

MORTALITY OF WORKERS ENTITLED TO OLD-AGE
BENEFITS UNDER OASDI

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THE Old-Age, Survivors, and Disability Insurance system (OASDI) now covers almost 65 million persons in a typical week, or about 90 per cent of all paid employment. In the middle of 1965, monthly benefits were paid to about 20.1 million persons, of whom 13.8 million were aged 65 and over (about 9.8 million retired workers, the remainder being spouses, widows, widowers, and surviving parents). These 13.8 million persons aged 65 and over represented 73 per cent of the total population of the country in this age group. Monthly benefits have been payable since January, 1940, so that a vast amount of mortality experience has developed.

This paper presents an analysis of the mortality of old-age beneficiaries (retired workers) aged 65 or over and covers the period 1941-61, based on administrative actions taken through 1962. Virtually all deaths occurring in the period considered were reported by the end of 1962. The total number of deaths included in the study was 3,669,614, consisting of 3,109,946 males and 559,668 females. Since the analysis is confined to old age beneficiaries, it does not include the mortality experience of persons entitled to monthly benefits only as dependents or survivors.

It should also be pointed out that the data relate to entitled beneficiaries and not to the larger category of aged eligible workers or to the slightly smaller category of beneficiaries in current payment status, who are not having benefits withheld or suspended because of the earnings test. The term "entitled" means that the individual is not only of the requisite age and possesses the necessary insured status (in which case, he is "eligible") but also has filed application for benefits. For mortality study purposes, it is necessary to use the "entitlement" basis.

The mortality experience is analyzed in a broad manner for 1941-61 and in a more detailed manner for 1959-61. The methodology used in developing the mortality rates (including the procedures for taking into account the lag in filing and in claims adjudication) is described in detail in

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*Actuarial Study No. 60.*¹ That report also gives more detailed analyses of some of the subjects dealt with in this paper (including life-table and commutation values for graduated OASDI mortality experience). On the other hand, this paper goes into certain additional aspects, such as the comparison with population mortality in certain past periods, differentials by race, and implications as to the "true" or "intrinsic" mortality at the highest ages.

TABLE 1
WORKERS ENTITLED TO OLD-AGE BENEFITS UNDER OASDI
AS PERCENTAGE OF TOTAL POPULATION, BY AGE
AND SEX, FOR VARIOUS YEARS

YEAR	AGE*				
	66-69	70-74	75-79	80-84	85 and Over
	Males				
1945.....	10%	14%	8%	5%	2%
1950.....	27	32	30	17	7
1955.....	48	58	55	43	20
1960.....	67	80	81	71	45
	Females				
1945.....	2%	2%	1%
1950.....	5	5	4	1%	1%
1955.....	20	17	12	7	2
1960.....	32	32	24	17	8

* Age nearest birthday in the middle of the year of exposure.

EXPERIENCE OF 1941-61

The steadily increasing impact of the OASDI system in providing economic security to the population aged 65 and over is indicated by Table 1. This shows, separately by sex and by age groups, the proportion of the total population that is entitled to old-age benefits in various quinquennial years from 1945 to 1960. As would be anticipated, with the maturing of the system and with the extensions of coverage that took place in the

¹ Francisco Bayo and Milton P. Glanz, "Mortality Experience of Workers Entitled to Old-Age Benefits under OASDI, 1941-1961" (Washington, D.C.: Social Security Administration, August, 1965).

early and middle 1950's, these ratios have steadily increased within each age-sex group, until by 1960 over 80 per cent of the males aged 70-79 were entitled beneficiaries. These ratios would be even higher at ages under 72, after which the earnings test does not apply, if eligibles who had not filed for benefits were included.

When the ratios are examined for any particular year, there tends to be a decreasing trend with advancing age, except that for males the ratio is lower for ages 66-69 than for ages 70-74, because of the operation of the earnings test, which results in many full-time eligible workers not filing for benefits until they later retire. After a number of years, in the future, the trend in the ratio will be more or less level with increasing age at ages 70 and over, and particularly at ages 72 and over, when the earnings test does not apply. The presently lower ratios at the oldest ages result, of course, from the fact that many of these individuals retired from gainful employment before their work was covered under OASDI.

The smaller ratios for females than for males are the result of their lower participation in the labor force. If dependent and survivor beneficiaries were also included in this comparison of beneficiaries with total population, the female ratios would be about as high as the male ratios.

