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MORTALITY AND REMARRIAGE EXPERIENCE FOR WIDOW BENEFICIARIES UNDER OASDI

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ABSTRACT

This paper presents an analysis of the mortality and remarriage experience of widow beneficiaries under OASDI. The data for young widows with children in their care (mother beneficiaries) are analyzed separately from the data for widow beneficiaries aged 62 and over.

The gross death rate (all ages and durations combined) for mother beneficiaries follows the trend of mortality in the United States—that is, a continuous decrease until the mid-1950's and a leveling-off thereafter, except for an increase observed in recent years, for which no explanation is apparent. The gross remarriage rate for mother beneficiaries increased to a high value at the end of World War II and then decreased slowly to the current low level. The gross death and remarriage rates for widow beneficiaries have been obscured by several factors discussed in the paper, but it is believed that the underlying trends would not be too different from those for mother beneficiaries.

The 1960–62 experience is analyzed in detail. For mothers, mortality increases with age except for a dip at ages 25–29. For widows, mortality increases smoothly with age. However, the rates for both types of beneficiaries would not join smoothly unless the values around the junction point (age 62) were significantly changed. Apparently, the requirement that a mother beneficiary be caring for a child is strong enough to ensure lower average mortality.

Remarriage rates based on the 1960–62 experience are presented on a five-year select and ultimate basis. The rates for mothers are significantly lower than those for widows, and no attempt was made to join them smoothly. Comparisons demonstrated the fact that these rates are higher than remarriage rates under the Railroad Retirement System but lower than previous experience under OASDI.

THIS paper presents an analysis of the mortality and remarriage experience of widow beneficiaries under the Old Age, Survivors and Disability Insurance System (OASDI). A brief study is made of the experience in the twenty-four-year period covering the calendar

years 1942–65, and a detailed analysis is conducted of the experience in the three-year period 1960–62. The data for widowed mothers are analyzed separately from those for aged widows because of their different characteristics.

The OASDI system is most generally known as a retirement system for practically the whole nation, operated by the federal government. An important aspect of the system, however, is the survivor benefits that are provided. As of the middle of calendar year 1968, monthly benefits were being paid to 5.8 million survivors, of which 2.9 million were aged widow beneficiaries (aged 60 or over) and 0.5 million were mother beneficiaries. There is a distinction between these two types of beneficiaries. The widow of a deceased insured worker can become entitled to mother's benefits at any age if she is caring for an entitled child (other than a student beneficiary aged 18–21). On the other hand, if she is not caring for an entitled child, a widow's benefit would be payable to her only after attainment of a specified age. Initially, the required age for widow's benefits was set at 65, but it was lowered to age 62 in the 1956 Amendments. It was lowered to age 60 in the 1965 Amendments, but with an accompanying actuarial reduction. The 1967 Amendments made it possible for a disabled widow to receive monthly benefits as early as age 50, but with an additional reduction in monthly benefits. When a mother beneficiary attains age 62, she will be reclassified as a widow beneficiary (since the benefit rate is higher), unless she cannot so qualify (because her husband was currently insured but not fully insured). As will be seen later, the eligibility requirements have had a significant effect on the mortality and remarriage experience of these beneficiaries.

The significant amount of data available on the mortality and remarriage of these survivor beneficiaries permits the preparation of tables for more homogeneous short periods of time. This is particularly true in the case of select tables, for which extensive data are needed if overgraduation is to be avoided. It should be observed from Table 1 that, for the month of March, 1966, more than one-third of all widows in the United States were entitled to either mother's or widow's benefits under OASDI. Table 1 does not include those widows who have earned enough credits to become eligible for a retirement benefit on their own account, since in the OASDI statistical system they are classified as old age beneficiaries. It is expected that the above proportion will decrease slowly in the future because of the increasing number of women who are becoming eligible for old age benefits and the current trend toward lower fertility in the United States.

OASDI data on mortality and remarriage of mother and widow beneficiaries have been collected since benefit payments started in 1940. The

amount of data was somewhat limited during the 1940's, and the development of rates from the experience was not attempted. However, a brief analysis of the data for calendar years 1940–48 was done by Robert J. Myers.[1] It was not until the early 1960's that a second study, covering the 1956 remarriage experience, was conducted by John P. Jones; in this study he published final graduated rates and made a brief analysis of the 1959 experience.[2] The study was limited to the remarriage experience, no attempt being made at that time to analyze the mortality experience of mother and widow beneficiaries.

TABLE 1

COMPARISON OF NUMBER OF MOTHER AND WIDOW OASDI *BENEFICIARIES AND UNITED STATES WIDOW* POPULATION, MARCH, 1966

Age (1)	Mother and Widow OASDI Beneficiaries (in Thousands) (2)	Widows in U.S. Population* (in Thousands) (3)	Ratio Col. (2) to Col. (3) (4)
Under 65	949	3,263	0.29
65–74	1,140	2,766	.41
75 and over	948	2,842	0.33
Total	3,037	8,871	0.34

* From Current Population Reports, P-20, No. 159, Bureau of Census, U.S. Department of Commerce.

The detailed results of the present remarriage study, covering the years 1960–62, are compared with the results of the 1956 experience, as well as with the most recent experience of the Railroad Retirement System. In regard to mortality, however, this being the first analysis of OASDI data, the results are compared with general United States population experience, as well as with the Railroad Retirement System experience.

It would be almost impossible at this time to analyze in detail all the experience accumulated since the OASDI system started paying mother's and widow's benefits. Aside from the lack of homogeneity of the data and their limited possible utility, the task of reconstructing the records (in addition to the sheer volume of data involved) would require a gigantic

[1] Robert J. Myers, "Further Remarriage Experience," *Proceedings of the Casualty Actuarial Society*, XXXVI, 73.

