ERMINATION EXPERIENCE OF DISABLED-WORKER BENEFITS UNDER OASDI, 1957-63

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Social Security Administration . . . . . Office of the Actuary

ACTUARIAL STUDY NO. 65

MARCH 1969

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FOREWORD

This study presents the first actuarial analysis of the disabled-worker benefit termination experience that has been observed under the Disability Insurance program. Some limitations were encountered in the data used, and these are discussed in some detail in the study. The approximations that were adopted eliminate, to a large extent, the problems created by the data limitations. It is believed that the resulting graduated rates are representative of the actual experience that was observed.

The study is limited to cases in which the disability began after 1966, and it does not include cases where there was only a disability freeze. This was necessary in order to make the observed group of disabled workers as homgeneous as possible. However, in programs of this type, it usually takes some time after its inception for the evaluative policies to reach a plateau of uniformity. In this sense, in addition to the effect of changes that have been made in the program, it is possible for future similar experience to be different from the final rates shown in this study.

It is hoped that the study will be of significant value to actuaries involved in the valuation of disability benefits, and that it will be followed by similar studies based on further data.

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Office of the Actuary

A. Introduction

This Actuarial Study presents data on the benefit termination experience for disabled-worker beneficiaries under the Old-Age, Survivors, and Disability Insurance system (OASDI). Various Actuarial Notes have previously presented data pertaining to the incidence of disability among insured persons[1/], but this is the first time that data regarding terminations are analyzed.

The delay in making this experience available is due in part to the fact that since historically disability termination rates have been found to be strongly dependent on duration of disability, it was necessary to have data for a relatively long period before a useful analysis could be attempted. However, part of the delay has been due to various difficulties encountered in obtaining data in the very specialized form that an actuarial analysis requires. In fact, the totality of the data now available are not strictly in the form that a definite actuarial analysis would require. However, it was decided to extract from them the most information that could be obtained with the use of several simplifying assumptions, instead of delaying their publication.

Since these assumptions are in some instance somewhat arbitrary, the reader is advised to view the termination rates presented here as being first approximations to the actual experience. It is hoped that, in the near future, there will be presented fully accurate rates that have been developed with only the routine actuarial assumptions which are customarily adopted in similar cases. However, it is believed that the rates presented here should not differ more than a few percentage points (5% at the most) from the "true" rates.

1/ See Actuarial Notes Nos. 18, 36, and 45 for an analysis of disability-incidence experience.

B. Analysis of Data

There are two types of disability benefit terminations of significant actuarial importance: death of the beneficiary and recovery of the beneficiary from the disability. The experience for both are discussed in this Actuarial Study. Other types of terminations either are peculiar to OASDI only, such as age 65 termination[2/] or are of very limited numerical significance[3/] .

Table 1 presents a brief analysis of the gross termination rates[4/] that have been observed. The gross death termination rate has been decreasing continuously since the beginning of the program. This rate was high initially, since the program then was limited to workers aged 50-64. The elimination of the age-50 limitation in the 1960 Amendments brought in many young disabled workers with correspondingly lower mortality. This reduced the overall gross death rate for all disabled workers. Part of the remaining decrease

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2/ According to administrative procedures followed in OASDI, benefits to disabled workers are terminated upon attainment of age 65, and old-age retirement benefits are automatically awarded to replace them.

3/ Other types of terminations are due principally to unusual circumstances or events resulting in erroneous awards. In some cases, a disabled worker is awarded disability benefits and he dies before the end of the first month for which he would be entitled. Legally, the worker was never entitled to benefits, but in actual practice, it is possible for information about his death to be recorded after the award was made. In that case, both an award and a termination are recorded to be effective for the same month. In other instances, disability benefits may be awarded before an age determination is made. If afterwards it is found that the worker was aged 65 or over at the date of entitlement, the disability benefits would be terminated retroactive to the date of entitlement, and old-age benefits are awarded instead.

4/ The gross termination rate is defined as the ratio of the number of terminations in a year to the average number of benefits in force in the year.

could be due to the maturation of the program. As the program grows older, there is a tendency towards a lower concentration of disabled-worker beneficiaries at the low duration periods, which generally are subject to higher mortality. However, this could not fully account for the rather rapid decrease that has been observed, and at this time, there is no definite explanation for the remainder of the decrease.

The gross recovery termination rate has been increasing. In part, this is due to the elimination of the age-50 limitation for benefit payments. This brought in young workers with higher recovery rates, which would tend to increase the overall rate for all disabled workers. In addition, there is the effect of the trial-work-period provision[5/] . This provision became effective in October 1960, but its full effect on the number of recoveries was not felt until 1964, due to the various lags involved in its application and administration.

The gross termination rate due to both death and recovery combined has been decreasing--from initial values of 15%-16% per year to current values of about 10%-11%.

Historically, benefit termination rates for disabled persons have been found to be strongly dependent on the duration of the disability as well as on the age of the person. This has again been found to be the case in the experience of disabled-worker beneficiaries under OASDI, as can be seen from Tables 4 to 7.