Table 2 shows the mortality trend of entitled old-age beneficiaries over the period 1941-61. The actual deaths in various triennial periods have been compared with the number of deaths that would result if the derived mortality rates for the entire 21-year period were applied to each triennial period. In this connection, it should be kept in mind that, because of the growth of the beneficiary roll, the experience of the period 1941-61 is weighted far more by the level of mortality in the later years than in the earlier years. The ages studied, in essence, include only those from exact age 65½ on, since it was deemed desirable to exclude the early-retirement experience (between ages 62 and 65, for women beginning in 1956, and for men beginning in 1961) as being atypical because the individuals involved probably have relatively high mortality; furthermore, there would be certain technical problems involved if this study attempted to include the mortality experience between the 65th birthday and age 65½.

The well-known steady decline in mortality at the younger ages of the age group 65 and over is clearly evident. For age groups under 75, mortality in the early 1940's was about 25-30 per cent above that for the entire period, while the mortality in 1959-61 was about 5 per cent lower than for the entire period. A somewhat similar trend is present for the age group 75-79, but with a less rapid decline, while for the age group 80-84 there is a further leveling-off in the trend. In fact, for the latter age group,

following the 1940's the mortality was relatively level for males. For the age group 85 and over, for which the data are relatively sparse (but nonetheless more numerous and reliable than other sources), mortality seems to have shown a slowly declining trend until the mid-1950's, but somewhat of an increase thereafter.

Table 3 compares the mortality of old-age beneficiaries with population mortality for periods approximately centering around the last three decennial censuses and also shows the number of deaths, by age group and sex, for the several periods. For 1959-61, male beneficiary mortality closely approximated general population mortality, although it was somewhat higher for ages 66-69 and somewhat lower for ages 80 and over. In the earlier periods, male beneficiary mortality significantly exceeded

TABLE 2
MORTALITY TREND OF WORKERS ENTITLED TO OLD-AGE BENEFITS UNDER OASDI, ACTUAL DEATHS AS PERCENTAGE OF NUMBER OF DEATHS ON BASIS OF MORTALITY FOR ENTIRE PERIOD 1941-61, BY AGE AND SEX

PERIOD	AGE*					
	66-69	70-74	75-79	80-84	85 and Over	66 and Over
	Males					
1941-43.....	124.4%	126.7%	122.9%	109.8%	106.5%	123.8%
1944-46.....	127.8	115.9	113.0	103.5	101.0	117.3
1947-49.....	112.0	108.8	106.1	101.9	99.3	107.9
1950-52.....	106.1	105.2	101.4	100.3	98.4	103.6
1953-55.....	101.8	100.6	99.4	98.4	97.2	100.1
1956-58.....	96.9	97.1	99.0	100.3	100.9	98.3
1959-61.....	91.3	95.2	98.2	100.0	100.5	96.4
1941-61.....	100.0	100.0	100.0	100.0	100.0	100.0
	Females					
1941-43.....	142.0%	114.0%	127.7%	107.1%	70.0%	138.5%
1944-46.....	144.3	130.8	128.0	122.0	107.6	133.5
1947-49.....	128.6	121.2	117.0	109.0	106.3	120.6
1950-52.....	112.1	109.9	106.2	104.8	102.1	109.0
1953-55.....	102.2	102.2	99.9	100.3	96.9	101.2
1956-58.....	98.3	98.6	98.3	99.8	101.3	98.7
1959-61.....	93.3	95.2	98.6	99.1	99.3	96.6
1941-61.....	100.0	100.0	100.0	100.0	100.0	100.0

* Age nearest birthday in the middle of the year of exposure.

population mortality at ages 66-74, although lower at the oldest ages.

Workers retiring shortly after age 65 or, in fact, retiring well before age 65 (possibly being disability beneficiaries) enter the experience upon reaching age 65. Undoubtedly, such workers have relatively high mortality as compared with those who remain in the labor force, who constitute a portion of the exposure for general population mortality. The relatively low mortality of the beneficiaries at the oldest ages is probably due in part to the fact that persons who have recently been employed at that stage of life are likely to have lower mortality than the general population. Such a tendency should be particularly evident in the early years of operation. However, in later years as the beneficiary roll matures this situation will change, since the roll will then consist of persons who retired

TABLE 3

ACTUAL DEATHS OF WORKERS ENTITLED TO OLD-AGE BENEFITS UNDER OASDI COMPARED WITH EXPECTED DEATHS ACCORDING TO UNITED STATES POPULATION LIFE TABLES,* BY AGE AND SEX FOR VARIOUS PERIODS

