Comparison of Individual Characteristics and Death Rates of Disabled-Worker Beneficiaries Entitled in 1972 and 1985

*by John C. Hennessey and Janice M. Dykacz**

The many changes to the Disability Insurance (DI) program that took place during the early 1980's suggest that there may be significant differences in the characteristics of newly awarded beneficiaries over time. This study compares two cohorts of newly entitled beneficiaries—one from 1972 and the other from 1985—in order to assess changes in individual characteristics and death rates between the pre-1980's and the late 1980's. The 1985 cohort had a greater percentage of beneficiaries with mental impairments and a lower percentage with diseases of the circulatory system. The 1985 cohort was also younger, more educated, had higher primary insurance amount levels, and had greater percentages of women and black beneficiaries. Although the death rates and survival curves for both cohorts were very similar, differences in the curves occurred for some covariate subgroups. When the populations were standardized, the estimated percentages of beneficiaries who survived 5 years after entitlement were 78 percent for the 1972 cohort and 77 percent for the 1985 cohort.

*Disability Research Staff, Office of Research and Statistics, Social Security Administration.

The Disability Insurance (DI) program grew considerably from the early seventies through the eighties. In 1972, applications for disability benefits numbered 947,500; in 1985, the number increased to 1,169,200.[1] The allowance rate over this period generally declined—from 48 percent (455,000) to 32 percent (377,400).[2] During this period, substantive program changes were made, which suggest significant differences in the characteristics of newly awarded beneficiaries over time.

This article compares two cohorts of beneficiaries, the first entitled in 1972 (the pre-1980's) and the second in 1985 (the late 1980's), with regard to demographic characteristics and death rates. In the analysis of death rates, we standardized the populations to determine whether differences in the death rates are due to differences in individual characteristics or to changes in the death rates over time.

Changes in the characteristics of beneficiaries from 1972 to 1985 could affect length of stay in the program; earlier studies [3] found that the mean number of years in the program varies by primary diagnostic group, age at entitlement, sex, educational level, and primary insurance amount (PIA). Thus, changes in beneficiary characteristics can affect program costs.

Changes in the Claims Process

Several changes were made in the disability determination and review process from 1972 to 1985, most notably in the Listings of Impairments for mental disorders. In general, the listings describe for each of the major body systems those impairments that are considered severe enough to prevent a person from doing any gainful activity. Benefits are awarded based on medical evidence and vocational factors. A determination of disability is made if the person "meets the listings" (the impairment is on the list); if he or she "equals the listings" (the impairment is not on the list but it is essentially the same as one that is on the list); or if vocational factors

indicate the person is not able to engage in gainful activity, even if the impairment is not as severe as those on the list.

The Social Security Benefits Reform Act of 1984 (P.L. 98-460) imposed a moratorium on reviews of all cases of mental impairment disability until the criteria in the listings could be revised. Claims denied during the period October 1984 to implementation of the new listings (in the latter half of 1985) were earmarked with a special code; they were held and readjudicated under the revised criteria.

Because of the new regulations and ensuing moratorium, the allowance rate for mental disorders peaked in fiscal year 1986 at 60 percent, but diminished in the later half of calendar year 1986 to 53 percent, which was comparable to the allowance rate of 52 percent in fiscal year 1985.[4]

A major impact of the revisions in the listings for mental disorders was that a greater proportion of allowances for mental disorders were based on meeting the listings. However, this increase in the "meets" category was offset by a decrease in the percentage of allowances for which medical and vocational factors were a consideration. The new listings specified nine mental disorders categories, which were different from the four previously used categories.

This legislation also contained a provision affecting the determination of medical severity. The combined effect of all impairments had to be considered in determining medical severity, whether or not any one impairment was severe.

Another change in the claims process was the formalization of vocational factors in making the disability determination. Because of the increase in the number of cases where vocational considerations were a factor, regulations were promulgated in 1979 to reduce the subjectivity and lack of uniformity in applying vocational factors (such as a beneficiary's age, education, past work experience, and residual functional capacity).

Post-Entitlement Changes

The Social Security Disability Amendments of 1980 (P.L. 96-265) precipitated many changes in the post-entitlement period through the early 1980's. Among the changes caused by this legislation was that impairment-related work expenses could be deducted from a beneficiary's earnings in determining substantial gainful activity (SGA). Also, a 15-month extended period of eligibility was created after the 9-month trial work period for beneficiaries who continued to be disabled. In addition, Medicare coverage was extended for up to 36 months after cash benefits ceased for a worker engaged in SGA, if he or she was not medically recovered. Further, a periodic review of continuing disability of beneficiaries with nonpermanent disabilities once every 3 years was instituted.

In the 1984 amendments, several new provisions were enacted. Among them was the provision that medical improvement must be established before a program termination could be made for medical reasons.

Cohort Selection

A cohort of beneficiaries entitled for the first time in 1972 was chosen for the pre-1980's cohort because this group entered the program just after the 1972 disability amendments, which changed the program substantially. For example, Medicare coverage was provided to beneficiaries who were in the program for more than 24 consecutive months, and the waiting period for entitlement was reduced to 5 months.

Although the focus of this study is a comparison of the characteristics of a 1970's cohort and a 1980's cohort, another goal of this study is to analyze the recovery rate for beneficiaries entitled in a year in the 1980's. A year earlier than 1985 could not be chosen because the 1984 amendments had the potential for greatly affecting the program and the recovery rate. A cohort in a year later than 1985 was not deemed appropriate because not enough followup time would be available to study how beneficiaries leave the program. An observation period of at least 4 or 5 years beginning at entitlement is needed to describe the patterns of how beneficiaries leave the program.

The cohorts analyzed in this article consist of beneficiaries who were newly entitled in 1972 and in 1985. The year of entitlement may be different from the year of award. That is, an award—a determination that an individual should receive benefits—may be made in 1986, although the year in which the individual was first eligible for benefits may be 1985. In this case, the year of entitlement would be 1985. The date of entitlement is the earliest date a beneficiary is eligible for benefits. It is dependent on the official date of onset of disability and the filing date—not on the date of award.

There were changes in the mental disorders listings that went into effect in 1985. Some cases were allowed under the old listings. Denials were held until the new listings could be used, so that some 1985 entitlements were processed under the new listings. This difference in the listings should not have had an effect on death rates.

As discussed previously, a peaking or irregularity in the allowance rate occurred for claimants with mental disorders in fiscal year 1986. This peaking was partly due to the administrative backlog of cases that were held until implementation of the new listings. The increase in the percentage of beneficiaries in the mental disorders group observed between the entitlement cohorts of 1972 and 1985 was not due to this backlog, since the date of award—not the date of entitlement—was affected by this backlog. The reason for this increase, however, is not known.

The increase in the percentage of persons in the mental disorders group does not affect most of the analyses, since most analyses have been done separately for each diagnostic group.

Description of the Data Files

The data file for the 1972 cohort was based on a 5-percent random sample—23,062 disabled-worker beneficiaries first entitled under the DI program in 1972—of whom 18,807 were used in the analysis. A 10-percent random sample was selected for the 1985 cohort consisting of 39,333 disabled-worker beneficiaries, of whom 34,762 were used in the analysis. For both cohorts, administrative records of persons whose age at entitlement was 62 or older were omitted because information distinguishing retired workers from disabled workers was not available in these data files. This exclusion accounts for the majority of the omissions. A smaller number of exclusions were made because the program termination date was in the same month as the entitlement date. The observation period for the 1972 cohort started at entitlement in 1972 and ended in June 1986. The observation period for the 1985 cohort was date of entitlement in 1985 to May 1990.

The samples were extracted from the Master Beneficiary Record (MBR) of the Social Security Administration (SSA). Information about an individual is recorded on the MBR when an administrative action takes place. Therefore, beneficiaries who were terminated from the program (because they medically recovered or returned to work) and later died may not have their death recorded on the MBR unless another administrative action was required—for example, payment of the lump-sum death benefit. However, we believe that nonreporting of deaths was minimal and should not affect the comparative analysis of interest in this study.

Distribution of Individual Characteristics

For every characteristic examined, the 1972 cohort is different from the 1985 cohort. Results will be discussed here one characteristic at a time; standard chi-square tests of independence indicated that differences in the samples were indicative of differences in the two populations at the 1-percent significance level. The results were confirmed by a logistic regression with all covariates analyzed simultaneously with no interaction terms. That is, the difference in a characteristic between the populations under study stands on its own and is not due to the characteristic being associated with other factors or characteristics. Details of the statistical methodology have been published in ORS Working Paper Number 57.[5]

One of the most important covariates is the primary diagnosis of the disabling condition—that is, the primary underlying medical impairment on which the entitlement decision was made. The diagnostic groups were taken from the International Classification of Diseases (ICD).[6]

In analyzing the 1985 cohort, a new category was added, acquired immune deficiency syndrome (AIDS). The AIDS group for that cohort included those individuals who were diagnosed as having AIDS as manifested by one or more diseases indicative of AIDS or who exhibited a condition called AIDS-related complex (ARC), that is, they showed evidence of AIDS but did not have the medical findings indicative of AIDS. It was not until about September 1987 that the Centers for Disease Control began using the category of human immunodeficiency virus (HIV).

The AIDS category was created for the 1985 cohort by using the three-digit primary diagnostic codes of 042, 043, and 136 from the infectious and parasitic diseases group; the code 173 from the neoplasms group; and the code 279 from the endocrine, nutritional, and metabolic diseases group. This approach is consistent with the definition that was used by SSA's Office of the Actuary.[7] Only 16 persons in the 1972 cohort had

Table 1.—International Classification of Diseases codes for the primary diagnostic groups

Category	International Classification of Diseases	
	8th rev. for 1972 cohort	9th rev. CM for 1985 cohort
Infectious and parasitic disease		001-041
(in 1972, infective and parasitic		044-135
diseases)	000-136	137-139
Neoplasms	140-239	140-172
		174-239
Endocrine, nutritional, and metabolic diseases, and immunity disorders (in 1972, and endorcine, nutritional, and metabolic diseases	240-279	240-278
Mental disorders	290-315	290-319
Diseases of the—		
Nervous system and sense organs	320-389	320-389
Circulatory system	390-458	390-459
Respiratory system	460-519	460-519
Digestive system	520-577	520-579
Genitourinary system	580-629	580-629
Musculoskeletal system and connective tissue	710-739	710-739
Congenital anomolies	740-759	740-759
Injury and poisoning (in 1972, accidents, poisonings, and violence)	800-999	800-999
AIDS and AIDS-related complex (ARC)	None	042, 043, 136, 173, 279
Other	All other codes	

these ICD codes, and presumably they were not AIDS cases, since the disease was not formally recognized until the early 1980's. Thus, these persons were placed in their original diagnostic groups.