The termination rates by age, sex, and duration presented here are based on the termination experience of calendar years 1957-63 that was recorded before October 1964. The data were limited to persons whose disability started in calendar year 1957-62. However, for persons who were under age 50 at onset of disability, their period of observation was further limited by using only their experience past age 50 if their onset was before calendar year 1961. This limi-

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5/ This provision encourages beneficiaries to work by permitting trial work for 9 months without loss of benefits; thereafter, benefits may be terminated because of "recovery", as demonstrated by substantial gainful employment, even though the medical impairment is unchanged.

tation was necessary to assure homogeneity of the data, since disability benefits to disabled workers under age 50 first became payable in October 1960. Some data on the disability freezes[6] awarded before that date are available, but it is believed that the experience would be significantly different from that developed for workers who were receiving monthly disability benefits, and it was decided to exclude it from the study.

Two significant limitations in the data should be noted. The first one is due to the inclusion as an award and later as a termination of those cases in which the disabled worker died during the month of "first entitlement" and the information was recorded too late to prevent the award action. Inclusion of these cases tends to overstate the terminations for the first year of duration.

The second limitation is due to the inclusion in the exposure, from the date of onset, of all cases with retroactive benefit payments. This type of case occurs when a worker applies for benefits after the mandatory 6-month waiting period[7]. The inclusion in the exposure from the month of onset of such cases tends to understate the termination rates.

These two limitations operate in different directions, and it is believed that the net effect is negligible for durations over 4 years. For durations 0-4, it is estimated that there is a net understatement of the termination rates of not over 5%.

Besides the usual actuarial approximations involved in studies of this type, it was also necessary to have two

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6/ The "disability freeze" provision resulted in the disabled worker having his insured status and his average monthly wage for benefit purposes maintained as they were when he became disabled. With the elimination in 1960 of the age-50 limitation for benefits, this provision lost almost all of its importance.

7/ As the law is written, this period seems to be 6 months, but actually, it is 7 to 8 months because the 6-month period is measured from the beginning of the calendar month following onset, and the beneficiary must live until the end of the calendar month following the 6-month period to receive his first benefit check.

additional ones. Both of them are based on an assumption of uniform distribution of events in the year of experience and in the year of birth. These approximations were necessary due to age being tabulated on a calendar-year basis, coupled with the need of having values at exact age 50 for some of the exposures, and also due to a definition of the observation period in calendar years instead of the desired "policy year"[8/]. The observation period was defined in terms of calendar years in order to include additional information, since otherwise, the data covering the period from onset anniversary in the last year to the end of the year would have been ignored. In this connection, it should be noted that no data were available for durations over six years and that only partial data were available for duration 6. As more data is collected for future studies, it is probable that the ultimate rates will be lower than those shown in this study due to the inclusion of the experience for higher durations in the rates.

A total of 242,243 terminations is included in this study. This is distributed as follows: 181,294 male deaths, 36,710 female deaths, 20,705 male recoveries, and 3,534 female recoveries. The death data are quite extensive, but the recovery data are regarded as being too limited to serve as a basis for select and ultimate tables. It was, therefore, decided to prepare termination rate tables for deaths and for both types of terminations combined, but not for recoveries alone[9/].

Observed termination rates were calculated by single years for ages 60-64, by 5-year age groups for ages 30-59, and as a single age group for ages under 30. The rates were computed for each integral year of duration 0 to 4 and for

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8/ According to "policy year" methods, each worker would be observed from an anniversary of his date of disability onset to the next anniversary of his date of disability onset.

9/ An estimate of absolute recovery rates $q^{(2)}_{[x]+n}$ can be obtained from the death rates $q_{[x]+n}$ and the total termination rates $q^{(T)}_{[x]+n}$ by using the formula,

$$q^{(2)}_{[x]+n} = \left[q^{(T)}_{[x]+n} - q_{[x]+n}\right]\left(1 + \tfrac{1}{2} q_{[x]+n}\right)$$

durations 5 and over. Graphical graduations were performed for each of the six duration curves. The resulting ratios of actual terminations to expected terminations are shown in Tables 2 and 3. The Karup-King formula was applied to the graduated values after they were extrapolated to age 20 in order to obtain rates by single years of age for the range of ages 20-64. The final interpolated rates are presented in Tables 4 to 7.

The rates in Tables 4 to 7 are based on the usual definition of 1-year probabilities for durations 1 and over. However, the rates for duration 0 represent 5-month probabilities. This is due to the manner in which the 6-month disability waiting period operates and to the measurement of durations from the month of onset. In this case, a worker could be assumed to become disabled, on the average, in the middle of the month of disability onset. Since OASDI benefits are payable after the worker has had a continuous disability that last 7 full calendar months, the total effective waiting period is 7½ months, on the average[10/].

The graduated quinquennial death termination rates for females are compared with those for males in Table 8. It should be noted that the female rates are higher at the younger ages, but that, in general, they are lower than male rates, as is the case in population mortality. However, the sex differential in mortality is lower for disabled beneficiaries than for the general population.

