4. Cost-of-Illness Estimates for Selected Conditions in Older Americans

Using the data and methods described in Section 3, we estimated the direct and indirect costs of illness associated with each of the six selected conditions in 2000 among individuals 65 and older. In this section, we separately summarize the results for CLD, ischemic heart diseases (IHD), stroke, lung cancer, pneumonia, and gastrointestinal illness. All costs reported in the results tables are expressed in 2000 dollars.

4.1 Chronic Lung Disease

As summarized in Table 4-1, we estimated that approximately 4.4 million older Americans suffered from CLD in 2000, and it was the primary cause associated with almost 100,000 deaths in individuals 65 and older. Based on these estimates, we also calculated aggregate direct and indirect costs from CLD in this population to be approximately $33.9 billion. These results are further described and disaggregated in the sections below.

Table 4-1. Costs of Illness Associated with Chronic Lung Disease—Estimated Aggregate Costs in 2000 for Individuals 65 and Older

Cost Category	Number of Affected Individuals	Mean Cost ($/person)	Aggregate Costs
Direct Costs			
Medical	4,190,512	$5,786	$24,246,304,937
Prescription Drug	4,190,512	$574	$2,405,354,137
Nursing Home	185,000	$3,471	$642,135,000
Indirect Costs			
Morbidity	4,190,512	$1,574	$6,594,623,730
Mortality	98,326	—	$9,895,808
Total Costs of Illness	—	—	$33,898,313,612

4.1.1 Direct Costs: Medical

Based on CAHPS-MFFS data, roughly 3.3 million (12.5 percent of) noninstitutionalized Medicare fee-for-service elderly beneficiaries suffered from CLD in 2000, and the annual medical costs for these beneficiaries averaged about $5,800 per year. As shown in Table 4-2, the largest component of these costs was associated with inpatient services, which averaged over $13,000 for nearly 1.2 million beneficiaries. The aggregate medical cost estimates shown in Table 4-1, were extrapolated from these estimates, assuming the same prevalence and average costs for CLD among the noninstitutionalized elderly who do not participate in Medicare fee-for-service. As described in Section 3, this extrapolation is likely to somewhat overestimate aggregate medical costs in the noninstitutionalized elderly population.

Rates of CLD among the male elderly population were found to be significantly higher than among the female elderly population in each of the three age categories listed in Table 4-2. Furthermore, whereas rates of CLD among the female population were between 10 and 12 percent for all three age categories, the rate for males climbed from 13 percent for those between 65 and 74 years to 19 percent for those 85 and older. Compared to this variation in prevalence rates, there was considerably less variation in average medical costs for CLD across age and gender categories, ranging between $5,000 and $6,500.

4.1.2 Direct Costs: Self-Administered Prescription Drugs and Nursing Home Care

Having CLD was associated with significantly higher prescription drug costs for males and females in the 65 to 74 years age group. These estimates are described in Table 4-3. Estimated costs for this age group were approximately $600 to $1,200. Estimated incremental prescription drug costs were $574 for the total population over 65 years with CLD. Excess costs for those in the two oldest age groups

Table 4-2. Direct Medical Costs Associated with Chronic Lung Disease—Number of Beneficiaries and Average Medical Payments by Type of Service and Age-Gender Category

	Beneficiaries with a Diagnosis			Direct Medical Costs ($/Person/Year)	
	Number	Percent	95%CI (±)	Mean	95%CI (±)
Total	3,264,847	12.5	(12.3, 12.7)	5,786	(5,568, 6,005)
Type of Medical Service					
Inpatient	1,196,221	4.6	(4.5, 4.7)	13,019	(12,535, 13,504)
Physician	1,611,419	8.8	(8.6, 8.9)	461	(439, 483)
Hospital outpatient	1,069,976	4.1	(3.9, 4.2)	570	(535, 610)
Home health	201,731	7.7	(0.7, 0.8)	2,643	(2,406, 2,880)
Durable medical equipment	720,079	2.7	(2.7, 2.8)	2,220	(2,142, 2,298)
Age-Gender Category					
Age 65–74 Years					
Male	754,596	12.9	(12.5,0.13.3)	5,596	(5,146, 6,046)
Female	706,640	10.1	(9.8, 10.5)	5,122	(4,655, 5,588)
Age 75–84 Years					
Male	649,188	17.1	(16.6, 17.7)	6,030	(5,539, 6,520)
Female	687,217	11.6	(11.2, 11.9)	6,461	(5,901, 7,021)
Age 85+ Years					
Male	192,794	19.0	(17.8, 20.1)	5,131	(4,610, 5,652)
Female	273,812	10.5	(10.0, 11.1)	6,219	(5,625, 6,814)

Note: Geographic weights used to obtain unbiased nationally representatives estimates for Medicare elderly population.

Table 4-3. Other Direct Costs Associated with Chronic Lung Disease—Incremental Cost Estimates for Prescription Medications and Nursing Home Services by Age-Gender Category

	Prescription Drug Incremental Costs			Nursing Home Incremental Costs		
Age	Sample Size	Mean ($/Person/ Year)	95% CI (±)	Sample Size	Mean ($/Person/ Year)	95% CI (±)
Age 65+ years	174	$574	(264, 884)	764	$3,471	(–3,138, 10,081)
Age 65–74 years						
Male	37	$563	(124, 1,003)	71	$28,200	(–43,331, 99,730)
Female	59	$1,215	(588, 1,843)	64	$9,574	(222, 18,927)
Age 75–84 years						
Male	24	$128	(–251, 506)	102	($651)	(–6,507, 5,206)
Female	40	$141	(–325, 607)	175	$505	(–3,286, 4,296)
Age 85+ years						
Male	4	($429)	(–701, –157)	104	$1,102	(–2,846, 5,049)
Female	10	$42	(–609, 694)	248	($634)	(–2,925, 1,657)

Notes: Prescription drug estimates exclude those with source of payment listed as Medicare. () denotes a negative value.

were not statistically significantly different from zero. The lower estimated excess drug costs for the two oldest age groups probably reflects the higher rate of comorbidity and prescription drug use among all individuals 75 years and older, which tends to make the prescription drug spending of those with CLD look similar to those without.