[2] "Remarriage Tables Based on Experience under OASDI and U.S. Employees Compensation System," *Actuarial Study No. 55* (Washington, D.C.: Social Security Administration).

effort. As a substitute, the gross rates for most of this experience are presented in Table 2. These data are based on the actual number of deaths and remarriages that were recorded in the years indicated, regardless of when they occurred, and on the average number of benefits in force (being paid or being withheld), as estimated from the year-end data.

As will be noted from Table 2, the gross death rate (all ages and durations combined) for mothers follows the trends of mortality in the United States; that is, there is a continuous decrease until the mid-1950's followed by a leveling-off thereafter. However, there is now no explanation for the increase in the 1963–65 period. The extensiveness of the data (7,322 deaths recorded in the period) practically eliminates the argument

TABLE 2

GROSS DEATH AND REMARRIAGE RATES FOR OASDI MOTHER AND WIDOW BENEFICIARIES, 1942–65

PERIOD	GROSS RATES PER THOUSAND			
	Death		Remarriage	
	Mothers	Widows	Mothers	Widows
1942–44	4.5	41.1	49.6	2.4
1945–47	4.5	40.8	76.9	3.1
1948–50	4.3	42.2	64.5	3.1
1951–53	4.1	45.5	61.9	2.8
1954–56	3.7	45.2	56.5	2.4
1957–59	4.0	45.8	50.0	3.0
1960–62	4.0	45.6	44.2	2.9
1963–65	4.4	49.4	45.9	2.9

for possible statistical fluctuations, and investigations have not uncovered any significant changes in death reporting and recording under OASDI.

The gross death rate for widows has an inverse trend, since mortality is shown to increase with time. Part of this trend is probably not real but is due to the effect on the gross rate of an increasing average age of the persons exposed. On the other hand, part of the increment can be due to a decreasing proportion of healthier widows in the group, since, as increasing numbers of widows become eligible for old-age benefits on their own account, the widow beneficiaries group is left with increasing numbers of persons who have not been in the labor force and who are in relatively poorer health.

It should be observed that the average age of mother beneficiaries should not be expected to change appreciably and that for this category

no other type of benefit is available that would withdraw the healthier beneficiaries. Therefore, the gross death rates for mothers, as well as their gross remarriage rates, could be viewed as acceptable indications of time trends. This is not the case for widows, for whom—in addition to the two sources of spurious trends already indicated—there have also been some changes in the age of earliest eligibility for benefits.

The gross remarriage rate for mother beneficiaries increases to a high value at the end of World War II and then decreases slowly to the current low levels. The trend for widow beneficiaries is somewhat obscured by the different factors previously discussed, but, if a clear picture were obtained, the trend would not be too different from that for mother beneficiaries.

The remarriage experience of widow beneficiaries will probably become more blurred in the future, since the 1965 Amendments incorporated changes by which widows aged 60 or over can remarry without having their benefits terminated. It was not until the addition in 1967 of benefits to disabled widows aged 50–59 that it became possible again for some widow's benefits to be terminated upon remarriage.

According to present law, a widow aged 60 or over who remarries has her benefit reduced (but not terminated) from 82½ per cent of her deceased husband's primary insurance amount to 50 per cent thereof. However, her benefit would continue at the 82½ per cent level if the new husband were a widower beneficiary, parent beneficiary, or disabled-child beneficiary under OASDI.

1960–62 MORTALITY EXPERIENCE

It is well known that mortality varies according to marital status. No categorical explanation has been found for the variation, but there are many students who believe that a great part of it is due to the selection process of marriage, since a person who is considering marriage would generally be inclined to select a healthy prospect. On the other hand, there are those who believe that married life is healthier than life under other marital statuses. Both arguments are plausible, and it is entirely possible that, to some extent, they are both applicable.

The fact that widows have higher mortality than the general population cannot be explained by the "marriage selection" argument in a fashion similar to that for married lives, since the same argument cannot be used to explain opposing results. It is possible, however, for the second argument to be regarded as applicable. It could be argued that widowhood status is in itself less healthy. This argument is in a way a truism, in which we could get caught in a vicious circle of the type "Lives are healthier

because fewer of them die, and fewer of them die because they are healthier." Nevertheless, regardless of arguments or explanations, it is well known that the mortality of widows is substantially higher than the mortality of wives. As can be seen from Table 3, according to the United States 1959–61 experience, the excess mortality ranges from about 200 to 300 per cent at the young ages to about 20 per cent at the older ages.

TABLE 3

COMPARISON OF MARRIED FEMALE MORTALITY AND WIDOWED FEMALE MORTALITY, U.S. POPULATION, 1959–61

AGE	CENTRAL DEATH RATE PER THOUSAND*		RATIO COL. (2) TO COL. (3)
	Widowed	Married	
(1)	(2)	(3)	(4)
20–24	2.47	0.58	4.26
25–29	2.40	0.74	3.24
30–34	3.30	1.04	3.17
35–39	3.88	1.54	2.52
40–44	5.16	2.41	2.14
45–49	6.81	3.70	1.84
50–54	9.45	5.60	1.69
55–59	12.17	8.02	1.52
60–64	18.19	12.91	1.41
65–69	25.97	19.99	1.30
70–74	39.85	32.52	1.23
75–79	64.57	53.30	1.21
80–84	110.23	93.96	1.17
85 and over	205.71	134.78	1.53

* These data were obtained from the Mortality Statistics Branch of the National Center for Health Statistics.