AGE †	MALES			FEMALES		
	1941-43	1949-51	1959-61	1941-43	1949-51	1959-61
Actual Number of Deaths						
66-69.....	22,351	76,714	198,150	1,844	8,694	50,743
70-74.....	15,346	101,735	296,884	1,102	10,841	72,614
75-79.....	7,294	76,243	270,461	420	7,487	61,876
80-84.....	2,436	31,676	172,978	120	2,513	38,140
85 and over..	544	10,248	97,477	14	726	19,439
66 and over..	47,971	296,616	1,035,950	3,500	30,261	242,812
Actual Deaths as Percentage of Expected Deaths						
66-69.....	131%	119%	104%	94%	93%	88%
70-74.....	119	106	99	92	84	85
75-79.....	108	97	98	83	82	85
80-84.....	90	94	94	70	81	82
85 and over..	86	92	93	‡	84	79
66 and over..	120	105	98	90	86	84

* For 1949-51 and 1959-61, the official United States Total Males and Total Females Life Tables were used. For 1941-43, the United States White Male and White Female Life Tables for 1941, 1942, and 1943, prepared by the Metropolitan Life Insurance Company were used.

† Age nearest birthday in the middle of the year of exposure.

‡ Insufficient data to yield reliable result.

at all ages. It is also possible that the lower beneficiary mortality at the oldest ages is really indicative of overstatement of population mortality rates.

Female beneficiary mortality was lower than population mortality for all periods and for all age groups. For 1959-61, the differential was about 15 per cent in each age group. This is due, at least in part, to the likelihood that women who have worked in gainful employment for some years before reaching retirement age have lower mortality than the general female population. Although this situation may have been very likely for the two earlier periods, it must be noted that it is less likely for 1959-61, because a woman could have received benefits at age 65 in 1961 and have worked no later than 1938.

EXPERIENCE OF 1959-61

In 1959-61 there was a total of 1,278,762 deaths of old-age beneficiaries included in the experience studied. Table 4 relates these deaths to the

TABLE 4
DEATHS OF WORKERS ENTITLED TO OLD-AGE BENEFITS UNDER OASDI AS
PERCENTAGE OF DEATHS RECORDED IN THE UNITED STATES,
BY AGE, SEX, AND RACE, 1959-61

AGE*	TOTAL PERSONS	MALES			FEMALES		
		Total	White	Nonwhite	Total	White	Nonwhite
65-69	54%	70%	72%	52%	28%	29%	21%
70-74	57	80	81	65	26	26	22
75-79	48	75	75	71	19	19	17
80-84	35	61	61	57	12	12	10
85-89	21	41	41	39	6	6	5
90 and over . . .	10	22	22	14	2	2	1
65 and over . . .	44	67	68	57	17	18	16

* Age last birthday at the beginning of the year of exposure.

total deaths recorded in the United States in the same period, by age, sex, and race. Although some deaths were with respect to beneficiaries residing outside the United States, and thus were not included in the national vital statistics, this is a relatively small item. For the entire age group 65 and over, the beneficiary deaths represented 44 per cent of the total deaths, but this ratio was close to 70 per cent for males, although somewhat less than 20 per cent for females. In fact, the ratio was as high as 80 per cent for males aged 70-74, with the lower ratio for ages 65-69 being due

to many persons of this category dying before retirement as OASDI beneficiaries. The lower ratios for the highest age groups are a consequence of the lower proportions of the population on the beneficiary roll at these ages. As would be anticipated, the ratios were much lower for females in all age groups, because of their employment characteristics. The ratios were slightly lower for nonwhites than for whites, because the coverage of the program in the early years excluded agricultural and domestic employment, which generally contains a larger proportion of nonwhites than does total employment.

It is believed that the OASDI data are extremely reliable as to reporting of ages for all persons now under age 90. For those aged 90 and over, there may not have been complete accuracy in adjudicating "age" in the past because, if the person was clearly much over age 65 at the time of filing a claim, costly efforts were not made to ascertain his exact age. In the future, however, the beneficiary roll will consist more and more of persons who retired at, or soon after, age 65 and for whom good evidence of age was available so that, when these persons survive on the benefit roll for more than 25 years, it will be reasonably certain that they are truly nonagenarians. Accordingly, in the next decade or two, the OASDI system should provide excellent and accurate data with respect to mortality at the very highest ages.

Tables 5 and 6 show, for men and women, respectively, the observed mortality rates of old-age beneficiaries by race, q_x . Also presented is the ratio of the nonwhite mortality rates to the white mortality rates. In considering these comparisons and in any analyses thereof, it should be kept in mind that the data as experienced and recorded are being used and that any mortality differentials shown do not necessarily indicate—and are not intended to indicate—any intrinsic mortality differentials. Qualitatively speaking, it seems certain that differences in economic and educational conditions have contributed significantly to any differential that is observed, but in these analyses we can proceed only from the observed data, and we are unable to analyze all the reasons or causes for the differences that appear.