Table 1 presents the categories of impairments in the listings and the corresponding ICD codes used for both cohorts. In the remainder of this article, some of these categories will be identified in an abbreviated form.

Some of the largest differences between the cohorts occur in the mental disorders and circulatory diagnostic groups (table 2). For the 1972 cohort, about 9 percent are in the mental disorders group. For the 1985 cohort, however, 24 percent—about 2½ times as many beneficiaries—are in this group. (As discussed previously, there was a backlog of awards based on mental impairments around 1985. Because this cohort was defined by the date of entitlement—not the date of award—the backlog should not have had an impact on the composition of the cohort.) Diseases of the circulatory system account for 29 percent of the beneficiaries in the 1972 cohort, but only 17 percent in the 1985 cohort. Also notable are differences in the infectious diseases, neoplasms, nervous system, digestive, congenital, accidents, and "other" groups. The 1985 cohort has greater percentages in the infectious diseases, neoplasms, and nervous system groups. The 1972 cohort has greater percentages in the digestive, congenital, accidents, and "other" groups. Because of the method used to create the AIDS group, there were no persons in this category in the 1972 cohort and 269 in the 1985 cohort (0.8 percent of the cohort).

The distributions of the demographic characteristics of sex, race, and age at entitlement are different for the two

Table 2.—Distribution of covariates, by sex and age at entitlement [1]

Covariate	Percent	Total	Men				Women			
			Total	Age of entitlement			Total	Age of entitlement		
				18-34	35-49	50-61		18-34	35-49	50-61
1972 cohort										
Total number	. . .	18,807	13,131	1,598	3,149	8,384	5,676	502	1,302	3,872
Total percent	100.0	100.0	69.8	8.5	16.7	44.6	30.2	2.7	6.9	20.6
Diagnostic group:										
Infectious	1.7	326	258	30	102	126	68	9	25	34
Neoplasms	8.1	1,521	951	67	229	655	570	39	144	387
Endocrine	3.3	619	389	30	88	271	230	23	44	163
Mental disorders	9.3	1,752	1,217	387	378	452	535	117	170	248
Nervous system	5.8	1,085	704	124	177	403	381	73	95	213
Circulatory	28.6	5,386	3,975	67	755	3,153	1,411	28	235	1,148
Respiratory	6.1	1,152	952	10	126	816	200	5	34	161
Digestive	2.9	545	398	24	127	247	147	10	43	94
Genitourinary	.9	. 169	109	25	34	50	60	3	21	36
Musculoskeletal	15.5	2,917	1,832	193	468	1,171	1,085	67	223	795
Congenital	1.1	198	131	39	43	49	67	10	27	30
Accidents	6.8	276	1,023	370	300	353	253	41	62	150
Other	9.9	1,861	1,192	232	322	638	669	77	179	413
Education (in years):										
0-8	36.1	6,796	5,202	252	1,115	3,835	1,594	39	263	1,292
9-11	21.0	3,946	2,669	338	720	1,611	1,277	72	321	884
12	23.0	4,328	2,808	530	695	1,583	1,520	220	392	908
13 or more	7.9	1,493	994	187	253	554	499	75	122	302
Unknown	11.9	2,244	1,458	291	366	801	786	96	204	486
Primary insurance amount:										
$1-$299	9.5	1,796	681	193	161	327	1,115	73	303	739
$300-$499	36.4	6,849	3,738	607	1,062	2,069	3,111	253	735	2,123
$500-$699	48.0	9,022	7,653	503	1,647	5,503	1,369	131	256	982
$700 or more	6.1	1,140	1,059	295	279	485	81	45	8	28
Race:										
Nonblack	85.9	16,151	11,292	1,341	2,631	7,320	4,859	429	1,084	3,346
Black	14.1	2,656	1,839	257	518	1,064	817	73	218	526

See footnote at end of table.

cohorts. The 1985 cohort is 34 percent female; in contrast, the 1972 cohort is 30 percent female. This difference is due in part to the fact that more females were in the workforce in 1985 and, therefore, more of them were earning the quarters of coverage needed for benefit entitlement. The 1985 cohort has a greater percentage of blacks (16 percent, compared with 14 percent in the 1972 cohort).

Age at entitlement was coded into three groups: Young (18-34 years), middle (35-49 years), and old (50-61 years). The 1985 cohort is younger at entitlement than the 1972 cohort. Nineteen percent of the 1985 cohort are in the young age group, compared with 11 percent of the 1972 cohort. Fifty-four percent of the 1985 cohort are in the oldest group, compared with 65 percent of the 1972 cohort. One explanation of why there are more young persons on the 1985 cohort is that this group has a greater percentage of persons with mental disorders. Apart from the AIDS category, the mental disorders group has the greatest percentage of young persons. However, when age groups are examined separately for each primary diagnostic group, the shift toward a younger population of beneficiaries in the 1985 cohort, compared with those of the 1972 cohort, occurs for all diagnostic groups.

Beneficiaries were classified according to educational level at the time of entitlement: 0-8 years, 9-11 years, 12 years (high school graduate), 13 or more years, and unknown. The 1985 cohort is more educated; only 21 percent were in the 0-8 years group, compared with 36 percent in the 1972 cohort. Thirty-five percent of the 1985

Table 2.—Distribution of covariates, by sex and age at entitlement—*Continued*

Covariate	Percent	Total	Men				Women			
			Total	Age of entitlement			Total	Age of entitlement		
				18-34	35-49	50-61		18-34	35-49	50-61
1985 cohort										
Total number	...	34,762	22,904	4,524	5,947	12,433	11,858	2,155	3,413	6,290
Total percent	100.0	100.0	65.9	13.0	17.1	35.8	34.1	6.2	9.8	18.1
Diagnostic group:										
Infectious	4.1	1,409	934	167	349	418	475	65	202	208
Neoplasms	10.8	3,740	2,264	189	525	1,550	1,476	127	412	937
Endocrine	3.7	1,301	674	86	220	368	627	70	185	372
Mental disorders	24.5	8,500	5,423	2,344	1,709	1,370	3,077	1,071	1,051	955
Nervous system	7.6	2,634	1,574	422	417	735	1,060	299	316	445
Circulatory	17.3	6,028	4,614	130	815	3,669	1,414	59	286	1,069
Respiratory	5.1	1,787	1,222	11	150	1,061	565	11	110	444
Digestive	1.5	512	354	37	127	190	158	28	57	73
Genitourinary	1.3	442	314	74	107	133	128	37	44	47
Musculoskeletal	14.5	5,046	3,056	306	824	1,926	1,990	171	487	1,332
Congenital	.3	100	58	18	13	27	42	10	14	18
Accidents	4.6	1,605	1,244	476	325	443	361	105	102	154
AIDS	.8	269	240	112	114	14	29	20	4	55
Other	4.0	1,389	933	152	252	529	456	82	143	231
Education (in years):										
0-8	21.2	7,384	5,545	338	1,234	3,973	1,839	90	407	1,342
9-11	20.4	7,097	4,724	914	1,245	2,565	2,373	250	662	1,461
12	35.1	12,205	7,494	1,994	2,105	3,395	4,711	993	1,466	2,252
13 or more	12.6	4,380	2,690	668	788	1,234	1,690	480	567	643
Unknown	10.6	3,696	2,451	610	575	1,266	1,245	342	311	592
Primary insurance amount:										
$1-$299	9.7	3,379	1,043	621	137	285	2,336	456	535	1,345
$300-$499	34.0	11,832	5,552	2,150	1,511	1,891	6,280	1,125	1,846	3,309
$500-$699	26.4	9,982	6,743	1,128	2,002	3,613	2,439	445	756	1,238
$700 or more	29.8	10,369	9,566	625	2,297	6,644	803	129	276	398
Race:										
Nonblack	84.0	29,192	19,440	3,702	4,878	10,860	9,752	1,789	2,703	5,260
Black	16.0	5,570	3,464	822	1,069	1,573	2,106	366	710	1,030

[1]The totals for the 1972 cohort are from a 5-percent random sample; totals for the 1985 cohort are from a 10-percent random sample. Persons whose age at entitlement is 62 or older are excluded.

cohort attained an educational level of high school graduate and 13 percent attained a higher level, compared with 23 percent and 8 percent, respectively, for the 1972 cohort.

Lastly, the distributions of primary insurance amounts (PIA) are different for the two cohorts. The PIA is the dollar figure on which cash benefits are based. It is a function of the number of years of covered earnings under the Social Security program before the onset of disability and the level of earnings for those years. It serves as a rough proxy for the level of lifetime earnings. The PIA also gives a rough indication of an individual's economic status because it is directly related to the cash benefit received.[8]

For both cohorts the PIA is in 1989 dollars. The four levels of PIA are $1-$299, $300-$499, $500-$699, and $700 or more. For the 1985 cohort, 30 percent are in the highest PIA category of $700 or more; the 1972 cohort contains only 6 percent in this category. In the next lower category, the 1985 cohort has 26 percent, compared with 48 percent for the 1972 cohort.

In summary, real change has occurred across all dimensions of individual characteristics. Differences remain even when all variables are analyzed simultaneously. The number of beneficiaries in the sample for various combinations of individual characteristics is also shown in table 2.