Mortality of Mother Beneficiaries

The mortality experience of OASDI mother beneficiaries for calendar years 1960–62 has been analyzed in more detail. As will be noted from Table 4, this study is based on a total of 5,759 deaths of mother beneficiaries and on an exposure of over 1.4 million life-years. The observed rates increase by age, as is to be expected, except that there is a dip at ages 25–29. This dip is similar to the one observed at the same ages for all widows in the United States (see Table 3), and it was retained in the final graduated rates for OASDI mother beneficiaries.

Troughs in mortality curves of a similar type were also observed for United States males, especially white males, in the 1959–61 Life Tables. For those tables, it was found that the irregularity was due for the most part to an excess in deaths due to violence (principally motor-vehicle acci-

dents) at ages 20–24. It is not known whether this is also the case for OASDI mother beneficiaries, since data on causes of death are not available. A preliminary analysis of the 1959–61 United States data for widows indicates that most of the trough could be explained as being due to motor-vehicle accidents at the younger ages.

The study of the mortality of mother beneficiaries (or, for that matter, of all the OASDI mortality and remarriage experience discussed in this paper) was conducted on a calendar-year basis. Deaths were grouped by calendar ages as well as by calendar duration. The exposures were based on these deaths and remarriages and on the number of benefits in force at

TABLE 4

ACTUAL DEATHS, EXPOSURES, AND DEATH RATES FOR OASDI MOTHER BENEFICIARIES, 1960–62

Age*	Actual Deaths	Exposure	Death Rate per Thousand
19–24	40	21,574	1.85
25–29	97	58,475	1.66
30–34	235	119,796	1.96
35–39	555	215,010	2.58
40–44	968	295,218	3.28
45–49	1,437	324,861	4.42
50–54	1,443	251,551	5.74
55–60	984	122,019	8.06
Total	5,759	1,408,504	4.09

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

the end of each calendar year. This type of study, which is the one most suitable to the available OASDI data, results in rates by half-durations instead of the usual integral durations. In addition, the exposure for the initial duration covers only one-half of a year. In order to avoid the manipulations and adjustments that would be needed, the first half-year of duration was not used in the mortality analyses. The elimination of such data does not impair the validity of the analysis, since, as can be noted from Tables 5 and 9, the differentials in mortality by duration are small.

The analysis by duration shows that mortality for mother beneficiaries increases slowly with duration but that this increase is not large enough to require the preparation of select tables. It is believed that some of the increase could be explained by a "remarriage selection" argument, since the healthier mothers would remarry sooner and would be withdrawn from the group. It will be noted from Table 5, nevertheless, that the

differentials are small, staying generally between 5 per cent below to 5 per cent above the average mortality. The low magnitude of these differentials invites some questions about the processes in life that change female mortality from that which is characteristic of wives to that which is characteristic of widows. Is it for the most part a sudden change that occurs close to the husband's death? How can a person's mortality change so fast? It will be noted from Table 3 that, for the total population, the ratio of widow mortality to wife mortality ranges from 4.26 at ages 20–24 to 1.52 at ages 55–59 (roughly the ages involved in mother's benefits).

TABLE 5

ACTUAL AND EXPECTED DEATHS BY DURATION FOR OASDI MOTHER BENEFICIARIES, 1960–62

DURATION (1)	NUMBER OF DEATHS		RATIO COL. (2) TO COL. (3) (4)
	Actual (2)	Expected* (3)	
½	921	972	0.948
1½	839	846	0.992
2½	713	727	0.981
3½	617	605	1.020
4½	524	499	1.050
5½	419	419	1.000
6½	358	363	0.986
7½	339	312	1.087
8½	250	255	0.980
9½	229	218	1.050
10½ and over	550	522	1.054
Total	5,759	5,738	1.004

* The expected deaths are calculated on the basis of graduated rates for the combined experience of durations ½ and over.

Is it possible that the matching process in marriage could be such that there is a tendency to bring together lives of similar health (poor or good)? If this argument were applicable, then a large part of the excess mortality of widows would arise not because of the husbands' deaths but because it had been present from the moment they were married. This argument is not supported, however, by the fact that the differentials in mortality decrease with age.

The observed and graduated mortality rates for mother beneficiaries are presented in Table 6, by single years of age. As indicated before, these rates are based on the experience for durations ½ and over. The graduated rates start at a relatively high value at age 19, decrease to a minimum at age 26, and increase from then until the last age shown.

The graduated death rates for mother beneficiaries are compared, for selected ages, with those for the total United States female population and with those for all widows in the United States (Table 7). When this study was started, it was expected that the mortality of OASDI mother beneficiaries would be lower than that for all United States widows. That this is the case can be seen from column (6) in Table 7, where the differentials

TABLE 6
OBSERVED AND GRADUATED MORTALITY RATES FOR OASDI MOTHER BENEFICIARIES, 1960–62

Age*	Death Rate per Thousand		Age*	Death Rate per Thousand	
	Observed	Graduated		Observed	Graduated
19	4.3	2.13	40	3.1	2.95
20	0.9	1.96	41	3.1	3.11
21	1.9	1.82	42	2.9	3.27
22	2.3	1.71	43	3.5	3.46
23	1.3	1.62	44	3.7	3.66
24	1.7	1.56	45	4.0	3.87
25	1.2	1.52	46	4.4	4.10
26	1.6	1.51	47	4.1	4.33
27	1.2	1.53	48	4.8	4.58
28	2.1	1.56	49	4.9	4.84
29	1.4	1.61	50	4.7	5.14
30	1.9	1.68	51	5.6	5.46
31	1.4	1.77	52	5.6	5.82
32	2.1	1.88	53	6.1	6.21
33	2.0	2.00	54	7.1	6.64
34	2.2	2.13	55	7.0	7.11
35	2.4	2.26	56	7.4	7.62
36	2.5	2.41	57	8.2	8.18
37	3.1	2.54	58	9.2	8.78
38	2.4	2.67	59	8.9	9.43
39	2.6	2.81	60	10.5	10.13

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

are shown to be somewhere between 30 and 80 per cent. However, it was also expected that mortality rates for mother beneficiaries would be higher than those for all females in the United States, but they are higher only at the younger ages (under 50). Apparently, the possibly superior health status of a woman who meets the requirement that she be caring for an entitled child is significant enough to offset the excess mortality generally associated with widowhood.

