Medicare Costs Prior to Retirement for Disabled-Worker Beneficiaries

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This article is the last in a series of studies concerning Medicare program costs of Social Security Disability Insurance (DI) beneficiaries who were under age 62 at time of entitlement to disabled-worker benefits. The earlier work provided the statistical analysis and mathematical models needed to construct estimates of Medicare costs for those beneficiaries while in the DI program. In this article, estimated costs are presented for beneficiaries with various characteristics. Data are also presented that relate possible extensions of Medicare eligibility—elimination of the 2-year waiting period and full Medicare coverage for recovered beneficiaries—to estimated Medicare costs for DI beneficiaries through age 64 under current law.

For the 1972 cohort of disabled-workers in this study, the per capita Medicare cost is estimated to be $20,129 at 1989 reimbursement levels. This cost is about 37 percent of the size of estimated cash benefits for the cohort while in the DI program. Elimination of the Medicare waiting period would result in an estimated cost increase of 29 percent. Extending Medicare eligibility through age 64 to all recovered beneficiaries would result in a cost increase of about 9 percent, assuming no Medicare "buy in" in effect.

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Legislative Background and Current Issues

The Social Security Amendments of 1972 extended Medicare entitlement to Social Security Disability Insurance (DI) beneficiaries. Before becoming eligible for Medicare, a disabled-worker beneficiary must have been receiving cash benefits for 24 months. Under the original provisions of the amendments, Medicare entitlement was eventually terminated if a disabled worker was able to return to work; for beneficiaries who returned to work, both DI and Medicare entitlements remained in effect during a 9-month trial work period, and for an additional 3 months after the trial work period ended.

The Social Security Disability Amendments of 1980 provided a 12-month period of extended eligibility for DI and Medicare benefits after completion of the trial work period for beneficiaries who returned to work despite a continuing severe impairment. Medicare coverage was extended for 24 additional months after the extended period of eligibility for DI benefits ended, resulting in a total of 36 extra months of Medicare coverage over previous law. The law also eliminated the 24-month waiting period if the individual became reentitled to DI benefits within 5 years after leaving the program. These provisions were added to encourage DI beneficiaries to return to work.

A provision of the Omnibus Budget Reconciliation Act of 1987 made Medicare a secondary payer in situations where a DI beneficiary with Medicare entitlement had alternative health insurance coverage. This situation would apply to DI beneficiaries who are covered as a dependent under a spouse's policy, or who have health insurance coverage from an employer during their trial work period or extended period of eligibility for DI benefits. The purpose of the law was to reduce Medicare costs.

The most recent extension of Medicare coverage for disabled workers was contained in the Omnibus Budget Reconciliation Act of 1989. That law permits a Medicare "buy in" arrangement for disabled workers who return to work despite a continuing severe impairment, and who exhaust the 36-month extended period of Medicare entitlement after termination of the trial work period. This extension of coverage ensures the availability of health insurance coverage for workers in those cases where it is not available on the job.

By July 1988, over 3.1 million DI beneficiaries with Medicare coverage accounted for 9.4 percent of Medicare beneficiaries. In 1988, Medicare costs for disabled beneficiaries amounted to nearly $9 billion, or 11 percent of Medicare expenses. Per capita costs for DI beneficiaries were $2,896, compared with $2,440 for all beneficiaries who become eligible for Medicare at age 65. Disabled workers comprise approximately 82 percent of all DI beneficiaries eligible for Medicare.

There has been much congressional interest in providing additional opportunities and inducements for disabled beneficiaries to return to work. One proposal would eliminate the 24-month waiting period for Medicare entitlement in order to improve early access to health care services, and increase the number of recoveries. Estimated costs and other issues related to eliminating the 24-month waiting period were presented in Bye and Riley [1989a, 1989b].

Similarly, anecdotal evidence suggests that disabled workers may be reluctant to return to work because of the prospect of eventually losing their Medicare coverage. Consequently, some analysts have proposed extending Medicare coverage beyond the 36 months currently available for disabled workers who return to work. For example, Medicare coverage could be guaranteed to age 65 for beneficiaries who return to work and who continue to have a severe impairment. Given the achievable earnings levels of disabled workers, the current cost of the Medicare buy in for Part A (Hospital Insurance) benefits, $177 per month, might be a significant work disincentive.

Purpose

This article completes a series of studies on Medicare costs of Social

Security DI beneficiaries. This study presents Medicare cost estimates at 1989 reimbursement levels for a 1972 cohort of beneficiaries through age 64. (The "discounted estimates" section below discusses this adjustment of the estimates to 1989 reimbursement levels.) The beneficiaries analyzed were under age 62 at first entitlement to DI cash benefits. To attain the cost estimates, a mathematical simulation of DI program histories of the cohort was done. Medicare costs were then estimated for the cohort during their simulated periods of Medicare entitlement while in the DI program.

The results of the simulation build on earlier studies. Hennessey and Dykacz [1989] provide analyses of duration in the DI program for the first period of disability and duration of the postrecovery period for beneficiaries whose cash benefits are terminated due to medical improvement or return to work [Dykacz and Hennessey, 1989]. The models of duration were used to simulate individual DI program histories. Bye and Riley [1989a and 1989c] and Bye, Riley, and Lubitz [1987] provide an analysis of Medicare utilization and reimbursement levels for disabled-worker beneficiaries. The reimbursement equations permit the estimation of Medicare costs for individuals at various points in their beneficiary histories.

Estimates of the Medicare costs for disabled-worker beneficiaries through age 64 are of interest because they are a partial measure of the dollar impact, on an individual basis, of Federal policies related to disabled workers. Analysis of costs by demographic and diagnostic groups can reveal where most of the program dollars are being spent. In general, Medicare costs are expected to vary substantially among groups of disabled workers who receive cash benefits because of differences in average time spent in the DI program, in average yearly expense levels, and in rates of death and recovery. Providing cost estimates for various subgroups permits an assessment of the kinds of changes in costs that might be expected with changes in demographic and diagnostic distributions of later entitlement cohorts. Medicare cost estimates also provide a reference point from which to examine cost estimates of extending Medicare coverage to disabled-worker beneficiaries in various ways.

In addition to cost estimates while in the DI program, Medicare cost estimates are given for the 24-month waiting period if the waiting period were eliminated and Medicare were first payer. The waiting period cost estimates are derived in essentially the same way as described in Bye and Riley [1989b] except that they are applied to the simulated disability histories. Comparing waiting period estimates with estimates of Medicare costs for disabled workers until their retirement at age 65 permits an assessment of the increase in Medicare costs that would be incurred by a given cohort of beneficiaries if the waiting period were eliminated.

This article also presents estimates of Medicare costs that would be incurred if Medicare benefits were extended through age 64 for recovered beneficiaries whose cash benefits are terminated. The data available for the 1972 cohort, however, did not distinguish beneficiaries whose recovery was due to a medical improvement (hereafter referred to as medical recoveries) from those who returned to work despite a continuing severe impairment (hereafter referred to as work recoveries). Thus, the data did not permit a detailed analysis of cohort members who might have obtained extended Medicare benefits under current law or who might have elected to buy in to Medicare upon return to work under a work recovery. Still, the estimates that were developed for beneficiaries after their recovery provide an upper bound of the potential cost to the Medicare program if benefits were extended through age 64 for recovered beneficiaries.

Estimates of Medicare costs for beneficiaries leaving the DI program are of interest in part because of recent legislation permitting beneficiaries who experience work recoveries to buy in to Medicare after their Medicare entitlement as disabled workers ends. Information on expected costs of disabled workers after they leave the DI program may be useful for setting an actuarially fair premium. Specifically, health care costs for beneficiaries leaving the DI program after recovery are expected to be lower than the costs for those remaining in the program.

Data and Methods

All of the analyses cited here have made use of a unique file of administrative data from the Social Security Administration (SSA) and the Health Care Financing Administration for a randomly selected cohort of disabled-worker beneficiaries. These beneficiaries were first entitled to DI benefits in 1972 and were under age 62 at the time of entitlement. Having longitudinal data for both DI and Medicare histories greatly facilitates the development of estimating equations and the resulting estimates of Medicare costs for disabled workers while in the DI program.

The data for this analysis are the same as those previously described in Bye, Riley, and Lubitz [1987]. A 5-percent sample of newly entitled disabled-worker beneficiaries was selected from the cohort of 1972 entitlements. The cohort was limited to beneficiaries under age 62 at the time of entitlement because it was difficult to ascertain retrospectively from SSA administrative records if initial periods of entitlement for persons aged 62–64 were for disability or for reduced retired-worker benefits.

After the sample cases were drawn, data were matched from two statistical data files: the Continuous Disability History Sample (CDHS) and the Continuous Medicare History Sample (CMHS). The CDHS contains information on beneficiary characteristics for a 20-percent sample of disability determination decisions at the time of benefit award. Included are the primary diagnosis associated with the disabling condition, former occupation, and years of education. The CMHS contains demographic and entitlement information, and information on use and costs of Medicare services for a 5-percent sample of Medicare beneficiaries. The file is longitudinal in structure and, at the time of the record linkage, included annual summaries of Medicare utilization and reimbursements for 1974–81.

The exclusion of beneficiaries aged 62–64 at entitlement to disabled-worker benefits has little impact on estimates of Medicare costs because Medicare eligibility before age 65 is generally only possible for those aged 62 at DI entitlement. There would also be little impact on estimated costs after recovery; however, estimated costs in the waiting period would be substantially higher if the costs for the beneficiaries aged 62–64 at DI entitlement had been included.

A second group of sample cases for those with end stage renal disease (ESRD) were excluded from the analysis for two reasons. There were insufficient ESRD cases to support separate models of DI program duration and Medicare costs for beneficiaries with ESRD are extremely high relative to non-ESRD beneficiaries. The high costs together with possibly inaccurate program duration estimates could have added significant variability to the Medicare cost estimates.

Disability Histories

Medicare expenditures for a cohort of disabled-worker beneficiaries through age 64 are not available. All of the cohort data that do exist are right censored in the sense that not all beneficiaries in the cohort have completed their histories as disabled-worker beneficiaries. Thus, the estimation of costs for the cohort through age 64 requires an approach that permits the projection of disability histories. For the analysis reported here, the simulation of disability histories was based on the mathematical models referenced above. For individuals entering the DI program, these models provided probability distributions of the time to the next event of interest—recovery, retirement, or death. For beneficiaries who recover, probability distributions for the next event—return to the DI program, retirement, death—were also used. Both sets of probability distributions are conditioned on a number of covariates—sex, age, race, and diagnosis—so that disability histories could be constructed for beneficiaries with a variety of background characteristics.