10/ For this study, it was decided to measure duration from the end of the calendar month of the onset of disability. This means that all durations as tabulated in the study are, on the average, ½ month longer than shown, and the values shown for $q_{[x]+n}$ truly pertains to $q_{[x]+n+\frac{1}{24}}$

C. Comparison With Other Experiences

In Table 9, the disabled-worker mortality is compared with general population mortality at similar attained ages. The disabled worker mortality is from about 3 to 4 times the population mortality at the higher ages and durations and about 25 to 45 times population mortality at the younger ages and lower durations. In all cases, this ratio is higher for females than for males.

A comparison is presented in Table 10 of the graduated mortality rates for total disability annuitants under the Railroad Retirement system and for OASDI male disability beneficiaries (since the vast majority of the RR coverage is males). There should be comparability between these two experiences since the same definition of disability is used in both cases. However, as can be seen, the Railroad Retirement rates are generally lower than the OASDI rates by about 5% to 20%. These differences are due partly to the margin introduced in the graduation of the Railroad Retirement rates to the later observation period used which would imply lower rates (as was observed in Table 1) and to the different way in which the date of onset was established. However, the Railroad Retirement rates are higher than the OASDI rates at the younger ages; this is possibly due to the limited amount of data available at the younger ages in the Railroad Retirement study. We believe that after taking into account all these differences the Railroad Retirement rates would still be lower than the OASDI rates by about 5% to 10% on the average.

It should be noted that, for each duration, the shape of the mortality curves by age for OASDI disabled males is similar to what was observed by Cowen and Niessen[11/] with respect to mortality of totally disabled workers under the Railroad Retirement system. The decrease in mortality after age 50 for duration 0 and the leveling-off tendency at that age for later durations had previously been noted by Cowen and Niessen. A study of the reasons for decreases in mortality has not been conducted. It is believed, however, that this could be due to a tendency to include more social factors

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11/ James L. Cowen and Abraham M. Niessen, "New Mortality Tables for Railroad Disability Annuitants", Transactions Society of Actuaries, XIX (1967).

(as opposed to physical and medical factors) in determining awards to older workers, which would mean that the group of older disabled workers were relatively healthier. Another possibility is the tendency for the impairments at the older ages to be more associated with diseases of the respiratory and circulatory systems, which are "slow killers".

Annuity values at various interest rates are presented in Tables 11 and 12. These annuities represent the present value at the end of the month of onset of a continuous benefit of $1 per year payable from the beginning of the eighth month after onset to age 65 or to prior termination. It should be observed that although the present values are taken as of the end of the month of onset, payment of the annuity is calculated to start at the end of the effective waiting period.

Commutation columns D and $\overline{N}$ for these tables are available on request. Also available are annuity values and commutation columns at the same interest rates, assuming payment of the annuity continues after age 65. These values are based on an extrapolation of the termination rates discussed in this study.

Table 1

NUMBER OF TERMINATIONS AND GROSS TERMINATION RATES FOR DISABLED-WORKER BENEFICIARIES, 1958-67

Calendar Year	Number of Terminations		Gross Termination Rates		
	Death	Recovery	Death	Recovery	Death and Recovery
1958[1/]	28,099	1,397	.1522	.0076	.1598
1959[1/]	42,771	3,228	.1367	.0103	.1470
1960	43,543	3,124	.1148	.0083	.1231
1961	60,538	2,936	.1121	.0054	.1175
1962	67,020	9,555	.0979	.0140	.1119
1963	73,344	12,931	.0929	.0164	.1093
1964	75,812	16,487	.0875	.0190	.1065
1965	79,823	18,441	.0842	.0194	.1036
1966	84,399	23,111	.0801	.0219	.1020
1967	92,084	37,151	.0795	.0321	.1116

1/ For statistical purposes, the years 1958 and 1959 were defined as covering the periods January 1, 1958 to November 30, 1958 and December 1, 1958 to December 31, 1959, respectively. However, the gross termination rates are shown after conversion to an annual basis.

Table 2

RATIO OF ACTUAL TERMINATIONS TO EXPECTED TERMINATIONS BY AGE AT ONSET

Age at Onset[1/]	Death Terminations		Death and Recovery Terminations	
	Male	Female	Male	Female
Under 30	1.00	.97	.99	1.02
30-34	1.01	.99	1.00	1.01
35-39	1.00	1.00	1.00	.99
40-44	.99	.99	1.00	1.00
45-49	1.01	1.01	1.00	1.00
50-54	1.00	.98	1.00	1.02
55-59	1.00	1.01	1.00	.99
60-64	1.00	1.00	1.00	1.01
Total	1.00	1.00	1.00	1.00

1/ Age nearest birthday.