Table 4-3 also shows estimates of nursing home costs associated with CLD. Although the standard errors on the estimated incremental nursing home costs were large, incremental costs were fairly large for males and females in the 65 to 74 years age group, especially for males. Estimated excess nursing home costs for the other two age groups were much smaller and were not statistically different from zero. Our findings of higher excess costs for the youngest age group with CLD is consistent with the hypothesis of a large degree of costly comorbidities within the 75 years and older population.

4.1.3 Indirect Costs: Morbidity

As shown in Table 4-4, we estimate that, for those older Americans suffering from CLD, the annual per person labor productivity losses resulting the illness vary across age and sex subgroups from about $900 to $2,000. These estimates include the probability of being out of the labor force, which is about 4 percentage points higher in people with CLD than for the average older American, and work-loss days among the 10 percent of older people with CLD who continue to work. Our estimates of work-loss days attributable to CLD are 4.6 for females and 3.4 for males.

Table 4-4. Morbidity-Related Indirect Costs Associated with Chronic Lung Disease—Estimated Annual Per-Person Productivity Losses by Age-Gender Category

Age	Labor Productivity Losses	Household Productivity Losses	Total Productivity Losses
Age 65+ years	$1,420	$154	$1,574
Age 65–74 years			
Male	$1,867	$103	$1,971
Female	$836	$211	$1,047
Age 75+ years			
Male	$1,566	$95	$1,660
Female	$752	$181	$933

Estimates of annual household productivity losses resulting from increased morbidity in those with CLD are fairly low and average $154 per person for all those over 65 years of age. Estimates range from $95 per year for males older than 75 years up to $211 per year for females in the 65 to 74 years age group. Our estimates indicate that the number of bed days per year attributable to CLD is about 5 for females and 3 for males.

Total productivity losses are calculated as the sum of estimated labor and household productivity losses. They are estimated to average about $1600 for those 65 and older with CLD.

4.1.4 Indirect Costs: Mortality

Using data from NSVR, Table 4-5 shows that the annual number of deaths with CLD as the cause was estimated to be about 98,000 in 2000, with 76 percent occurring in people between 65 and 84 years of age. Because many of the expected deaths resulting from CLD are in the 65 to 74 and 75 to 84 years age groups, the present value of labor productivity losses associated with CLD is high—over $2 billion per year. The combined value of labor and productivity losses is also high—about $9.9 billion per year. As discussed in Section 3, the value of productivity losses for those 85 and older could not be estimated due to lack of data on expected productivity for this age group.

Table 4-5. Mortality-Related Indirect Costs Associated with Chronic Lung Disease—Estimated Aggregate Productivity Losses by Age Category

Age	Number of Deaths	Aggregate Labor Productivity Losses (in 1,000s)	Aggregate Labor and Household Productivity Losses (in 1,000s)
Age 65+ years	98,326	$2,120,309	$9,895,808
Age 65–74 years	29,869	$1,523,485	$5,685,484
Age 75–84 years	44,651	$596,824	$4,210,324
Age 85+ years	23,806	—	—

Notes: Chronic lung disease diagnosis in mortality data is based on ICD-9 codes of 490-496. Mortality related indirect costs for 85+ not estimated due to lack of data on expected productivity for this age group.

4.2 Ischemic Heart Disease

Of the six conditions analyzed in this report, IHD is the most prevalent condition among older Americans. We estimate that approximately 6.9 million older Americans experienced IHD in 2000, and other data indicate that almost 450,000 deaths were primarily attributable to the disease. As reported in Table 4-6, we estimate the aggregate direct (except nursing home) and indirect costs from CLD in this population to be approximately $50.1 billion in 2000. These results are further described and disaggregated in the sections below.

Table 4-6. Costs of Illness Associated with Ischemic Heart Disease—Estimated Aggregate Costs in 2000 for Individuals 65 and Older

Cost Category	Number of Affected Individuals	Mean Cost ($/person)	Aggregate Costs
Direct Costs			
Medical	6,604,030	$5,716	$37,748,632,961
Prescription drug	6,604,030	$680	$4,490,740,100
Nursing home	290,080	—	—
Indirect Costs			
Morbidity	6,604,030	$1,193	$7,878,384,878
Mortality	443,494	—	$34,535,761
Total Costs of Illness	—	—	$50,152,293,701

4.2.1 Direct Costs: Medical

Our analysis of direct medical costs, summarized in Table 4-7, indicates that over 5.1 million (20 percent of) Medicare fee-for-service elderly beneficiaries experienced IHD in 2000. The prevalence of IHD is therefore almost 60 percent greater than for CLD in this population; however, the annual medical costs per beneficiary are very similar, averaging about $5,700 per year. As with all of the conditions analyzed in this report, the largest component of estimated medical costs was associated with inpatient services, in this case averaging about $13,000 for over 1.8 million beneficiaries. When the estimated medical costs of IHD for fee-for-service beneficiaries ($5716) are extrapolated to the entire noninstitutionalized population of adults over 65 in 2000 (33.5 million), they sum to almost $38 billion, as shown in Table 4-5.

As is the case with CLD, the prevalence of IHD was found to be significantly higher among the male elderly population than the female elderly population in each of the three age categories listed in Table 4-7. However, rates of IHD for both males and females were significantly higher in the older age categories. The rate for males was 22 percent for those between 65 and 74 years and 32 percent for those

Table 4-7. Direct Medical Costs Associated with Ischemic Heart Disease—Number of Beneficiaries and Average Medical Payments by Type of Service and Age-Gender Category

	Beneficiaries with a Diagnosis			Direct Medical Costs ($/Person/Year)	
	Number	Percent	95%CI (±)	Mean	95%CI (±)
Total	5,145,229	19.6	(19.4,19.9)	5,716	(5,557, 5,875)
Type of Medical Service					
Inpatient	1,878,134	7.2	(7.0, 7.3)	13,181	(12,852, 13,511)
Physician	4,084,632	15.6	(0.1, 0.2)	641	(621, 661)
Hospital outpatient	1,859,793	7.1	(7.0, 7.2)	407	(389, 425)
Home health	265,519	1.0	(1.0, 1.1)	2,063	(1,913, 2,213)
Durable medical equipment	40,886	0.2	(0.1, 0.2)	831	(584, 1,079)
Age-Gender Category					
Age 65–74 Years					
Male	1,280,121	21.9	(21.4, 22.3)	5,707	(5,359, 6,056)
Female	832,829	11.9	(11.6, 12.3)	5,803	(5,385, 6,220)
Age 75–84 Years					
Male	1,169,587	30.8	(30.1, 31.5)	5,770	(5,429, 6,110)
Female	1,028,219	17.3	(16.8, 17.8)	5,792	(5,439, 6,146)
Age 85+ Years					
Male	320,908	31.5	(30.2, 32.9)	4,957	(4,530, 5,385)
Female	513,565	19.8	(19.0, 20.5)	5,793	(5,400, 6,186)

Note: Geographic weights used to obtain unbiased nationally representatives estimates for Medicare elderly population.