A disability history was constructed for each beneficiary in the sample beginning at the date of entitlement by making a random draw from the distributions corresponding to the first period of entitlement in the DI program. This random draw provided the simulated next event and the time of the next event based on the background characteristics of the beneficiary. If the random draw resulted in a recovery, then a second draw was made from the probability distributions for recovered beneficiaries. These steps were repeated until each simulated history resulted in the attainment of age 65 or death before age 65. The detailed steps and assumptions involved in this simulation process are described in the first part of the Appendix to this article. The Appendix also contains some results on the goodness-of-fit of the simulation results.

Medicare Costs

Disabled workers through age 64.—After simulating a full disability history for each sample case, the next step associated estimates of Medicare costs with each period of Medicare eligibility in the simulated history until attainment of age 65 or death, whichever came first. This was done using the same sets of equations that were originally developed as part of the analysis of waiting period costs. The equations describe the relationship between Medicare utilization and a set of covariates—demographic characteristics and factors relating to the nature of the disability—conditional on DI program outcome (death, recovery, still in the program). The equations were used to construct estimates of annual Medicare costs for each year in the simulated periods of Medicare eligibility. These annual figures were aggregated to obtain estimates of the total cost for disabled workers while in the DI program. The Appendix describes the construction of the estimates in more detail.

Waiting period and postrecovery.— Estimates of Medicare costs during the waiting period were computed in exactly the same manner in the analysis referenced above except that the Medicare reimbursement equations were applied to the simulated disability histories instead of the actual disability histories. For recovered beneficiaries with more than one period of disability involving additional waiting periods (resulting from a simulated gap of 5 or more years before reentitlement), the estimated cost of the additional periods was included in the overall waiting period estimate.

Estimated Medicare costs for recovered beneficiaries during their time out of the Medicare program were also computed based on the same reimbursement equations. The choice of equations was based on the simulated outcome of the period while not entitled to Medicare. The estimates of postrecovery medical expenses included estimates of costs that might have been incurred during the additional waiting periods described above. Because the data available did not permit the separation of work recoveries from medical recoveries, it was not possible to

separate these two groups in the simulation especially as it concerns the extended Medicare eligibility periods for work recoveries. For the purpose of approximating the costs of extended Medicare eligibility under current law, the simulation assumed that all beneficiaries who recovered within 2 years of DI entitlement were medical recoveries. All other recoveries were assumed to be work recoveries. These assumptions most likely result in an overstatement of the number of work recoveries and, therefore, an overstatement of the Medicare costs (due to the 3 years of extended Medicare) and an understatement of costs for disabled workers during those periods out of the DI program.

Discounted Estimates

In this article, all cost estimates are adjusted to reflect 1989 price and utilization levels without discounting. In Bye and Riley [1989b] and Bye, Riley, and Lubitz [1987] cost estimates were adjusted to reflect the 1981 price level for medical care expenditures. The additional adjustment used to convert the estimates to 1989 price and utilization levels is described in the appendix.

In the remaining discussion, the terms "1989 (reimbursement) level" and "constant level" are used to describe estimates adjusted to 1989 levels over the projected analysis period and the terms imply a zero interest rate to compute the present value of projected costs.

This approach is equivalent to assuming that the growth rate of per capita Medicare costs due to price and utilization changes and the composite interest rate that can be earned by the Health Insurance Trust Funds and general revenues (from which most Part B (Supplementary Medical Insurance) costs are paid) are approximately the same. Of course, the growth rate for Medicare costs and the relevant interest rates may be quite different. If the growth in Medicare costs due to price and utilization change is higher than the interest rate, then the present value of Medicare costs incurred in the future might be substantially higher than the corresponding estimates at 1989 levels. If the growth rate in Medicare costs is lower than the interest rate, then the present value of future costs would be lower than the estimate at corresponding 1989 levels.

Historically, the growth rate of Medicare costs has exceeded the interest rate. More information about these data series can be found in the Social Security and Medicare Trustees Reports. The sensitivity of the estimates to alternative discounting assumptions that combine the price, utilization, and interest rate effects is explored in the Appendix.

The discounting assumptions can have sizable effects on the relative Medicare costs for different groups such as age groups and diagnostic groups. The discounting assumption can also have sizable effects on the relative costs of the two proposals examined in this article. These effects are considered in the appendix. The Appendix indicates that a modest difference of about 1.5 percentage points between the growth rate of Medicare costs and the interest rate will change the ratio of Medicare costs to cash benefit costs by about 7 percentage points.

Results

Cost for Disabled Workers Through Age 64

Table 1 presents overall Medicare estimates for all disabled-worker beneficiaries with year of entitlement 1972 and under age 62 at entitlement. (Table III in the Appendix presents some of the same estimates under different discounting assumptions.)

Column 1 gives the number of sample cases in the analysis for beneficiaries with the specified characteristics. The overall total is slightly less than the figures reported in previous analyses because of slight differences in edit criteria. Column 2 gives the percent of the total population for beneficiaries with specified characteristics.

Column 3 gives the average estimated Medicare costs for disabled-worker beneficiaries through age 64 at 1989 levels. The numerator of this statistic includes estimated Medicare costs for all periods of disability before age 65, including estimates of Medicare costs during the period of extended Medicare eligibility for disabled workers who recovered more than 2 years after DI entitlement (the presumed work recoveries).

Column 4 estimates include in the numerator the costs for Medicare waiting periods. The waiting period estimates take into account the initial 24-month waiting period for all beneficiaries and subsequent waiting periods for recovered beneficiaries whose simulated disability histories showed a return to the DI program more than 5 years after recovery, thus requiring an additional waiting period. The waiting period estimates were made under the assumption that the beneficiary was covered under Medicare during the entire period and that Medicare was first payer. Column 5 indicates the percentage increase in costs that would occur if Medicare paid all waiting period costs.

Column 6 cost estimates include in the numerator the additional cost per beneficiary that might be incurred if Medicare eligibility continued for recovered beneficiaries without a break in coverage after their cash benefits terminated. That is, Medicare coverage would be in effect continuously after the initial 2-year waiting period. Generally, the costs for noncovered periods consist of costs for periods out of the DI program for which no Medicare coverage exists under current law, including subsequent waiting periods. The estimates assume (1) Medicare coverage for both medical and work

Table 1.—Estimated average Medicare costs for disabled-worker beneficiaries through age 64

[At 1989 reimbursement levels]

Characteristic	Sample size (1)	Percent of population (2)	Average Medicare cost per entitlee (3)	Average Medicare cost per entitlee: Including waiting periods: Cost (4)	Including waiting periods: Percent increase (5)	Including non-covered periods after recovery: Cost (6)	Including non-covered periods after recovery: Percent increase (7)
Total	18,510	100.0	$20,129	$25,991	29.1	$21,973	9.2
Diagnostic group							
Infective	319	1.7	18,218	23,031	26.4	23,829	30.8
Neoplasms	1,520	8.2	8,061	20,672	156.4	8,333	3.4
Endocrine	610	3.3	25,820	34,234	32.6	26,039	.8
Mental disorders	1,733	9.4	27,383	31,065	13.4	30,247	10.5
Nervous system	1,072	5.8	25,120	29,655	18.1	26,856	6.9
Circulatory	5,298	28.6	16,725	22,558	34.9	17,257	3.2
Respiratory	1,150	6.2	18,206	24,818	36.3	18,254	.3
Digestive	539	2.9	22,233	30,261	36.1	23,114	4.0
Genitourinary	128	.7	23,347	31,524	35.0	23,697	1.5
Musculoskeletal	2,879	15.6	20,063	24,450	21.9	22,407	11.7
Congenital anomalies	192	1.0	29,520	34,523	16.9	32,854	11.2
Accidents	1,259	6.8	19,137	22,630	18.3	28,727	50.1
Other	1,811	9.8	28,912	34,195	18.3	30,073	4.0
Sex							
Men	12,927	69.8	17,388	22,489	29.3	19,187	10.3
Women	5,583	30.2	26,476	34,103	28.8	28,423	7.4
Race							
Nonblack	15,918	86.0	19,965	25,858	29.5	21,801	9.2
Black	2,592	14.0	21,143	26,815	26.8	23,027	8.9
Years of education							
0–8	6,715	36.3	15,896	21,346	34.2	16,590	4.4
9–11	3,886	21.0	20,652	26,767	29.3	22,434	8.6
12	4,251	23.0	22,415	28,680	28.0	25,701	14.7
13 or more	1,465	7.9	21,310	28,098	31.9	24,986	17.3
Unknown	2,193	11.8	26,947	32,230	19.6	28,401	5.4
Age at entitlement							
18–34	2,055	11.1	39,836	44,204	11.0	50,402	26.5
35–49	4,370	23.6	28,804	34,420	19.5	31,135	8.1
50–61	12,085	65.3	13,643	19,848	45.5	13,826	1.3
Occupation							
White collar	4,025	21.7	21,652	28,683	32.5	24,248	12.0
Service	2,645	14.3	21,233	27,751	30.7	22,960	8.1
Farming	753	4.1	11,269	14,902	32.2	12,609	11.9
Manufacturing	5,547	30.0	18,515	24,089	30.1	20,055	8.3
Unknown and miscellaneous	5,540	29.9	21,318	26,608	24.8	23,043	8.1
Primary insurance amount							
$1–$299	2,994	16.2	21,869	27,631	26.3	25,361	16.0
$300–$499	7,984	43.1	20,974	26,639	27.0	23,195	10.6
$500–$699	7,302	39.4	18,198	24,327	33.7	18,761	3.1
$700 or more	230	1.2	29,501	35,062	18.8	37,419	26.8

recoveries, (2) Medicare is first payer in the case of multiple health insurance coverage, and (3) no adjustment for the buy in provisions of recent legislation.

Column 7 gives the percentage increase in costs that would be incurred if Medicare simply covered all beneficiaries after the 2-year waiting period up to age 65 (or death before age 65) regardless of subsequent disability history.

Estimated Medicare costs were $20,129 per disabled worker at 1989 levels. As illustrated in chart 1, average costs were more than 50 percent higher for women than for men ($26,476 compared with $17,388), primarily due to differences in Medicare utilization and cost but not to differences in duration of eligibility. Although age and diagnosis distributions differed somewhat for men and women, these differences do not explain all of the variations in Medicare costs by sex [Hennessey and Dykacz, 1989, table 1]. The Medicare reimbursement equations indicate that women use Medicare services more often than men and incur higher costs for those services even when such factors as age and diagnostic group are held constant.

Overall estimated Medicare costs were similar for black and nonblack beneficiaries (chart 2). However, the Medicare reimbursement equations indicate lower probabilities of Medicare utilization for blacks but higher costs given Medicare use. Apparently these effects are offsetting in the computation of Medicare estimates for disabled workers through age 64. Also the results in Hennessey and Dykacz [1989] indicate little difference in DI program duration for blacks and nonblacks.