Population studies of mortality by marital status have been frequently regarded as lacking in accuracy on account of questionable validity of census and vital statistics data by marital status. This has been particu-

larly the case at the very young ages, where the largest differentials in mortality have been obtained. It is argued that there are few widows in the population at those ages and that a small tabulating or reporting error could significantly affect the results. It is believed that young women are reluctant to report themselves in the census as widows. However, the mortality study in this paper does not raise questions about the credibility of the 1959–61 United States mortality of widows. It can be seen from Tables 7 and 10 that the OASDI rates are reasonably comparable with the United States population rates.

TABLE 7

COMPARISON OF MORTALITY RATES FOR OASDI MOTHER BENEFICIARIES WITH THAT OF UNITED STATES POPULATION

	Death Rate per Thousand			Ratio	
Exact Age	Mother Beneficiaries, 1960–62	Females, U.S., 1959–61	Widows, U.S., 1959–61*	Col. (3) to Col. (2)	Col. (4) to Col. (2)
(1)	(2)	(3)	(4)	(5)	(6)
20.....	2.04	0.64	2.62	0.31	1.28
25.....	1.54	0.79	2.26	0.51	1.47
30.....	1.65	1.06	2.92	0.64	1.77
35.....	2.20	1.51	3.59	0.69	1.63
40.....	2.88	2.30	4.56	0.80	1.58
45.....	3.76	3.51	6.00	0.93	1.60
50.....	4.99	5.41	8.32	1.08	1.67
55.....	6.87	7.83	10.68	1.14	1.55
60.....	9.78	12.09	15.33	1.24	1.57

* Calculated from mortality data by marital status supplied to the author by the National Center for Health Statistics.

Mortality of Widow Beneficiaries

Widow's benefits under the OASDI system, although payable without the requirement of care for an entitled child, have always been subject to limitations regarding the youngest age at which they can be paid. Initially, benefits were payable only to widows aged 65 or over (younger widows having to wait until that age before becoming eligible for benefits). In 1956, the requirement was reduced to age 62, and in 1965 it was lowered to age 60, but with benefits being actuarially reduced. In the 1967 Amendments there was a further reduction to age 50 in regard to disabled widows, and again there was a reduction in benefit amount.

The age limitation has some effect on the analysis of rates by durations, since the durations are measured in this study from the year of entitlement rather than from the year of death of the husband. This form of

measuring duration has very little effect on the mortality and remarriage rates for mother beneficiaries. Studies have demonstrated that about 97–98 per cent of mothers file for benefits during the year in which their husbands died. Practically all the remaining 2–3 per cent file the following year and also become entitled in the year in which their husbands died. The effect on the rates for widow beneficiaries is also relatively small, since their filing experience is similar to that for mother beneficiaries, except for those who become widows before the minimum eligibility age. Particular attention was given to the data for these widows, but no significant difference in the flow of rates by age or duration was noticed, and it was decided to incorporate the data without adjustments.

TABLE 8

ACTUAL DEATHS, EXPOSURES, AND DEATH RATES FOR OASDI WIDOW BENEFICIARIES, 1960–62

Age*	Actual Deaths	Exposure	Death Rate per Thousand
62–64.....	12,544	721,838	17.38
65–69.....	31,097	1,261,192	24.66
70–74.....	46,900	1,196,381	39.20
75–79.....	58,762	943,940	62.25
80–84.....	46,745	471,734	99.09
85–89.....	20,785	138,605	149.96
90–94.....	4,541	20,394	222.66
95–98.....	408	1,424	286.52
Total....	221,782	4,755,508	46.64

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

This mortality study for widow beneficiaries is based on 221,782 deaths and 4¾ million life-years of exposure. From Table 8, it will be noted that the observed death rates increase smoothly with age. As was done in the case of mother beneficiaries, the data for widow beneficiaries were tabulated on a "calendar year of occurrence" basis and exclude the experience for the initial duration, 0–½. This exclusion does not affect the over-all rate significantly, since there is little variation in mortality by duration of widowhood (Table 9).

The differential in mortality by duration ranges only from 3 per cent below the average to 2 per cent above the average. This fact again raises some questions about differences in mortality by marital status. The OASDI 1960–62 experience for widow beneficiaries indicates that there is a tendency for mortality to increase with duration but that the increases are not comparable to the differentials by marital status observed in the

United States population. It is not known whether the higher mortality of widows as compared to wives is due to a selection process at marriage or whether it is associated with the immediate effects of the loss of a husband, but it is clear from this study that the differentials in mortality, if none existed before the husband's death, accumulate rather rapidly in a short period after widowhood begins.

