

Estimating the Cost of Cancer: Results on the Basis of Claims Data Analyses for Cancer Patients Diagnosed With Seven Types of Cancer During 1999 to 2000

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ABSTRACT

Purpose

Cancer accounts for \$60.9 billion in direct medical costs and \$15.5 billion for indirect morbidity costs. These estimates are derived primarily from national surveys or Federal databases. We derive estimates of the costs of cancer using administrative databases, which include claims and employment-related information on individuals insured by private or Medicare supplemental health plans.

Methods

A retrospective matched-cohort control analysis was performed using 1998 to 2000 databases with information on insurance claims, benefits, and health productivity for 3 million privately insured employees, their dependents, and early retirees. Study patients had new diagnoses of one of seven types of cancer ($n = 12,709$). Controls without cancer were matched at a 3:1 ratio by demographics. A variable follow-up length was used (maximum of 2 years). Direct costs included health care costs for patients and deductibles and copayments for caregivers. Indirect costs of work absence and short-term disability (STD) were calculated for a subgroup of cancer patients and caregivers.

Results

Mean monthly health care costs ranged from \$2,187 for prostate cancer to \$7,616 for pancreatic cancer, most often driven by hospitalization. Costs for controls were \$329 per month. Indirect morbidity costs to employees with cancer averaged \$945, a result of a mean monthly loss of 2.0 workdays and 5.0 STD days.

Conclusion

The economic burden of cancer is substantial. It is feasible to derive tumor-specific estimates of direct and indirect costs for large numbers of cancer patients using administrative databases. Policy makers charged with providing annual cost-of-cancer estimates should incorporate data obtained from a broad range of sources.

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INTRODUCTION

More than 1.3 million people in the United States were diagnosed with cancer in 2003, and the incidence of cancer continues to increase. Cancer is among the most significant contributors of health care spending in the United States, with the National Institutes of Health estimating its costs in 2002 at \$171.6 billion, \$60.9 billion of which was attributed to direct medical costs, \$15.5 billion of which was attributed to indirect morbidity costs, and \$95.2 of which was attributed to indirect mortality costs.¹

The economic burden of cancer is usually measured by cost-of-illness methods developed by Rice et al.² In response to a congressional mandate, these estimates are summarized and reported periodically by National Institutes of Health investigators. The primary data source has been national survey information, sometimes combined with claims data, such as the Surveillance, Epidemiology, and End Results (SEER)–Medicare data sets. These estimates have limitations, primarily related to the source databases. Direct medical cost estimates based on the National Medical Expenditure

Survey and National Hospital Discharge Survey address inpatient care only.³ SEER-Medicare direct medical cost estimates include information on older persons with cancer who reside only in the 11 regions contained in the SEER databases in the 1990s.⁴ Most of the 40% of cancer patients in the United States who are younger than 65 years of age are not covered by Medicare and would not be included in SEER-Medicare studies. Indirect morbidity costs are based on self-reported work disability obtained from the National Health Interview Survey,⁵ which are likely to understate the actual number of disability days for cancer because they report days lost from all illnesses. In 2001, Hayman et al⁶ reported on caregiver costs using relatively dated information from 1993, collected in the first wave of the Asset and Health Dynamics Study.

Herein, we describe a methodology and data source for estimating the direct medical costs and indirect morbidity costs of seven types of malignant neoplasms. Our data were obtained from reviews of insurance claims and work productivity information from 1998 to 2000 for 3 million individuals with private or Medicare supplemental insurance throughout the United States. Our cancer cost estimates were derived using case-control analysis, a methodology that has been applied in only a few studies.⁷⁻¹⁰ These findings provide an example of how the next wave of costs of cancer estimates can be augmented with readily available information obtained from databases that have not been used in previous cost estimation efforts.