The mortality differential for nonwhite males as compared with white males is about 10 per cent at ages 65–69 and then decreases steadily until the late 70's, when the mortality rates are about the same. Following this, nonwhite mortality is lower, with a differential of about 10 per cent in the early 80's and 20 per cent thereafter. On the other hand, for females nonwhite mortality is about 40 per cent higher at ages 65–67, with the differential then gradually decreasing to about 10 per cent at ages 75–79. Thereafter, a further decline occurs, so that at ages 80–85 there is no dif-

ferential, while for higher ages the differential is significantly in the opposite direction (but note that the data here are relatively sparse).

In considering the foregoing analysis, and particularly that in regard to the experience at the oldest ages, it is recognized that, although the OASDI experience is not of large magnitude, there are many more data of a reliable nature than from most other sources. Data from the decennial censuses at the oldest ages are not regarded as being fully reliable because

TABLE 5
OBSERVED MORTALITY RATES OF MALE WORKERS ENTITLED
TO OLD-AGE BENEFITS UNDER OASDI, BY RACE,
1959-61*

Age†	Total Persons (1)	White Persons (2)	Nonwhite Persons (3)	Ratio of Col. (3) to Col. (2) (4)
65.....	.04077	.0405	.0444	1.10
66.....	.04007	.0397	.0445	1.12
67.....	.04224	.0419	.0469	1.12
68.....	.04469	.0445	.0475	1.07
69.....	.04758	.0473	.0520	1.10
70.....	.05121	.0509	.0550	1.08
71.....	.05433	.0540	.0584	1.08
72.....	.05772	.0574	.0623	1.09
73.....	.06185	.0616	.0652	1.06
74.....	.06641	.0662	.0701	1.06
75.....	.07206	.0719	.0739	1.03
76.....	.07790	.0776	.0827	1.07
77.....	.08413	.0840	.0858	1.02
78.....	.09008	.0902	.0888	0.98
79.....	.09676	.0969	.0951	0.98
80.....	.10694	.1072	.1028	0.96
81.....	.11368	.1143	.1033	0.90
82.....	.12335	.1237	.1165	0.94
83.....	.13177	.1323	.1232	0.93
84.....	.14359	.1444	.1312	0.91
85.....	.15342	.1544	.1373	0.89
86.....	.16632	.1674	.1502	0.90
87.....	.18049	.1829	.1444	0.79
88.....	.19019	.1926	.1534	0.80
89.....	.20132	.2038	.1620	0.79
90.....	.21485	.2173	.1756	0.81
91.....	.23248	.2350	.1858	0.79
92.....	.25130	.2545	.1939	0.76
93.....	.26898	.2736	.2050	0.75
94.....	.27689	.2792	.2469	0.88

* There were 969,578 white deaths and 66,372 nonwhite deaths in the period.

† Age last birthday at the beginning of the year of exposure.

of age misstatements, and many students of the subject express particular skepticism in regard to the accuracy of the nonwhite data at these ages.² Most life tables are closed at the oldest ages by artificial rates, and so they are not generally truly indicative of actual-experience mortality.³

² For example, see Robert J. Myers, "Validity of Centenarian Data in 1960 Census," a paper presented at the Annual Meeting of the Population Association of America, April 24, 1965.

³ The decennial United States life tables for 1949-51 and 1959-61 have been closed on the basis of the mortality of Civil War veterans, which data involved a unique group of reliable statistics (see Robert J. Myers and Louis O. Shudde, "Mortality Experience of Union Civil War Veterans," *TSA*, VII, 63).

TABLE 6
OBSERVED MORTALITY RATES OF FEMALE WORKERS EN-
TITLED TO OLD-AGE BENEFITS UNDER OASDI,
BY RACE, 1959-61*

Age†	Total Persons (1)	White Persons (2)	Nonwhite Persons (3)	Ratio of Col. (3) to Col. (2) (4)
65.....	.01743	.0168	.0251	1.49
66.....	.01819	.0178	.0241	1.35
67.....	.02004	.0195	.0271	1.39
68.....	.02211	.0216	.0292	1.35
69.....	.02354	.0231	.0303	1.31
70.....	.02624	.0258	.0330	1.28
71.....	.02857	.0279	.0392	1.40
72.....	.03153	.0310	.0399	1.29
73.....	.03514	.0346	.0437	1.26
74.....	.03946	.0390	.0464	1.19
75.....	.04255	.0423	.0470	1.11
76.....	.04697	.0466	.0540	1.16
77.....	.05243	.0522	.0571	1.09
78.....	.05809	.0580	.0611	1.05
79.....	.06413	.0638	.0712	1.12
80.....	.07008	.0700	.0720	1.03
81.....	.07687	.0770	.0734	0.95
82.....	.08617	.0865	.0786	0.91
83.....	.09457	.0942	.1041	1.10
84.....	.10492	.1048	.1078	1.03
85.....	.11433	.1143	.1145	1.00
86.....	.12733	.1280	.1103	0.86
87.....	.13899	.1409	.0894	0.63
88.....	.13920	.1405	.1104	0.79
89.....	.16531	.1664	.1396	0.84

* There were 226,551 white deaths and 16,261 nonwhite deaths during the period.