Although a difference from one point in time to another does not necessarily indicate a trend, these findings are consistent with trends observed in the general worker population and in SSA data on awards.[9]

Death Rates

The preceding analysis indicates that the DI population entitled in 1985 is younger, more educated, and has a higher PIA level, compared with the 1972 cohort. Coupled with the advances in medical technology through the 1980's, one might expect the death rate for the population to have declined over this period.

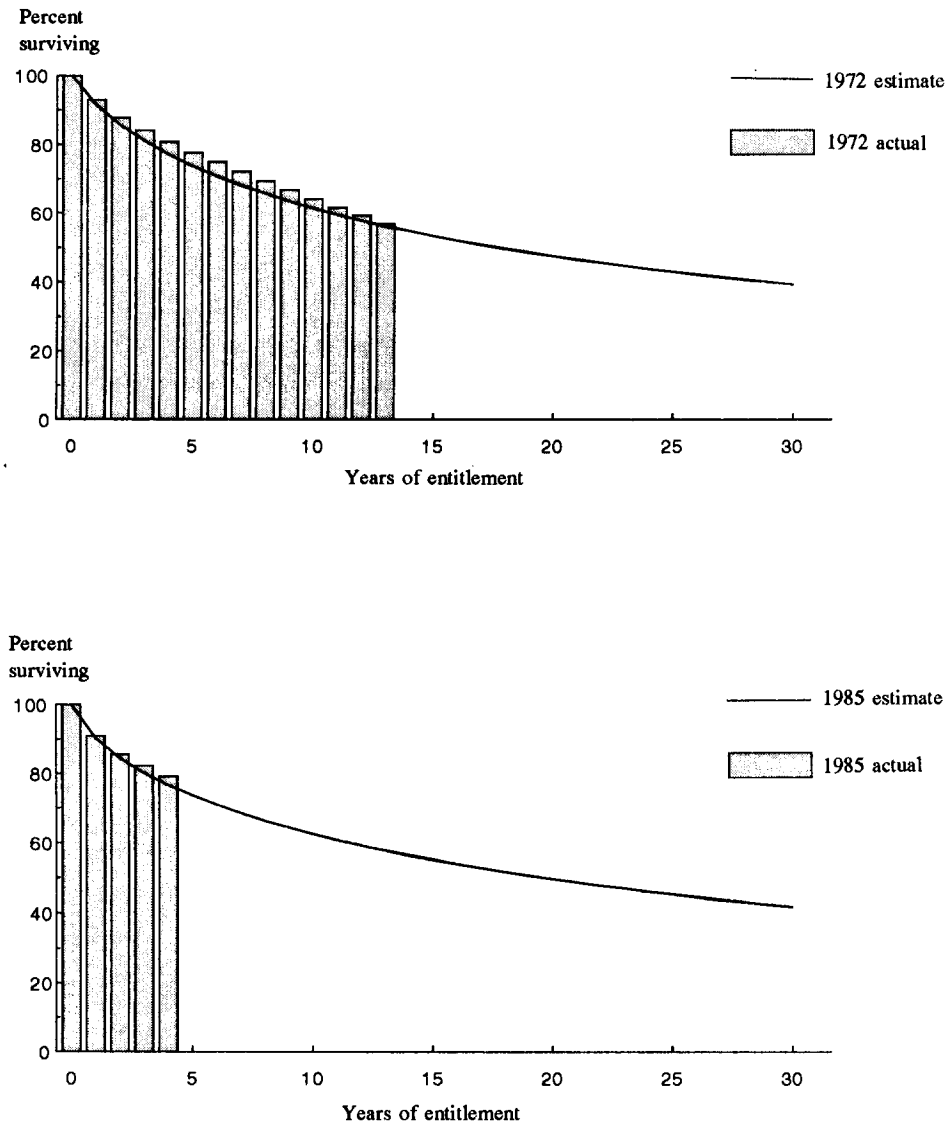
In this study, we have the opportunity to compare the death rates of two different entitlement cohorts of beneficiaries. For an individual, there may be a program termination because of recovery or retirement prior to death. This article does not attempt to analyze the termination process.

Since the observation period for some individuals in the 1985 cohort was less than 5 years, a direct comparison of deaths over only the first 4 years of entitlement can be made from the data. Table 3 shows that, for the total population, a greater percentage of disabled-worker beneficiaries died during the first year of entitlement in the 1985 cohort (9.1 percent) than in the 1972 cohort (7.0 percent). This difference essentially disappears in the second year. During the third and fourth years, the percentage of deaths in the 1985 cohort drops just below the percentage for the 1972 cohort.

The table also shows the percentages computed for each age group. For the youngest and oldest groups, the percentage who died in both the first and second years after entitlement is greater for the 1985 cohort, compared with the 1972 cohort.

In order to better understand the death rates, we developed a mathematical model to examine the

Chart 1.—Actual and estimated survival curves



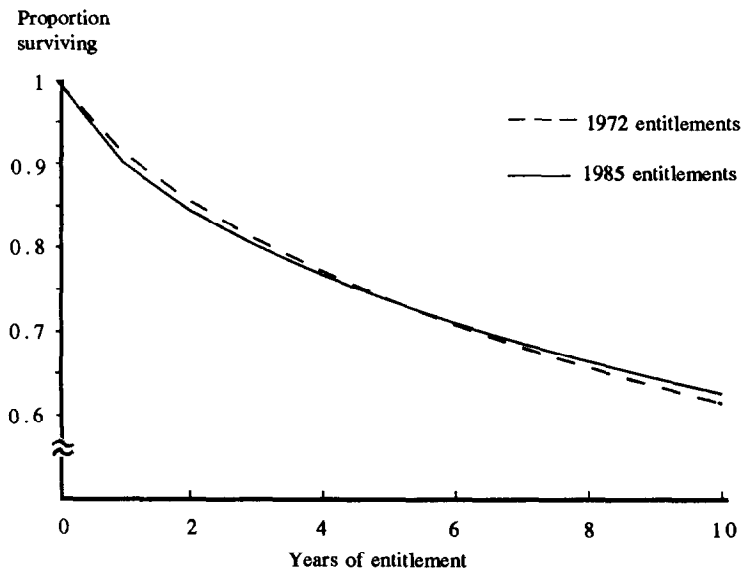
effect of covariates on these rates. (Technical details are described in ORS Working Paper Number 57.) In summary, mathematical models of the survival curves were constructed. These survival curves were projected beyond the first 4 years and took into account covariate effects of age, sex, race, and primary diagnosis.

The value of the survival curve at time t is the percentage of beneficiaries still alive t years after entitlement. If the death rate increases, then fewer people survive and the survival curve drops more rapidly. Thus, in a comparison of two survival curves, the lower survival curve has the higher death rate.

In chart 1, the line represents the estimated survival curve. The bars represent the actual percentages surviving each year in the sample data. The 1972 cohort has a longer observation period, so the graphs are constructed for the first 13 years after entitlement. For the 1985 cohort, data are available for only the first 4 years. We see that, in general, the model provides a reasonable estimate of the actual survival experience over time, and therefore the model should yield valid results when comparing the two cohorts.

Chart 2 compares the two estimated survival curves for the first 10 years. Overall, the curves are not very different. For the 1985 cohort, the curve is slightly lower during the first several years, which implies that the death rate for the 1985 cohort is slightly higher for the first several years. This fact is consistent with the earlier observation in the actual data that the percentage of deaths in the first year is higher in the 1985 cohort. This trend continues for a few more years and can be observed in the raw data for the youngest and oldest groups (table 3). Thus, there is substantial evidence to conclude that the death rate for the 1985 cohort is higher during the early years, but not dramatically higher.

Chart 2.—Survival curves for each entitlement cohort



Covariate Effects

Differences in death rates could be due to a number of factors including the changing individual characteristics of the beneficiary population, advances in medical technology, or changes in the disability determination process. In order to understand the effect of individual characteristics or covariates on the survival curves, separate curves were estimated for each of the primary diagnostic groups. In addition, each curve was estimated as a function of age, sex, race, and year of entitlement. The coefficient estimates in the model appear in ORS Working Paper Number 57. In general, the expected effects of age, sex, and race on the death rates are present. The death rate is higher for older beneficiaries and higher for males. For about half of the primary diagnostic groups, race is not a significant factor. When it was significant, the death rate is higher for blacks than for nonblacks.

The relationship between entitlement year and the death rate is fairly complex and varies with primary diagnosis. For some groups there is no discernible difference in the death rates between the entitlement years. For others, there is an interaction between entitlement year and age, sex, and race—for example, the association of

Table 3.—Percent of DI beneficiaries who died within the first 4 of years of entitlement

Age at entitlement	First year		Second year		Third year		Fourth year	
	1972	1985	1972	1985	1972	1985	1972	1985
Total	7.0	9.1	5.2	5.3	3.7	3.3	3.2	3.1
18-34	3.8	4.8	1.4	2.7	1.7	1.5	1.3	1.2
35-49	6.9	9.1	5.0	4.5	3.2	2.9	2.5	2.1
50-61	7.6	10.6	5.9	6.7	4.3	4.2	3.8	4.2

age with the death rate is different for each entitlement year.