Medicare costs for disabled workers through age 64 varied substantially by age at DI entitlement (chart 3). Average costs were 2.9 times higher for beneficiaries becoming entitled to DI benefits at ages 18–34 than for beneficiaries becoming entitled at

Chart 1.—Average Medicare cost, by sex

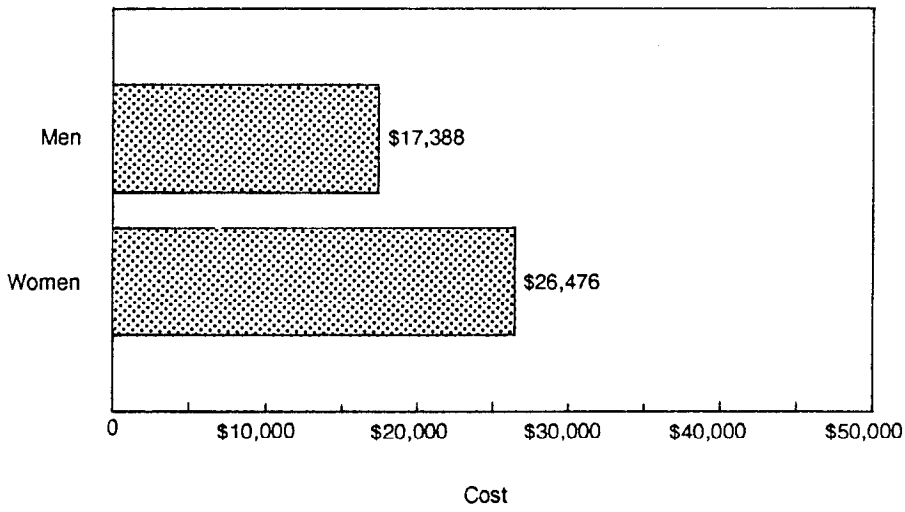


Chart 2.—Average Medicare cost, by race

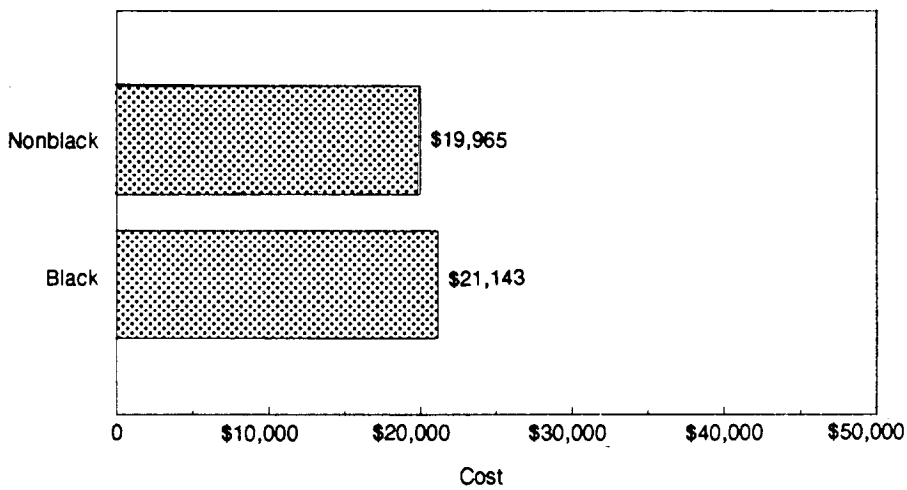
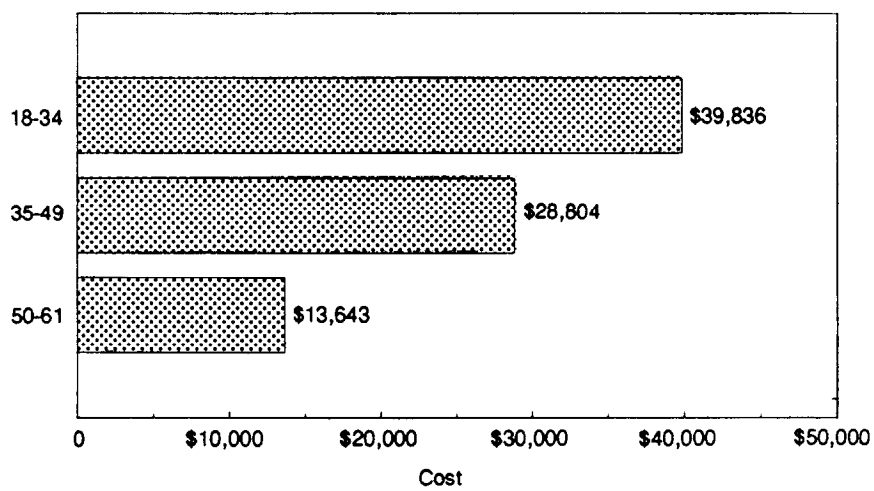


Chart 3.—Average Medicare cost, by age



ages 50–61. The reason, as shown in table 2, is that younger beneficiaries who attained Medicare eligibility had an average of 22.3 years of Medicare coverage, compared with 5.1 years for older beneficiaries. The impact of age at entitlement on total Medicare costs is shown in the following tabulation:

Age	Percent of sample	Percent of Medicare cost
18–34	11.1	21.8
35–49	23.6	33.9
50–61	65.3	44.4

Younger beneficiaries (aged 18–34) comprised 11.3 percent of the disabled workers in the 1972 cohort, but accounted for 21.8 percent of total costs of the cohort. Conversely, disabled workers aged 50–61 comprised nearly two-thirds of the cohort but accounted for only 44.4 percent of the Medicare costs for disabled workers through age 64.

Important differences were also evident among diagnostic groups with respect to costs per entitlee (chart 4). The highest costs were attributable to congenital anomalies, "other diagnoses," and mental disorders, all of which were associated with long periods of time in the DI program. The lowest average cost was attributable to persons with neoplasms, most of whom died during the waiting period and consequently never became entitled to Medicare. The second lowest cost was attributable to persons with circulatory diseases; this diagnostic group was associated with a short average time on Medicare due largely to the relatively advanced age at which these beneficiaries became entitled to DI benefits.

Column 4 of table 1 contains estimated Medicare costs per entitlee, including costs associated with the 24-month waiting period. The average cost for all disabled workers was estimated to be $25,991, or 29.1 percent higher than costs with the waiting period retained (chart 5). For beneficiaries with cancer, eliminating the waiting period increased the estimate of total costs by a factor of 2.5 because of the high death rates during their waiting period. Eliminating the waiting period would greatly increase the number of beneficiaries with cancer who become entitled to Medicare, and many of them would become entitled in the last year or two of life, when Medicare reimbursements are large.

Eliminating the waiting period would also disproportionately affect older beneficiaries (chart 6). Medicare costs for beneficiaries through age 64 who became entitled to DI benefits at ages 50–61 would increase 46 percent, from $13,643 to $19,848. For beneficiaries first entitled at ages 18–34, Medicare costs would increase only 11 percent, from $39,836 to $44,204.

Column 6 contains estimated Medicare costs for disabled workers through age 64 under the assumption that Medicare benefits for recovered beneficiaries continue until age 65 or death if death occurs before age 65. However, the first waiting period is retained. Under the assumptions stated above, average costs for the cohort were estimated to be $21,973,

Chart 4.—Average Medicare cost, by diagnostic group

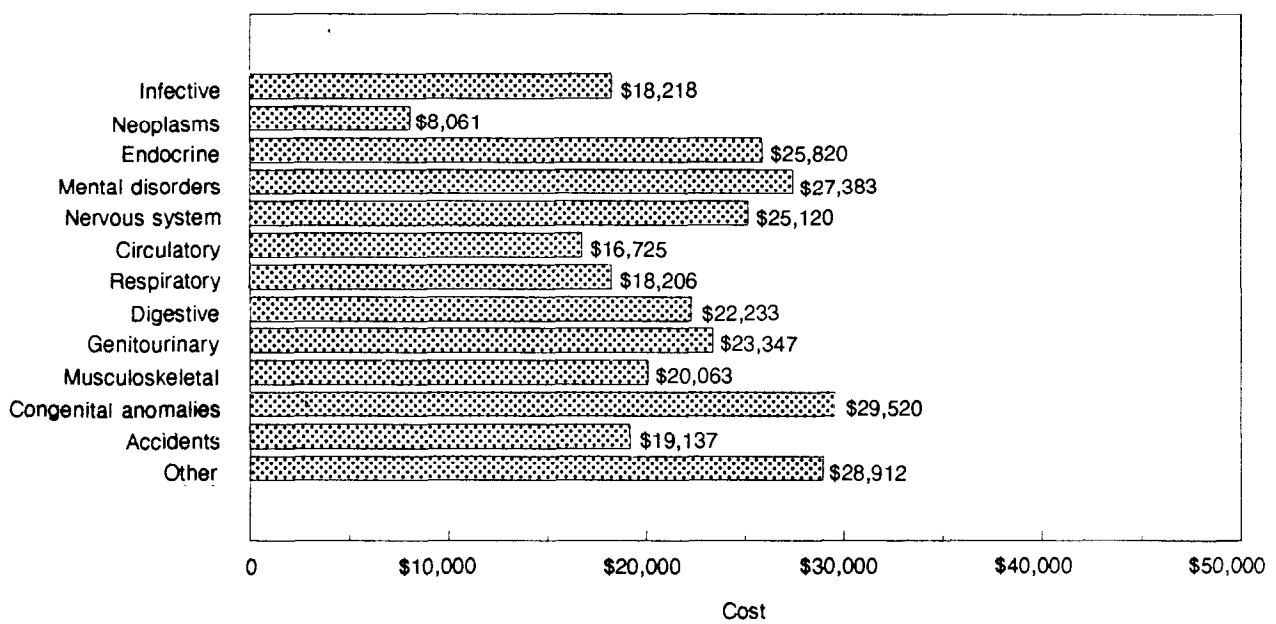


Table 2.—Estimated average Medicare costs for disabled-worker beneficiaries through age 64, by Medicare eligibility

[At 1989 reimbursement levels]