85 and older. For women, the rates of IHD were 12 and 20 percent, respectively. The average medical costs for IHD across age and gender categories varied by less than $1,000 (i.e., between $4,900 and $5,800).

4.2.2 Direct Costs: Self-Administered Prescription Drugs and Nursing Home Care

Our estimates of the excess prescription drug costs associated with heart disease were positive for all age and sex subgroups. As reported in Table 4-8, on average, prescription drug costs for those over 65 years with IHD were $680 higher than for those without. These findings suggest that heart disease drug costs exceed the cost of drugs for many other diseases that afflict the elderly. Estimated incremental prescription costs for the 65 to 74 years age group were $700 to $1,100 and statistically different from zero. For the two older age groups, estimated excess drug costs were generally positive, but much lower and not significantly different from zero.

Estimates of excess nursing home costs for individuals with heart disease are not significantly different from zero for any of the age and sex subgroups. These findings suggest that among nursing home residents older than 64 years, those with heart disease have nursing home costs that are no higher than those without the condition. The estimated negative mean value for incremental nursing home costs reported in Table 4-8 was assumed to be implausible and therefore not included in the aggregate estimates for IHD reported in Table 4-6.

Table 4-8. Other Direct Costs Associated with Ischemic Heart Disease—Incremental Cost Estimates for Prescription Medications and Nursing Home Services by Age-Gender Category

	Prescription Drug Incremental Costs			Nursing Home Incremental Costs		
Age	Sample Size	Mean ($/Person/ Year)	95% CI (±)	Sample Size	Mean ($/Person/ Year)	95% CI (±)
Age 65+ years	156	$680	(400, 961)	1,042	($1,357)	(–3,187, 474)
Age 65–74 years						
Male	45	$722	(203, 1,240)	55	($9,572)	(–27,005, 7,860)
Female	37	$1,120	(467, 1,773)	55	$3,240	(–3,486, 9,967)
Age 75–84 years						
Male	22	$18	(–233, 269)	116	($1,286)	(–6,962, 4,389)
Female	35	$675	(260, 1,091)	231	($1,969)	(–5,371, 1,433)
Age 85+ years						
Male	8	$311	(–460, 1,082)	127	($905)	(–4,847, 3,038)
Female	9	$237	(–167, 642)	458	($645)	(–3,011, 1,722)

Notes: Heart disease diagnosis based on ICD-9 code of 410-414. Sample weights used and complex survey design taken into account in calculating standard errors. Prescription drug estimates exclude those with a source of payment listed as Medicare. () denotes a negative value.

4.2.3 Indirect Costs: Morbidity

The estimated labor productivity losses resulting from increased morbidity in people with IHD are a bit lower than estimated losses for those with CLD. Table 4-9 reports estimated labor productivity losses per person with IHD of about $470 to $1,200, with a portion of those losses arising because people with heart disease have a 3 percentage point higher probability of being unable to work than the analogous population without heart disease. Among those with heart disease who do work, we estimate work-loss days attributable to heart disease of 1.7 for females and 1 for males. The average labor productivity loss across age and sex subgroups is $880 per year.

Table 4-9. Morbidity-Related Indirect Costs Associated with Ischemic Heart Disease—Estimated Annual Per-Person Productivity Losses by Age-Gender Category

Age	Labor Productivity Losses	Household Productivity Losses	Total Productivity Losses
Age 65+ years	$878	$315	$1,193
Age 65–74 years			
Male	$1,156	$210	$1,366
Female	$517	$449	$966
Age 75+ years			
Male	$969	$192	$1,162
Female	$465	$385	$850

Estimated household productivity losses in older people with heart disease are $315 and range from $192 to $449 per year within specific age and sex subgroups. These estimates are based on estimated bed days attributable to heart disease of 10 for females and 6 for males.

4.2.4 Indirect Costs: Mortality

The estimated annual number of deaths in 2000 with IHD as the cause is over 443,000—over four times the number of deaths resulting from CLD in this age group and almost three times the number of stroke deaths. The large number of deaths caused by heart disease is associated with high labor and household productivity losses. As shown in Table 4-10, the estimated annual labor productivity losses resulting from heart disease mortality are $7 billion, while the estimated annual labor and household productivity losses are almost $35 billion.

Table 4-10. Mortality-Related Indirect Costs Associated with Ischemic Heart Disease—Estimated Aggregate Productivity Losses by Age Category

Age	Number of Deaths	Aggregate Labor Productivity Losses (in 1,000s)	Aggregate Labor and Household Productivity Losses (in 1,000s)
Age 65+ years	443,494	$7,231,200	$34,535,761
Age 65–74 years	97,226	$4,959,013	$18,506,512
Age 75–84 years	169,993	$2,272,187	$16,029,249
Age 85+ years	176,275	—	—

Notes: Ischemic heart disease diagnosis in mortality data is based on ICD-9 codes of 410-414. Mortality related indirect costs for 85+ not estimated due to lack of data on expected productivity for this age group.

4.3 Stroke

As summarized in Table 4-11, we estimate that approximately 2.6 million older Americans experienced strokes in 2000. We also find that over 150,000 deaths in individuals 65 and older were primarily attributable to stroke. Based on these estimates, we calculated aggregate direct (except for nursing home) and indirect costs from stroke in this population to be approximately $18.1 billion. These results are further described and disaggregated in the sections below.