METHODS

The study population consisted of newly diagnosed cancer patients with one of seven selected tumors. A retrospective matched-cohort control study comparing these patients and controls without cancer was performed. The difference in costs between cancer patients and controls was assumed to be attributable to cancer. Data used for the analysis were derived from the MarketScan 1998 to 2000 Commercial Claims and Encounters (CCAE), Medicare Supplemental and Coordination of Benefits, and Health and Productivity Management databases.

These databases represent the health services of approximately 3 million employees, dependents, and retirees in the United States, with primary or Medicare supplemental coverage through privately insured fee-for-service, point of service, or capitated health plans. The CCAE and Medicare supplemental databases are generally representative of the US population in terms of sex (49% male). The mean ages of the CCAE and Medicare populations were 34 and 74 years, respectively. A higher concentration of MarketScan patients reside in the southern United States (50%) than the general population. All enrollment records and inpatient, outpatient, ancillary, and drug claims were collected. A subset of these 3 million individuals (n = 350,000) also contributed data to the Health and Productivity Management database, which contained workplace absence and short-term disability (STD) data from January to December 1999.

The study population consisted of persons with newly diagnosed cancer with one of seven selected tumors (primary malig-

nant neoplasms of the brain; colorectal, lung, ovarian, pancreatic, or prostate cancer; or non-Hodgkin's lymphoma [NHL]) during 1999 and 2000. These cancers were chosen because large numbers of individuals were affected (colorectal, lung, or prostate cancer); prior studies reported high costs (ovarian or pancreatic cancer); or no prior cost estimates had been reported (brain or NHL). The International Classification of Diseases (9th revision, clinical modification [ICD9-CM]) diagnoses used to identify patients are listed in Table 1. Patients with multiple types of chemotherapy were classified as having indolent NHL. Patients with multiple cancers were classified according to the cancer diagnosis that first

Table 1. Demographic and Baseline Clinical Characteristics of the Study Population

Characteristic	Controls (n = 38,127)		Total Cancer* (n = 12,709)	
	No. of Patients	%	No. of Patients	%
Sex				
Male	27,032	70.9	8,918	70.2
Female	11,095	29.1	3,791	29.8
Insurance plan type				
Capitated	5,565	14.6	1,864	14.7
Noncapitated	32,562	85.4	10,845	85.3
Medicare coverage				
	21,521	56.5	7,120	56.0
Geographic region				
Northeast	8,884	23.3	2,991	23.5
North central	12,658	33.2	4,008	31.5
South	14,183	37.2	4,876	38.4
West	2,050	5.4	666	5.2
Unknown	352	0.9	168	1.3
Age, years				
Median		69		67
SD		13.2		12.6
Charlson comorbidity index				
Mean		0.6		0.9
SD		1.3		1.5
Days of follow-up				
Mean		328.4		328.2
SD		193.1		199.4
Cancer stage				
Early to mid-stage	NA	NA	9,763	76.9
Late stage	NA	NA	2,946	23.2
Type of cancer (ICD9-CM code)				
Brain (191.xx)	NA	NA	653	5.1
Colorectal (153.xx, 154.0x, 154.1x)	NA	NA	2,860	22.5
Lung (162.2x, 162.3x, 162.4x, 162.8x, or 162.9x)	NA	NA	2,040	16.1
Ovarian (183.xx)	NA	NA	440	3.5
Pancreatic (157.xx)	NA	NA	412	3.2
Prostate (185.xx)	NA	NA	5,250	41.3
NHL, aggressive (200.0x-200.2x, 200.8x, 202.9x)	NA	NA	356	2.8
NHL, indolent (202.0x, 202.1x, 202.3x-202.6x, 202.8x)	NA	NA	698	5.5

Abbreviations: SD, standard deviation; ICD9-CM, International Classification of Diseases (9th revision, clinical modification); NA, not applicable; NHL, non-Hodgkin's lymphoma.