Diagnostic Group

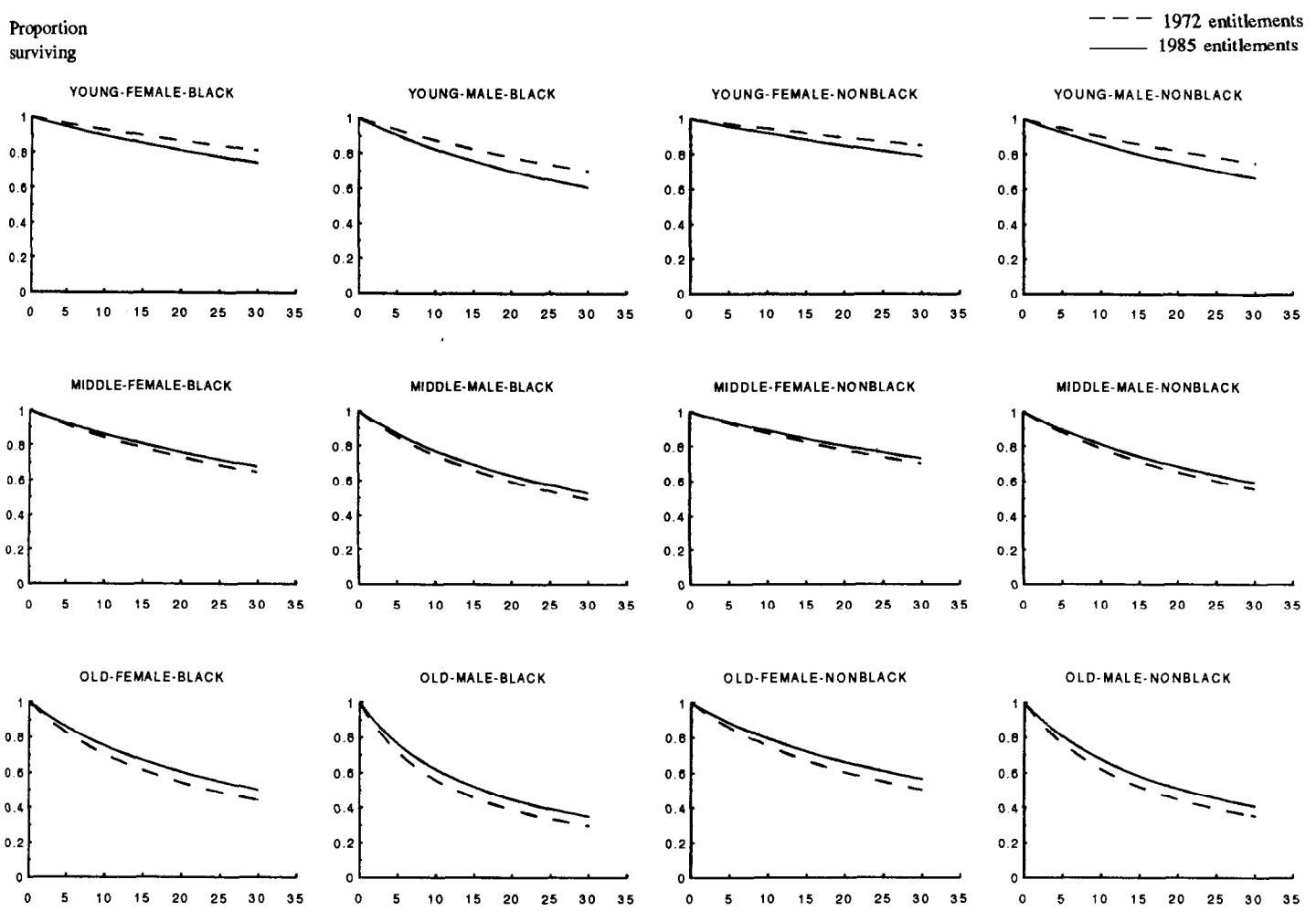
Genitourinary, respiratory, congenital, digestive, and nervous system.—Among these groups, there is no significant difference in the death rates between the entitlement years. For the nervous system group, age, sex, and race have statistically significant effects on the death rates, which are in the expected direction. For the genitourinary, digestive, and respiratory groups, race is not a significant factor, but age and sex are significant in the expected directions. In the congenital group, age is the only significant factor; individuals in the old age group have a higher death rate than the young age group. The death rates are different between entitlement years for all other primary diagnostic groups.

Endocrine.—For this group, the death rate for the 1985 cohort is slightly lower than that for the 1972 cohort. The rate for females is also slightly lower than the rate for males in both years. Age at entitlement and race have no effect on the death rate for either cohort.

Mental disorders and infectious diseases.—For the remaining diagnostic groups, there is an interaction between entitlement year and at least one of the other variables. In both the mental disorders and infectious diseases groups, gender and race have significant effects on the death rate and there is no interaction—that is, the effects are the same for both cohorts. However, age does interact with entitlement year. The results for the mental disorders group are illustrated in chart 3 for both cohorts.

The chart presents the survival curves for each of the age-sex-race combinations. It should be noted that all of the differences between the survival curves for the two entitlement years were tested and found to be statistically significant at the 5-percent level. For the young-black-female group, the survival curve for the 1985 cohort is lower than the curve for the 1972 cohort. This result indicates that the death rate for this subgroup in the 1985 cohort is higher than the rate

Chart 3.—Survival curves for mental disorders group



for the same subgroup in the 1972 cohort. However, for the middle-black-female group, the two curves reverse their relative positions, although they are very close together. They seem to be further apart in the old-black-female group. Thus, for the young group the 1985 cohort's death rate is higher than that for the 1972 cohort; the reverse is true for the old group. This pattern appears to be the same for the other combinations of sex and race.

Another aspect of the entitlement year-age interaction is shown in chart 4 by overlaying the curves for the three age groups for each entitlement year separately. Even though this chart displays the curves for nonblack males, the findings are typical of the other race-sex groups. The subgroup of nonblack males was chosen because it was the largest of all the subgroups. In both graphs the usual age effect is present—that is, older beneficiaries have a lower survival curve because their death rate is higher. However, the three survival curves for the 1985 cohort are closer together than those for the 1972 cohort. Thus, in the 1985 cohort, the death rates for young, middle, and old beneficiaries are not as different as they are for the 1972 cohort.

Chart 5 presents survival curves for the infectious diseases group. In this group, the age effect is even more complicated. The 1985 cohort's survival curve for the young age group is below that of the 1972 cohort. This pattern reverses for the middle age group, and again for the old age group. Thus, compared with the death rates for the 1972 cohort, the 1985 cohort's death rates are higher for the youngest and oldest entitlees and lower for the middle age group.

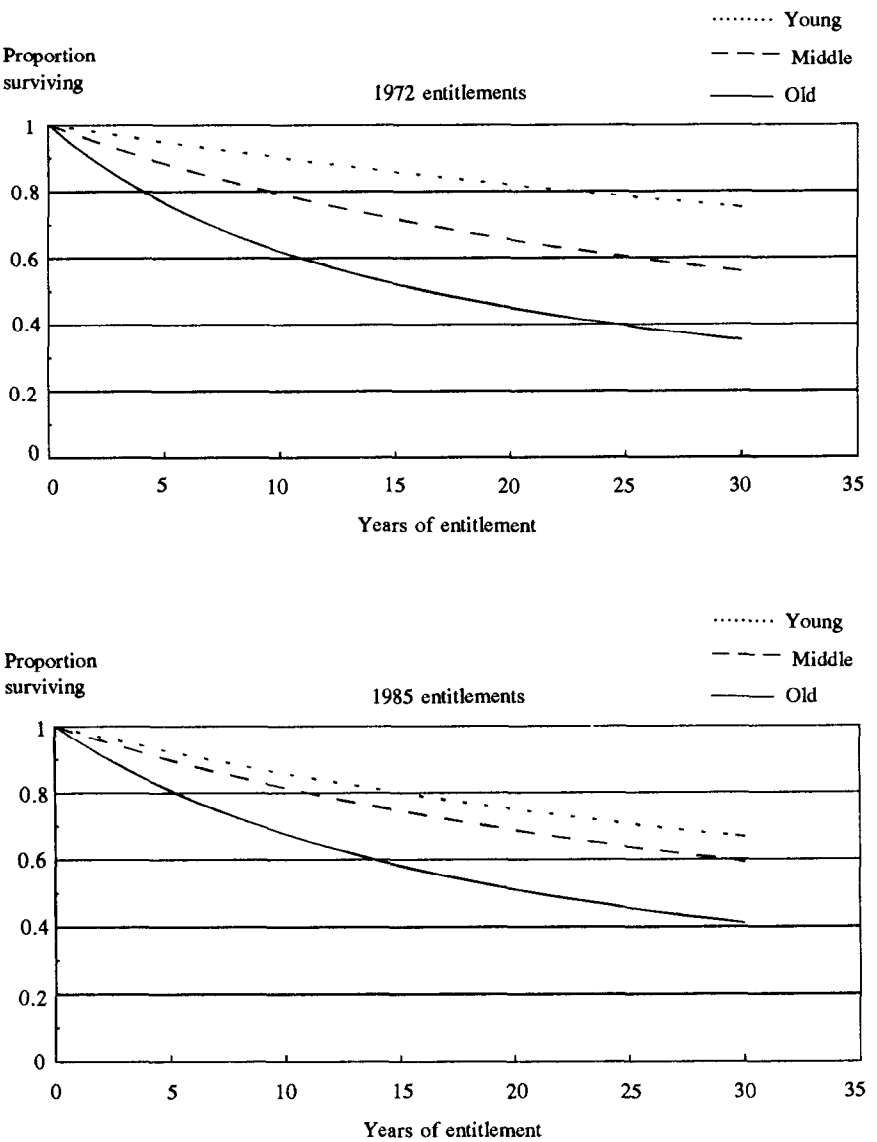
Once again, if the survival curves for each age group were overlaid separately for each entitlement year, as in chart 4, the survival curves for the 1985 entitlement cohort would be in the expected order and would be closer together than the 1972 curves. Thus, the findings are the same for the mental disorders and infectious diseases groups. Age at entitlement has less of an effect for the 1985 cohort than it does for the 1972 cohort.

Musculoskeletal.—The survival curves for the musculoskeletal group are presented in chart 6. For this group, the usual age, sex, and race effects are significant. The sex effect is the same for both entitlement years—that is, females have a higher survival curve and therefore a lower death rate. However, in contrast to the infectious diseases and mental disorders groups, the first column (representing black females) shows that the 1985 cohort's survival curve is slightly below the 1972 cohort's, indicating that the death rate for the 1985 cohort is slightly higher for all three age groups.

This relationship is also true for black males (as shown in the second column). Thus, this relationship holds for all blacks, regardless of age or sex. However, in the last two columns—which give the survival curves for nonblacks—the relationship is reversed. Thus, the death rate is lower for the 1985 cohort than it is for the 1972 cohort.