Table 4-11. Costs of Illness Associated with Stroke—Estimated Aggregate Costs in 2000 for Individuals 65 and Older

Cost Category	Number of Affected Individuals	Mean Cost ($/person)	Aggregate Costs
Direct Costs			
Medical	2,535,378	$3,725	$9,444,281,366
Prescription drug	2,535,378	$945	$2,395,931,783
Nursing home	111,000	—	—
Indirect Costs			
Morbidity	2,535,378	$2,478	$6,281,881,402
Mortality	156,000	—	$10,423,691
Total Costs of Illness	—	—	$18,132,518,242

4.3.1 Direct Costs: Medical

Table 4-12 summarizes our estimates of stroke-related medical costs among Medicare fee-for-service elderly beneficiaries. We estimate that roughly 2 million (7.5 percent of) beneficiaries experienced stroke in 2000. The annual medical costs per beneficiary averaged $3,700 per year, which is significantly lower than for CLD and IHD. Extrapolating these prevalence and average cost estimates to the entire population of noninstitutionalized adults over 65 in 2000 results in an aggregate estimate of stroke-related medical costs of $9.4 billion (shown in Table 4-11).

Table 4-12. Direct Medical Costs Associated with Stroke—Number of Beneficiaries and Average Medical Payments by Type of Service and Age-Gender Category

	Beneficiaries with a Diagnosis			Direct Medical Costs ($/Person/Year)	
	Number	Percent	95% CI (±)	Mean	95% CI (±)
Total	1,975,324	7.5	(7.4,7.7)	3,725	(3,528, 3,923)
Type of Medical Service					
Inpatient	479,335	1.8	(1.8, 1.9)	11,555	(10,959, 12,151)
Physician	1,161,419	6.1	(6.0, 6.3)	461	(439, 483)
Hospital outpatient	576,421	2.2	(2.1, 2.3)	615	(568, 662)
Home health	143,443	0.5	(0.5, 0.6)	3,282	(2,792, 3,592)
Durable medical equipment	202,001	0.8	(0.7, 0.8)	1,243	(1,091, 1,395)
Age-Gender Category					
Age 65–74 Years					
Male	376,615	6.4	(6.1,6.7)	3,658	(3,102, 4,214)
Female	334,302	4.8	(4.6, 5.0)	3,663	(3,227, 4,100)
Age 75–84 Years					
Male	433,262	11.4	(10.9, 11.9)	3,682	(3,209, 4,155)
Female	460,068	7.7	(7.4, 8.1)	3,785	(3,397, 4,172)
Age 85+ Years					
Male	136,725	13.4	(12.5, 14.4)	3,248	(2,765, 3,732)
Female	234,353	9.0	(8.5, 9.5)	4,165	(3,748, 4,581)

Note: Geographic weights used to obtain unbiased nationally representatives estimates for Medicare elderly population.

As is the case with CLD and IHD, the prevalence of stroke was found to be significantly higher for males than for females in each of the three age categories. Similar to IHD, the prevalence of stroke for both males and females was significantly higher in the older age categories, going from 6 percent of men and 5 percent of women between 65 and 74 years to 13 percent and 9 percent, respectively, for those 85 and older. The average medical costs again show relatively little variation across age and gender categories, varying between $3,600 and $4,200 for stroke.

4.3.2 Direct Costs: Self-Administered Prescription Drugs and Nursing Home Care

Our assessment of the prescription drug and nursing home costs associated with stroke, summarized in Table 4-13, resulted in generally positive incremental cost estimates for prescription drugs. For the total population 65 years and older, a stroke diagnosis in the past year was associated with significantly higher prescription drug costs of about $945 per person per year. For males and females in the 65 to 74 years age group, costs were even higher—$1,200 to $1,700 per year. Although a stroke diagnosis was also associated with positive incremental prescription drug costs for the 75 to 84 years age group, the magnitude was much smaller—approximately $500 to $1,000. For the oldest age group, stroke was not associated with significantly higher prescription drug costs.

Table 4-13. Other Direct Costs Associated with Stroke—Incremental Cost Estimates for Prescription Medications and Nursing Home Services by Age-Gender Category

	Prescription Drug Incremental Costs			Nursing Home Incremental Costs		
Age	Sample Size	Mean ($/Person/ Year)	95% CI (±)	Sample Size	Mean ($/Person/ Year)	95% CI (±)
Age 65+ years	114	$945	(596, 1,294)	73	($403)	(–5,089, 4,283)
Age 65–74 years						
Male	30	$1,708	(687, 2,728)	7	($2,103)	(–30,046, 25,840)
Female	23	$1,215	(353, 1,622)	8	$3,632	(–14,938, 22,203)
Age 75–84 years						
Male	16	$507	(–133, 1,147)	10	($9,402)	(–14,138, 4,665)
Female	23	$988	(353, 1,622)	19	($2,991)	(–9,744, 3,762)
Age 85+ years						
Male	11	($177)	(–612, 257)	4	$21,157	(–14,511, 56,826)
Female	11	$34	(–386, 455)	25	($670)	(–7,049, 5,709)

Notes:. Stroke diagnosis based on ICD-9 code of 430-434 and 436. Sample weights used and complex survey design taken into account in calculating standard errors. Prescription drug estimates exclude those with a source of payment listed as Medicare. () denotes a negative value.

Somewhat surprisingly, nursing home costs for those with a reported stroke were no higher than costs for those without stroke as a diagnosis. Although the estimated excess cost for males in the 85 years and older age group was $21,000, this estimate is not significantly different from zero. Moreover, aggregate nursing home costs for individuals in the NNHS with a stroke diagnosis were no higher than nursing home costs for those without a stroke diagnosis. Due to the small sample size and high standard errors, these estimates of stroke related nursing home costs are not included in our aggregate cost estimates.

4.3.3 Indirect Costs: Morbidity

According to the results shown in Table 4-14, the annual labor productivity losses resulting from increased morbidity in older people who experience a stroke are relatively high, ranging from about $1,000 to $2,400 per person. These losses result in large part from the estimated increase in the probability of being unable to work among people with a reported stroke—6 percentage points higher than average for the over-65 population. For those with a stroke diagnosis who did work (4.8 percent), we estimated that females had about 3.2 work-loss days that could be attributed to stroke, while males had 1.7.

Table 4-14. Morbidity-Related Indirect Costs Associated with Stroke—Estimated Annual Per-Person Productivity Losses by Age-Gender Category

Age	Labor Productivity Losses	Household Productivity Losses	Total Productivity Losses
Age 65+ years	$1,820	$658	$2,478
Age 65–74 years			
Male	$2,403	$455	$2,858
Female	$1,069	$885	$1,954
Age 75+			
Male	$2,015	$417	$2,432
Female	$961	$759	$1,720

Our estimates of annual household productivity losses among those with a stroke diagnosis range from approximately $420 to $890. Although these estimates appear to be fairly low, because of the relatively low value of household productivity in older adults ($11,000 to $16,000 per year), we estimated that the annual number of bed-loss days attributable to stroke was 20.4 for females and 13.5 for males. These estimates suggest that stroke has a large impact on the ability of older people to perform simple household duties, including cooking, cleaning, or even providing care for grandchildren. Total labor and household productivity losses associated with stroke for the 65 years and older population are almost $2,500 per person per year.