† Age last birthday at the beginning of the year of exposure.

A Gompertz curve was fitted to the observed beneficiary mortality rates presented in Tables 5 and 6, and a surprisingly good fit was obtained (see Chart I). The values of B and c were .00017641 and 1.082878, respectively, for males, and .00001863 and 1.107557, respectively, for females. The Gompertz curve fitted the male experience very closely from ages 72 to 93, while for females the corresponding range was from ages 68 to 87. Although the Gompertz curve is a good indication of mortality rates at ages 65 and over, it is not surprising that there are some deviations of the actual experience from the curve at the oldest ages, where the data are both relatively sparse and possibly less accurate.

TABLE 7
AVERAGE RATIO OF NONWHITE MALE MORTALITY RATES TO
WHITE MALE DEATH RATES FOR VARIOUS PERIODS

Age*	UNITED STATES POPULATION			OASDI 1959-61
	1939-41†	1949-51	1959-61	
65-69.....	1.16	1.22	1.24	1.10
70-74.....	0.99	1.03	1.07	1.07
75-79.....	0.90	0.88	0.86	1.02
80-84.....	0.81	0.78	0.80	0.93
85-89.....	0.72	0.75	‡	0.83
90-94.....	0.70	‡	‡	0.80

* Age last birthday.

† This ratio is for Negro males compared with white males.

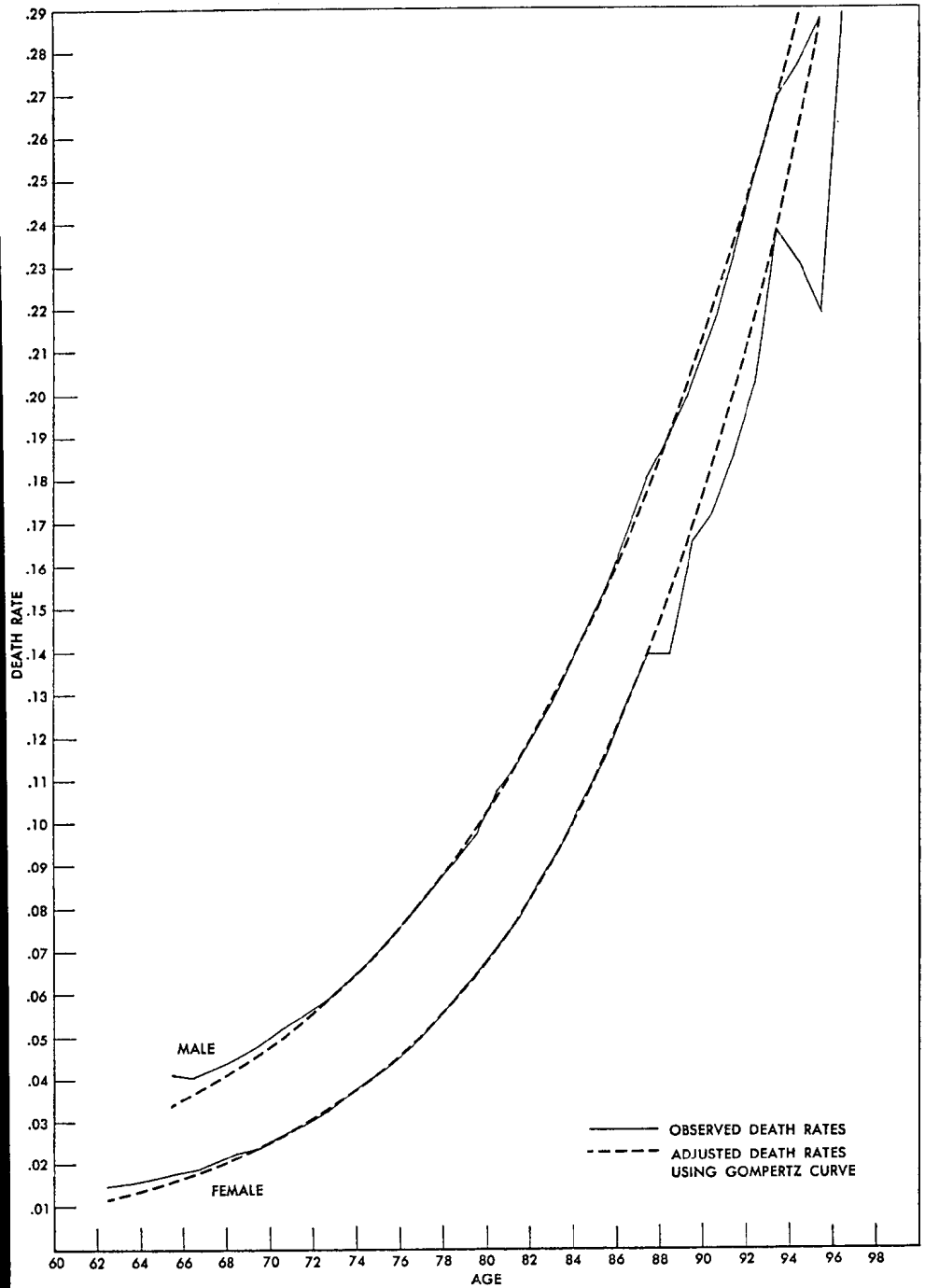
‡ This value was greatly affected by the artificial procedure used to close the life tables.