This interaction between race and

Chart 4.—Survival curves for nonblack males in the mental disorders group, by age



entitlement year is presented from a different point of view in chart 7, which displays the survival curves by race for males in the old age group. From this perspective, it can be seen that the difference in death rates for blacks and nonblacks is very small for the 1972 cohort. However, for the 1985 cohort, the difference is larger, with blacks having the higher death rate. It should be noted that this finding is not consistent across diagnostic groups and, in fact, reverses for the accidents group.

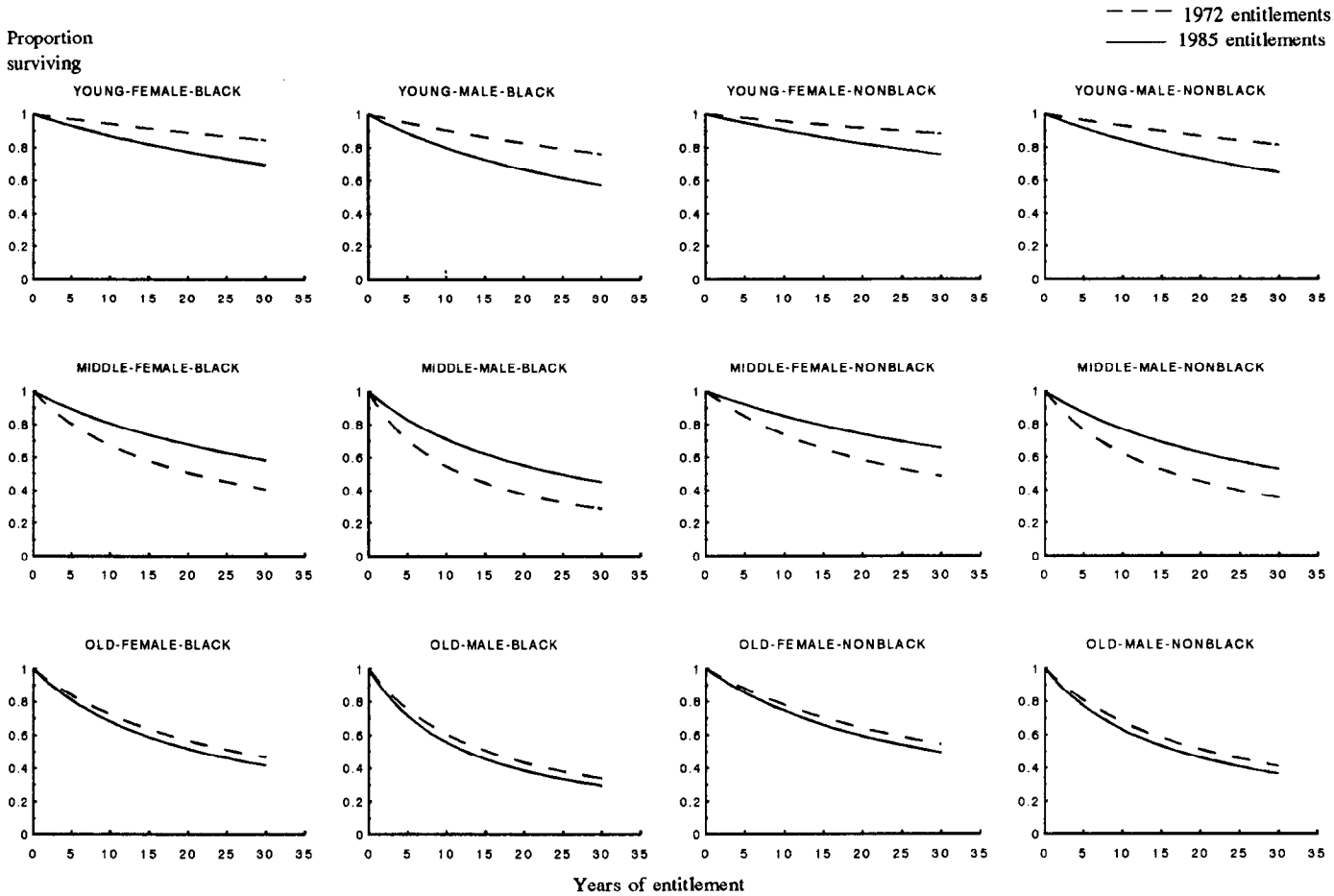
Accidents.—Chart 8 presents the results for the accidents group. Age, sex, and race are again significant. Once again, the first column (for black females) indicates the complex effect of age on the two cohorts. For the young group, the 1985 cohort's death rate is slightly higher than the rate for the 1972 cohort. This pattern reverses itself for the middle age group. A larger difference in the death rates is shown for the old age group. The death rates for black males shown in the second column exhibit the same patterns as for black females. Nonblacks show a somewhat different pattern. In this case, the two curves reverse their position in the old age group, not in the middle age group. In general, a reversal occurs for both blacks and nonblacks. It seems that the 1985 cohort's death rate is higher than that for the 1972 cohort for beneficiaries who are entitled in the young age group and is lower for those who are entitled in the old age group. The pattern reverses somewhere in between, and the reversal is sooner for blacks than for nonblacks.

Again, if the survival curves for the age groups were overlaid as in chart 4, the curves for each age group would be closer together for the 1985 cohort than for the 1972 cohort. This fact indicates that the death rates for the three age groups are not as different for the 1985 cohort as they are for the 1972 cohort.

If the survival curves by race were overlaid as in chart 7, the interaction for the accidents group would be the reverse of that for the musculoskeletal group. In this case, the difference in the 1985 cohort's death rates by race is smaller than that for the 1972 cohort.

Circulatory system.—The circulatory group exhibits the most complex results of all groups. Age, sex, and race have the usual effects on the death rates for each cohort. But, the effect of each of the covariates is different for each entitlement year. The results are most easily seen in chart 9. Some columns

Chart 5.—Survival curves for infectious diseases group



show a reversal of the survival curves going from the young to the old group, while others do not. For males (shown in the second and fourth columns), the young age group shows the 1985 cohort's survival curve below that of the 1972 cohort's curve. The middle age group shows both survival curves very close together. In fact, for blacks, the two curves are indistinguishable. In the old age group, the 1985 cohort's curve is higher than the 1972 cohort's.

This reversal of curves does not occur for females. However, the two curves get closer together as age increases. These findings are indicative of the fact that entitlement year is interacting with age, sex, and race.

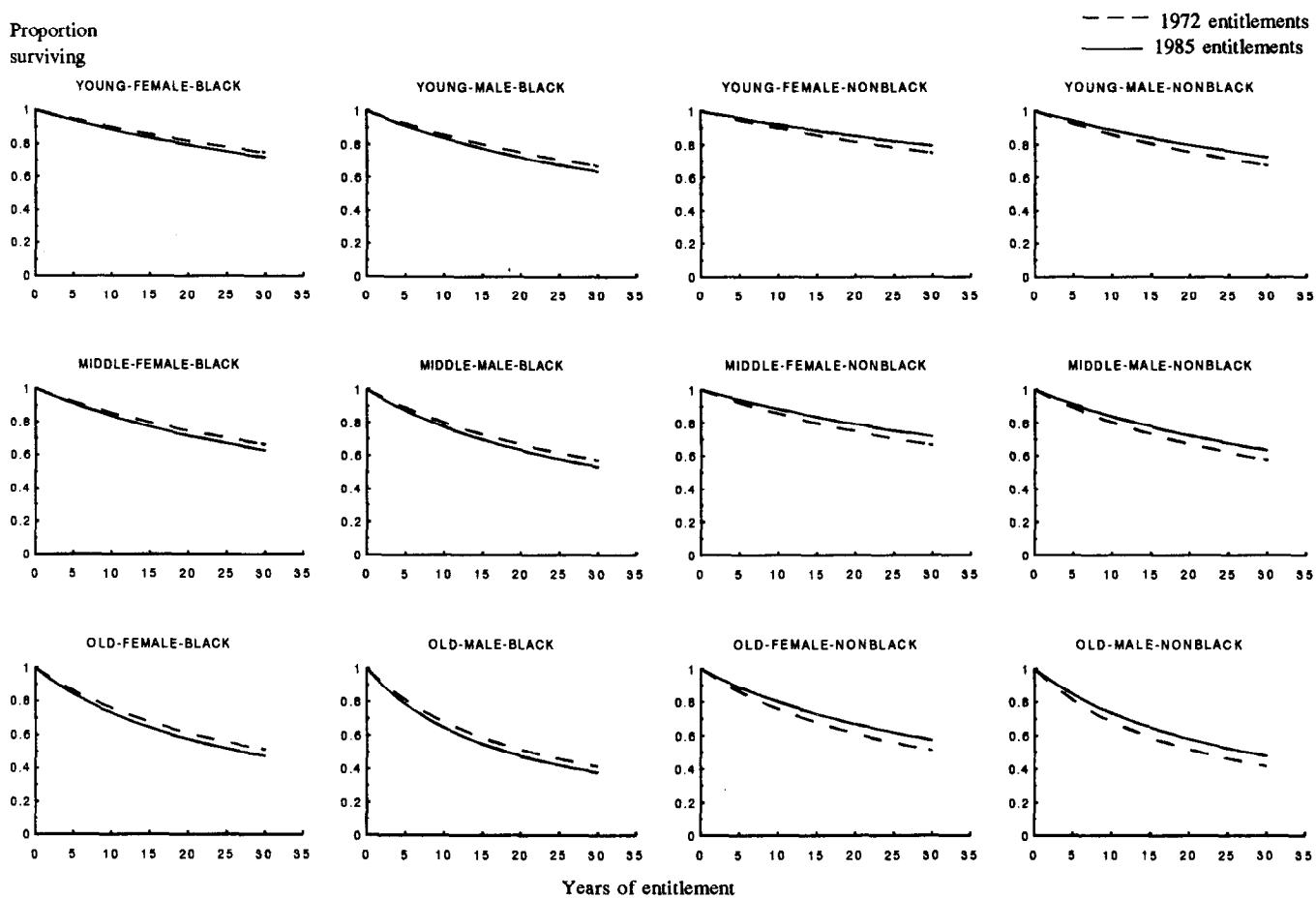
If the survival curves for each age group were overlaid for each entitlement year separately, as in chart 4, the significant decrease in differences in death rates from the 1972 cohort to the 1985 cohort would be striking. If the same arrangement is done by sex, it would not be as dramatic. The 1985 curves would be closer together than the 1972 curves, indicating less of a difference in the death rates for the 1985 beneficiaries than for those in the 1972 cohort. If done by race, an increase in the difference in death rates between the cohorts becomes evident for the circulatory group, as is observed for the musculoskeletal group.

