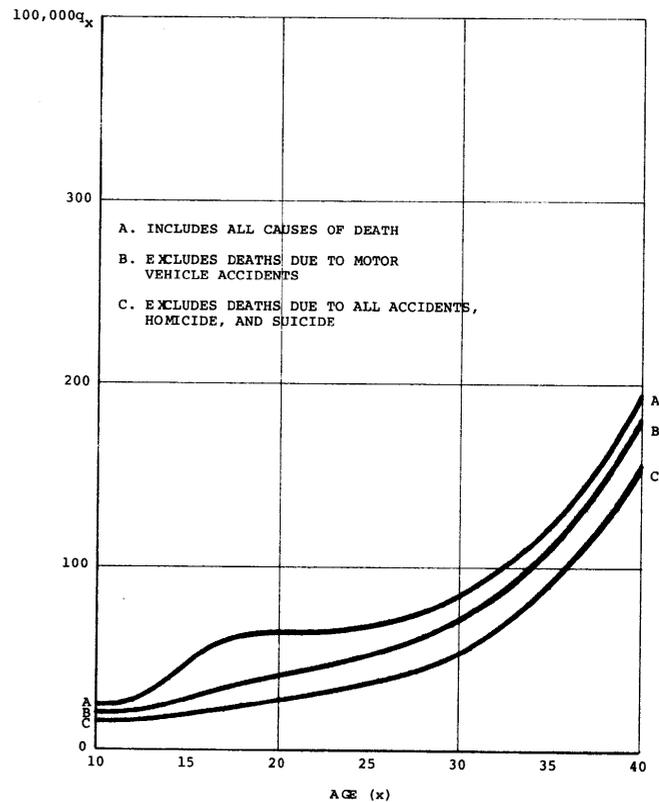
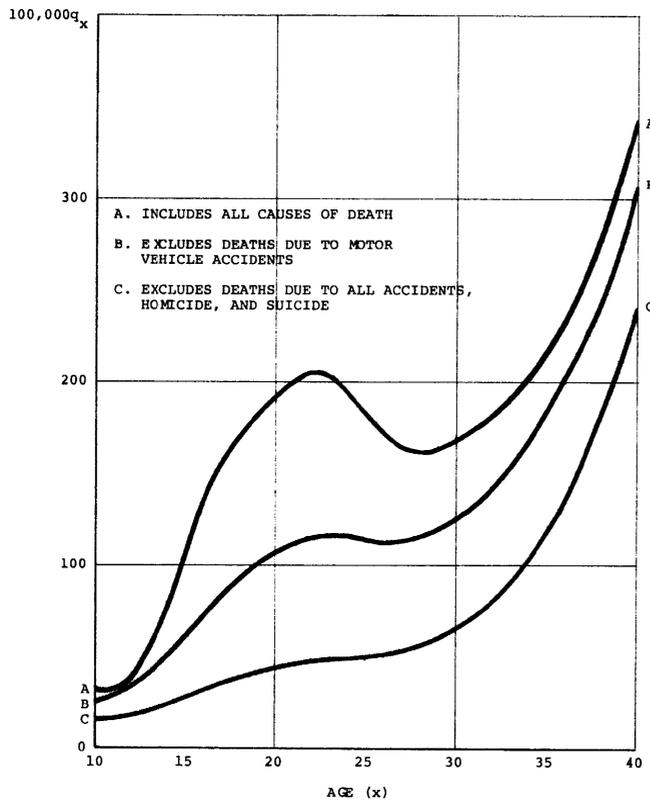


FIG. 1.—Mortality rate comparison, 1969–71 United States life tables: white males

FIG. 2.—Mortality rate comparison, 1969–71 United States life tables: white females