Table 3

RATIO OF ACTUAL TERMINATIONS TO EXPECTED TERMINATIONS BY DURATION

Duration	Death Terminations		Death and Recovery Terminations	
	Male	Female	Male	Female
0	1.00	1.01	1.01	1.00
1	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	1.00
3	1.00	1.00	1.00	1.00
4	1.00	.99	1.00	1.00
5 and Over	1.00	.96	1.00	1.00
Total	1.00	1.00	1.00	1.00

Table 4

GRADUATED DEATH TERMINATION RATES FOR OASDI
MALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[1] x	$q_{[x]}$[2]	$q_{[x]+1}$	$q_{[x]+2}$	$q_{[x]+3}$	$q_{[x]+4}$	q_{x+5}
20	37.6	49.7	26.0	16.4	13.5	11.5
21	38.3	50.0	26.9	17.4	14.8	12.9
22	39.1	50.4	27.8	18.5	16.1	14.3
23	39.9	50.8	28.7	19.6	17.4	15.7
24	40.6	51.1	29.6	20.6	18.7	17.1
25	41.4	51.5	30.5	21.7	20.1	18.5
26	42.1	51.8	31.4	22.7	21.4	19.9
27	42.9	52.2	32.3	23.8	22.7	21.3
28	43.5	52.3	33.3	24.9	23.9	22.6
29	43.9	52.2	34.4	26.1	25.0	23.7
30	44.3	52.2	35.4	27.3	26.1	24.9
31	44.9	52.5	36.3	28.6	27.3	26.2
32	46.0	53.5	37.0	30.1	28.8	27.8
33	47.6	55.3	38.7	31.8	30.5	29.6
34	49.5	57.6	40.6	33.7	32.4	31.6
35	51.7	60.3	42.8	35.7	34.5	33.8
36	53.9	63.3	45.1	37.9	36.7	36.1
37	56.0	66.3	47.4	40.3	39.1	38.5
38	58.0	69.4	49.8	43.0	41.8	41.0
39	60.0	72.8	52.3	45.9	44.8	43.7
40	62.0	76.3	54.8	49.0	47.9	46.4
41	64.0	79.8	57.4	52.0	50.9	49.2
42	66.0	83.2	60.0	54.8	53.8	52.0
43	68.2	86.6	62.6	57.4	56.5	54.8
44	70.6	90.1	65.3	59.9	59.0	57.6
45	72.9	93.5	68.0	62.3	61.5	60.4
46	74.8	96.6	70.6	64.7	63.9	63.2
47	76.0	99.3	73.2	67.0	66.3	66.0
48	76.3	101.5	75.8	69.3	68.7	68.7
49	75.9	103.3	78.4	71.5	71.1	71.5

Table 4 (Continued)

GRADUATED DEATH TERMINATION RATES FOR OASDI
MALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[1] x	$q_{[x]}$[2]	$q_{[x]+1}$	$q_{[x]+2}$	$q_{[x]+3}$	$q_{[x]+4}$	q_{x+5}
50	75.1	104.8	80.9	73.7	73.4	74.2
51	74.1	106.0	83.1	75.8	75.7	76.8
52	73.4	107.0	85.0	77.8	77.9	79.3
53	72.9	107.6	86.4	79.7	80.2	81.8
54	72.3	107.8	87.4	81.5	82.8	84.2
55	71.8	107.9	88.1	83.2	85.0	86.5
56	71.1	107.9	88.8	84.7	86.9	88.6
57	70.5	108.0	89.6	86.2	88.5	90.6
58	69.4	108.2	90.1	87.6	89.7	92.4
59	68.3	108.5	90.6	88.6	90.5	93.9
60	67.3	108.7	91.1	89.4	91.0	--
61	66.7	109.2	92.3	89.7	--	--
62	65.9	109.7	93.6	--	--	--
63	65.1	109.8	--	--	--	--
64	64.2	--	--	--	--	--

1/ Age nearest birthday.

2/ This value represents the probability that a worker who became disabled at age x nearest birthday and who survived with the disability to the end of the 7th calendar month following the month of disability onset will die during the next 5 calendar months.

Table 5

GRADUATED DEATH TERMINATION RATES FOR OASDI FEMALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[1] x	$q_{[x]}$[2]	$q_{[x]+1}$	$q_{[x]+2}$	$q_{[x]+3}$	$q_{[x]+4}$	q_{x+5}
20	23.2	29.7	27.2	22.2	16.8	20.1
21	24.8	32.1	28.4	22.9	18.0	21.1
22	26.3	34.5	29.7	23.7	19.3	22.2
23	27.8	36.9	31.0	24.5	20.6	23.3
24	29.4	39.3	32.2	25.2	21.8	24.3
25	30.9	41.6	33.5	26.0	23.1	25.4
26	32.5	44.0	34.7	26.7	24.3	26.4
27	34.0	46.4	36.0	27.5	25.6	27.5
28	35.5	48.7	37.3	28.3	26.7	28.4
29	37.0	50.9	38.7	29.1	27.7	29.3
30	38.4	53.1	40.0	30.0	28.6	30.1
31	40.0	55.6	41.4	30.9	29.6	31.0
32	41.6	58.5	42.8	31.8	30.7	32.0
33	43.4	62.0	44.2	32.8	31.9	33.1
34	45.2	66.0	45.7	33.9	33.1	34.2
35	47.2	70.2	47.2	35.0	34.4	35.4
36	49.1	74.3	48.7	36.1	35.7	36.8
37	51.0	78.0	50.2	37.3	37.0	38.3
38	52.9	81.4	51.8	38.5	38.4	40.2
39	54.8	84.8	53.4	39.7	39.8	42.3
40	56.7	87.9	55.1	41.0	41.3	44.5
41	58.5	90.4	56.5	42.3	42.7	46.5
42	60.2	92.3	57.8	43.5	44.0	48.0
43	61.9	93.3	58.8	44.7	45.2	48.8
44	63.6	93.5	59.7	46.0	46.4	49.2
45	65.2	93.3	60.4	47.3	47.5	49.3
46	66.3	92.8	60.9	48.4	48.5	49.3
47	66.7	92.4	61.2	49.3	49.3	49.5
48	66.1	92.0	61.1	50.0	49.9	49.9
49	64.8	91.4	60.8	50.4	50.3	50.3