4.3.4 Indirect Costs: Mortality

As reported in Table 4-15, the productivity losses associated with stroke as the cause of death are very high. We estimate that approximately 156,000 Americans over 65 years would have likely died from stroke in 2000. Over 40 percent of those estimated deaths were among people over 85 years of age. The present value of labor productivity losses resulting from stroke deaths exceeds $2 billion. However, because a high percentage of the 65 years and older population is retired (about 73 percent based on our analysis of NHIS), the present value of labor and household productivity losses is far higher and is estimated to exceed $10 billion annually.

Table 4-15. Indirect Costs Resulting from Increased Mortality Associated with Stroke—Estimated Aggregate Productivity Losses by Age Category

Age	Number of Deaths	Aggregate Labor Productivity Losses (in 1,000s)	Aggregate Labor and Household Productivity Losses (in 1,000s)
Age 65+ years	156,000	$2,079,434	$10,423,691
Age 65–74 years	25,053	$1,277,826	$4,768,713
Age 75–84 years	59,972	$801,608	$5,654,978
Age 85+ years	70,975	—	—

Notes: Stroke diagnosis in mortality data is based on ICD-9 codes 430-438. Mortality related indirect costs for 85+ not estimated due to lack of data on expected productivity for this age group.

4.4 Lung Cancer

Compared to the other health conditions examined in this report, the prevalence of lung cancer among the elderly is relatively low; however, the mortality rate and average costs of illness are comparatively high. As shown in Table 4-16, roughly 116,000 deaths in the 65 and older population were primarily attributable to lung cancer in 2000, and the aggregate costs of illness were estimated to be $4.4 billion, even excluding prescription drug costs, nursing home costs, and most morbidity-related productivity losses (due to data limitations). Further details regarding the estimated direct and indirect costs associated with lung cancer are described below.

Table 4-16. Costs of Illness Associated with Lung Cancer—Estimated Aggregate Costs in 2000 for Individuals 65 and Older

Cost Category	Number of Affected Individuals	Mean Cost ($/person)	Aggregate Costs
Direct Costs			
Medical	393,853	$10,859	$4,276,854,803
Prescription drug	393,853	—	—
Nursing home	17,760	—	—
Indirect Costs			
Morbidity	393,853	$401[a]	$157,935,240
Mortality	116,360	—	$15,182,419
Total Costs of Illness	—	—	$4,449,972,462

[a]Does not include household productivity losses. Prescription drug and nursing home costs not included due lack of sufficient data.

4.4.1 Direct Costs: Medical

Estimates of medical costs associated with lung cancer among Medicare fee-for-service elderly beneficiaries are summarized in Table 4-17. Using CAHPS-MFFS data, we estimate that about 300,000 (1.2 percent of) beneficiaries suffered from lung cancer in 2000. This rate is lower than any of the other conditions examined, but the average medical costs per affected beneficiary, estimated to be nearly $11,000, are almost twice as high as even CLD and IHD. As shown in Table 4-16, extrapolating these prevalence and average cost estimates to the entire noninstitutionalized population of adults over 65 in 2000 results in an aggregate estimate of medical costs from lung cancer of $4.3 billion..

Table 4-17. Direct Medical Costs Associated with Lung Cancer—Number of Beneficiaries and Average Medical Payments by Type of Service and Age-Gender Category

	Beneficiaries with a Diagnosis			Direct Medical Costs ($/Person/Year)	
	Number	Percent	95% CI (±)	Mean	95% CI (±)
Total	306,853	1.2	(1.1,1.2)	10,859	(9,963, 11,756)
Type of Medical Service					
Inpatient	139,141	0.5	(0.5, 0.6)	15,308	(14,030, 16,587)
Physician	234,149	0.9	(0.8, 0.9)	3,070	(2,502, 3,638)
Hospital outpatient	148,165	0.6	(0.5, 0.6)	2,725	(2,334, 3,116)
Home health	25,928	0.1	(0.1, 0.1)	2,093	(1,570, 2,616)
Durable medical equipment	21,118	0.1	(0.1, 0.1)	1,195	(885, 1,505)
Age-Gender Category					
Age 65–74 Years					
Male	75,239	1.3	(1.2, 1.4)	11,949	(10,356, 13,542)
Female	71,305	1.0	(0.9, 1.1)	10,920	(9,119, 12,721)
Age 75–84 Years					
Male	66,395	1.8	(1.6, 1.9)	10,575	(8,363, 12,788)
Female	61,153	1.0	(0.9, 1.2)	11,341	(9,083, 13,599)
Age 85+ Years					
Male	14,594	1.4	(1.1, 1.8)	7,223	(4,851, 9,595)
Female	18,167	0.7	(0.6, 0.9)	8,443	(5,235, 11,652)

Note: Geographic weights used to obtain unbiased nationally representatives estimates for Medicare elderly population.

As with all of the other conditions examined in this report, the prevalence of lung cancer among older Americans is significantly higher for males than for females; however, the rates of lung cancer are relatively stable across the three age categories——for females they vary between 0.7 and 1 percent and for males they vary between 1.3 and 1.8 percent. In contrast, the estimated average medical costs are not significantly different between men and women. Estimated average costs are somewhat lower for men and women in the highest age group (85 and older), going from about $11,000 to $8,000, but this difference is only statistically significant for men.

4.4.2 Direct Costs: Self-Administered Prescription Drugs and Nursing Home Care

The 2000 MEPS contained information about only a handful of older people with lung cancer. Because of the small number of observations in MEPS on people with lung cancer, we were unable to generate reliable estimates of the excess prescription drug costs for age and sex subgroups for people with lung cancer. However, to be consistent with our analysis for the other five conditions, we generated

incremental cost estimates for age and sex subgroups with at least three observations, and these estimates are reported in Table 4-18. The estimated incremental cost of prescription drugs for the 65 years and older population with lung cancer is about $1,400 per year. This estimate is not quite statistically significant at the 95 percent confidence level, but the large mean suggests that the prescription drug costs associated with lung cancer among the elderly are substantially larger than prescription drug costs in those without lung cancer. Due to the very small sample sizes associated with these estimates, they are not included in our aggregate cost of illness estimates.