Characteristic	Sample size (1)	One or more periods of Medicare eligibility				Never Medicare eligible	
		Percent (2)	Average number of years of Medicare (3)	Average cost through age 64 (4)	Average waiting period costs (5)	Percent (6)	Average waiting period costs (7)
Total	18,510	85.5	8.9	$23,537	$4,953	14.5	$11,233
Diagnostic group							
Infective	319	82.1	8.0	22,182	4,522	17.9	6,145
Neoplasms	1,520	35.2	4.6	22,905	10,415	64.8	13,802
Endocrine	610	87.5	6.6	29,494	7,450	12.5	15,181
Mental disorders	1,733	94.5	15.0	28,988	3,515	5.5	6,566
Nervous system	1,072	93.7	11.7	26,821	4,253	6.3	8,672
Circulatory	5,298	87.8	6.1	19,044	5,155	12.2	10,723
Respiratory	1,150	90.4	5.5	20,132	5,884	9.6	13,503
Digestive	539	80.5	6.8	27,613	6,681	19.5	13,590
Genitourinary	128	75.8	7.1	30,808	6,952	24.2	12,012
Musculoskeletal	2,879	94.2	9.0	21,291	4,128	5.8	8,608
Congenital anomalies	192	89.6	13.8	32,953	4,552	10.4	8,882
Accidents	1,259	85.7	11.5	22,331	3,628	14.3	2,673
Other	1,811	92.3	11.4	31,334	4,836	7.7	10,620
Sex							
Men	12,927	84.8	8.8	20,514	4,264	15.2	9,753
Women	5,583	87.3	9.1	30,334	6,504	12.7	15,338
Race							
Nonblack	15,918	85.5	8.8	23,360	4,985	14.5	11,230
Black	2,592	85.9	9.5	24,608	4,758	14.1	11,251
Years of education							
0–8	6,715	86.0	7.4	18,490	4,584	14.0	10,749
9–11	3,886	85.4	8.8	24,195	5,198	14.6	11,451
12	4,251	83.9	9.9	26,720	5,245	16.1	11,569
13 or more	1,465	81.3	9.4	26,213	5,503	18.7	12,373
Unknown	2,193	90.5	11.2	29,786	4,762	9.5	10,229
Age at entitlement							
18–34	2,055	86.8	22.3	45,913	3,883	13.2	7,547
35–49	4,370	84.9	13.0	35,145	4,807	15.1	10,169
50–61	12,085	85.5	5.1	15,948	5,191	14.5	12,209
Occupation							
White collar	4,025	84.1	8.4	25,738	5,822	15.9	13,444
Service	2,645	86.5	8.5	24,557	5,588	13.5	12,456
Farming	753	83.4	7.4	13,512	3,152	16.6	6,046
Manufacturing	5,547	85.4	8.5	21,686	4,713	14.6	10,598
Unknown and miscellaneous	5,540	86.5	9.9	24,635	4,510	13.5	10,313
Primary insurance amount							
$1–$299	2,994	86.2	9.4	25,379	5,026	13.8	10,340
$300–$499	7,984	86.1	9.3	24,368	4,934	13.9	10,183
$500–$699	7,302	84.7	7.9	21,485	4,962	15.3	12,590
$700 or more	230	84.4	16.0	34,977	4,391	15.7	11,865

Chart 5.—Average Medicare cost, by diagnostic group, including the waiting period

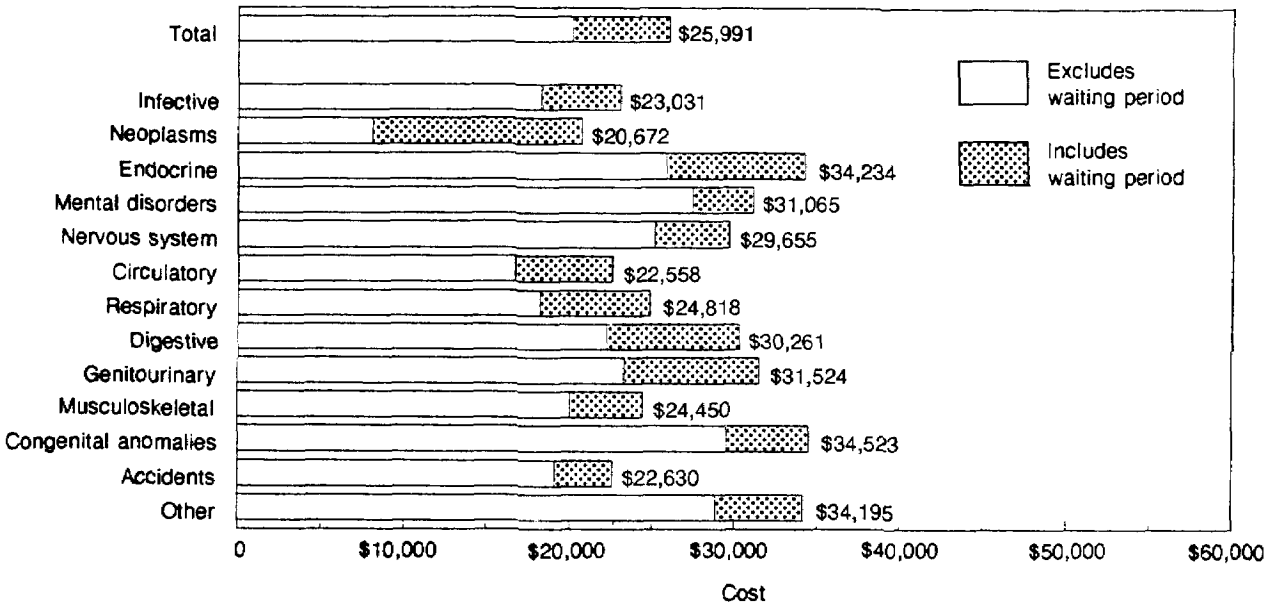
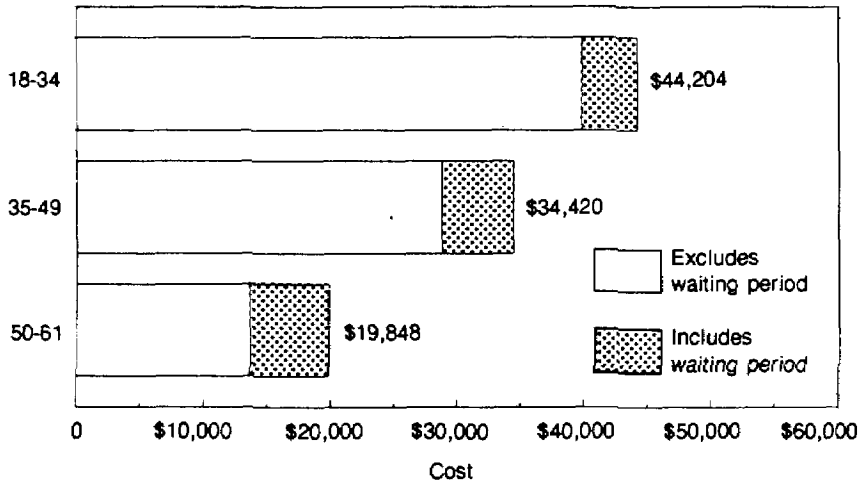


Chart 6.—Average Medicare cost, by age, including time until age 65 or death



or 9 percent higher than costs for beneficiaries with no additional Medicare coverage for recovered beneficiaries. Although the direct simulation of current program conditions for recovered beneficiaries was not possible, the results indicate that extending Medicare entitlement through age 64 for persons leaving the DI program would be much less expensive than eliminating the waiting period particularly for those leaving the program because of work recoveries.

As expected, the cost of extending Medicare entitlement through age 64 for disabled workers who recover is much higher for younger beneficiaries than older ones. Recoveries are more common among younger beneficiaries and they have longer periods of time out of the DI program before they attain age 65 (chart 7). If Medicare benefits were extended for members of the cohort who recovered, the total Medicare cost per disability entitlee *who became entitled at ages 18–34* would have increased 27 percent ($50,402 compared with $39,836). For those entitled at ages 50–61 costs per disabled worker would have been only 1 percent higher if Medicare benefits were extended to age 65 (from $13,643 to $13,826).

Among diagnostic categories, estimated Medicare costs would have increased the most for beneficiaries disabled by accidents (from $19,137 *to $28,727, or 50 percent) if Medicare* benefits were continued after recovery (chart 8). The reason for this relatively large increase is that the recovery rate of cohort members disabled by accidents was very high (35.7 percent, as shown in table 3). Beneficiaries with cancer, who would benefit the most from eliminating the waiting period, would experience only a 3-percent increase in Medicare costs if Medicare benefits were extended to *recovered beneficiaries.*

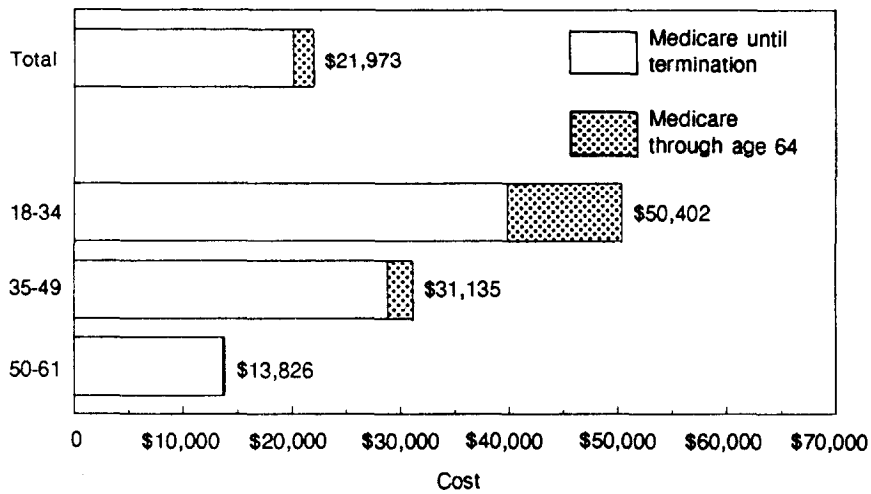
Waiting Period Costs

Table 2 presents estimates of Medicare costs and potential waiting period costs for those disabled-worker beneficiaries who have at least one period of Medicare eligibility and those who do not.

Column 1, again, provides sample size counts for all disabled workers by individual characteristics. Column 2 gives the percentage of the beneficiaries with a given characteristic who became eligible for Medicare some time during their disability history before they attained age 65 or died. Included in this group is a small number of beneficiaries who recover within the first 2 years of DI entitlement but return to the program and later become eligible for Medicare.

Column 3 provides estimates of the average number of years of Medicare eligibility from all periods of disability before death or attainment of age 65.

Chart 7.—Average Medicare cost, by age, including time until age 65 or death



Column 4 provides the average estimated cost per eligible beneficiary through age 64. This cost differs from the estimates in column 3 of table 1, which included all DI beneficiaries in the denominator, not just those who became eligible for Medicare. The numerators of both calculations are the same. Column 5 provides the cost of eliminating the waiting period for those beneficiaries with one or more periods of Medicare eligibility.

Columns 6 and 7 pertain to disabled workers who leave the DI program within the first 2 years either because of death or recovery and, for the recovered, do not become eligible for Medicare before age 65. Column 6 provides the proportion of beneficiaries with no Medicare eligibility, and column 7 provides waiting period cost estimates for this group.