*Includes all patients with NHL, lung, colorectal, pancreatic, ovarian, brain, and prostate cancers.

appeared in the claims. The study population was restricted to those patients who, in the year before the initial cancer diagnosis, had no other cancer diagnoses or treatments. Study patients were required to have at least one subsequent cancer claim (diagnosis or treatment) in the 3 months after initial diagnosis to ensure that the initial claim was not a follow-up visit for a patient in remission or a visit for a diagnosis to be ruled out. Patients with any claims for unidentifiable antineoplastic agents ($n = 795$; 6% of the eligible population) were excluded from the analysis.

For each selected tumor group, study patients were matched 3:1 to controls according to age, sex, geographic region, type of health plan, and length of follow-up. Age and length of follow-up were allowed to vary by up to 2.5% between matched patients. Claims of the control groups, spanning the longest possible lengths of available pre- and follow-up periods (January 1998 to December 2000), were reviewed to verify the absence of any cancer. The subset of individuals eligible for indirect costs analysis was not matched.

Clinical characteristics included summary information on cancer stage, comorbidities, and treatments. Cancer stage was assigned using Medstat's Disease Staging algorithm.¹¹ All patients were classified as stage 1 on cancer diagnosis. Advancement to stage 2 required spread of the neoplasm within the affected organ system or extensive display of the symptoms of carcinoma. Stage 3 patients experienced failure of the affected organ, shock, or metastasis to other organ systems. Patients were classified as reaching stage 4 if the data indicated the patient died in-hospital and a cancer diagnosis was listed on the claim indicating hospital mortality. Patients classified as stage 1 or 2 were considered to have early- to mid-stage cancer, and the remaining patients were considered to have late-stage cancer. A Charlson comorbidity index (CCI) was constructed for each patient in the prestudy period and the study period.¹²

Patients were observed from initial diagnosis until in-hospital death, enrollment ended, or the database ended (maximum length was 2 years). Resource use and costs were summarized for each patient and control group. Cost estimates were based on paid amounts of adjudicated claims, including insurer and health plan payments, copayments, and deductibles. The costs paid to providers for medical treatment were considered the direct medical costs. Copayments and deductibles for health care received by dependents were assessed as a measure of direct costs to caregivers. Summary statistics were standardized as the number of services or dollars per month across all patients and controls, regardless of whether a patient or control had the service.

Indirect costs were measured by days absent from work and STD days per month. A daily wage was assigned to each study patient or caregiver by matching to average Bureau of Labor Statistics wages by sex, age category, and geographic region. Because the population of patients and caregivers with absenteeism or STD data was substantially smaller than the number of patients available for direct cost analysis, indirect cost analysis was performed on the aggregate level rather than by tumor type.

To determine statistical significance between the patient and control groups in the descriptive analysis, χ^2 tests and two-sided t test were employed for categorical and continuous variables, respectively. Regression-adjusted total direct costs per month and across the study period were computed for each tumor type using fixed multivariate models with variable inclusion based on a priori hypotheses. Models included sex, age, health plan type, geographic region, CCI, length of follow-up, and in-hospital mortality as

covariates. Length of follow-up was included as a covariate to adjust for differences in follow-up duration due to censoring.

Cost models were performed separately for cancer patients and controls for two reasons: both populations were matched on the majority of the covariates, and the cost data distributions for the populations were different. An ordinary least squares model with a natural logarithmic transformation of the dependent variable (total direct costs) was found to be the most appropriate based on total explained variance of the costs. The logged predicted values were then transformed into actual costs via exponentiation and application of a smearing estimate.¹³ Eight patients with extreme outlier monthly direct costs ($> \$250,000$ or $\$0/\text{mo}$) were excluded from the multivariate analysis. Two-part models were used to estimate the costs for controls because of left-skewed distribution. The first part of the two-part model was a logistic regression to estimate the probability of having costs greater than zero. The second part of the model performed an ordinary least squares regression on the log transformation of costs among controls with costs greater than zero. Retransformed and predicted monthly direct costs for cancer patients were then compared with those of the controls using a t test.