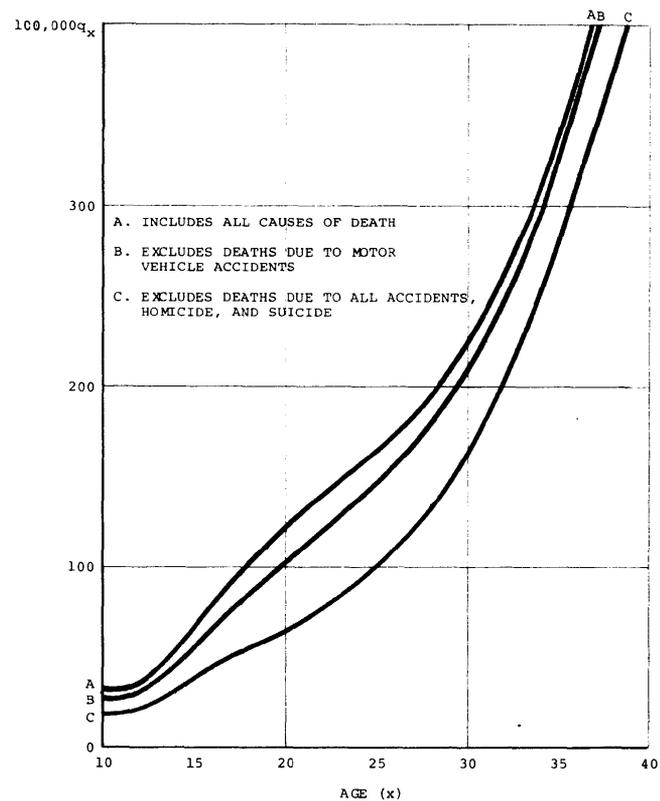
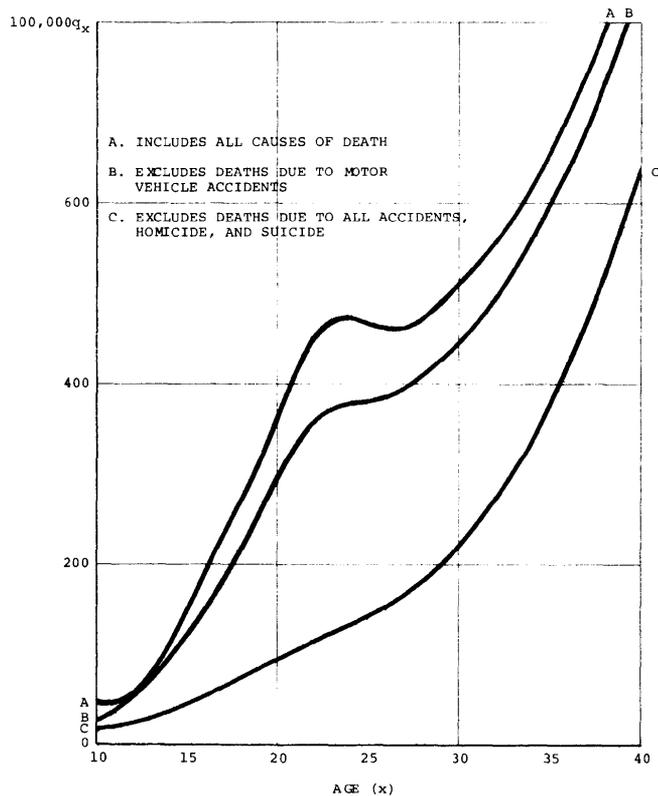


FIG. 3.—Mortality rate comparison, 1969–71 United States life tables: males other than white

FIG. 4.—Mortality rate comparison, 1969–71 United States life tables: females other than white

It may be observed that the bulge (or the peak-and-trough pattern) is substantially less pronounced if motor vehicle accidents are eliminated, and disappears almost completely if all violent causes of death are eliminated. This may be established more readily from Table 4, which shows the coefficients of determination of the various mortality curves after eliminating first motor vehicle accidents and then all violent causes.