Table 5 (Continued)

GRADUATED DEATH TERMINATION RATES FOR OASDI
FEMALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[1] x	$q_{[x]}$[2]	$q_{[x]+1}$	$q_{[x]+2}$	$q_{[x]+3}$	$q_{[x]+4}$	q_{x+5}
50	63.0	90.7	60.2	50.7	50.7	50.7
51	61.1	89.9	59.7	51.1	51.0	51.2
52	59.6	88.9	59.5	51.5	51.4	51.6
53	58.3	87.5	59.4	52.1	51.9	52.1
54	56.9	85.7	59.4	52.6	52.4	52.6
55	55.6	83.9	59.6	53.2	53.0	53.0
56	54.7	82.5	59.9	53.7	53.5	53.5
57	54.2	81.9	60.5	54.3	54.0	54.0
58	54.6	82.0	61.5	55.7	54.8	54.9
59	55.6	84.2	63.2	57.7	56.1	56.3
60	56.6	86.1	64.6	59.9	58.0	--
61	57.2	87.5	65.9	62.1	--	--
62	57.8	88.7	67.1	--	--	--
63	58.4	90.5	--	--	--	--
64	59.1	--	--	--	--	--

1/ Age nearest birthday.

2/ This value represents the probability that a worker who became disabled at age x nearest birthday and who survived with the disability to the end of the 7th calendar month following the month of disability onset will die during the next 5 calendar months.

Table 6

GRADUATED TOTAL TERMINATION RATES[1] FOR OASDI MALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[2] x	$q^{(t)}_{[x]}$[3]	$q^{(t)}_{[x]+1}$	$q^{(t)}_{[x]+2}$	$q^{(t)}_{[x]+3}$	$q^{(t)}_{[x]+4}$	$q^{(t)}_{x+5}$
20	38.1	75.8	96.1	65.8	61.0	53.2
21	38.9	76.4	96.8	66.4	61.2	53.6
22	39.7	76.9	97.5	67.0	61.4	54.0
23	40.6	77.4	98.2	67.6	61.6	54.4
24	41.4	78.0	98.9	68.1	61.8	54.8
25	42.3	78.5	99.6	68.7	62.0	55.2
26	43.1	79.0	100.3	69.2	62.2	55.5
27	43.9	79.5	101.0	69.8	62.3	55.9
28	44.7	80.0	101.7	70.3	62.4	56.3
29	45.4	80.4	102.4	70.8	62.5	56.6
30	46.1	80.8	103.2	71.4	62.6	57.0
31	47.0	81.4	103.9	71.9	62.8	57.3
32	48.1	82.1	104.5	72.6	63.2	57.8
33	49.5	83.0	105.2	73.4	63.7	58.3
34	51.1	84.0	105.8	74.2	64.4	58.8
35	53.0	85.2	106.4	75.1	65.2	59.4
36	54.8	86.5	106.8	76.1	66.0	60.2
37	56.7	88.0	107.0	77.1	67.0	61.1
38	58.7	89.7	106.7	78.2	68.1	62.3
39	60.7	91.5	106.1	79.3	69.2	63.6
40	62.8	93.5	105.4	80.5	70.5	65.0
41	64.9	95.6	104.6	81.7	71.8	66.6
42	67.0	97.9	104.0	82.8	73.3	68.3
43	69.2	100.4	103.6	83.9	74.9	70.2
44	71.6	103.3	103.3	85.1	76.7	72.3
45	73.9	106.2	103.0	86.2	78.6	74.6
46	75.8	108.9	102.8	87.2	80.4	76.8
47	77.0	111.1	102.6	88.1	82.0	78.6
48	77.3	112.9	102.4	88.8	83.4	80.1
49	76.9	114.5	102.2	89.5	89.5	84.7

Table 6 (Continued)

GRADUATED TOTAL TERMINATION RATES[1] FOR OASDI MALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[2] x	$q^{(t)}_{[x]}$[3]	$q^{(t)}_{[x]+1}$	$q^{(t)}_{[x]+2}$	$q^{(t)}_{[x]+3}$	$q^{(t)}_{[x]+4}$	$q^{(t)}_{x+5}$
50	76.2	115.7	102.0	90.0	85.9	82.5
51	75.2	116.6	101.8	90.5	87.0	83.7
52	74.5	117.1	101.6	91.0	88.1	85.0
53	73.9	117.0	101.4	91.5	89.1	86.4
54	73.3	116.4	101.3	92.0	90.1	87.9
55	72.7	115.5	101.1	92.4	90.9	89.4
56	72.0	114.5	100.8	92.9	91.7	90.9
57	71.2	113.8	100.5	93.2	92.3	92.5
58	70.3	113.3	100.0	93.3	92.7	94.1
59	69.2	112.9	99.4	93.3	92.9	95.8
60	68.0	112.5	98.7	93.2	92.8	--
61	67.3	112.0	98.0	93.0	--	--
62	66.4	111.6	97.4	--	--	--
63	65.5	111.2	--	--	--	--
64	64.5	--	--	--	--	--

1/ Total termination rates include terminations due to death or to recovery from the disability.