Neoplasms.—The death rate for the neoplasms group is much higher than for any of the previously mentioned groups. Thus, the survival curve drops much more severely than in the other groups. Race has no significant effect on the death rate. For all age-sex combinations, the 1985 cohort's death rate is slightly higher than the 1972 cohort's although the difference for males is very slight. There is a decrease in the differences in death rates between the 1972 and the 1985 cohorts, but the decrease is small.

AIDS.—The 1985 AIDS group is unique because there is no comparable group of cases in 1972. This primary diagnostic group exhibited the highest death rates of all groups. Females had a lower death rate than males and blacks had a higher death rate than nonblacks.

Other.—The pattern of association exhibited in the primary diagnostic group labeled other is not discussed since the combination of disabling conditions found in this group does not lend itself to easy interpretation. (The survival curves are estimated for this

Chart 6.—Survival curves for musculoskeletal group



group for the sake of completeness and not for interpretative purposes.)

Standardized 5-Year Survival Rates

To further illustrate the effect of the different death rates for the 1972 and 1985 cohorts, the 5-year survival rate—that is, the percentage of persons surviving 5 years after entitlement—a standard measure in survival studies, is presented in table 4 for various subgroups. In order to highlight the pure effect of the different death rates between the two cohorts, death rates for each cohort are applied separately to the distribution of covariates of age, sex, race, and primary diagnosis in the 1985 cohort. Thus, the population is standardized to the 1985 covariate distribution; both the 1972 cohort's death rates and the 1985 cohort's death rates are applied to the 1985 population. Consequently, the differences in 5-year survival rates for the two cohort's are due only to the different death rates and not to any variation in age, sex, or race characteristics of the population. The AIDS group does not appear on any of the charts with standardized populations because this category did not exist in 1972.

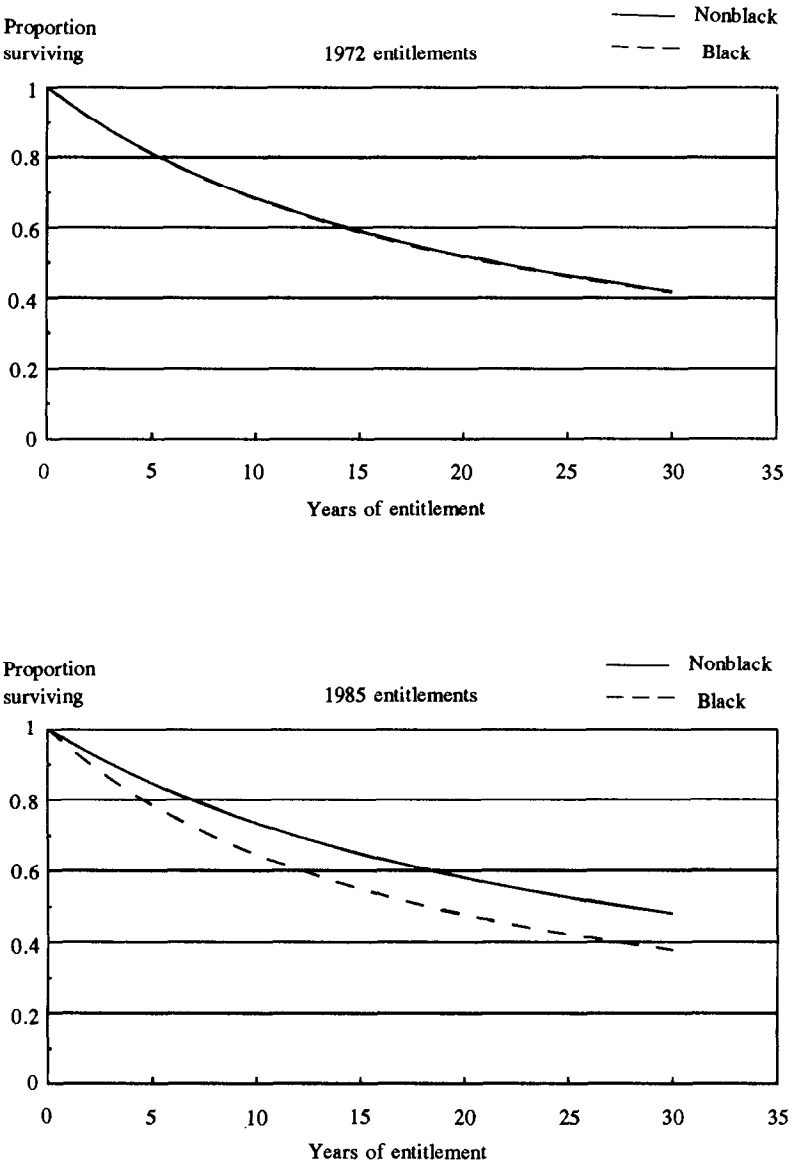
Table 4 shows that the 5-year survival rate for the total population of the 1985 cohort is about the same as the rate for the 1972 cohort, 77 percent and 78 percent, respectively. This does not mean that there are no striking differences in the subgroups of the two cohorts. In fact, significant differences have been discussed in this article.

If the 5-year survival rate is examined by primary diagnosis, differences begin to appear. For example, the percentage surviving 5 years after entitlement for the circulatory group is 74 percent for the 1972 cohort, compared with 78 percent for the 1985 cohort. This is true even though some of the subgroups in this group exhibit lower survival curves in 1985, as shown in chart 9. It may be that the distribution of age, sex, and race in the circulatory group is such that the subgroups with a lower death rate in the 1985 cohort dominate the whole group. The neoplasms, accidents, and "other" diagnostic groups show a lower 5-year survival rate for the 1985 cohort than for the 1972 cohort. The group labeled other, with 87 percent surviving 5 years after entitlement in the 1972 cohort, shows a dramatic decline to 31 percent in the 1985 cohort. Since this category does not represent a specific diagnostic group, the explanation for this sharp decline is not clear.

When the total population is examined by three age groups, a different pattern emerges. In all three groups, the percentage surviving 5 years after entitlement is lower for the 1985 cohort than for the 1972 cohort, although in the old group the difference is quite small.

By gender, males show a slight decrease in the percent surviving between the 1972 and the 1985 cohorts. The decrease for females is larger. There seem to be small differences in the survival rates by race.

Chart 7.—Survival curves for males, aged 50-61, in the musculoskeletal group, by race



Survival Projections to Age 65

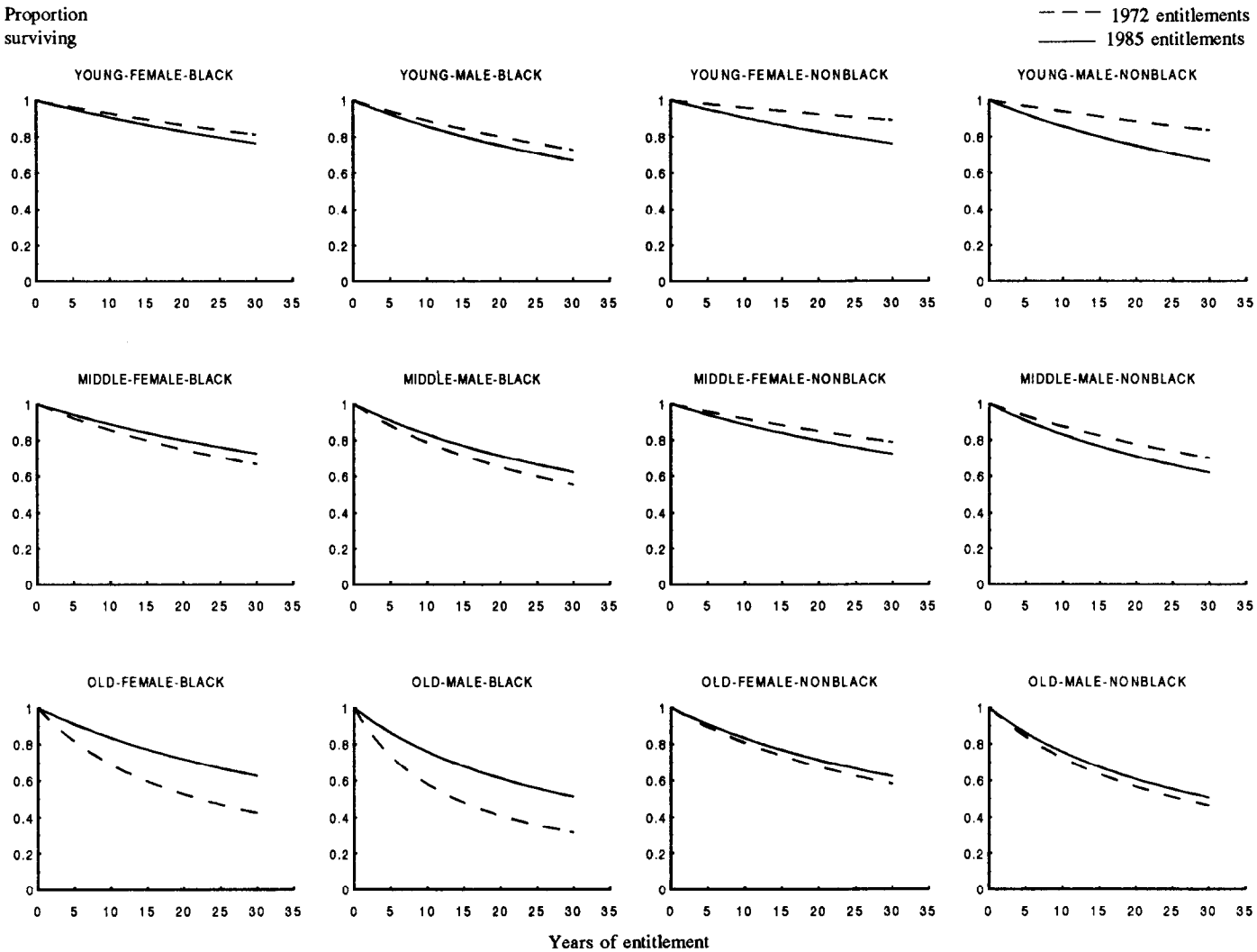
The Social Security program pays disability benefits until age 65, at which time the beneficiary is automatically converted to the retirement program. It is of interest, therefore, to compute the percentage of beneficiaries who are estimated to die before they reach retirement age (table 4).