The graduated death rates for OASDI widow beneficiaries are compared, for selected ages, with those for the United States 1959–61 total females and with those for United States 1959–61 widows (Table 10). The

TABLE 9

ACTUAL AND EXPECTED DEATHS BY DURATION FOR OASDI WIDOW BENEFICIARIES, 1960–62

Duration	Number of Deaths		Ratio Col. (2) to Col. (3)
	Actual	Expected*	
(1)	(2)	(3)	(4)
½	22,457	23,190	0.968
1½	22,037	22,557	0.977
2½	20,916	21,178	0.988
3½	22,623	22,645	0.999
4½	20,784	20,908	0.994
5½	19,960	19,609	1.018
6½	14,688	14,594	1.006
7½	13,192	13,125	1.005
8½	11,082	10,967	1.010
9½	9,949	9,768	1.019
10½ and over	44,094	43,226	1.020
Total	221,782	221,767	1.000

* The expected deaths are calculated on the basis of the graduated rates for the combined experience of durations ½ and over.

OASDI widow beneficiaries have higher mortality than do United States total females at ages below 80, but the reverse occurs above that age. Something similar was observed previously for mother beneficiaries, and it was indicated that the better health probably enjoyed by those who can meet the requirement of care for an entitled child may more than offset the usual higher mortality associated with widowhood. However, in the case of aged widow beneficiaries, a portion of the reverse in the differential is due to the way in which the 1959–61 United States Life Tables were closed. At those ages, the tables were prepared by progressively blending the observed rates with those of the experience of Union Civil War Veterans from ages 85 to 94. At that time it was believed that the observed rates in the population were too low and unreliable, because of

the known tendency of aged people to overstate their ages in the census.

A comparison of the OASDI death rates for widow beneficiaries with those for United States widows shows the latter to be higher. However, no significant pattern for the differential to increase or decrease by age is observed. No explanation for the differential is available.

A comparison is made, for selected ages, of graduated death rates for OASDI widow beneficiaries with those for female beneficiaries in the Railroad Retirement System and with those for OASDI female retired workers (Table 11).[8] It can be noted that the rates for OASDI widow beneficiaries

TABLE 10

COMPARISON OF MORTALITY OF OASDI WIDOW BENEFICIARIES WITH THAT OF UNITED STATES POPULATION

	Death Rate per Thousand			Ratio	
Exact Age	Widow Beneficiaries, 1960–62	Females, U.S., 1959–61	Widows, U.S.,* 1959–61	Col. (3) to Col. (2)	Col. (4) to Col. (2)
(1)	(2)	(3)	(4)	(5)	(6)
65.....	19.58	18.54	21.97	0.95	1.12
70.....	30.93	29.29	32.46	0.95	1.05
75.....	49.51	47.67	50.96	0.96	1.03
80.....	80.18	81.44	85.38	1.02	1.06
85.....	126.91	134.23	142.71	1.06	1.12
90.....	191.36	223.29	.....	1.17	.....

* Calculated from mortality data by marital status supplied to the author by the National Center for Health Statistics.

are higher in both cases but that the differences tend to decrease with age. As should be expected, the differences are smaller for the Railroad Retirement System rates, since they were based on the combined experience of wives and widows. The differences for the OASDI female worker rates are larger, since retired workers normally are relatively healthier than others of the same age.

The observed and graduated rates for OASDI widow beneficiaries are presented by single years of age in Table 12. The graduation of the observed rates for this category was performed separately from that for the corresponding rates for mother beneficiaries (see Table 6), and no attempt was made to obtain a smooth joint of both series of death rates. An initial

[8] These rates were presented by James L. Cowen in "The 1962 RRB Female Mortality and Remarriage Tables," *TSA*, XVII, 58, and by Robert J. Myers and Francisco Bayo in "Mortality of Workers Entitled to Old-Age Benefits under OASDI," *TSA*, XVII, 417.

TABLE 11

COMPARISON OF MORTALITY OF OASDI WIDOW BENEFICIARIES WITH THAT OF RAILROAD RETIREMENT FEMALE BENEFICIARIES AND OASDI FEMALE RETIRED WORKERS

EXACT AGE	DEATH RATE PER THOUSAND			RATIO	
	Widow Beneficiaries, 1960–62	Female Beneficiaries, Railroad Retirement, 1959–61*	Female Workers, OASDI, 1959–61†	Col. (3) to Col. (2)	Col. (4) to Col. (2)
(1)	(2)	(3)	(4)	(5)	(6)
65	19.58	17.27	14.89	0.88	0.76
70	30.93	26.60	24.70	0.86	.80
75	49.51	44.81	40.83	0.91	.82
80	80.18	76.61	67.12	0.96	.84
85	126.91	123.01	109.34	0.97	.86
90	191.36	191.82	175.50	1.00	0.92

* From *TSA*, XVII, 62.

† From *Actuarial Study No. 60*, Social Security Administration.

TABLE 12

OBSERVED AND GRADUATED MORTALITY RATES FOR OASDI WIDOW BENEFICIARIES, 1960–62

AGE*	DEATH RATE PER THOUSAND		AGE*	DEATH RATE PER THOUSAND	
	Observed	Graduated		Observed	Graduated
62	15.9	15.66	81	92.8	92.43
63	16.9	17.12	82	101.5	101.41
64	19.1	18.72	83	112.1	111.10
65	19.8	20.48	84	121.1	121.48
66	22.0	22.42	85	130.9	132.59
67	25.3	24.57	86	147.9	144.41
68	27.3	26.93	87	159.7	156.93
69	29.0	29.53	88	167.3	170.14
70	32.4	32.40	89	183.6	184.12
71	35.7	35.57	90	206.2	198.88
72	39.7	39.07	91	213.3	214.49
73	42.6	42.92	92	233.0	231.05
74	46.2	47.20	93	270.8	248.77
75	51.6	51.94	94	266.5	267.92
76	57.1	57.20	95	260.9	289.27
77	63.1	63.01	96	275.1	313.69
78	69.0	69.41	97	323.4	341.82
79	76.3	76.44	98	443.2	373.51
80	85.0	84.10	.....	.....	.....