Beneficiaries with one or more periods of Medicare eligibility averaged 8.9 years of coverage. Costs averaged $23,537 per Medicare entitlee. Waiting period costs were estimated to be $4,953, or 21 percent of existing Medicare costs for these beneficiaries. Among beneficiaries

Chart 8.—Average Medicare cost, by diagnostic group, including time until age 65 or death

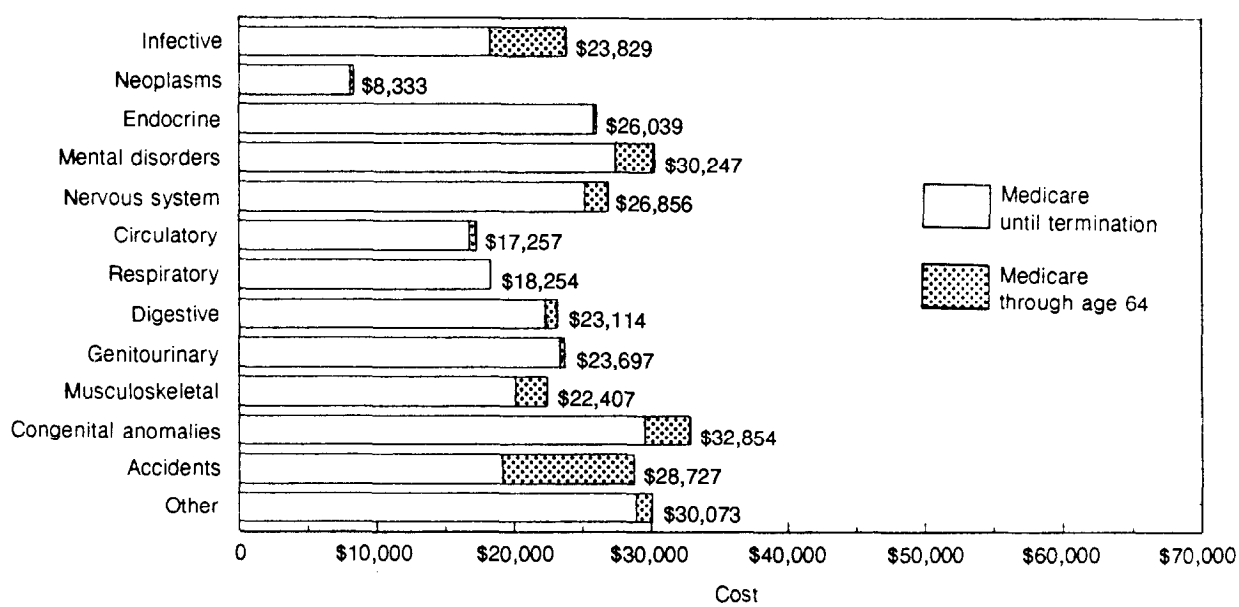


Table 3.—Estimated average Medicare costs for disabled-worker beneficiaries through age 64, by outcome of first disability entitlement

[At 1989 reimbursement levels]

Characteristic	Sample size (1)	Percent of population (2)	Death			Age 65			Recovery (all periods)		
			Percent (3)	Average number of years of Medicare (4)	Average cost (5)	Percent (6)	Average number of years of Medicare (7)	Average cost (8)	Percent (9)	Average number of years of Medicare (10)	Average cost (11)
Total	15,831	100.0	28.1	6.0	$32,336	62.0	9.8	$20,123	9.9	11.3	$19,972
Diagnostic group											
Infective	262	1.7	29.4	6.2	34,369	45.0	9.2	16,754	25.6	8.0	17,738
Neoplasms	535	3.4	62.2	3.1	26,357	34.2	7.1	16,705	3.6	7.0	22,118
Endocrine	534	3.4	36.7	5.2	36,011	60.3	7.4	25,611	3.0	9.4	27,835
Mental disorders	1,637	10.3	24.0	9.4	29,016	63.7	17.4	30,129	12.4	13.4	23,078
Nervous system	1,004	6.3	20.9	7.5	37,720	71.0	12.7	24,045	8.1	13.0	23,004
Circulatory	4,653	29.4	32.2	4.7	26,128	62.9	6.6	15,468	4.9	9.2	18,383
Respiratory	1,040	6.6	39.3	4.4	30,651	58.9	6.2	13,511	1.7	4.9	6,557
Digestive	434	2.7	49.5	5.9	35,605	42.6	7.7	20,803	7.8	7.9	14,125
Genitourinary	97	.6	49.5	6.0	32,942	44.3	8.4	31,136	6.2	5.5	11,387
Musculoskeletal	2,713	17.1	15.1	6.6	39,442	73.2	9.1	17,800	11.7	11.4	19,753
Congenital anomalies	172	1.1	18.6	8.8	44,413	57.0	15.9	34,442	24.4	12.4	20,745
Accidents	1,079	6.8	12.8	7.8	39,057	51.5	12.3	20,724	35.7	11.7	18,654
Other	1,671	10.6	29.1	9.3	45,349	61.6	12.1	25,943	9.3	12.8	23,215
Sex											
Men	10,958	69.2	31.3	6.1	28,282	57.8	9.8	16,787	11.0	11.1	18,012
Women	4,873	30.8	20.9	5.9	45,942	71.6	9.8	26,172	7.5	11.9	26,488
Race											
Nonblack	13,604	85.9	27.5	6.0	32,270	62.6	9.6	19,970	9.9	11.3	20,035
Black	2,227	14.1	31.5	6.3	32,685	58.4	11.0	21,122	10.1	11.1	19,596
Years of education											
0–8	5,773	36.5	27.4	4.9	26,269	67.0	8.2	15,704	5.6	9.4	13,688
9–11	3,317	21.0	28.3	5.8	32,114	60.9	9.8	21,195	10.8	11.1	20,385
12	3,566	22.5	28.6	6.4	35,349	57.4	11.2	23,683	14.1	11.5	21,608
13 or more	1,191	7.5	29.0	5.9	34,007	55.6	10.5	23,136	15.5	12.1	22,670
Unknown	1,984	12.5	28.2	8.9	43,378	61.6	12.0	24,744	10.2	13.2	22,698
Age at entitlement											
18–34	1,783	11.3	26.8	14.0	50,621	37.2	35.0	61,517	36.0	15.2	26,237
35–49	3,710	23.4	38.3	7.9	37,821	45.2	18.4	36,029	16.4	10.2	19,069
50–61	10,338	65.3	24.6	3.5	25,833	72.3	5.6	12,876	3.1	5.3	9,078
Occupation											
White collar	3,386	21.4	26.3	5.5	34,938	63.5	9.2	22,216	10.2	10.6	23,934
Service	2,287	14.4	25.7	5.6	33,259	65.0	9.3	21,765	9.3	11.4	20,054
Farming	628	4.0	23.4	4.8	17,275	67.8	8.1	12,501	8.8	9.4	11,286
Manufacturing	4,736	29.9	29.7	5.6	29,748	61.3	9.5	18,128	9.1	11.3	19,344
Unknown and miscellaneous	4,794	30.3	29.5	7.1	34,447	59.5	11.0	20,856	11.0	11.9	18,773
Primary insurance amount											
$1–$299	2,580	16.3	24.7	6.6	35,752	60.1	10.2	22,956	15.2	11.1	18,154
$300–$499	6,872	43.4	27.2	6.4	31,780	62.7	10.5	22,508	10.2	10.2	16,028
$500–$699	6,185	39.1	30.7	5.4	31,453	62.9	8.6	16,150	6.4	12.5	26,155
$700 or more	194	1.2	22.2	8.7	44,804	35.6	21.0	31,754	42.3	15.7	32,534

who did not attain Medicare eligibility, waiting period costs were estimated to be $11,233, or more than twice the waiting period costs of the Medicare eligibles. The reason for their high estimated costs is that many of the beneficiaries who did not attain Medicare entitlement died during the waiting period, with high estimated medical care costs shortly before death. If the waiting period had not been in effect, an estimated 28 percent of the additional costs attributed to the entire cohort would have gone to the 14.5 percent who did not attain Medicare eligibility under current law.

Among Medicare eligibles, both average time in the DI program and average Medicare expenses tended to be lower at lower educational levels. For example, beneficiaries with 0–8 years of education averaged 7.4 years of Medicare eligibility and incurred $18,490 in Medicare costs. Beneficiaries with 13 or more years of education experienced, on average, 9.4 years of Medicare eligibility, and incurred $26,213 in Medicare costs. Beneficiaries whose former occupation was farming incurred only an estimated $13,512 in Medicare costs on average, with 7.4 years of eligibility. In contrast, average Medicare expenses of white-collar beneficiaries were estimated to be 90 percent higher ($25,738), although they had only about 1 year more of eligibility (8.4 years, compared with 7.4). The variation in cost by education and occupation are due in part to the fact that vocational aspects of the DI program criteria require relatively higher medical severity for persons with more education and in higher occupational strata.

Medicare Eligibility by DI Outcome

Table 3 provides a summary of Medicare costs for DI beneficiaries who become eligible for Medicare by projected outcome of the first period of disability—death, attainment of age 65, or recovery.

Column 1 provides the sample sizes for those beneficiaries who become eligible for Medicare at some point in their disability history. Column 2 provides a vertical percentage distribution by characteristic for that group. The differences between these percentages and those of column 2 of table 1 are mainly the result of differential survival rates (during the first 2 years) for beneficiaries with various characteristics.

Columns 3, 6, and 9 provide a horizontal percentage distribution of the Medicare eligibles by outcome of their first period of disability. Columns 4, 7, and 10 provide estimates of the average number of years of Medicare eligibility for each group. For the recovered group, this figure includes the estimated number of years from all periods of disability.

Columns 5, 8, and 11 provide the average Medicare cost per eligible beneficiary for each group. The estimates for recovered beneficiaries include all periods of disability and include the estimated cost during periods of extended Medicare eligibility after termination of cash benefits.

Estimated Medicare costs through age 64 varied substantially according to the eventual outcome of an individual's first period of disability. Although periods of Medicare eligibility ending in death averaged only 6.0 years duration, average Medicare costs were very high ($32,336). Periods of eligibility ending with attainment of age 65 averaged $20,123 in Medicare costs (9.8 years duration), and periods ending in recovery averaged $19,972 (11.3 years duration).

Estimated costs also varied by sex. Costs for female decedents were 62 percent higher than for male decedents ($45,942 compared with $28,282), although women have slightly less duration (5.9 years, compared with 6.1 years). For periods of disability ending in the attainment of age 65 and those ending in recovery, Medicare costs are estimated to be much higher for women than for men.

Recovered Beneficiaries

Table 4 includes only those beneficiaries whose first period of disability ends in recovery either before or after becoming eligible for Medicare.