It was observed previously that the coefficient of determination for nonwhite persons increased from the 1939-41 tables to the 1959-61 tables. This means that during that period the bulge was becoming smaller with time. This would seem to be a contradiction, since motor vehicle

TABLE 4
COEFFICIENT OF DETERMINATION (R^2) FOR UNITED STATES
LIFE TABLES FOR 1969-71: ALL CAUSES COMBINED,
ELIMINATING MOTOR VEHICLE ACCIDENTS
(MVA), AND ELIMINATING
ALL VIOLENCE*

Color and Sex	All Causes	Eliminating MVA	Eliminating All Violence
White males.....	0.648	0.885	0.952
White females.....	0.920	0.990	0.981
Nonwhite males.....	0.814	0.838	0.980
Nonwhite females.....	0.966	0.975	0.992

* See text of discussion for a description of the coefficient. "All violence" refers to the combination of all accidents, homicides, and suicides.

accidents and other violent causes of deaths were increasing. Our investigation of this point revealed that the bulges in nonwhite mortality during the 1940's and 1950's were due more to natural causes of death, mainly communicable diseases, of which tuberculosis was the most important. That is, mortality increases due to increased violence were more than offset by decreases due to control of communicable diseases, especially among nonwhite persons.

As a final point, we can conclude that with increasing motor vehicle use in the United States we should expect that the current bulges in mortality around the twenties will become peaks and troughs, and that the present peaks and troughs will become more pronounced.

THOMAS N. E. GREVILLE:

Mr. Myers has provided an excellent survey of the 1969-71 United States life tables, and I have nothing to add. He mentions the state life

tables in his footnote 3. These are now available and are contained in fifty-one reports, one for each state and the District of Columbia. These reports constitute Volume II, Nos. 1-51, of *U.S. Decennial Life Tables for 1969-71* (Rockville, Md.: National Center for Health Statistics, Health Resources Administration, United States Department of Health, Education, and Welfare, June, 1975).

The 1969-71 state life tables provided some surprises. It has become customary to rank the states according to the expectation of life at birth for the total population, all races and both sexes combined. For 1959-61 the top five states were all in the western north central division (Nebraska, Iowa, Kansas, Minnesota, and North Dakota). In the 1969-71 ranking, Hawaii had climbed from seventh to first place, and Utah from sixth to third.

The emergence of Hawaii as the highest-ranking state has some interesting aspects. Its preeminence is due entirely to the showing of its male population. For females this state ranks only third, after North Dakota and Minnesota. However, Hawaii's males, with an expectation of life at birth of 71.02 years, surpass by more than one and one-half years the males of the nearest competitor, Utah, who registered 69.49 years.

It is of interest to examine more closely the comparative mortality of males in Hawaii and other states. Since the expectation of life at birth of nonwhite males in Hawaii is 71.08 years, scarcely different from that for total males, it would appear that the ethnic composition of the population is not a significant factor. (The value for white males was not published because of the relatively small number of deaths involved.) A comparison of death rates of males in 1969-71 by broad age groups reveals that Hawaii's males have lower death rates than those of any other state for the age groups 5-14, 45-54, 55-64, 65-74, and 75-84. For various groupings of causes of deaths, age-adjusted death rates for 1969-71 have been computed using the direct method, with the age distribution of the total United States population in 1940 as the standard. For the important group of major cardiovascular diseases, males in Hawaii have an age-adjusted death rate of 315.3 per 100,000, as compared with 348.9 for New Mexico, the next lowest state. Further subdivision of this group of causes of death has failed to pinpoint any specific causes that play a major role in differentiating the males of Hawaii from those of other states. Further details will be given in the report "Some Trends and Comparisons of United States Life-Table Data, 1900-1971" (Vol. I, No. 4, of the work previously cited).

(AUTHOR'S REVIEW OF DISCUSSION)

ROBERT J. MYERS:

I would like to thank Frank Bayo and Tom Greville for their excellent discussions. The additional information presented by these distinguished authorities will be very valuable to persons interested in this subject. The only comment I would make is in connection with Mr. Bayo's reference to "increasing motor vehicle use." I wonder whether this is a reasonably certain assumption for the future in view of likely energy problems and fuel shortages in a few years.