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

analysis of the observed rates indicated that a smooth joint would have required substantial increases in the rates for mother beneficiaries at the older ages or decreases in the rates for widow beneficiaries at the younger ages, or both. It was decided, since the bulk of the data is principally at those ages, that it would be preferable to prepare separate graduations and to allow those interested in a single graduation to prepare their own, according to their needs and preferences.

1960–62 REMARRIAGE EXPERIENCE

As was indicated earlier, this paper is the third analysis that has been made of OASDI remarriage experience. The first analysis was conducted by Robert J. Myers, covering in the main the years 1940–46. The second analysis was done by John P. Jones, covering the years 1956 and 1959. The present study covers the experience in the three calendar years 1960–62. The analysis is based on 67,984 remarriages of mother beneficiaries and on 14,878 remarriages of widow beneficiaries that occurred in the three-year period. It is believed that this is the largest amount of remarriage data ever studied in detail.

All data were tabulated by calendar occurrences, but special efforts were made to secure the experience for the first half-year of duration, since it is very significant in remarriage analysis. All durations were measured from the calendar year of entitlement to benefits. This introduces no significant error in the rates for mother beneficiaries, since, in practically all cases, entitlement occurs in the year of death of the husbands. For widows, a small error was introduced as a result of the fact that those who become widows before the minimum age for benefits have to wait until that age for entitlement. However, no abrupt deviations in the flow of the observed rates were noticed around the ages involved.

It will be seen from Table 13 that, according to the OASDI 1960–62 experience, remarriage rates for mother beneficiaries vary significantly by duration and that the effect lasts for more than ten years. This was not found to be the case for the mortality experience, where the effect of duration was observed to be relatively minor. Nevertheless, for convenience, the remarriage rates were graduated to produce a five-year select period.

The experience for widow beneficiaries does not show that the effect of duration is very long, since there is not much difference in the rates for durations $5\frac{1}{2}$–$9\frac{1}{2}$ (Table 14). In this case, a five-year select period could be justified on the basis of the experience.

The final graduated rates for mother beneficiaries are presented in Table 15, while those for widow beneficiaries are presented in Table 16.

TABLE 13

ACTUAL AND EXPECTED REMARRIAGES BY DURATION FOR OASDI MOTHER BENEFICIARIES, 1960–62

DURATION (1)	NUMBER OF REMARRIAGES		RATIO COL. (2) TO COL. (3) (4)
	Actual* (2)	Expected† (3)	
½	15,309	14,230	1.076
1½	13,956	11,239	1.242
2½	9,967	8,693	1.147
3½	7,102	6,692	1.061
4½	4,811	5,154	0.933
5½	3,636	4,061	0.895
6½	2,655	3,337	0.796
7½	1,996	2,721	0.734
8½	1,441	2,191	0.658
9½	1,156	1,780	0.649
10½ and over	2,055	3,799	0.541
Total	64,084	63,897	1.003

* In addition, there were 3,900 remarriages in the initial duration 0–½.

† The expected remarriages are calculated on the basis of graduated rates for the combined experience of durations ½ and over.

TABLE 14

ACTUAL AND EXPECTED REMARRIAGES BY DURATION FOR OASDI WIDOW BENEFICIARIES, 1960–62

DURATION (1)	NUMBER OF REMARRIAGES		RATIO COL. (2) TO COL. (3) (4)
	Actual* (2)	Expected† (3)	
½	3,166	3,115	1.016
1½	3,027	2,566	1.180
2½	2,251	2,003	1.124
3½	2,097	2,039	1.028
4½	1,348	1,470	0.917
5½	816	1,034	0.789
6½	315	409	0.770
7½	220	297	0.741
8½	158	203	0.778
9½	113	146	0.774
10½ and over	156	286	0.545
Total	13,667	13,568	1.007

* In addition, there were 1,211 remarriages in the initial duration 0–½.

† The expected remarriages are calculated on the basis of graduated rates for the combined experience of durations ½ and over.

The graduations were done separately, since the remarriage rates for widow beneficiaries are significantly higher than those for mother beneficiaries. A similar difference between remarriage rates for mother and widow beneficiaries was observed in the Railroad Retirement System data, but in that case a single table was desired and a smooth joint was obtained.

TABLE 15

GRADUATED REMARRIAGE RATES FOR MOTHER BENEFICIARIES, 1960–62

(Per Thousand)