Table 4-18. Other Direct Costs Associated with Lung Cancer—Incremental Cost Estimates for Prescription Medications and Nursing Home Services by Age-Gender Category

	Prescription Drug Incremental Costs			Nursing Home Incremental Costs		
Age	Sample Size	Mean ($/Person/ Year)	95% CI (±)	Sample Size	Mean ($/Person/ Year)	95% CI (±)
Age 65+ years	14	$1,351	(–117, 2,819)	29	$5,367	(–4,085, 14,820)
Age 65–74 years						
Male	4	$2,279	(–1,993, 6,550)	5	($14,492)	(–36,609, 7,625)
Female	2	—	—	4	$13,049	(–13,390, 39,489)
Age 75–84 years						
Male	2	—	—	3	($8,267)	(–16,502, -33)
Female	3	$2,414	(1,470, 3,358)	6	$16,867	(–18,764, 52,499)
Age 85+ years						
Male	1	—	—	5	$11,099	(–614, 22,812)
Female	2	—	—	6	($717)	(–13,883, 12,448)

Notes: Lung cancer diagnosis based on ICD-9 codes of 162, 197, and 231. Sample weights used and complex survey design taken into account in calculating standard errors. () denotes a negative value.

The number of individuals in the NNHS with lung cancer listed as a diagnosis was also relatively small (three to six observations per age and sex subgroup). Our estimates of incremental nursing home costs for people with lung cancer vary widely, and none is significantly different from zero. Because of the small samples and resulting large standard errors, it is difficult to draw any conclusions about the likely impact of lung cancer on nursing home costs from these findings.

4.4.3 Indirect Costs: Morbidity

The indirect costs resulting from increased morbidity in people with a lung cancer diagnosis, as summarized in Table 4-19, are based solely on the estimated increased probability of being unable to work among people with lung cancer. Among the 41 respondents in NHIS with a lung cancer diagnosis, the probability of being unable to work was about 1.3 percentage points higher than for analogously defined individuals without lung cancer. Resulting cost estimates are $211 to $530 per year, and average $400 per year across all age and sex subgroups. The work loss days attributable to lung cancer could not be estimated precisely because of the small percentage of those over 65 years with lung cancer who reported working (about 7 percent). Further, lung cancer was not considered in our analysis of the number of bed days attributable to a health condition.

Table 4-19. Morbidity-Related Indirect Costs Associated with Lung Cancer—Estimated Annual Per-Person Productivity Losses by Age-Gender Category

Age	Labor Productivity	Household Productivity	Total Productivity Losses
Age 65+ years	$401	—	—
Age 65–74 years			
Male	$530	—	—
Female	$234	—	—
Age 75+ years			
Male	$444	—	—
Female	$211	—	—

4.4.4 Indirect Costs: Mortality

Mortality estimates for lung cancer are presented in Table 4-20. The estimated number of deaths among those 65 years and older with lung cancer as the cause is about 116,000 in 2000—somewhat higher than the estimated number of deaths from CLD yet lower than the estimated number of stroke deaths. Almost 50 percent of these deaths were in the 65 to 74 years age group and resulted in high estimated productivity losses. Estimated labor productivity losses resulting from lung cancer mortality have a present value of $3.5 billion; estimated labor and household productivity losses have a present value of $15 billion.

Table 4-20. Mortality-Related Indirect Costs Resulting Associated with Lung Cancer—Estimated Aggregate Productivity Losses by Age Category

Age	Number of Deaths	Aggregate Labor Productivity Losses (in 1,000s)	Aggregate Labor and Household Productivity Losses (in 1,000s)
Age 65+ years	116,360	$3,507,104	$15,182,419
Age 65–74 years	56,402	$2,876,801	$10,735,918
Age 75–84 years	47,156	$630,303	$4,446,501
Age 85+ years	12,802	—	—

Notes: Lung cancer diagnosis in mortality data is based on ICD-9 codes of 160-161 and 163-165 and excludes 197 and 231

4.5 Pneumonia

As summarized in Table 4-21, we estimate that approximately 1.9 million older Americans experienced pneumonia in 2000, and pneumonia was the primary cause of about 83,000 deaths in individuals 65 and older. Based on these estimates, we calculated aggregate direct and indirect (except for morbidity) costs from pneumonia in this population to be approximately $11 billion. These results are further described and disaggregated in the sections below.

Table 4-21. Costs of Illness Associated with Pneumonia—Estimated Aggregate Costs in 2000 for Individuals 65 and Older

Cost Category	Number of Affected Individuals	Mean Cost ($/person)	Aggregate Costs
Direct Costs			
Medical	1,779,693	$5,623	$10,007,215,290
Prescription drug	1,779,693	$302	$537,467,369
Nursing home	78,440	$4,987	$391,180,280
Indirect Costs			
Morbidity	1,779,693	—	—
Mortality	83,264	—	$4,695,729
Total Costs of Illness	—	—	$10,940,558,668

Notes: Morbidity related indirect costs not estimated due to lack of data.

4.5.1 Direct Costs: Medical

Table 4-22 summarizes our estimates of medical costs associated with pneumonia. Among Medicare fee-for-service beneficiaries in 2000, we estimate that almost 1.4 million (5.3 percent of) beneficiaries aged 65 and older suffered from pneumonia. The annual medical costs per beneficiary averaged $5,600 per year, which is very similar to the average estimates for CLD and IHD. Extrapolating these prevalence and average cost estimates to the entire noninstitutionalized population of adults over 65 in 2000, we estimate aggregate medical costs associated with pneumonia to be $10 billion (shown in Table 4-21).

The prevalence of pneumonia was found to be significantly higher among males and among those in the higher age categories. For women 65 to 74, rates of pneumonia were about 3.3 percent compared to 4.1 percent for males of the same ages. For those 85 years and older, rates of pneumonia were 8.2 and 12.3 percent, respectively, for females and males. The average medical costs for pneumonia showed relatively little variation across age and gender categories, varying between $5,100 and $6,000.