Caution should be used in making long-term projections because the observation period for the 1985 cohort is less than 5 years. The observation period for the 1972 cohort, however, is considerably longer—about 13 years, and models were constructed using both data sets simultaneously. In addition, any lifetime model of death rates over time must take into account the fact that even though death rates will decrease after the first few years of entitlement, they will begin to increase in the older years of life. This analysis makes no attempt to estimate this upturn in death rates. We use the death rates only up to age 65. Although there are limitations in the use of these projections, the estimates should reflect the basic patterns in the death rates. The projections can provide meaningful comparisons between the 1972 and 1985 cohorts and are not intended to provide precise estimates of the percentages of beneficiaries who die before retirement.

Deaths Before Retirement

Table 4 presents a comparison of the percentage of beneficiaries estimated to die before retirement age for the 1972 and 1985 standardized populations. For the total population, the percentage is almost the same for the 1972 cohort as it is for the 1985 cohort—40 percent and 41 percent, respectively. However, similar to the 5-year survival rates, differences occur throughout the diagnostic groups. In this case, however, the age distribution in each subgroup plays an important role because the number of years to retirement is shorter for the old age groups. In both cohorts, the neoplasms group has a percentage of deaths that is

Chart 8.—Survival curves for accidents group



quite a bit higher than the rest, 86 percent for the 1972 cohort and 88 percent for the 1985 cohort.

When grouped by age at entitlement, the young group is the only group with a higher percentage of deaths in the 1985 cohort than in the 1972 cohort. For each entitlement cohort the drop in the percentage from the middle age group to the old age group occurs because of the shorter time to retirement for the old group.

The percentages of deaths before retirement age, when grouped by sex and race, yield comparisons that are basically in agreement with the 5-year survival rates.

Length of Time to Death

The median time from entitlement to death for those who die before age 65 is also presented in table 4, using populations standardized to the 1985 population. The number displayed is the median number of years before which death occurs. For example, for those beneficiaries in the 1972 cohort who died before age 65, the median is estimated to be 4 years. In other words, of those who died before age 65, half had died by some time in the fourth year. Any more precise calculation of the median would have required a substantial increase in computational effort and was not deemed necessary.

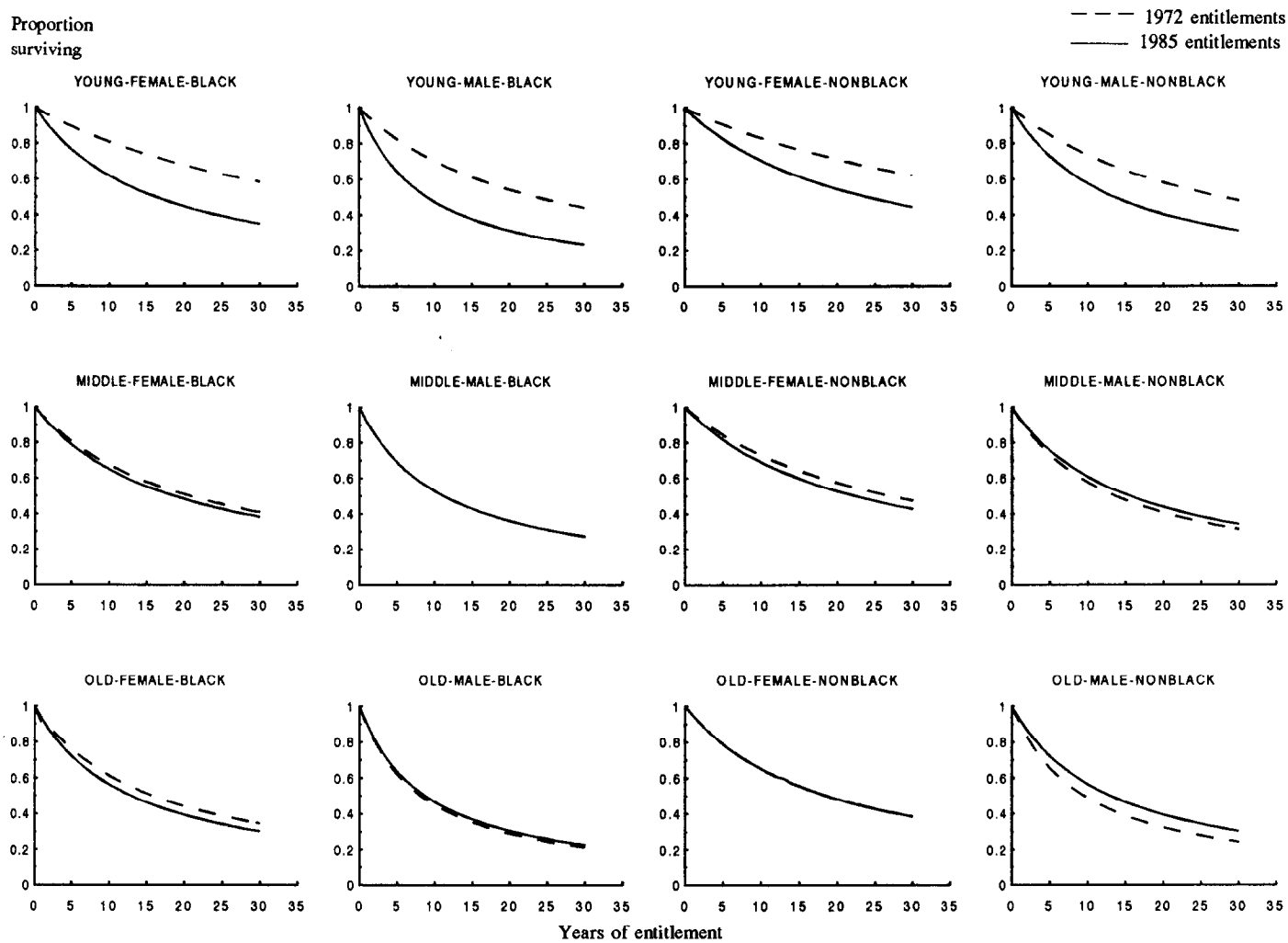
The median for both the 1972 and the 1985 cohorts is the same—4 years. This fact coincides with the finding in chart 2 that the survival curves for both cohorts are about the same.

When considering primary diagnosis, the median varies considerably. In some groups, the 1985 cohort has a higher median year; in others, it has a lower median year. As expected, the lowest median occurs in the neoplasms group for both cohorts.

The old age group has the same median year for both cohorts. The median number of years before death for the young and middle age groups are higher for the 1972 cohort than for the 1985 cohort, giving further evidence that the young and middle age groups have higher death rates in the 1985 cohort than in the 1972 cohort. There is a slight drop in the median for females and nonblacks in the 1985 cohort.

The mean number of years for those who died before age 65 is also presented in table 4. In almost all

Chart 9.—Survival curves for circulatory group



cases, the mean is larger than the median because the distribution of deaths is not bell-shaped and has a long right tail.

Nonstandardized Estimates

In table 4, the population was standardized to 1985—that is, the number of individuals with a given set of characteristics was set to the number that occurred in the 1985 sample. Thus, that table reflects the differences created only by the change in death rates. Table 5 presents the same statistics computed with nonstandardized populations—that is, death rates for the 1972 cohort were applied to the 1972 population, and death rates for the 1985 cohort were applied to the 1985 population. Therefore, the nonstandardized table reflects changes not only in the death rates but also in the distributions of the covariates between the 1972 and 1985 cohorts.

For example, table 5 presents the mean number of years from entitlement to death for those who die before age 65 for the total population and for each primary diagnosis, age, sex, and race group. The mean is slightly higher for the 1985 entitlement cohort and for most of the subgroups, but this is partially due to the fact that the 1985 cohort is younger than the 1972 cohort. In the young age group, the mean for the 1972 cohort is greater than that of the 1985 cohort. The mean for the other two age groups is about the same for both cohorts. Results for the other group are presented for those who are interested.

Conclusions

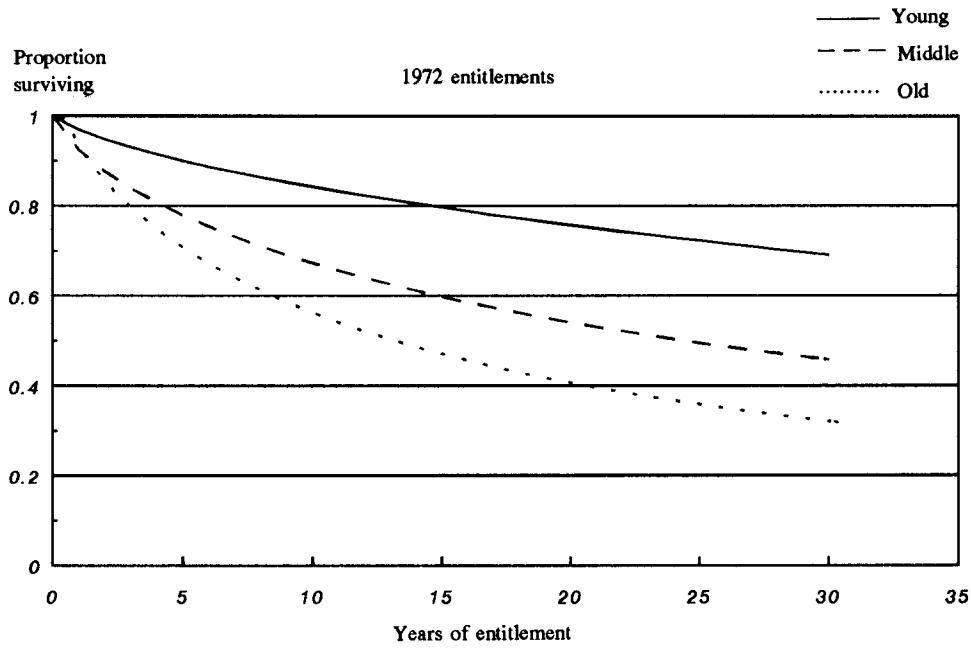
Overall, the death rates for the two cohorts are very similar. Chart 2 shows that there is very little difference between the survival curves for the 1972 and 1985 cohorts. However, differences in the death rates between the cohorts appear when subgroups of these cohorts are examined.