Exact Age x	$m_{q[x]}$	$m_{q[x]+1}$	$m_{q[x]+2}$	$m_{q[x]+3}$	$m_{q[x]+4}$	$m_{q_{x+5}}$
19	197.2	280.0	244.6	179.4	136.5	85.1
20	183.5	261.2	228.2	171.4	132.5	83.4
21	171.4	243.6	213.0	163.5	128.5	81.6
22	159.7	227.0	199.0	155.7	123.9	79.6
23	148.9	211.5	186.0	148.0	119.0	77.3
24	138.9	196.9	173.9	140.2	113.7	74.8
25	129.5	183.2	162.8	132.5	108.2	72.0
26	120.8	170.6	152.4	125.0	102.5	68.9
27	112.7	159.0	142.7	117.7	96.9	65.6
28	105.2	148.5	133.6	110.7	91.5	62.1
29	98.0	138.8	125.1	104.1	86.1	58.4
30	91.3	129.6	117.1	97.1	80.9	54.7
31	85.0	120.9	109.5	91.5	75.7	51.1
32	78.8	112.4	102.3	85.8	70.7	47.6
33	72.7	104.1	95.3	80.3	65.9	44.3
34	67.1	96.1	88.7	75.0	61.2	41.2
35	61.6	88.6	82.4	70.0	56.7	38.3
36	56.5	81.4	76.4	65.0	52.5	35.9
37	51.4	74.6	70.6	60.3	48.5	32.8
38	46.7	68.2	65.2	55.7	44.9	30.3
39	42.1	62.3	60.0	51.3	41.3	27.8
40	37.8	56.8	55.1	47.1	37.9	25.3
41	34.0	51.6	50.3	43.0	34.5	23.0
42	30.3	46.6	45.7	39.0	31.2	20.8
43	27.1	41.9	41.1	35.0	28.0	18.8
44	23.9	37.5	36.6	31.2	25.0	16.8
45	21.1	33.2	32.2	27.4	22.0	14.9
46	18.5	29.1	28.1	23.8	19.3	13.2
47	15.8	25.3	24.3	20.5	16.7	11.6
48	13.5	21.8	20.9	17.5	14.4	10.2
49	11.1	18.6	17.9	14.9	12.3	8.9
50	9.3	15.7	15.3	12.6	10.5	7.7
51	7.8	13.3	13.1	10.8	8.9	6.7
52	6.5	11.2	11.2	9.3	7.6	5.8
53	5.7	9.4	9.7	8.0	6.4	5.0
54	4.7	8.0	8.5	6.9	5.4	4.3
55	4.1	6.8	7.4	6.0	4.6	3.7
56	3.6	5.9	6.5	5.2	4.0	3.1
57	3.1	5.1	5.7	4.6	3.6	.....
58	2.6	4.5	5.1	4.1	.....	.....
59	2.2	3.6	4.1	.....	.....	.....
60	1.9	3.1	.....	.....	.....	.....
61	1.6	.....	.....	.....	.....	.....

TABLE 16

GRADUATED REMARRIAGE RATES FOR WIDOW BENEFICIARIES, 1960–62

(Per Thousand)

Exact Age x	m $q_{[x]}$	m $q_{[x]+1}$	m $q_{[x]+2}$	m $q_{[x]+3}$	m $q_{[x]+4}$	m q_{x+5}
62	5.4	7.3	7.1	5.7	4.3	3.2
63	4.9	6.8	6.5	5.2	3.9	2.9
64	4.4	6.2	6.0	4.8	3.6	2.6
65	3.9	5.7	5.5	4.3	3.2	2.4
66	3.5	5.2	5.0	3.8	2.9	2.1
67	3.2	4.7	4.4	3.4	2.7	1.8
68	2.8	4.2	4.0	3.1	2.4	1.6
69	2.5	3.8	3.6	2.7	2.2	1.4
70	2.3	3.4	3.1	2.4	2.0	1.1
71	2.0	3.0	2.7	2.2	1.8	0.9
72	1.8	2.7	2.4	1.9	1.6	0.8
73	1.5	2.4	2.2	1.7	1.3	0.6
74	1.3	2.2	2.0	1.5	1.1	0.5
75	1.2	1.9	1.7	1.3	0.9	0.4
76	1.1	1.7	1.5	1.1	0.7	0.3
77	1.0	1.5	1.3	0.9	0.5	0.2
78	0.8	1.3	1.1	0.8	0.4	0.2
79	0.7	1.1	1.0	0.6	0.3	0.1
80	0.6	0.9	0.8	0.4	0.2	0.1
81	0.5	0.8	0.7	0.3	0.1	.....
82	0.4	0.7	0.5	0.2	.....	.....
83	0.3	0.6	0.3	.....	.....	.....
84	0.2	0.4	.....	.....	.....	.....
85	0.1	.....	.....	.....	.....	.....

TABLE 17

COMPARISON OF GRADUATED REMARRIAGE RATES OASDI 1956 EXPERIENCE AS PER CENT OF OASDI 1960–62 EXPERIENCE

AGE AT WIDOWHOOD* x	DURATION					
	0	1	2	3	4	5 and Over†
	Mother Beneficiaries					
20	94%	113%	103%	113%	129%	160%
25	89	114	109	114	122	139
30	85	108	108	111	116	132
35	85	105	103	106	111	130
40	88	102	99	103	107	127
45	84	99	96	101	105	122
50	94	110	106	120	116	121
55	132	157	135	148	159	151
	Widow Beneficiaries					
65	77%	104%	100%	114%	125%	125%
70	87	118	119	138	140	191
73	100	121	123	141	154	267

* Age nearest birthday at widowhood.

† Calculated for age $x + 5$.

A comparison is made, for selected ages, of the graduated remarriage rates with those obtained from the analysis of the OASDI 1956 experience (Table 17). The remarriage rates experienced in 1956 generally were significantly higher than those experienced during 1960–62. According to the comparison, the 1956 rates for duration 0 are lower than the 1960–62 rates, but it is possible that some of the difference is due to changes in the methods used to obtain the graduated rates for that duration. The 1956

TABLE 18

COMPARISON OF GRADUATED REMARRIAGE RATES, RAILROAD RETIREMENT 1955–62 EXPERIENCE AS PER CENT OF OASDI 1960–62 EXPERIENCE

AGE AT WIDOWHOOD* x	DURATION					
	0	1	2	3	4	5 and Over†
	Mother Beneficiaries					
20	65%	76%	90%	81%	76%	112%
25	70	85	99	83	75	92
30	62	88	102	86	74	84
35	56	81	93	82	71	74
40	50	74	76	74	71	69
45	45	64	66	73	75	73
50	69	84	84	103	103	91
55	106	136	119	146	159	124
	Widow Beneficiaries					
62	48%	82%	82%	84%	91%	86%
65	54	89	85	86	94	90
70	67	114	101	94	94	134

* Age nearest birthday at widowhood.