4.5.2 Direct Costs: Self-Administered Prescription Drugs and Nursing Home Care

We used the 2000 MEPS to assess the incremental prescription drug costs associated with pneumonia and the 1999 NNHS to estimate incremental nursing home costs associated with pneumonia. As described in Table 4-23, our findings suggest that excess prescription drug costs for people who reported having pneumonia during the study year were fairly low and were only significantly different from zero for females in the 75 to 84 years age group. However, estimated incremental costs for the full over-65 population with a pneumonia diagnosis are significantly different from zero—about $300 per person per year.

Incremental nursing home costs for people who had pneumonia were generally positive and quite large, ranging from about $3,500 for the oldest females to $15,000 for 75 to 84 year-old males. Although none of the estimates is significantly different from zero, the large standard errors on the mean estimate are due in large part to the wide variation in nursing home costs and the relatively small number of individuals who had pneumonia as a diagnosis. For the total population over 65 years, the incremental cost estimates suggest that a pneumonia diagnosis is associated with significantly higher nursing home costs, averaging about $5,000 per person per year.

Table 4-22. Direct Medical Costs Associated with Pneumonia—Number of Beneficiaries and Average Medical Payments by Type of Service and Age-Gender Category

	Beneficiaries with a Diagnosis			Direct Medical Costs ($/Person/Year)	
	Number	Percent	95%CI (±)	Mean	95%CI (±)
Total	1,386,567	5.3	(5.2,5.4)	5,623	(5,305, 5,940)
Type of Medical Service					
Inpatient	646,530	2.5	(2.4, 2.6)	11,028	(10,436, 11,619)
Physician	1,078,170	4.1	(4.0, 4.2)	310	(295, 324)
Hospital outpatient	321,993	1.2	(1.2, 1.3)	298	(252, 344)
Home health	111,684	0.4	(0.4, 0.5)	1,837	(1,662, 2,012)
Durable medical equipment	28,733	0.1	(0.1, 0.1)	1,089	(834, 1,345)
Age-Gender Category					
Age 65–74 Years					
Male	241,755	4.1	(3.9, 4.4)	5,626	(4,903, 3,650)
Female	229,631	3.3	(3.1, 3.5)	5,103	(4,341, 5,866)
Age 75–84 Years					
Male	270,826	7.1	(6.8, 7.5)	5,915	(4,935, 6,894)
Female	306,271	5.2	(4.9, 5.4)	5,638	(5,018, 6,2596)
Age 85+ Years					
Male	125,536	12.3	(11.4, 13.3)	5,394	(4,707, 6,082)
Female	212,548	8.2	(8.0, 9.0)	5,950	(5,275, 6,564)

Note: Geographic weights used to obtain unbiased nationally representatives estimates for Medicare elderly population.

Table 4-23. Other Direct Costs Associated with Pneumonia—Incremental Cost Estimates for Prescription Medications and Nursing Home Services by Age-Gender Category

	Prescription Drug Incremental Costs			Nursing Home Incremental Costs		
Age	Sample Size	Mean ($/Person/ Year)	95% CI (±)	Sample Size	Mean ($/Person/ Year)	95% CI (±)
Age 65+ years	145	$302	(64, 540)	175	$4,987	(824, 9,151)
Age 65–74 years						
Male	26	($199)	(–490, 91)	11	($5,160)	(–23,978, 13,658)
Female	48	$348	(–193, 889)	8	$3,995	(–4,739, 12,730)
Age 75–84 years						
Male	18	$214	(–166, 595)	24	$14,890	(–868, 30,648)
Female	35	$882	(489, 1276)	30	$4,182	(–7,699, 16,064)
Age 85+ years						
Male	6	($293)	(–665, 79)	34	$4,968	(–2,685, 12,621)
Female	12	$42	(–530, 616)	68	$3,486	(–2,057, 9,028)

Notes:. Pneumonia diagnosis based on ICD-9 code of 480-486 and 487. Sample weights used and complex survey design taken into account in calculating standard errors. () denotes a negative value.

4.5.3 Indirect Costs: Morbidity

Because pneumonia was not reported in the NHIS, we were unable to estimate the costs of increased morbidity attributable to pneumonia.

4.5.4 Indirect Costs: Mortality

Mortality costs represent the present value of all future earnings (earnings and household productivity) losses resulting from pneumonia, discounted at 5 percent. These costs are reported in Table 4-24 and are estimated to exceed $916 million in labor market earnings losses alone. The present value of earnings and household productivity losses resulting from pneumonia deaths is almost $4.7 billion. The estimated number of deaths with pneumonia indicated as the cause of death is approximately 83,000, with over half of deaths occurring among those 85 years and older.

Table 4-24. Mortality-Related Indirect Costs Associated with Pneumonia—Estimated Aggregate Productivity Losses by Age Category

Age	Number of Deaths	Aggregate Labor Productivity Losses (in 1,000s)	Aggregate Labor and Household Productivity Losses (in 1,000s)
Age 65+ years	83,264	$915,661	$4,695,729
Age 65–74 years	10,408	$530,854	$1,981,091
Age 75–84 years	28,789	$384,807	$2,714,638
Age 85+ years	44,067	$0	$0

Notes: Pneumonia diagnosis in mortality data is based on ICD-9 code of 480-486

4.6 Gastrointestinal Illness

Of the six health conditions examined in this report for older Americans, gastrointestinal illnesses are estimated to impose the lowest aggregate cost burden; however, the costs are still substantial. As summarized in Table 4-25, we estimated that in 2000 approximately 0.8 million older Americans experienced gastrointestinal illnesses that were severe enough to seek medical attention, and we calculated aggregate direct and indirect costs from gastrointestinal illness in this population to be approximately $1 billion (even excluding nursing home and morbidity related indirect costs)..

Table 4-25. Costs of Illness Associated with Gastrointestinal Illness—Estimated Aggregate Costs in 2000 for Individuals 65 and Older

Cost Category	Number of Affected Individuals	Mean Cost ($/person)	Aggregate Costs
Direct Costs			
Medical	813,519	$1,160	$943,681,600
Prescription drug	813,519	$76	$61,827,415
Nursing home	35,520	—	—
Indirect Costs			
Morbidity	813,519	—	—
Mortality	573	—	$38,675
Total Costs of Illness	—	—	$1,005,547,690

Notes: Nursing home costs and morbidity related indirect costs not estimated due to lack of sufficient data.