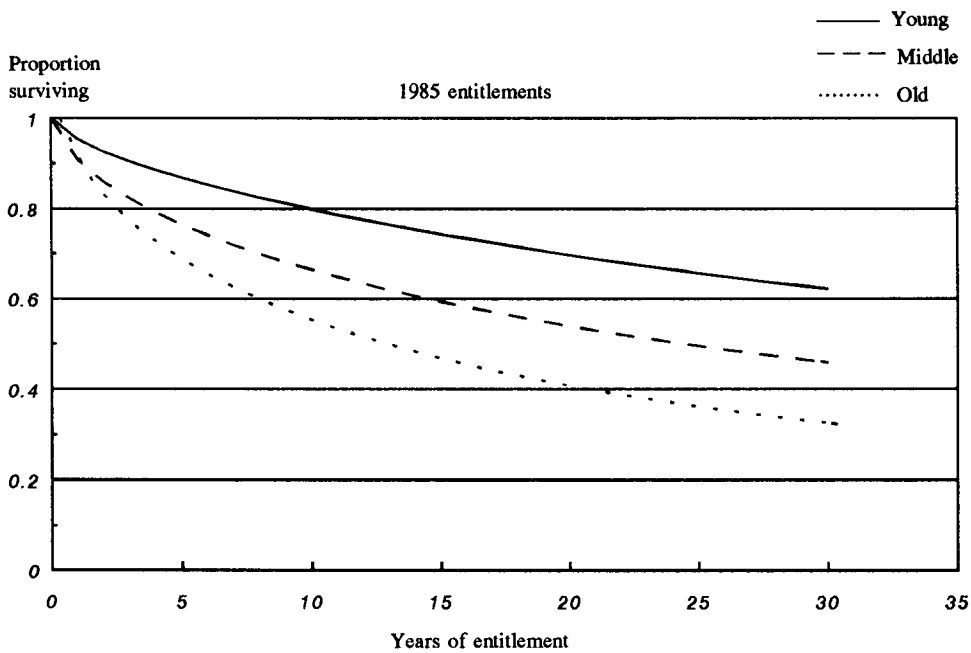
Chart 10 shows the entitlement year-age interaction for the total population. This interaction appears minor. However, the entitlement year-age interaction appears very striking for certain diagnostic groups, such as the mental disorders group (chart 4).

In addition, the distributions of the covariates of age, sex, race, education, PIA, and primary diagnosis have changed significantly between the cohorts. These changes may be partially caused by changes in the applicant population. An investigation was not conducted to determine if the characteristics of people applying to the DI program had changed because such a study is beyond the scope of this article.

Regardless of why the shift occurred, these results suggest reasons for the increase in the size of the DI program.

Chart 10.—Survival curves for each entitlement cohort, by age





For example, comparing the 1985 cohort with the 1972 cohort, an increase in the relative size of the young and middle age groups was observed. In a previous paper[10] that analyzed mean time in the program for those entitled in 1972, a longer mean time in the program was observed for individuals in the young age group compared with individuals in the old age group. Assuming that this phenomenon is still true, it appears that this shift in age distribution will cause the average time in the program to increase. An examination of the other covariates of sex, race, education, PIA, and primary diagnosis also points toward an increase in the mean time in the program. If this phenomenon is real, the size of the program could increase even if the number of new awards does not.

Notes

Acknowledgments: The authors would like to thank the following persons: in SSA's Office of Research and Statistics, Barry Bye for his expert guidance and Jan Olson for her helpful comments on an earlier draft; in the Office of Disability, Alan Shafer for his help with the awards process; and in the Office of the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services, Kalman Rupp for his comments on an earlier draft.

[1] *1988 Annual Statistical Supplement* to the *Social Security Bulletin*, Washington, DC: U.S. Government Printing Office, 1988, table 6.C7 and table 6.C2.

[2] *Ibid.*

[3] John C. Hennessey and Janice M. Dykacz, "Projected Outcomes and Length of Time in the Disability Insurance Program," *Social Security Bulletin*, September 1989, pp. 2-41; and Janice M. Dykacz and John C. Hennessey, "Analysis of the Postrecovery Experience of Disabled-Worker Beneficiaries," *Social Security Bulletin*, September 1989, pp. 42-66.

[4] Beverly A. Bedwell, "Impact of the Revised Listings for Mental Disorders—Fiscal Year 1986 and July-December 1986," Office of Assessment (currently the Office of Program Integrity and Reviews),

Table 4.—Survival experience: Populations standardized to 1985

Covariate	Percent surviving 5 years		Percent dying before age 65		Survival projections to age 65: Median number of years		Survival projections to age 65: Mean number of years	
	1972	1985	1972	1985	1972	1985	1972	1985
Total	78	77	40	41	4	4	7.3	7.1
Diagnostic group								
Infectious	86	88	37	34	6	6	8.3	8.5
Neoplasms	26	23	86	88	2	1	2.6	2.5
Endocrine	75	79	50	46	5	5	5.8	6.1
Mental disorders	91	92	29	30	8	9	11.3	11.1
Nervous system	88	88	32	32	6	6	8.9	8.9
Circulatory	74	78	43	38	3	4	4.5	4.6
Respiratory	71	71	44	44	3	3	4.1	4.1
Digestive	68	68	58	58	4	4	5.9	5.9
Genitournary	69	69	62	62	4	4	7.0	7.0
Musculoskeletal	88	90	26	23	5	5	6.6	6.7
Congenital	92	92	22	22	7	7	9.2	9.2
Accidents	93	92	22	27	7	11	10.7	10.2
Other	87	31	30	86	5	2	7.4	3.4
Age at entitlement								
18-34	92	89	34	41	12	11	15.8	15.0
35-49	81	79	46	46	6	5	8.7	8.6
50-61	72	71	39	39	2	2	3.6	3.5
Sex								
Male	76	75	43	43	4	4	7.1	6.9
Female	82	79	34	37	4	3	7.5	7.3
Race								
Nonblack	78	77	39	40	4	3	7.2	7.0
Black	78	77	43	45	4	4	7.7	7.5

Social Security Administration, March 24, 1987, table 1.

[5] John C. Hennessey and Janice M. Dykacz, *Statistical Methodology for a Comparison of Individual Characteristics and Death Rates of Disabled-Worker Beneficiaries, 1972 and 1985* (ORS Working Paper No. 57), Office of Research and Statistics, Social Security Administration, September 1992.

[6] *Manual of the International Classification of Diseases, Injuries, and Causes of Death* (Eighth Revision, 1967; Ninth Revision, Clinical Modification, 1978), Geneva: World Health Organization.

[7] Eli N. Donkar, "Short-Range Impact of AIDS and AIDS-Related Complex on the Disability Insurance Trust Fund as Estimated for the 1989 Trustees Report" (Draft Report), Office of the Actuary, Social Security Administration, June 1989.

[8] *1989 Annual Statistical Supplement* to the *Social Security Bulletin*, Washington, DC: U.S. Government Printing Office, 1989, table 2.A14.

[9] *Ibid.*, table 6.C2.

[10] John C. Hennessey and Janice M. Dykacz, "Projected Outcomes and Length of Time in the Disability Insurance Program," *Social Security Bulletin*, September 1989, pp. 2-41.

Table 5.—Survival experience: Populations not standardized

Covariate	Percent surviving 5 years		Percent dying before age 65		Survival projections to age 65			
					Median number of years		Mean number of years	
	1972	1985	1972	1985	1972	1985	1972	1985
Total	77	76	39	42	4	4	6.1	7.0
Diagnostic group								
Infectious	84	88	37	34	6	6	7.4	8.5
Neoplasms	25	23	86	88	2	1	2.6	2.5
Endocrine	75	79	46	46	4	5	5.0	6.1
Mental disorders	89	92	30	30	7	9	9.6	11.1
Nervous system	87	88	31	32	6	6	7.5	8.9
Circulatory	74	78	42	38	4	4	4.4	4.6
Respiratory	71	71	45	44	3	3	4.0	4.1
Digestive	67	68	56	58	4	4	5.0	5.9
Genitourinary	69	69	56	62	4	4	5.9	7.0
Muscuuloskeletal	88	90	26	23	5	5	6.3	6.7
Congenital	92	92	23	22	7	7	9.7	9.2
Accidents	92	92	22	27	7	11	10.3	10.2
AIDS	0	17	0	96	0	1	0	2.8
Other	87	31	31	86	6	2	7.5	3.4
Age at entitlement								
18-34	91	87	36	42	12	11	15.9	14.7
35-49	80	78	47	47	6	5	8.2	8.5
50-61	73	71	37	39	2	2	3.6	3.5
Sex								
Male	75	75	42	44	4	4	6.1	6.9
Female	82	79	32	37	4	3	6.0	7.3
Race								
Nonblack	77	76	39	45	4	3	6.0	6.9
Black	76	76	43	41	4	4	6.4	7.5