The deviations of the observed values from the Gompertz curve at the youngest ages, at which the observed rates are significantly higher, can readily be explained by the fact that persons on the benefit roll at ages just beyond age 65 are in poorer health than those who are eligible for benefits but who are actively engaged in employment. In fact, one could well argue that the adjusted death rates from the Gompertz curve are very probably indicative of the actual mortality for all insured workers, including those still in employment.

Next, let us consider the subject of mortality rates by race, so as to throw further light on the relative differences in this area that have been indicated by the decennial life tables.⁴ Tables 7 and 8 show the average ratios of nonwhite mortality rates to white mortality rates, for males and

⁴ See Robert J. Myers and Francisco Bayo, "United States Life Tables for 1959-61," *TSA*, XVI, 436.

CHART I
MORTALITY OF WORKERS ENTITLED TO OLD-AGE BENEFITS, 1959-61
DEATH RATES BY SINGLE YEARS



females, respectively, for various decennial life tables and for the OASDI experience for 1959-61. The average ratio, shown for each quinquennial age group is merely the average of the five single-year ratios of the mortality rate for nonwhites to that for whites.

For males, the last two decennial life tables show excess nonwhite mortality of about 20 per cent at ages 65-69 and about 5 per cent at ages 70-74. A reversal occurs thereafter, with nonwhite mortality being 20-25 per cent lower at ages 80 and over. The OASDI experience for male old-age beneficiaries presents a significantly different picture; nonwhite mortality is only 10 per cent higher at ages 65-69, and this differential gradually decreases until, at ages 80 and over, nonwhite mortality is lower.

TABLE 8
AVERAGE RATIO OF NONWHITE FEMALE MORTALITY RATES
TO WHITE FEMALE DEATH RATES FOR VARIOUS PERIODS

AGE*	UNITED STATES POPULATION			OASDI 1959-61
	1939-41 †	1949-51	1959-61	
62-64.....	1.68	1.90	1.94	1.42
65-69.....	1.35	1.57	1.56	1.38
70-74.....	1.03	1.16	1.29	1.29
75-79.....	0.83	0.91	0.94	1.11
80-84.....	0.69	0.73	0.80	1.00
85-89.....	0.62	0.68	‡	0.82
90-94.....	0.62	‡	‡	0.73

* Age last birthday.

† This ratio is for Negro females compared with white females.

‡ This value was greatly affected by the artificial procedure used to close the life tables.

For females, the last two decennial life tables show excess nonwhite mortality of as much as 90 per cent at ages 62-64 and 55 per cent at ages 65-69, decreasing until there is a significant reversal at ages 75 and over. The OASDI experience, on the other hand, shows considerably lower differentials at ages 62-69. Likewise, at ages 85 and over, the lower nonwhite mortality shown by the decennial life tables is present in the OASDI experience, but not to as great an extent.

Study of the data in Tables 7 and 8 indicates that the mortality differentials by race at ages 65 and over shown by the decennial life tables may present an incorrect picture of the true situation. In the OASDI experience the differentials in both directions are not so large as the decennial life tables show. In other words, it appears that, at the youngest

ages in this age group, the excess mortality of nonwhites shown by the decennial life tables is probably overstated, and correspondingly the much lower nonwhite mortality at the advanced ages is also overstated.