Column 1 provides counts of the number of sample cases for beneficiaries whose simulated DI program histories indicated that the first event was a recovery. Column 2 provides percentage distributions of these beneficiaries by case characteristics.

Column 3 gives the proportion of recovered beneficiaries who are projected to attain age 65 or die but not to return to the DI program before age 65; or if they do return, to stay in the program less than 2 years. Column 4 gives estimates of the number of years with no Medicare coverage before age 65 or death. Column 5 gives the estimated Medicare costs if Medicare were first payer during the noncovered period.

Column 6 provides the percentage of beneficiaries whose simulations indicate more than one period in the DI program resulting in Medicare eligibility. Column 7 indicates average numbers of years during intervening periods when the beneficiaries were not eligible for Medicare. These intervening periods include the times between prior Medicare eligibility periods and reentitlement to Medicare, including additional waiting periods for projected histories with disability episodes more than 5 years apart. Column 8 provides the corresponding estimated costs during these noncovered periods. Estimates based on columns 5 and 8 were included in column 6 of table 1 to produce a Medicare estimate that contains costs

Table 4.—Estimated average costs not covered by Medicare for disabled-worker beneficiaries whose first period of disability entitlement ends in recovery

[At 1989 reimbursement levels]

Characteristic	Sample size (1)	Percent of population (2)	No reentitlement to Medicare			One or more reentitlements		
			Percent (3)	Average number of noncovered years (4)	Average cost of noncovered years (5)	Percent (6)	Average number of noncovered years (7)	Average cost of noncovered years (8)
Total	2,051	100.0	60.0	15.5	$20,190	40.0	7.4	$11,301
Diagnostic group								
Infective	99	4.8	53.5	18.8	21,637	46.5	7.4	13,974
Neoplasms	36	1.8	69.4	8.0	14,342	30.6	2.4	4,812
Endocrine	19	.9	57.9	2.3	10,921	42.1	.8	1,682
Mental disorders	240	11.7	59.2	18.2	24,542	40.8	9.2	15,110
Nervous system	106	5.2	56.6	14.8	22,892	43.4	6.8	10,593
Circulatory	291	14.2	56.7	7.8	11,809	43.3	4.0	6,910
Respiratory	19	.9	68.4	3.0	3,635	31.6	.7	1,213
Digestive	39	1.9	71.8	7.5	15,209	28.2	3.0	4,441
Genitourinary	8	.4	37.5	15.9	12,834	62.5	1.0	1,289
Musculoskeletal	409	19.9	59.9	15.9	20,670	40.1	7.2	10,279
Congenital anomalies	51	2.5	64.7	9.8	12,088	35.3	5.6	13,406
Accidents	536	26.1	62.1	22.5	26,335	37.9	11.8	16,275
Other	198	9.7	60.6	9.0	13,974	39.4	3.7	5,452
Sex								
Men	1,571	76.6	57.9	16.4	18,122	42.1	7.7	10,239
Women	480	23.4	67.1	12.9	26,023	32.9	6.5	15,752
Race								
Nonblack	1,752	85.4	60.1	15.5	20,317	40.0	7.5	11,232
Black	299	14.6	59.9	15.8	19,443	40.1	7.1	11,701
Years of education								
0–8	444	21.6	66.2	12.5	12,043	33.8	6.4	7,447
9–11	463	22.6	55.9	16.3	19,799	44.1	6.1	8,789
12	643	31.4	58.0	18.3	26,422	42.0	9.3	15,227
13 or more	242	11.8	60.7	17.8	26,392	39.3	9.2	15,855
Unknown	259	12.6	61.0	11.3	15,500	39.0	5.2	7,317
Age at entitlement								
18–34	790	38.5	55.7	26.4	34,434	44.3	12.7	18,752
35–49	795	38.8	59.0	13.2	16,771	41.0	4.5	7,124
50–61	466	22.7	69.1	4.0	5,703	30.9	1.5	2,647
Occupation								
White collar	428	20.9	57.0	14.8	31,020	43.0	6.5	15,627
Service	282	13.7	65.6	14.0	17,228	34.4	10.1	14,244
Farming	84	4.1	67.9	15.5	13,404	32.1	9.3	9,072
Manufacturing	576	28.1	60.1	17.0	18,486	39.9	7.1	9,320
Unknown and miscellaneous	681	33.2	58.6	15.3	17,386	41.4	7.2	9,294
Primary insurance amount								
$1–$299	533	26.0	70.4	17.4	21,943	29.6	11.0	14,087
$300–$499	959	46.8	70.3	17.5	20,767	29.7	9.9	13,097
$500–$699	464	22.6	33.6	4.0	12,462	66.4	3.6	7,048
$700 or more	95	4.6	27.4	5.3	26,293	72.6	6.3	16,485

for noncovered periods after the initial waiting period.

Beneficiaries who did not become reentitled to Medicare comprised 60 percent of all recoveries in the cohort and had the higher costs ($20,190) for noncovered years. Conversely, estimated costs for beneficiaries who eventually became reentitled to Medicare were only $11,301 for noncovered periods. Average number of noncovered years for the reentitled group was 7.4 years, compared with 15.5 years for beneficiaries who did not become reentitled.

Because many recoveries occur among younger beneficiaries, those who recover are often out of the program for a long time. This longer period of noncoverage results in high estimated total Medicare costs for those beneficiaries through age 64. For example, beneficiaries entitled at ages 18–34 averaged 26.4 noncovered years when they did not become reentitled and 12.7 years when they did become reentitled to Medicare. Medicare costs for noncovered years were estimated to have been $34,434 and $18,752 for non-reentitlements and reentitlements, respectively. For recovered beneficiaries who first became entitled to DI benefits at ages 50–61, costs for noncovered years were only $5,703 for those not reentitled and $2,647 for those reentitled to Medicare benefits. Among diagnostic groups, the highest costs for noncovered years were attributed to accidents and mental disorders; persons with each diagnosis who did not become reentitled were estimated to have more than 18 noncovered years.

Discussion

The per capita Medicare cost for the cohort of disabled beneficiaries through age 64 was estimated to be $20,129 at 1989 levels. This estimate is thought to be about 37 percent of the estimated present value of disability cash benefits. (The estimated present value of disability cash benefits in 1985 dollars was supplied by SSA's Office of the Actuary, and estimated Medicare costs were adjusted to 1985 dollars for comparison purposes.) Thus, Medicare dollars constitute a substantial portion of total Social Security related expenses that go to disabled-worker beneficiaries. Keep in mind that the $20,129 estimate, when taken as a present value estimate, assumes that the combined growth rate in Medicare price and reimbursement levels for this group equals the interest rate that could be earned on HI Trust Fund and relevant general revenue monies. The relative sizes of these numbers could be somewhat different with different discounting assumptions. The Appendix indicates that a modest difference of about 1.5 percentage points between the growth rate of Medicare costs and the interest rate will change the ratio of Medicare costs to cash benefit costs by 7 percentage points.

As expected, Medicare costs were much higher for beneficiaries entitled at younger ages because they tended to be in the DI program for much longer periods of time. Less expected was the substantially higher costs, per Medicare eligible, for women than for men, as discussed above.

If the 2-year waiting period for Medicare coverage had not been in effect, Medicare costs for the cohort through age 64 would have increased by 29 percent. Elimination of the waiting period would have the greatest effect on groups with high death rates during the waiting period—notably persons with cancer and, presumably, AIDS (Acquired Immune Deficiency Syndrome). The estimates of waiting period costs do not include costs that would be incurred for DI beneficiaries aged 62–64 at entitlement. Although Medicare costs for this group through age 64 under current law would be quite small due to the small number of eligibility years available before age 65, waiting period costs that begin at the month of entitlement could be quite large. Based on the figure in Bye and Riley [1989b], the cost of eliminating the waiting period for beneficiaries aged 60–61 at entitlement is $6,539 per beneficiary at 1989 levels. Costs per beneficiary for those aged 62–64 at entitlement would probably be somewhat smaller because beneficiaries aged 63–64 would not have a full 2 years of DI program benefits prior to attainment of age 65. Nevertheless, using the average cost for the group aged 60–61 and assuming entitlements at ages 62–64 to add about 10 percent to the size of an entitlement cohort, the cost of eliminating the waiting period might result in an increase of as much as 33 percent of current costs, compared with the overall estimate of 29 percent shown in table 1.

If Medicare eligibility had been extended through age 64 for all recovered beneficiaries, per entitlee costs for the cohort would have increased by 9 percent. This cost should be considered an upper bound of the estimated cost of extending Medicare eligibility for this cohort under current regulations. If, under current law, Medicare eligibility were extended through age 64 for beneficiaries experiencing work recoveries, the additional cost to Medicare would probably be substantially less than the estimates given here because the estimates are based on both work and medical recoveries after 2 years of DI entitlement. It is not known whether medical care costs, during noncovered years, for beneficiaries who undergo work recoveries are greater than or less than the costs of beneficiaries who medically recover.

With respect to the estimate of waiting period costs and the costs of

extending Medicare eligibility for recoveries, two additional points should be kept in mind. First, the cost estimates assume Medicare is the primary payer. If the waiting period were eliminated under current program regulations, Medicare would be the secondary payer if other insurance were available; consequently, Medicare costs during the waiting period could be less than those estimated in this analysis. However, assuming that the prevalence of other health insurance is similar during covered and noncovered periods, the percent changes reported in this analysis would be more robust than the corresponding dollar figures. Estimating Medicare costs under a secondary payer arrangement was not possible with the data available. Second, the cost estimates for extending Medicare entitlement beyond current program conditions do not account for the cost effects of any behavioral changes that may result from an extension of Medicare entitlement. Specifically, eliminating the 24-month waiting period for Medicare benefits could cause an increase in applications for DI benefits, increasing Medicare costs as well. It was beyond the scope of this study to simulate behavioral responses to the proposed program changes examined in this article.

The Omnibus Budget Reconciliation Act of 1989 permits a Medicare buy in arrangement for disabled workers who return to work for more than 36 months and continue to have a severe impairment. The analysis shows that Medicare costs for disabled workers who later recover (including both medical and work recoveries) are substantially less than the costs for those who die or who remain in the DI program until age 65. It seems reasonable to assume that the medical care costs of beneficiaries who return to work will be no higher after Medicare eligibility ends than the costs were while eligible for Medicare. The estimated Medicare costs suggest that an actuarially fair premium under the buy in arrangement might be less than the average cost for all Medicare beneficiaries aged 65 or older, the reference group under current law.