Multivariate models to predict demographically and clinically adjusted absence and STD costs did not have sufficient statistical power to produce statistically sound estimates because of a limited number of covariates and small sample size. More stable unadjusted results of indirect costs were reported instead. The descriptive and multivariate analyses were performed with SAS version 8.2 software (SAS Institute, Cary, NC).

RESULTS

The overall sample for direct costs estimations of selected tumors consisted of 38,127 controls and 12,709 cancer patients. Table 1 depicts the cancer and control populations. The majority of cancer patients (77%) had early- to mid-stage disease on initial diagnosis of cancer. The median age ranged from 57 to 69 years for the cancer patients and 57 to 70 years for controls. The mean follow-up was 11 months.

Direct Medical Costs

Cancer patients had significantly higher ($P < .05$) monthly resource use rates than their control counterparts with the exception of intensive care unit admissions (data not shown). Cancer patients averaged a monthly mean of 3.5 additional inpatient days and 4.1 additional outpatient visits compared with controls. However, medical care use varied according to diagnosis. The mean number of monthly inpatient days ranged from 1.9 days for prostate cancer to 7.1 days for pancreatic cancer, whereas for outpatient visits, the monthly mean ranged from 3.2 for prostate cancer to 10.6 for aggressive NHL.

Over the course of the study, the regression-adjusted mean direct medical cost of all tumor groups combined was \$32,629 and \$3,218 for controls ($P < .0001$; Table 2). The mean monthly incremental costs ranged from \$1,844 for prostate cancer to \$7,282 for pancreatic cancer.

Total direct costs were evaluated according to types of services and insurance coverage. The largest component of

Table 2. Regression-Adjusted Mean Total Direct Medical Costs in the Study Population*

Patient Cohort	No. of Patients	Total Cost per Month (US \$)		Total Costs per Study Period (US \$)	
		Mean	SD	Mean	SD
Overall					
Cancer	12,701	3,905	2,647†	32,629	17,611†
Controls	38,127	329	446†	3,218	5,485†
Incremental cost		3,576	1,293	29,411	10,003
Brain					
Cancer	652	6,364	4,423†	49,242	23,729†
Controls	1,959	277	426†	2,790	4,555†
Incremental cost		6,087	2,243	46,452	12,492
Colorectal					
Cancer	2,858	4,067	2,192†	34,155	14,997†
Controls	8,580	325	353†	3,216	4,252†
Incremental cost		3,742	1,140	30,939	8,352
Lung					
Cancer	2,038	6,520	4,511†	45,897	31,099†
Controls	6,120	339	376†	2,907	4,056†
Incremental cost		6,181	2,277	42,990	15,934
Ovarian					
Cancer	440	6,373	5,323†	54,828	34,938†
Controls	1,320	281	303†	2,849	2,991†
Incremental cost		6,092	2,587	51,979	17,650
Pancreatic					
Cancer	409	7,616	6,572†	42,890	30,883†
Controls	1,236	334	462†	2,657	5,952†
Incremental cost		7,282	3,300	40,233	16,180
Prostate					
Cancer	5,250	2,187	859†	21,468	9,516†
Controls	15,750	343	524†	3,500	5,615†
Incremental cost		1,844	625	17,968	6,803
NHL, aggressive					
Cancer	356	5,873	2,821†	53,537	28,281†
Controls	1,068	355	427†	3,324	6,019†
Incremental cost		5,518	1,461	50,213	14,128
NHL, indolent					
Cancer	698	3,878	3,236†	31,839	17,618†
Controls	2,094	289	331†	3,013	5,305†
Incremental cost		3,589	1,644	28,826	9,933

Abbreviations: SD, standard deviation; NHL, non-Hodgkin’s lymphoma; CCI, Charlson comorbidity index.

*Adjusted for sex, age, health plan type, geographic region, CCI, length of follow-up, and in-hospital mortality. Eight outliers from the cancer cohort were excluded from the multivariate analysis.