Some students have believed that the very much lower nonwhite mortality than white mortality shown in the decennial life tables at the most advanced ages are not correct but rather resulted from misreporting of age. On the other hand, other students have believed that this is a picture indicative of the situation and has resulted from the "weeding-out" process, whereby relatively high mortality at the younger ages leaves

TABLE 9
MORTALITY RATES OF MALE WORKERS ENTITLED TO OLD-AGE BENEFITS UNDER OASDI COMPARED WITH MORTALITY RATES OF RAILROAD RETIREMENT EMPLOYEE ANNUITANTS,* BY AGE

Age†	Male OASDI 1959-61 (1)	Railroad Retirement 1958-62* (2)	Ratio of Col. (2) to Col. (1) (3)
66.....	40.07	40.56	1.01
70.....	51.21	53.43	1.04
75.....	72.06	78.35	1.09
80.....	106.94	116.08	1.09
85.....	153.42	167.15	1.09
90.....	214.85	243.15	1.13
95.....	287.76	335.94	1.17

* Includes a small proportion of female lives. Value for ages 80 and over from *TSA*, XVI, 456; other values furnished by A. M. Niessen.

† Age last birthday at beginning of year of exposure.

survivors at the oldest ages who are extremely hardy. In the opinion of the authors, such a favorable nonwhite differential is present at the most advanced ages, but it is not so high as has been shown in the decennial life tables. We do not know of any reason for the existence of this differential and have no hypothesis to offer for it.

COMPARISON WITH OTHER GOVERNMENT RETIREMENT SYSTEMS

Table 9 compares the mortality rates of male OASDI old-age beneficiaries with corresponding experience for the Railroad Retirement System, the vast majority of whose beneficiaries are males. At ages just beyond 65, the mortality rates under the two programs are virtually the same, but with advancing age the Railroad Retirement rates become increasingly higher, with the differential being about 10 per cent at ages 75

and over. No reason can be offered as to why this differential exists. As pointed out by A. M. Niessen, the Railroad Retirement experience is based on very good verification of age and on complete reporting of deaths (*TSA*, XVI, 457). It is believed that the OASDI data are similarly valid, at least for ages up to 90.

Table 10 compares the OASDI beneficiary mortality rates with those for employee annuitants under the Civil Service Retirement System (according to graduated experience rates used in an actuarial valuation of the program). In general, the mortality of the CSR annuitants appears to be about 10 per cent lower than OASDI experience. This may possibly be due to the more favorable economic and educational status of the CSR annuitants.

TABLE 10
MORTALITY RATES OF WORKERS ENTITLED TO
OLD-AGE BENEFITS UNDER OASDI COM-
PARED WITH MORTALITY OF CIVIL SERVICE
RETIREMENT ANNUITANTS,* BY AGE AND
SEX

Age†	OASDI 1959-61 (1)	CSR 1958-62* (2)	Ratio of Col. (2) to Col. (1) (3)
Males			
66.....	40.07	33.60	0.84
70.....	51.21	45.50	0.89
75.....	72.06	66.60	0.92
80.....	106.94	97.45	0.91
85.....	153.42	142.25	0.93
90.....	214.85	207.45	0.97
95.....	287.76	301.95	1.05
Females			
66.....	18.19	15.35	0.84
70.....	26.24	23.10	0.88
75.....	42.55	38.20	0.90
80.....	70.08	62.45	0.89
85†.....	114.33	101.05	0.88

* Graduated ultimate rates for age annuitants. Values from p. 27, *43rd Annual Report of the Board of Actuaries of the Civil Service Retirement System* (House Doc. No. 48 [89th Cong.], January 12, 1965, adjusted to "age last birthday" basis.

† Age last birthday at beginning of year of exposure.

‡ OASDI data at ages 90 and 95 are too limited to be used.

SUMMARY

The extensive mortality experience under the OASDI system in the two-decade period studied has supplied some additional insight into the knowledge about mortality at ages 65 and over. There are certain limitations in using these data—such as the fact that at ages 65–71 many of the healthier lives in the insured population are not included because of the earnings test.⁵ Nonetheless, greater accuracy in reporting of ages is more likely than in experience derived from vital statistics and census records because not only is each individual followed through his lifetime but also a good proof of age was obtained when claim was filed.

In a decade or two, the OASDI experience will give some valid indications of the true mortality at the most advanced ages, a subject that has been very much among the great scientific unknowns. The past experience indicates—and much more will be known from future experience—that at least some of the puzzling differentials in mortality by race at ages 65 and over are probably not present. Specifically, mortality by race among the aged does not vary as greatly as the decennial life tables would seem to indicate.