4.6.1 Direct Costs: Medical

Table 4-26 summarizes our estimates of medical costs associated with gastrointestinal illness for Medicare fee-for-service beneficiaries in 2000. We estimate that over 600,000 (2.4 percent of) beneficiaries aged 65 and older experienced gastrointestinal illness that was severe enough to seek medical attention. Of the six conditions analyzed in this report, gastrointestinal illness imposes the lowest annual medical costs per affected beneficiary, averaging less than $1,200 per year. When these prevalence and average cost estimates were extrapolated to the entire noninstitutionalized population of adults over 65 in 2000, we estimate aggregate medical costs associated with gastrointestinal illness to be $0.9 billion (shown in Table 4-25).

Table 4-26. Direct Medical Costs Associated with Gastrointestinal Illness—Number of Beneficiaries and Average Medical Payments by Type of Service and Age-Gender Category

	Beneficiaries with a Diagnosis			Direct Medical Costs ($/Person/Year)	
	Number	Percent	95% CI (±)	Mean	95% CI (±)
Total	633,816	2.4	(2.3,2.5)	1,160	(1,057, 1,264)
Type of Medical Service					
Inpatient	153,738	0.4	(0.4, 0.5)	5,217	(4,860, 5,574)
Physician	474,861	1.8	(1.7, 1.9)	132	(125, 139)
Hospital outpatient	184,115	0.7	(0.7, 0.7)	316	(280, 353)
Home health	11,066	0.0	(0.0, 0.1)	2,505	(1,546, 3,464)
Durable medical equipment	188	0.0	(0.0, 0.0)	793	(–1,012, 2,597)
Age-Gender Category					
Age 65–74 Years					
Male	10,530	1.8	(1.6, 1.9)	642	(386, 900)
Female	175,163	2.5	(2.3, 2.7)	1,133	(908, 1,358)
Age 75–84 Years					
Male	100,098	2.6	(2.4, 2.9)	1,031	(824, 1,238)
Female	156,930	2.6	(2.5, 2.8)	1,375	(1,175, 1,574)
Age 85+ Years					
Male	29,546	3.0	(2.4, 3.4)	1,272	(1828, 1,717)
Female	67,049	2.3	(2.3, 2.9)	1,685	(1,372, 1,999)

Note: Geographic weights used to obtain unbiased nationally representatives estimates for Medicare elderly population.

Prevalence rates for gastrointestinal illness were found to be very similar across age and gender categories. Only in the 65 to 74 age category were prevalence rates significantly different between men and women, with rates for females at 2.5 percent compared to 1.8 percent for males. As with most other conditions, the average medical costs for gastrointestinal illness showed relatively little variation across age and gender categories, varying between $600 and $1,700 per beneficiary in 2000.

4.6.2 Direct Costs: Self-Administered Prescription Drugs and Nursing Home Care

Our analysis of prescription drug costs from the 2000 MEPS, summarized in Table 4-27, suggests that the excess costs associated with gastrointestinal illness among those 65 to 74 years of age is $200 to $750 per person for year. For the other age groups, our incremental cost estimates and the associated confidence intervals indicate that prescription drug costs for those with a gastrointestinal illness diagnosis are not significantly different from the prescription costs of those without a gastrointestinal diagnosis.

Table 4-27. Other Direct Costs Associated with Gastrointestinal Illness—Incremental Cost Estimates for Prescription Medications and Nursing Home Services by Age-Gender Category

	Prescription Drug Incremental Costs			Nursing Home Incremental Costs		
Age	Sample Size	Mean ($/Person/ Year)	95% CI (±)	Sample Size	Mean ($/Person/ Year)	95% CI (±)
Age 65+ years	165	$76	(–101, 253)	32	$22,495	(–593, 45,582)
Age 65–74 years						
Male	34	$749	(438, 1,059)	2	—	—
Female	56	$215	(–167, 596)	1	—	—
Age 75–84 years						
Male	22	$181	(–327, 690)	4	$45,552	(–57,356, 148,461)
Female	44	($198)	(–489, 93)	11	$11,281	(–6,671, 29,233)
Age 85+ years						
Male	3	($685)	(–944, -425)	1	—	—
Female	6	$266	(–605, 1,137)	13	$35,123	(–13,532, 83,779)

Notes: Gastrointestinal illness diagnosis based on ICD-9 codes of 001-009 and 558. Sample weights used and complex survey design taken into account in calculating standard errors. () denotes a negative value.

Our analysis of the excess nursing home costs associated with gastrointestinal illness also produced small age and sex subgroups and large resulting standard errors. For the 65 to 74 years age group, only three individuals had a diagnosis of gastrointestinal illness; these observations were excluded from our analysis. For the over-65 nursing home population with a diagnosis of gastrointestinal illness, estimated incremental costs exceeded $22,000. This estimate was not quite statistically significant and may be driven in large part by the presence of other comorbidities that make nursing home residents more susceptible to gastrointestinal illnesses. Given the small number of observations and large standard errors, it is difficult to draw any conclusions about the likely impact of gastrointestinal illness on nursing home costs; therefore, these estimates are not included in our aggregate cost estimates.

4.6.3 Indirect Costs: Morbidity

Gastrointestinal illness was not reported in the NHIS. Consequently, we were unable to estimate the costs of increased morbidity attributable to gastrointestinal illness.

4.6.4 Indirect Costs: Mortality

As shown in Table 4-28, the estimated number of deaths in 2000 with gastrointestinal illness as the cause was much lower than estimated deaths for the other five conditions. We estimated that about 570 deaths among those 65 years and older were due to gastrointestinal illness. Because over half of those deaths occurred in the 85 years and older age group, the estimated indirect costs resulting from gastrointestinal illness mortality are much lower than for the other conditions—a present value of $7.8 million in labor productivity losses and $38.7 million in labor and household productivity losses combined.

Table 4-28. Mortality-Related Indirect Costs Associated with Gastrointestinal Illness—Estimated Aggregate Productivity Losses by Age Category

Age	Number of Deaths	Aggregate Labor Productivity Losses (in 1,000s)	Aggregate Labor and Household Productivity Losses (in 1,000s)
Age 65+ years	573	$7,837	$38,675
Age 65–74 years	98	$4,999	$18,656
Age 75–84 years	212	$2,838	$20,019
Age 85+ years	263	—	—

Notes: Gastrointestinal illness diagnosis in mortality data is based on ICD-9 codes of 004 and 006-009 and excludes 001-003, 005, and 558.9. Mortality related indirect costs for 85+ not estimated due to lack of data on expected productivity for this age group.