2/ Age nearest birthday.

3/ This value represents the probability that a worker who became disabled at age x nearest birthday and who survived with the disability to the end of the 7th calendar month following the calendar month of onset of disability will die or recover from the disability during the next 5 calendar months.

Table 7

GRADUATED TOTAL TERMINATION RATES[1] FOR OASDI FEMALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[2] x	$q_{[x]}^{(t)}$[3]	$q_{[x]+1}^{(t)}$	$q_{[x]+2}^{(t)}$	$q_{[x]+3}^{(t)}$	$q_{[x]+4}^{(t)}$	$q_{x+5}^{(t)}$
20	23.5	48.2	93.8	77.4	65.1	53.1
21	25.0	50.6	93.4	76.8	64.8	53.3
22	26.6	53.1	93.0	76.1	64.5	53.4
23	28.2	55.6	92.6	75.5	64.2	53.6
24	29.7	58.0	92.2	74.8	63.9	53.7
25	31.2	60.4	91.8	74.2	63.7	53.9
26	32.8	62.9	91.4	73.5	63.4	54.1
27	34.3	65.3	91.0	72.9	63.1	54.2
28	35.8	67.7	90.6	72.3	62.8	54.3
29	37.3	70.0	90.2	71.7	62.5	54.4
30	38.8	72.4	89.8	71.0	62.3	54.5
31	40.3	74.8	89.4	70.4	62.0	54.7
32	42.0	77.5	89.0	69.7	61.7	55.0
33	43.8	80.6	88.5	68.9	61.4	55.5
34	45.7	84.0	88.1	68.1	61.1	56.3
35	47.7	87.5	87.6	67.3	60.8	57.0
36	49.7	90.7	87.0	66.4	60.5	57.6
37	51.6	93.4	86.5	65.6	60.2	58.0
38	53.5	95.6	86.0	64.7	59.9	58.0
39	55.5	97.5	85.4	63.8	59.6	57.7
40	57.5	99.1	84.8	62.9	59.4	57.3
41	59.3	100.2	84.2	62.1	59.1	56.9
42	61.0	100.9	83.4	61.5	58.8	56.5
43	62.7	101.0	82.5	61.1	58.6	56.2
44	64.5	100.6	81.5	60.9	58.4	55.8
45	66.1	99.8	80.4	60.8	58.2	55.5
46	67.3	98.9	79.2	60.7	58.0	55.2
47	67.7	98.0	77.9	60.5	57.8	55.0
48	67.2	97.2	76.3	60.2	57.6	55.0
49	65.9	96.4	74.4	59.9	57.5	55.1

Table 7 (Continued)

GRADUATED TOTAL TERMINATION RATES[1] FOR OASDI FEMALE DISABILITY BENEFICIARIES, 1957-63
(per thousand)

Age[2] x	$q_{[x]}^{(t)}$[3]	$q_{[x]+1}^{(t)}$	$q_{[x]+2}^{(t)}$	$q_{[x]+3}^{(t)}$	$q_{[x]+4}^{(t)}$	$q_{x+5}^{(t)}$
50	64.3	95.5	72.5	59.6	57.3	55.2
51	62.5	94.4	70.8	59.3	57.1	55.4
52	61.0	93.2	69.4	59.0	57.0	55.5
53	59.6	91.5	68.3	58.8	56.9	55.7
54	58.2	89.4	67.5	58.5	56.8	55.9
55	56.8	87.3	66.9	58.3	56.7	56.1
56	55.8	85.7	66.6	58.2	56.6	56.3
57	55.2	84.8	66.5	58.3	56.6	56.5
58	55.4	85.0	67.0	59.4	57.1	56.7
59	56.4	86.6	68.1	61.1	58.4	57.0
60	57.2	88.0	69.0	62.8	59.5	--
61	57.7	89.2	69.8	64.0	--	--
62	58.2	90.3	70.5	--	--	--
63	58.7	91.6	--	--	--	--
64	59.3	--	--	--	--	--

1/ Total termination rates include terminations due to death and to recovery from the disability.

2/ Age nearest birthday.

3/ This value represents the probability that a worker who became disabled at age x nearest birthday and who survived with the disability to the end of the 7th calendar month following the calendar month of onset of disability will die or recover from the disability during the next 5 calendar months.

Table 8

RATIO OF FEMALE TO MALE GRADUATED MORTALITY RATES FOR DISABLED WORKERS

Age at Onset[1]	Duration					
	0	1	2	3	4	5 and Over[2]
Under 30	.76	.83	1.10	1.18	1.14	1.37
30-34	.90	1.09	1.16	1.06	1.07	1.15
35-39	.91	1.18	1.06	.93	.95	.99
40-44	.91	1.11	.96	.79	.82	.92
45-49	.88	.93	.84	.74	.74	.75
50-54	.81	.83	.70	.66	.66	.65
55-59	.77	.76	.68	.63	.61	.60

1/ Age nearest birthday.