† $P < .05$.

direct medical costs was inpatient services, followed by outpatient office visits. This pattern was consistent among all selected tumors except prostate cancer. Mean monthly surgery costs ranged from \$153 for lung cancer to \$2,590 for ovarian cancer, whereas radiation therapy costs ranged from \$32 for ovarian cancer to \$694 for lung cancer (Table 3). Mean monthly costs for antineoplastic drug therapy (chemotherapy, hormone, and immunotherapy)-related office visits ranged from \$10 for prostate cancer to \$749 for ovarian cancer.

Cancer patients with Medicare coverage had significantly lower monthly expenditures than patients with commercial coverage (\$2,853 v \$5,473, respectively; $P < .0001$; data not shown). Of the cancers in this study, brain, aggressive NHL, and ovarian cancers, which have high treatment costs, were found in higher proportions in commercial patients. Medicare patients had a higher proportion of prostate cancer as well as more comorbidities at baseline.

Results from the regression models indicated that for cancer patients, higher monthly direct medical costs were significantly ($P < .05$) associated with female sex, younger age of cancer diagnosis, higher baseline CCI, shorter follow-up length, and in-hospital mortality. Similarly, these variables were significant predictors of cost in control groups, except older age (rather than younger age) at index date was associated with higher monthly costs. Capitated health care plan coverage was significantly ($P < .05$) associated with lower monthly cost levels in cancer patient groups but not in the control groups.

Indirect Costs

Among the 603 employees who were eligible for indirect cost analysis, the 127 cancer patients had notably higher absenteeism than the 426 controls, translating into higher costs (\$373 v \$101; $P < .05$; Table 4). Cancer patients had more mean monthly STD days than controls (5.2 v 0.2 days; $P < .05$), translating to mean monthly costs of \$698 among cancer patients and \$25 among the control group ($P < .05$). The mean monthly cost of deductibles and copayments was higher for caregivers of cancer patients (\$302) versus caregivers of controls (\$29). Cancer caregivers had a mean of 2.2 absence days per month versus a mean for the controls of 1.4 days per month, translating to a monthly mean of \$255 for cancer caregivers versus \$161 per month for controls. Because of small sample sizes, these differences were not statistically significant.

DISCUSSION

We estimated the incremental direct medical costs and indirect morbidity costs due to cancer for 12,701 persons with private or Medicare supplemental insurance diagnosed and treated for seven selected cancers during the years 1999 and 2000. Our findings indicate that compared with 38,129 controls, incremental monthly direct costs ranged from \$1,844 for prostate cancer to \$7,282 for pancreatic cancer. Incremental indirect medical costs to employees averaged \$945, a result of a mean monthly loss of 2 workdays and 5 STD days. Mean monthly incremental indirect morbidity costs associated with caregiving for cancer patients averaged \$94 monthly in lost income because of absenteeism and \$273 for copayments and deductibles.

In interpreting our findings, several factors should be considered. Our study represents one of the first to include

Table 3. Mean Monthly Cancer-Related Costs (US \$) by Cancer Treatment Approach Among All Cancer Patients

Type of Cancer	No. of Patients	Office Visit Associated With Antineoplastic Drug Treatment		Outpatient Pharmacy-Dispensed Antineoplastic Treatment		Radiation Treatment		Surgical Treatment	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Total cancer	12,709	186	843	13	58	397	1,194	844	7,552
Brain cancer	653	105	606	6	38	658	1,436	365	1,684
Colorectal cancer	2,860	140	617	5	31	138	685	1,986	12,942
Lung cancer	2,040	553	1,566	10	49	694	1,801	153	1,098
Ovarian cancer	440	749	1,435	7	29	32	196	2,590	8,235
Pancreatic cancer	412	360	1,104	13	44	391	1,130	1,574	19,296
Prostate cancer	5,250	10	132	22	78	461	1,168	332	1,579
NHL, aggressive	356	486	1,119	9	40	232	751	1,020	4,373
NHL, indolent	698	96	445	5	20	171	733	870	6,680