⁵ But note that this situation will be changed under the new hospital insurance program, since persons aged 65 and over who are eligible for monthly benefits will be encouraged to file claim even though they cannot immediately receive benefits because of being engaged in substantial gainful employment. The reason for this is that such “entitlement” to cash benefits is necessary under the law in order to be entitled to hospital benefits (and to receive an identification card indicating this).

DISCUSSION OF PRECEDING PAPER

MORTIMER SPIEGELMAN:

Although the authors are willing to offer hypotheses in explanation of their observations at several places in their paper, they hesitate to do so with regard to the lower nonwhite mortality at the very old ages. One year ago, when I referred to the "weeding-out" hypothesis in the discussion of the paper on the United States life tables for 1959-61 by the same authors, the rejoinder was, "The difficulty with this principle is that it is based upon the exception and not the most frequently observed events."¹ Since then, it has been my pleasure to furnish the authors with several further so-called exceptions, and to these I would now add that cited in the current paper. They did not cite references to the "most frequently observed events" except for the artifact of the model life tables of the United Nations.

Consider the hypothesis in its simplest form. Start with two categories of population, whether distinguished by race, religion, residence, or nationality, and assume that one is living at a poorer socioeconomic level than the other. A poorer socioeconomic level would usually imply also a lower level of medical care. Assume also, for simplicity, that the two categories have the same age-specific rates of invalidity and of mortality for the active lives. However, with the lower level of medical care, it is reasonable to assume that the category in the poorer socioeconomic status will have the higher mortality rates for its invalid lives. Smaller proportions of its invalid lives will survive to the older ages. In this situation, we should have lower ratios of invalid to total lives at the older ages for the category in the poorer socioeconomic status and consequently lower mortality rates. Conversely, the category in the better socioeconomic status should have larger proportions of invalid lives at the younger ages, but at this stage they will have the benefit of lower mortality.

Actually, this exposition of the hypothesis is an oversimplification, for the circumstances that produce the poorer socioeconomic status may also be expected to produce higher rates of invalidity. In fact, the rates of invalidity may be so high as to offset the consequences of the hypothesis in its simplest form. Also contributing in the same direction would be the lower rates of recovery from invalidity that one may expect for the poorer socioeconomic category.

¹ TSA, XVI, 453.

These are the pros and cons of the "weeding-out" hypothesis. It is an actuarial problem worthy of investigation in order to ascertain the circumstances under which mortality curves will or will not cross. The concern here is not with the trivial case of incidental crossings at intervals over short age ranges. Although the task is by no means easy, it is important for the insight it may provide into the trend of mortality at the high ages. Account would have to be taken of changing patterns in the incidence of acute and chronic disease and of the consequences of new therapies. Essentially we are asking whether improvements in medical care will curtail, or even reverse, an otherwise downward mortality trend at the older ages. The Social Security Administration should have a unique opportunity for studies in this direction when the medical-care records of old age beneficiaries now only in the early planning stages are integrated with their mortality records.

(AUTHORS' REVIEW OF DISCUSSION)

ROBERT J. MYERS AND FRANCISCO BAYO:

We thank Mr. Spiegelman for his comments, which essentially are an extension of the discussion we had last year about the "weeding-out" hypothesis. On that occasion, the argument was based on the mortality differential by race shown by the official United States life tables. These tables are based on census and vital statistics records and are regarded by many as not entirely accurate at the older ages because of misstatement of ages. Our present investigation was started with the idea of bringing to the attention of actuaries, demographers, and other researchers a sizable amount of mortality data that we believe are of high reliability. It was later extended to include studies of differentials by race, since demographers generally think that misstatement is more prevalent for nonwhites than for whites and no acceptable measure exists of their different effect on the mortality rates.

Although we certainly have not proved any hypothesis in our paper, we believe that our findings tend to show that the mortality differential by race in the official tables could be partially due to misstatement of age but that the whole differential cannot be explained by this factor.

Hypotheses could be provided as explanation for the differential, but we have refrained from doing so. However, we have offered explanations about certain aspects of our observations. This was done because we believed that it was necessary to caution the reader about peculiarities in our OASDI program that are reflected in the statistics and that might lead to erroneous conclusions. The "weeding-out" process is, in

our view, a rather strong hypothesis and would require a certain amount of data in its support before we could present it in a paper. The fact that two mortality curves cross does not constitute, in our opinion, any more sufficient support for the hypothesis than that two noncrossing curves could support a complete absence of the "weeding-out" process.

We do not regard the UN model life tables as an artifact just because they do not provide for a crossing in the mortality rate. We believe that generally an actuary who is given mortality rates based on limited age data for extrapolation will refer them to a standard table and then assume a continuation of any differential. In very few instances could we conceive of said actuary projecting a reversal in the differential.