2/ Calculated at 5 years older than age at onset.

Table 9

RATIO OF DISABLED WORKER GRADUATED MORTALITY RATES TO THE 1959-61 UNITED STATES POPULATION MORTALITY RATES

Age at Onset[1]	Duration[2] 1	2	3	4	5 and Over[3]
			Male		
32	25.48	16.52	12.54	11.12	8.89
37	21.53	14.02	10.80	9.49	8.46
42	16.61	10.89	9.06	8.09	7.07
47	12.14	8.04	6.61	5.92	5.37
52	8.03	5.90	5.02	4.66	4.38
57	5.48	4.16	3.67	3.47	3.27
			Female		
32	44.66	30.57	21.06	18.83	18.08
37	40.62	23.90	16.22	14.74	13.98
42	30.97	17.84	12.39	11.55	11.57
47	20.42	12.36	9.11	8.36	7.75
52	12.96	8.12	6.58	6.11	5.66
57	8.21	5.52	4.49	4.07	3.72

1/ Age nearest birthday.

2/ Values for duration 0 are not shown due to the non-comparability of the death rates.

3/ Calculated at 5 years older than age at onset.

Table 10

RATIO OF RAILROAD RETIREMENT DISABLED GRADUATED MORTALITY[1] TO OASDI DISABLED MALE GRADUATED MORTALITY

Age at Onset[2]	1	2	3	4	5 and Over[3]
32	1.08	1.36	1.55	1.56	1.59
37	.89	1.08	1.17	1.17	1.15
42	.82	.89	.90	.90	.88
47	.83	.81	.83	.81	.78
52	.82	.85	.89	.81	.81
57	.82	.95	.94	.87	.86

1/ Railroad Retirement totally disabled annuitants experience in 1961-64, from Tranactions, Society of Actuaries, XIX, page 203.

2/ Age nearest birthday.

3/ Calculated at 5 years older than age at onset.

Table 11

PRESENT VALUE AT ONSET OF A DISABILITY ANNUITY PAYABLE CONTINUOUSLY: 1957-63 OASDI MALE WORKER

Age at Onset[1]	Present Value of Annuity at[2]				
	3½%	4%	4½%	5%	5½%
20	9.53	9.08	8.67	8.29	7.94
21	9.46	9.02	8.61	8.24	7.89
22	9.39	8.96	8.56	8.19	7.85
23	9.32	8.89	8.50	8.13	7.80
24	9.25	8.83	8.44	8.08	7.75
25	9.18	8.76	8.38	8.03	7.70
26	9.10	8.70	8.32	7.97	7.65
27	9.03	8.63	8.26	7.92	7.60
28	8.95	8.56	8.19	7.86	7.55
29	8.87	8.49	8.13	7.80	7.50
30	8.79	8.41	8.06	7.74	7.44
31	8.70	8.33	7.99	7.67	7.38
32	8.60	8.24	7.91	7.60	7.31
33	8.49	8.14	7.82	7.52	7.24
34	8.37	8.04	7.72	7.43	7.15
35	8.25	7.92	7.62	7.33	7.07
36	8.12	7.81	7.51	7.23	6.97
37	7.99	7.68	7.40	7.13	6.88
38	7.86	7.56	7.28	7.02	6.78
39	7.72	7.43	7.17	6.92	6.68
40	7.58	7.30	7.05	6.81	6.58
41	7.43	7.17	6.92	6.69	6.47
42	7.28	7.03	6.79	6.57	6.36
43	7.12	6.89	6.66	6.45	6.25
44	6.96	6.73	6.52	6.32	6.12
45	6.80	6.58	6.38	6.18	6.00
46	6.64	6.43	6.24	6.05	5.88
47	6.48	6.29	6.10	5.93	5.76
48	6.33	6.14	5.97	5.80	5.65
49	6.17	6.00	5.84	5.68	5.53

Table 11 (Continued)

PRESENT VALUE AT ONSET OF A DISABILITY ANNUITY PAYABLE CONTINUOUSLY: 1957-63 OASDI MALE WORKER

Age at Onset[1]	Present Value of Annuity at[2]				
	3⅓%	4%	4⅔%	5%	5⅓%
50	6.01	5.85	5.70	5.55	5.41
51	5.84	5.69	5.54	5.41	5.27
52	5.65	5.51	5.38	5.25	5.13
53	5.44	5.31	5.19	5.08	4.96
54	5.21	5.10	4.99	4.88	4.78
55	4.96	4.86	4.76	4.66	4.57
56	4.68	4.59	4.50	4.42	4.34
57	4.35	4.28	4.21	4.13	4.06
58	3.99	3.93	3.87	3.81	3.75
59	3.57	3.52	3.48	3.43	3.38
60	3.10	3.06	3.02	2.99	2.95
61	2.55	2.52	2.50	2.47	2.45
62	1.92	1.90	1.89	1.87	1.86
63	1.20	1.19	1.18	1.18	1.17
64	0.36	0.36	0.36	0.35	0.35

1/ Age nearest birthday at disability onset.