Abbreviations: SD, standard deviation; NHL, non-Hodgkin's lymphoma.

detailed direct medical, tumor-specific cost information for certain cancer types. Detailed costs for brain cancer and NHL have not been reported previously. Comparing the costs of matched cancer patients with controls estimates the incremental costs related to cancer, netting out the costs of medical care associated with other comorbid disease.⁷ A few previous studies used this type of case-control study design^{4,8-10} to quantify the costs of cancer. Brown et al⁴ reported, for example, the first-year colorectal cancer-related costs for stage II at approximately \$24,000. In managed care patients with colon cancer, Fireman et al¹⁰ estimated the incremental lifetime direct health care costs of \$42,000. In this study, incremental

direct health care costs over the study period for patients with colorectal cancer were about \$31,000. The variability among results is most probably due to differences in the data sources.

We used a single longitudinal data source with individuals of all age ranges and geographic regions, providing a more comprehensive assessment of total costs for various reasons. First, a wider age range is included in our study; most database studies were limited to patients older than 65 years. It has been reported that cancer costs vary by age,^{8,14,16} and it has been suggested that younger patients may receive more aggressive therapy.⁴ Given that the large portion of cancer patients are younger than 65 years,¹⁵ results from this study provide broader application for cost estimates. Second, previous studies were limited to a maximum of 11 states⁴ or one employer.⁹ Our study included patients from several large US employers. Third, our study analyzes payments, which are more reflective of actual costs than are charges.¹⁶

Although the goal of this study was not to compare costs between privately and Medicare-insured cancer patients, we did find significant differences. Medicare cancer patients had more comorbidities at baseline, yet their costs were half that of commercial patients. This difference may be a result of different rates of cancer types by age, different payments negotiated by Medicare, or younger patients receiving more aggressive treatments. Because Medicare patients in this study have supplemental insurance, we captured prescription drug costs, a component that is often missing in other data describing patients covered only by Medicare, but is crucial in the public debate about future Medicare coverage.

Common cancer services, including antineoplastic drug therapy, radiation therapy, and surgery, were reviewed. A small number of cancer cost studies included similar types of information. Although Thorpe and

Table 4. Monthly Indirect Costs to Employees and Indirect and Direct Out-of-Pocket Costs to Caregivers (US \$)

Patient Cohort	No. of Patients	Costs per Month: Employee Patients		No. of Patients	Costs per Month: Employee Caregivers	
		Mean	SD		Mean	SD
Absenteeism						
Cancer	127	373	709*	58	255	566*
Controls	426	101	335*	190	161	430*
Incremental cost		272	440		94	465
Short-term disability						
Cancer	349	698	1,242*	NA	NA	NA
Controls	1,180	25	220*	NA	NA	NA
Incremental cost		673	623	NA	NA	NA
Copays and deductibles						
Cancer	NA	NA	NA	58	302	634*
Controls	NA	NA	NA	190	29	76*
Incremental cost	NA	NA	NA		273	312

NOTE. Adjusted for sex, age, health plan type, geographic region, CCI, length of follow-up, and in-hospital mortality.

Abbreviations: SD, standard deviation; NA, not applicable; CCI, Charlson comorbidity index.

* $P < .05$ in comparing each cancer with tumor-specific control.

Howard¹⁸ estimated that inpatient care accounts for 68% of the total costs of medical care for privately insured cancer patients, they were unable to provide estimates by cancer type. For pancreatic cancer patients, Wilson and Lightwood³ estimated that hospital costs accounted for 77% of total direct costs. In this study, we estimated that inpatient care accounted for approximately 58% of the total direct medical costs. This trend was consistent across all tumors except prostate cancer. Of the three common cancer treatments, cancer-related surgery and radiation contributed the most toward total direct medical costs, whereas costs for office visits to administer antineoplastic drugs contributed the least. Of those receiving antineoplastic drug therapy, nearly all (99%) received it in an outpatient setting sometime during their treatment.