† Calculated for age $x + 5$.

experience was extrapolated to obtain data for the initial duration, but for the 1960–62 experience presented in this paper a method was devised to obtain rates that fully agree with the experience. Except for the difference in the first duration, the results in Table 17 confirm the observation made earlier, on the basis of Table 2, that OASDI remarriage rates have been decreasing.

A comparison with the most recent Railroad Retirement System experience shows that remarriage rates for OASDI are somewhat higher (Table 18). This is true for practically all ages and durations. The OASDI

rates are shown to be lower at age 55, probably because in the graduation of the Railroad Retirement System experience it was found necessary to overstate the rates near that age in order to obtain a smooth joint with the rates at the older ages.

METHODOLOGY

The rates for the 1960–62 OASDI experience were computed, using methods especially designed to suit the available data. Ideally, one would first design the procedure and later collect data to suit it. However, in actual practice it happens very often that large amounts of data, which have been collected for other purposes, are available, and they can be salvaged if proper formulas and procedures are designed to extract the desired information.

The procedures used in this study are based on data by calendar year of occurrence. In the OASDI statistical system, data are collected on a routine basis for all types of beneficiaries—containing the number of benefits in force at the end of each calendar year, by calendar year of birth, and by calendar year of entitlement. Also available are data on benefits terminated in a calendar year, by reason for termination, by effective year of termination, and by year of entitlement. These data lead to the use of the following exposure formulas:

$$ {}^{v}E^{Z}_{Z-b} = \tfrac{1}{2}({}^{v}F^{Z-1}_{Z-1-b} + {}^{v}F^{Z}_{Z-b} + {}^{v}\theta^{Z}_{Z-b}) , \qquad \text{for } y < Z $$

$$ {}^{v}E^{Z}_{Z-b} = {}^{v}F^{Z}_{Z-b} + {}^{v}\theta^{Z}_{Z-b} + \tfrac{1}{2}{}^{v}\omega^{Z}_{Z-b} , \qquad \text{for } y = Z , $$

where E, F, θ, and ω stand for exposure, benefits in force, benefits terminated by the reason being studied, and benefits terminated by other reasons, respectively; and where the subscripts and superscripts b, Z, and y stand for the year of birth, the year of occurrence or tabulation, and the year of entitlement, respectively.

These exposures yield the following rates:

$$ {}^{Z}q_{[v-b]+(Z-v-1/2)} = \frac{{}^{v}\theta^{Z}_{Z-b}}{{}^{v}E^{Z}_{Z-b}} , \qquad \text{for } y < Z $$

$$ \tfrac{1}{2}{}^{Z}q_{[v-b]} = \frac{{}^{v}\theta^{Z}_{Z-b}}{{}^{v}E^{Z}_{Z-b}} , \qquad \text{for } y = Z . $$

It should be observed that these formulas are based on the assumption that lives begin to be exposed to the risk involved at the moment of entitlement. In the OASDI program, however, benefits can be paid retroactively for up to twelve months, and there is the possibility of a beneficiary's being included in the exposure retroactively even though it is

known that the risk did not materialize during the period of retroactivity. This assumption, therefore, tends to understate the rate by overstating the exposure, but it has been found that the error is negligible, since about 97–98 per cent of these survivor beneficiaries file a claim in the calendar years of their husbands' deaths.

Another difficulty that had to be resolved is due to administrative lags. It is known that some time elapses between the occurrence of an event and its recording in the OASDI system and also that it takes some time to process a claim for benefits. This means that the tabulated number of benefits in force does not truly reflect the number of beneficiaries eligible to receive benefits, since it includes cases that have terminated but that have not been recorded and excludes cases where benefits will be awarded later retroactively.

After careful analysis of the data, it was decided to base the in-force values on data as recorded a full year after the desired date. This means that the in-force tabulated data were adjusted to reflect all the recordings of the next calendar year that would have been included if there were no lags. This adjustment reduced the error to a negligible level, since very few occurrences are recorded with a lag of more than a calendar year. However, for the terminations being studied (death and remarriage), since very high accuracy was desired, it was decided to use the recordings of up to two full calendar years after the year of occurrence.

As was indicated previously and as can be observed from the formulas used, the rates obtained were for half-durations instead of the usual integral durations (except that the initial duration was for a half-year of exposure, although at exact duration 0). The rates for the desired integral durations were interpolated, using a third-difference, four-point, symmetric formula for durations 2, 3, 4, and 5 and over. A second-difference, three-point formula was used to interpolate the rates for duration 1.

The values for duration 0 were calculated by requiring the interpolated rates at integral durations to reproduce interpolated ${}_5\hat{p}_{[x]}$ values that were calculated from the half-duration rates. The same third-difference, four-point symmetric formula was used in this interpolation. In every instance, the observed rates at each half-duration were graduated before the interpolation.

Whittaker-Henderson, type-A formulas with $a = 3$ were used in all graduations. The graduations were performed on the logarithms of the rates in all cases, except for remarriage rates for widow beneficiaries, in which case the graduation was performed on the rates themselves.

Graduations were done on the logarithms instead of on the rates themselves because it was desired to use relative errors instead of absolute

errors as a measure of fit, due to the wide range of the observed rates. Interpolations were also done on the logarithms because of the better accuracy achieved thereby. A study of the rates indicates that they could be approximated by exponential curves, demonstrating that geometric interpolation would be superior.[4]

[4] See Charles B. Baughman, "Some Instances of the Superiority of Geometric Methods over Arithmetic Methods of Interpolation and Extrapolation," *TSA*, XVII, 159.