2/ Present value at the end of the month of disibility onset calculated on the basis of one unit payment per year starting at the end of the effective waiting period and ending at age 65.

Table 12

PRESENT VALUE AT ONSET OF A DISABILITY ANNUITY PAYABLE CONTINUOUSLY: 1957-63 OASDI FEMALE WORKER

Age at Onset[1]	Present Value of Annuity at[2]				
	3½%	4%	4½%	5%	5½%
20	10.03	9.54	9.09	8.68	8.30
21	9.98	9.49	9.05	8.64	8.26
22	9.92	9.44	9.00	8.60	8.23
23	9.86	9.39	8.95	8.55	8.19
24	9.80	9.33	8.90	8.51	8.15
25	9.74	9.28	8.85	8.46	8.10
26	9.68	9.22	8.80	8.42	8.06
27	9.61	9.16	8.75	8.37	8.02
28	9.55	9.10	8.70	8.32	7.98
29	9.48	9.04	8.64	8.27	7.93
30	9.41	8.98	8.58	8.22	7.88
31	9.33	8.91	8.52	8.16	7.83
32	9.25	8.83	8.45	8.10	7.78
33	9.16	8.75	8.38	8.04	7.72
34	9.06	8.67	8.30	7.96	7.65
35	8.97	8.58	8.22	7.89	7.58
36	8.87	8.50	8.15	7.82	7.52
37	8.78	8.42	8.08	7.76	7.46
38	8.69	8.34	8.01	7.70	7.41
39	8.60	8.26	7.93	7.63	7.35
40	8.50	8.17	7.85	7.56	7.28
41	8.40	8.08	7.77	7.48	7.22
42	8.29	7.98	7.68	7.41	7.15
43	8.18	7.87	7.59	7.32	7.07
44	8.05	7.76	7.49	7.23	6.99
45	7.92	7.64	7.38	7.13	6.89
46	7.77	7.51	7.26	7.02	6.80
47	7.62	7.36	7.13	6.90	6.69
48	7.45	7.21	6.99	6.78	6.57
49	7.28	7.05	6.84	6.64	6.45

Table 12 (Continued)

PRESENT VALUE AT ONSET OF A DISABILITY ANNUITY PAYABLE CONTINUOUSLY: 1957-63 OASDI FEMALE WORKER

Age at Onset[1]	Present Value of Annuity at[2]				
	3⅔%	4%	4⅓%	5%	5⅓%
50	7.08	6.88	6.68	6.49	6.31
51	6.87	6.68	6.49	6.32	6.15
52	6.62	6.45	6.28	6.12	5.96
53	6.35	6.19	6.04	5.89	5.75
54	6.05	5.91	5.77	5.64	5.51
55	5.71	5.59	5.47	5.35	5.24
56	5.33	5.22	5.12	5.02	4.92
57	4.90	4.81	4.72	4.64	4.56
58	4.41	4.34	4.27	4.20	4.13
59	3.87	3.82	3.76	3.71	3.66
60	3.29	3.25	3.21	3.17	3.13
61	2.66	2.63	2.61	2.58	2.55
62	1.97	1.96	1.94	1.93	1.91
63	1.21	1.21	1.20	1.19	1.19
64	0.36	0.36	0.36	0.36	0.35

1/ Age nearest birthday at disability onset.

2/ Present value at the end of the month of disability onset calculated on the basis of one unit payment per year starting at the end of the effective waiting period and ending at age 65.

Actuarial Studies Available from the Office of the Actuary*

46. Illustrative United States Population Projections--May 1957.

48. Long-Range Cost Estimates for Old-Age, Survivors, and Disability Insurance under 1956 Amendments--August 1958.

49. Methodology Involved in Developing Long-Range Cost Estimates for the Old-Age, Survivors, and Disability Insurance System--May 1959.

50. Analysis of Benefits, OASDI Program, 1960 Amendments--December 1960.

51. Present Values of OASI Benefits in Current Payment Status, 1960--February 1961.

52. Actuarial Cost Estimates for Health Insurance Benefits Bill--July 1961.

53. Medium-Range Cost Estimates for Old-Age, Survivors, and Disability Insurance and Increasing-Earnings Assumption--August 1961.

54. Estimated Amount of Life Insurance in Force as Survivor Benefits under OASI 1959-60--October 1961.

55. Remarriage Tables Based on Experience under OASDI and U. S. Employees' Compensation System--December 1962.

56. Analysis of Benefits under 26 Selected Private Pension Plans--January 1963.

57. Actuarial Cost Estimates for Hospital Insurance Bill--July 1963.

58. Long-Range Cost Estimates for Old-Age, Survivors, and Disability Insurance System, 1963--January 1964.

60. Mortality Experience of Workers Entitled to Old-Age Benefits under OASDI 1941-1961--August 1965.

61. History of Cost Estimates for Hospital Insurance--December 1966.

62. United States Population Projections for OASDHI Cost Estimates--January 1967.

63. Long-Range Cost Estimates for Old-Age, Survivors, and Disability Insurance System, 1966--January 1967.

64. Methods Used in Estimating Long-Range Costs for the Old-Age, Survivors, and Disability Insurance System. (In Preparation)

* Numbers not listed are out of print.