Few studies to date have examined the impact of cancer on STD. In one analysis of employer records, chemotherapy patients averaged between \$947 and \$1,047 per month in lost work due to STD, depending on the incidence of complications.¹⁸ Another study of six large US employers showed that, despite a relatively low prevalence rate, colorectal cancer ranked among the top 20 most expensive conditions to the employer.¹⁹ The average annual health care and disability costs for cancer patients to a large employer were estimated to be five times higher than those for employees without cancer.⁹ We estimated that the indirect costs of cancer, using actual employer records, were nearly four times higher for absenteeism and 28 times higher for STD than those of controls.

The majority of studies on the cost burden to caregivers were based on surveys of small convenience samples.²⁰⁻²² Although most studies have focused on the lost wages of the family caregiver, Stommel et al²⁰ also estimated that the cost of care to families as caregiver labor and out-of-pocket expenditures during 3 months of cancer treatment. Of the \$4,563 mean total lost to the family, the proportion due to out-of-pocket expenditures (\$660) was small relative to caregiver labor costs (\$2,612). Our study indicates the out-of-pocket costs of deductibles and copayments paid by caregivers were comparable to wages lost and should be considered when evaluating the overall burden of cancer.

The limitations of our study should be noted. Although the database allowed for the analysis of a large sample of cancer patients from across the United States, only patients with commercial health coverage or private Medicare supplemental coverage were included. Because our database contained claims for employees, their dependents and early retirees, the age distributions of some cancers (colorectal, pancreatic, lung, and NHL) was younger than those reported by the National Cancer Institute; thus, our results for those tumors maybe overestimated.²³ The study popu-

lation was limited to the seven tumor types and does not represent a broad group of patients with any type of cancer. Although the disease staging algorithm was applied to identify stage of the disease, only broad categories of stages could be assigned, and we were not able to determine precise disease stages. The database did not include information on patient race or ethnicity, or income, limiting the number of important covariates to be included in multivariate analyses. To identify incident cases, we selected patients with no record of cancer in the year before their initial diagnosis. This criterion seemed reasonable for most of the tumor types; however, patients who experienced disease relapse and who were in remission longer than 1 year could have been included. Patients were observed from initial diagnosis of cancer for up to 2 years, with a mean of 11 months of follow-up. Thus, study period cost estimates do not cover the lifetime costs of many individuals with cancer diagnoses that have fairly long expected survival estimates, such as NHL or prostate cancer. For persons with cancer diagnoses of fairly short survival (ie, advanced lung, colorectal, pancreatic, or brain cancers), censoring is not likely to have had a large effect on the derived cost estimates. For other persons, our study results, when updated using more analyses of more recent data, will provide better estimates of lifetime cancer costs. Results from the indirect cost analysis should be interpreted with caution because information was available for only a small proportion of patients, data on long-term disability and reason for termination of employment were not available, and controls used for these analyses were not matched. Therefore, we reported only descriptive estimates of indirect costs.

In conclusion, our study estimates the direct medical and indirect morbidity costs for a range of cancer patients on the basis of sociodemographic characteristics, geography, and cancer type. The economic burden attributed to the seven types of cancers is considerable and indicates a need for increased prevention, earlier diagnosis, and new therapies that may assist in reducing direct and indirect costs. Policy makers charged with providing estimates of cancer costs to Congress would be wise to incorporate data obtained from a range of data sources for a more comprehensive picture of the economic burden of cancer.

Authors' Disclosures of Potential Conflicts of Interest

The following authors or their immediate family members have indicated a financial interest. No conflict exists for drugs or devices used in a study if they are not being evaluated as part of the investigation. Performed contract work within the last 2 years: Stella Chang, Eli Lilly & Co; Stacey R Long, Eli Lilly & Co; William Crown, Eli Lilly & Co.

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