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Appendix

The following discussion provides some additional information concerning the methods used to construct the various Medicare cost estimates presented in tables 1-4. The estimation approach began with a Monte Carlo simulation of a DI program history for each sample case using the equations presented in the technical appendices of Dykacz and Hennessey [1989] and Hennessey and Dykacz [1989]. Medicare reimbursement equations given in Bye and Riley [1989a] were then used to estimate costs separately for aggregate periods of Medicare eligibility, waiting periods, and for periods after termination of cash benefits for recovered beneficiaries. In the discussion below, familiarity with the previous studies is assumed. The section on disability histories focuses on the simulation itself and not on the equations used. Similarly, the section on the construction of Medicare cost estimates deals mainly with the special assumptions that were made in using the equations to make the estimates rather than the construction of the equations themselves. There is also some discussion of the accuracy of the simulated results, including a small sensitivity analysis concerning the effects of discounting on the estimates.

Simulation of DI Entitlement Histories

Hennessey and Dykacz [1989], analyzed the first entitlement period of the 1972 cohort of beneficiaries. They estimated probabilities that a beneficiary (with a given set of covariates) will be terminated from the Disability Insurance (DI) program because of a recovery or death, for each year after entitlement up to retirement at age 65. These estimates were based on formulas developed using survival analysis techniques, with a Weibull distribution as the basic underlying structure. Dykacz and Hennessey [1989], used similar techniques to analyze the first postrecovery period. Formulas were constructed to estimate the probability that a beneficiary who had left the program became reentitled to benefits or died before reaching retirement age.

Using these formulas, one simulated history for each sample case was created as follows:

(1) The interval [0,1] was partitioned into three subintervals. The length of the first subinterval was set equal to the probability that a person with a certain set of characteristics would be terminated from the DI program because of a recovery. The length of the second subinterval was the probability that this type of person would leave the DI program because of death. The length of the third was the probability that a person of this type would be terminated from the program because of attainment of age 65.

(2) The first two subintervals were further subdivided into segments whose lengths represented the probabilities of each event—recovery or death—occurring in the first year of entitlement, the second year, and so forth, up to the attainment of age 65.

(3) The subroutine GGUBFS from IMSL generated a uniform [0,1] random number. The simulated event and time of the event was then recorded according to the segment that contained the random number.

(4) If the first or prior event was a recovery, the interval [0,1] was again partitioned into three subintervals. The length of the first subinterval was set equal to the probability that a person of this age at recovery would become reentitled to DI benefits. The length of the second subinterval was the probability that a person of this type would die before becoming reentitled or retiring. The length of the last subinterval was the probability that this type of individual would next retire before becoming reentitled to DI benefits or die.

(5) Again, the first two subintervals were further subdivided into segments that were equal to the probability that the event would occur in the first year after recovery, the second year, and so forth.

(6) Another uniform random draw was made, and the simulated event and the time of the event were recorded.

(7) If the event was a reentitlement, then steps 1-6 were repeated for an individual with the same characteristics except for an adjustment to the age at the new entitlement.

(8) These steps were continued until a simulated death or attainment of age 65 occurred.

A comparison of actual and simulated histories over the entire lifetimes of the beneficiaries is not possible because the data are right censored. Because the majority of the beneficiaries will leave the program by retirement or death, the most important components of the lifetime history are the estimates for the first entitlement period. Table I shows the proportion of beneficiaries whose first DI entitlement period ended because of recovery, death, or retirement, sometime before 1981. The table is further broken out by whether the person ever became eligible for Medicare—that is, remained in the DI program beyond the 2-year waiting period. Those cases in which the beneficiary did not survive the first 2 years after entitlement are further broken out by number of years (less

Table I.—Percentage of disabled-worker beneficiaries by reason for program termination and Medicare eligibility
[Actual data in parentheses]

Medicare eligibility and length of DI entitlement	Program termination				No termination by 1981
	Total	Recovery	Death	Retirement	
Total	100.00 (100.00)	9.55 (9.58)	29.44 (29.50)	29.05 (28.32)	31.97 (32.60)
Medicare eligible					
Total	83.54 (81.86)	4.96 (4.29)	17.57 (16.65)	29.05 (28.32)	31.97 (32.60)
Year of DI program termination:					
1974	3.43 (2.92)	1.23 (.75)	2.20 (2.18)	.00 (.00)	.00 (.00)
1975	7.14 (6.93)	1.04 (1.21)	3.11 (3.22)	2.99 (2.50)	.00 (.00)
1976	9.45 (9.07)	.79 (.54)	3.04 (3.01)	5.62 (5.52)	.00 (.00)
1977	8.21 (7.94)	.52 (.45)	2.32 (2.30)	5.36 (5.19)	.00 (.00)
1978	7.05 (6.94)	.44 (.43)	2.07 (1.89)	4.54 (4.62)	.00 (.00)
1979	6.60 (6.14)	.40 (.38)	1.94 (1.56)	4.26 (4.20)	.00 (.00)
1980	5.36 (5.03)	.30 (.24)	1.70 (1.36)	3.37 (3.43)	.00 (.00)
1981	4.33 (4.29)	.24 (.28)	1.19 (1.14)	2.91 (2.87)	.00 (.00)
No termination	31.97 (32.60)	.00 (.00)	.00 (.00)	.00 (.00)	31.97 (32.60)
Non-Medicare eligible					
Total	16.46 (18.14)	4.59 (5.30)	11.87 (12.84)	.00 (.00)	.00 (.00)
Less than 1 year in DI program	8.12 (8.99)	1.30 (1.35)	6.82 (7.65)	.00 (.00)	.00 (.00)
1972	4.34 (4.55)	.49 (.32)	3.85 (4.23)	.00 (.00)	.00 (.00)
1973	3.78 (4.44)	.80 (1.02)	2.97 (3.42)	.00 (.00)	.00 (.00)
More than 1 year in DI program	8.34 (9.15)	3.29 (3.95)	5.05 (5.20)	.00 (.00)	.00 (.00)
1973	4.62 (5.33)	1.74 (2.32)	2.88 (3.02)	.00 (.00)	.00 (.00)
1974	3.71 (3.81)	1.55 (1.63)	2.16 (2.18)	.00 (.00)	.00 (.00)

than 1, 1–2) in the DI program. The year of program termination is shown for all cases. The numbers not in parentheses are computed from the simulated histories. The numbers in the parentheses are the actual data based on observations until 1981.

The estimated proportions of beneficiaries whose DI entitlement ends by recovery, death, or retirement through 1981 are quite close to the actual figures. The separate estimates for those who became eligible for Medicare and for those who did not are also quite accurate. As the estimates for each year are considered, the accuracy still remains within the reasonable bounds. This numerical agreement confirms that the simulated histories provide accurate information about the first entitlement period of this 1972 cohort through 1981. The close agreement also creates confidence in the use of the simulated histories beyond the observation period.

A small percentage (about 11 percent) of beneficiaries recovered and left the program during their first period of entitlement (9.5 percent through the first 10 years). For these cases, formulas for the first postrecovery period are used to simulate the next event. The shortness of the observation period precluded any possibility of modeling separately the second and subsequent periods of DI entitlement. The assumption was made that the second entitlement period would be

stochastically identical to the first period for a person with the same characteristics. In fact, the second entitlement period may be different from the first. For example, the primary disabling condition in the second period could be more severe, or altogether different. Because it was estimated that less than 5 percent of the beneficiaries left the program because of a recovery during their first period of entitlement and later became reentitled, gross distortion in the overall estimates of Medicare costs are not expected.

Medicare Costs for Disabled Workers Through Age 64

In Bye and Riley [1989a], a total of 12 Medicare reimbursement equations were estimated, four for each of the three program outcome groups—death, recovery, attainment of age 65. The four equations measured:

- The probability of Medicare reimbursement in a year;
- the probability of hospital use in a year, given Medicare reimbursement in that year;
- the average reimbursement per month, given hospital use in a year; and
- the average reimbursement per month given Medicare reimbursement but no hospital use in a year.

These equations taken together can yield cross-section estimates of Medicare costs in the year of the program outcome—death, recovery, attainment of age 65—and estimates of costs in the 7 preceding years. The equations cover an 8-year period because only 8 years of observed Medicare data were available when the equations were estimated.

For simulated episodes in the DI program of more than 8 years' duration, Medicare reimbursement equations need to be selected to estimate costs for that part of the disability episode prior to the 8-year period leading to the end of the episode. The equations chosen were selected from those that were used to estimate costs for persons still in the program. These were the equations associated with beneficiaries whose DI program status in the 8 years of observed Medicare eligibility did not end in death or recovery. In these equations, the variable representing the time before year 1981 or age 65 was fixed at the reference year—that is, the 7th year before the event. Thus, this setting was used for all beneficiaries with episodes of more than 8 years to estimate Medicare costs for that part of the episode prior to the last 8 years. Starting with the 7th year before the end of the episode, the set of Medicare reimbursement equations was chosen dependent on the outcome of the episode. Approximately one-third of the cohort had initial Medicare eligibility episodes of more than 8 years; therefore, with the exception of a small number of recovered beneficiaries with multiple episodes of disability, one-third of the simulated histories involved this two-part procedure.

An alternative to the procedure described above would have been to use the equations for the appropriate DI program outcome group throughout the entire estimation period rather than switching from one set to another. This approach would have meant using the Medicare equations for beneficiaries whose next event was death to estimate costs for the years before the last 8 years of the episode for deaths beyond 8 years and similarly for recoveries when the time to recovery was more than 8 years. Examination of the estimating equations indicates that this approach would result in larger estimated costs for beneficiaries whose episodes ended in death and smaller estimates for those who recovered. A test of this approach resulted in Medicare cost estimates about 6 percent higher than those presented in tables 1–3.

An overall assessment of the goodness-of-fit of the estimated lifetime Medicare costs can be obtained by comparing the simulated costs of the first disability period through the end of 1981 with the actual Medicare costs in the data file. Table II provides estimated average costs during the period by year of DI termination and exit status for the first period of disability. These comparisons are similar to those in Bye and Riley [1989a]. The difference is that their model estimates were obtained by applying the Medicare reimbursement equations to actual disability histories; but here, the Medicare equations are applied to the simulated histories. Estimates are given in price-adjusted 1981 dollars to facilitate the comparisons.

The overall model-based estimate of costs per DI program beneficiary is $6,056. This estimate is about 6 percent higher than the observed average of $5,722. This overestimate appears to be due primarily to the large overestimate of average Medicare costs for beneficiaries dying in the years 1974-76. The possible reasons for this overestimate are discussed more fully in Bye and Riley [1989a]. Although this overestimate contributes on the upside to the net bias between projected lifetime costs and what the actual costs might be, its effect will be a smaller part of the lifetime estimate than of the estimate through 1981. As can be seen from the estimates in table II, the model tracks the cumulative Medicare costs fairly well, exhibiting systematic but small underestimates of Medicare costs for recovery and retirement terminations and small under estimates and over estimates for program terminations because of death after 1977.

