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State-Level Estimates of Cancer-Related Absenteeism Costs

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Abstract

Background—Cancer is one of the top five most costly diseases in the United States and leads to substantial work loss. Nevertheless, limited state-level estimates of cancer absenteeism costs have been published.

Methods—In analyses of data from the 2004–2008 Medical Expenditure Panel Survey, the 2004 National Nursing Home Survey, the U.S. Census Bureau for 2008, and the 2009 Current Population Survey, we used regression modeling to estimate annual state-level absenteeism costs attributable to cancer from 2004 to 2008.

Results—We estimated that the state-level median number of days of absenteeism per year among employed cancer patients was 6.1 days and that annual state-level cancer absenteeism costs ranged from $14.9 million to $915.9 million (median = $115.9 million) across states in 2010 dollars. Absenteeism costs are approximately 6.5% of the costs of premature cancer mortality.

Conclusions—The results from this study suggest that lost productivity attributable to cancer is a substantial cost to employees and employers and contributes to estimates of the overall impact of cancer in a state population.

Cancer is one of the top five most costly diseases in the United States.[1] For example, in 2007, the total direct cost of cancer treatment in the United States was estimated to be $103.8 billion, and the cost of lost productivity from premature deaths attributed to cancer was estimated to be $123.0 billion,[2] and is projected to increase to $147.6 billion by 2020.[3] In addition, cancer generates lost productivity costs associated with missed work among employed cancer patients (ie, absenteeism).[4–9] Of all US residents in whom cancer was diagnosed from 2005 through 2009, 46.8% were younger than 65 years at the time of diagnosis.[10] Nevertheless, despite published evidence of the large direct and indirect

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(premature mortality, absenteeism) economic costs associated with cancer at the national level and evidence of direct costs at the state level,[11,12] to our knowledge there has not been an analysis of state-level cancer absenteeism costs.

To fully understand the total economic cost of cancer to society, it is important to know the value of missed workdays among employed cancer patients. Thus, the purpose of this study is to estimate annual state-level costs of cancer-related absenteeism. Our costs were estimated as the value of lost productivity to employees and employers that could be averted if cancer were prevented. To our knowledge, this is the first study to examine the productivity loss attributable to missed workdays among cancer patients at the state level.

METHODS

Overview

We estimated state-level cancer absenteeism costs in two steps. First, we estimated the "treated cancer prevalence rate" (ie, the percentage of a state's residents who had been treated for cancer within the previous year) and the average number of cancer-attributable days of absenteeism per person treated in the previous year, by age group (18 to 44, 45 to 64, or ≥65 years) and sex (male or female). Second, we estimated the total state-level costs of cancer-attributable absenteeism for each age/sex group by multiplying the state population by the treated cancer prevalence rate, the percentage of cancer patients who were employed, the average duration of cancer-related absenteeism, and the average wages for each age/sex group, and then adding the costs for all age/sex groups.

Estimates of the Percentage of State's Residents Treated for Cancer

To estimate the average annual percentage of state's residents who had been treated for cancer from 2004 through 2008, we used data from the "Medical Condition files" of the 2004–2008 Medical Expenditure Panel Survey (MEPS),[13] a nationally representative survey of the civilian noninstitutionalized population administered by the Agency for Healthcare Research and Quality. MEPS respondents self-reported their conditions, or those of household members, and these reported conditions were then assigned codes from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM), and grouped into clinically meaningful categories using Clinical Classification Codes.[14] Cancer was defined using ICD-9-CM codes on the basis of any diagnosis of cancer (including nonmelanoma skin cancer), either at admission or at the time of the survey and primary or secondary diagnosis. We define persons treated for cancer as individuals with a medical event with Clinical Classification Codes of 11 through 43 and 45 during the interview year. This definition includes both new and existing cancers.

Because sample sizes were too small to estimate the percentage of MEPS respondents treated for cancer directly by age, sex, and region, we used logistic regression models to estimate the percentage of MEPS respondents treated for cancer. The logistic regression models were adjusted for survey year and survey participants' age, sex, and region of residence (ie, Northeast, South, Midwest, or West). Preliminary stepwise regressions were performed to identify statistically significant age-by-sex-by-region interactions (at $\alpha = 0.05$)

for which there was sufficient sample size and power to detect differences in treated cancer prevalence. The nationally representative average treated population prevalence for 2004 to 2008 was predicted from the final, survey-weighted logistic regressions for each age, sex, and region combination. These estimates reflected additional adjustments accounting for cancer prevalence among nursing home residents using data from the 2004 National Nursing Home Survey (NNHS) and the same ICD-9-CM codes as in MEPS.[15] For each age and sex group, the treated population prevalence from MEPS was scaled by the ratio of the number of people with cancer in MEPS and the NNHS to the number of people with cancer in MEPS alone. These methods have been used in earlier studies of state-level direct costs of cancer.[11,12]