Table II.—Estimated and actual Medicare costs for disabled-worker beneficiaries, by reason for DI program termination, 1974-81

[In 1981 dollars]

Program termination	Actual		Model estimate	
	Number of cases	Average cost	Number of cases	Average cost
Total	18,792	$5,722	18,510	$6,056
Death	5,540	5,967	5,449	7,001
Before 1974	2,412	0	2,197	0
1974	409	2,752	408	3,784
1975	604	5,302	575	7,284
1976	565	8,774	563	9,964
1977	432	11,199	430	12,662
1978	355	14,317	383	14,776
1979	293	15,847	359	16,030
1980	255	19,459	314	17,400
1981	215	19,751	220	20,469
Recovery	1,800	596	1,767	640
Before 1974	995	0	849	0
1974	140	96	227	94
1975	228	296	193	402
1976	102	638	146	978
1977	85	719	96	1,414
1978	81	2,153	82	2,118
1979	72	3,287	74	2,893
1980	45	4,838	56	3,504
1981	52	4,554	44	3,865
Retirement	5,320	4,749	5,377	4,351
Before 1974	0	0	0	0
1974	0	0	0	0
1975	469	1,902	554	1,871
1976	1,037	2,714	1,040	2,601
1977	974	3,858	993	3,612
1978	868	4,673	840	4,504
1979	788	6,578	789	5,579
1980	645	6,437	623	6,348
1981	539	8,166	538	7,295
No program termination	6,122	7,855	5,917	8,354

Waiting Period Costs

The methodological approach underlying the estimates of waiting period costs is essentially the same as that described in Bye and Riley [1989a, 1989b] and will not be repeated here. The one difference is that the Medicare cost equations are applied to the simulated waiting periods as opposed to the observed initial waiting period as was done in the earlier study. An examination of results not shown here indicates only very small differences between estimates for the first waiting period in the current analysis and those in the previous analysis (comparing costs in 1981 dollars). This is not surprising because the simulated histories do such a good job of re-creating the actual DI program histories and the same Medicare utilization equations are used in both analyses. In those few cases where the simulated DI program histories indicate two or more waiting periods, the same waiting period equations are used for the second and subsequent periods as the first.

Recovered Beneficiaries During Periods Without Medicare Eligibility

The data available for this analysis provided no observations on Medicare utilization by recovered beneficiaries after DI program termination. (With the Medicare extensions granted in the 1980 Disability Amendments and subsequent legislation, some data may be available on the level of Medicare costs after termination of cash benefits for beneficiaries in more recent entitlement cohorts who return to work despite a severe impairment.) The following decisions were made as to which Medicare equations to use. If the period after a recovery termination ends in death, then the equations were used that pertained to beneficiaries whose disability episode ended in death. The assumption was that costs in the period immediately preceding death would be about the same whether or not the individual was receiving cash benefits. If the period ended in return to the DI program, then the equations were used that pertained to those still in the program. The assumption in this case is that return to the DI program suggests a worsening of health and, therefore, Medicare utilization somewhat similar to beneficiaries currently in the program. If the recovery period ended in the attainment of age 65, then the "recovery" equations were used. In all cases, if the postrecovery period was more than 8 years, the equation choices above were preceded by the use of the recovery equations. In both of these situations, the assumption is that Medicare utilization would be somewhat similar to the use exhibited prior to recovery. Unfortunately, with the data available, there is no way to validate this set of assumptions, and care should be taken in interpreting the results.

Adjusting Estimates to 1989 Reimbursement Levels

The Medicare equations provided estimates adjusted to 1981 medical care price levels. To adjust the

estimates to 1989 reimbursement levels, a factor of 2.167 was used. This factor had two components.

The first component accounted for changes in Medicare utilization by disabled beneficiaries from 1974 to 1981. During this period, per capita Medicare costs rose substantially, even after adjusting for the increase in medical care prices. The Medicare equations, which were estimated using payment data from 1974 through 1981, therefore underestimate 1981 utilization. The ideal procedure would have been to adjust the original year-by-year payment data up to 1981 utilization levels (in the same way that the data were adjusted to 1981 price levels) before estimating the Medicare equations. For this study, it was only possible to apply a uniform adjustment to all the equations to account for the average underestimate in utilization. A Medicare utilization time series was calculated from data on per capita Medicare costs by adjusting it for growth in medical care prices; this series was divided by its 1981 value to determine utilization relative to 1981 for each year from 1974 through 1981; and an average of these values was calculated to determine the average utilization underestimate in the Medicare equations. The reciprocal of this average was then used as a correction factor to bring the estimates up to 1981 utilization levels. The value of the factor was 1.23.

This uniform adjustment to 1981 utilization will undercorrect the growth in utilization for those individuals with shorter DI program durations—those who in the original data are represented by reimbursements only for a year or two starting in 1974 and who then either died or recovered. Because of the high death and recovery rates during the first 2 years of DI entitlement, the uniform adjustment may therefore have led to a significant underestimate of the costs in the Medicare waiting period.

The second component of the adjustment accounted for both price and utilization changes from 1981 to 1989. This component was computed directly from estimates of per capita reimbursements to disabled beneficiaries during that period and had a value of 1.762. All reimbursement data used were unpublished data obtained from HCFA's Office of the Actuary.

Discounted (Present Value) Estimates

Presenting estimates at 1989 reimbursement levels may not provide the best way to gauge the overall size of expected Medicare costs, to examine the relative costs among subgroups of beneficiaries, or to assess the effects of extending Medicare eligibility. Special concerns exist when costs are incurred over a long period of time, especially when the highest costs tend to be incurred at the end of the benefit period.

Presenting estimates in constant dollars implicitly entails the assumption that the growth rate in Medicare costs will be approximately the same over the projected analysis period as the composite interest rate that could be earned on monies used to pay Medicare costs (Hospital Insurance Trust Fund monies that pay for Part A costs and monies collected in general revenues that pay Part B costs). If this is not true, then the present value of Medicare costs over the projected analysis period could be quite different from that estimated assuming 1989 levels.

The calculation of the present or discounted value of Medicare costs for an individual through age 64 involves the sum of the discounted values of each amount in the cost history, beginning with the first year of DI program eligibility.

That is

$$M = \sum_{i=1}^{n} M_i$$

where

M is the estimated present value of Medicare costs
n is the number of years of Medicare eligibility, and
M_i is the discounted estimate for the ith year.

The values of M_i are computed from their corresponding constant level values by

$$M_i = C_i\left(\frac{P_i}{R_i}\right)$$

where

C_i is the constant level estimate of the costs in the ith year
P_i is the cumulative growth factor for Medicare costs to year i, and
R_i is the cumulative interest factor to year i.

If growth and interest rates are more or less constant over time, then

$$P_i = (1 + p)^{i-1} \text{ and } R_i = (1 + r)^{i-1}$$

where p and r are the annual growth and interest rates, respectively.

Under this assumption the present value of n years of Medicare costs is given by

$$M = \sum_{i=1}^{n} M_i$$

$$= \sum_{i=1}^{n} C_i \left(\frac{1 + p}{1 + r}\right)^{i-1}$$

From this formulation of the present value calculation, one can see the two features of the Medicare estimate discussed above. If the ratio $(1+p)/(1+r)$ is greater than 1 (that is, if the growth rate exceeds the interest rate), then the present value will be larger than the constant level estimate. If $(1+p)/(1+r)$ is less than 1, then the reverse will be true. Also, to the extent that C_i increases with i, discount factors different from one will have a larger impact on the overall estimate. Table III presents estimates using alternative discount factors for selected cost estimates from table 1 of this article. The items selected were chosen because of the wide variation in duration of Medicare eligibility. Two non-unit discount ratios were chosen, one greater than 1 and one less than 1, to provide some sense of the sensitivity of the Medicare estimates to discounting assumptions.

The application of alternative discount factors can have a significant impact on the overall and relative sizes of the cost estimates. As an example, the 1989 level estimate of Medicare costs per DI program beneficiary through age 64 is $20,129. The corresponding alternative estimates are $23,716 and $17,361, $(1+p)/(1+r) = 1.015$ and 0.985, respectively. Thus, there is quite a wide range of estimates to choose from depending on one's discounting assumptions. There also appears to be a wide range of potential effects of expanding Medicare coverage as indicated in columns 3 and 5 of the table. In terms of overall cohort costs, the increase in cost of eliminating the waiting period ranges from 25 percent to 33 percent. The increase in cost of added Medicare coverage through age 64 for recovered beneficiaries increases costs from 7.5 percent to 11.5 percent depending on assumptions.

Also, as table IV indicates, the relative sizes of per capita costs for beneficiaries through age 64 varies greatly by discounting assumption. For example, the ratio of costs for the youngest to the oldest age group varies from 3.6:1 for $(1+p)/(1+r) = 1.015$ to 2.4:1 for $(1+p)/(1+r) = 0.985$.

Table IV.—Selected cost ratios and discount rates

Ratio	Discount rate $(1+p)/(1+r)$		
	1.015	1.0	.985
Mental/neoplasms	3.8	3.4	3.1
(Age 18-34)/(Age 35-49)	1.6	1.4	1.2
(Age 18-34)/(Age 50-61)	3.6	2.9	2.4

Table III.—Medicare costs for selected subgroups through age 64 and discount rates

[At 1989 reimbursement levels]

Diagnostic group and age	Average cost per entitlee	Average cost per entitlee including waiting period	Percent increase	Average cost per entitlee including time through age 64 or death	Percent increase
	$(1+p)/(1+r) = 1.015$				
Total	$23,716	$29,696	25.2	$26,498	11.5
Mental disorders	34,260	38,034	11.0	38,492	12.4
Neoplasms	9,003	21,793	142.1	9,434	4.8
18–34	53,833	58,491	8.7	70,924	31.7
35–49	34,054	39,785	16.8	37,185	9.2
50–61	14,857	21,153	42.4	15,079	1.5
	$(1+p)/(1+r) = 1.0$				
Total	$20,129	$25,991	29.1	$21,973	9.2
Mental disorders	27,383	31,065	13.4	30,247	10.5
Neoplasms	8,061	20,672	156.4	8,333	3.4
18–34	39,836	44,204	11.0	50,402	26.5
35–49	28,804	34,420	19.5	31,135	8.1
50–61	13,643	19,848	45.5	13,826	1.3
	$(1+p)/(1+r) = .985$				
Total	$17,361	$23,122	33.2	$18,659	7.5
Mental disorders	22,562	25,957	16.2	24,368	9.1
Neoplasms	7,297	19,629	170.5	7,477	2.5
18–34	30,431	34,625	13.8	37,441	23.0
35–49	24,553	30,067	22.5	26,331	7.2
50–61	12,539	18,654	48.8	12,692	1.2