Estimates of Cancer-Attributable Absenteeism

We used a negative binomial regression model to estimate the average annual number of days of work missed because of illness among participants in the 2004–2008 MEPS. Negative binomial models, an extension of Poisson models, are used when the dependent variable is a count (ie, a nonnegative integer). The model for workdays missed was estimated for the adult working population from the MEPS. The dependent variable was the annual number of workdays missed because of illness or injury from the Household Component survey. All regressions were adjusted for the following variables (n = 59,368): age; age squared; sex; race/ethnicity (white non-Hispanic [reference], black, white Hispanic, and other race/ethnicity); education (missing, less than high school, high school, college degree [reference], graduate degree, other degree, and younger than 16 years); household income (<100% of poverty line, 100% to 200% of poverty line, 200% to 400% of poverty line [reference], and >400% of poverty line); health insurance status (Medicaid, uninsured, private insurance, and other insurance—not mutually exclusive); family size; occupation (professional occupations, management/business/finance, sales, clerical, construction/extraction/maintenance, production/transportation/material moving, service industry, farming/fishing/forestry, military, unclassified, and missing occupation [reference]); survey year; and indicator variables for cancer, arthritis, asthma, back problems, congestive heart failure, chronic obstructive pulmonary disease, coronary heart disease, depression, diabetes, dyslipidemia, HIV/AIDS, hypertension, injuries, other cardiovascular disease, other mental health/substance abuse, pneumonia, pregnancies, renal failure, skin disorders, and stroke.

Standard calculations of attributable costs can double-count costs in nonlinear regression models with multiple medical conditions.[16] One way to avoid double-counting is to use the regression model to predict absenteeism for every combination of observed conditions. We estimated days of absenteeism attributable to cancer by comparing predicted days of absenteeism for people with each unique combination of diseases with predicted days of absenteeism for people without that combination of diseases while holding all other variables constant. For example, we considered cancer alone and cancer with hypertension as two different combinations of diseases. We then divided the total number of days of absenteeism attributable to the combinations of diseases back to the constituent diseases (ie, a share of all cancer with hypertension disease absenteeism that are attributable to cancer). The process attributes a greater share of the absenteeism for the combination of diseases to the disease with the larger coefficient in the regression.[16] We then estimated average annual per-person days of cancer-attributable absenteeism (excess number of days missed because of cancer) for each age/sex/region category on the basis of coefficients from the national model.

Population, Employment, and Wage Estimates

Our estimates of total state populations and state populations broken down by sex and age for 2008 were based on 2008 U.S. Census Bureau estimates.[17] To estimate the number of people in each age/sex/state category who had been treated for cancer in 2008, we multiplied our estimates of the treated cancer prevalence rate for each age/sex category by our estimates of the total number of people in the corresponding age/sex/state category.

Our estimates of the percentage of people treated for cancer who were employed, by age and sex, were obtained from the 2004–2008 MEPS. Because we adjusted our estimates of treated cancer prevalence rates upward to account for cancer cases among nursing home residents, we used the 2004 NNHS to include nursing home residents in our count of nonemployed patients in the denominator in determining the percentage of cancer patients who were employed. Our estimates of average daily earnings by sex/age/state were taken from the 2009 Current Population Survey; nevertheless, these estimates did not reflect the cancer status of survey participants.[18]

For each age and sex group, we calculated total absenteeism costs attributable to cancer by multiplying (1) the total number of people in that group who had been treated for cancer (obtained by multiplying the state population by the treated cancer prevalence rate) by (2) the percentage of those treated for cancer who were employed by (3) the average annual number of workdays missed per employed person because of cancer by (4) the average daily earnings of US workers. We then added our estimates of absenteeism costs for state residents in each age/sex group to produce our overall estimates of state-level absenteeism costs. All cost estimates are expressed as 2010-equivalent dollars using the gross domestic product general price index as recommended by the Agency for Healthcare Research and Quality to reflect more current dollar values.[19]

Because of the large number of data sources that we used to produce our estimates, we could not generate standard errors for our estimates of cancer-attributable absenteeism costs. Nevertheless, because the MEPS was our primary source of data, we were able to generate standard errors for our estimates of treated cancer prevalence rates.

RESULTS

Adjusting for personal characteristics, the rate of workdays missed for people with cancer was 2.87 ($P = 0.00$) times higher than for people without cancer (Table 1). Other covariates in the regression had the expected impact on absenteeism. The rate of workdays missed were higher for people with the included medical conditions, older workers, females, blacks, lower education, lower income, and the uninsured.

Our state-level estimates of average annual treated cancer prevalence rates during 2004 to 2008 ranged from 3.2% in Utah to 5.1% in Florida (median = 4.2%; relative standard error =

8%) (Table 2). Estimates of the average annual number of employed residents treated for cancer ranged from 9808 in Wyoming to 618,312 in California (median = 78,485). Estimates of the average annual number of days of work missed because of cancer per employed resident ranged from 5.9 days in Utah to 6.3 days in Ohio (median = 6.1 days) (Table 2). Estimates of the total average annual number of days of work missed because of cancer during 2004 to 2008 ranged from 59,302 days in Wyoming to 3,726,439 days in California (median = 482,730). Estimates of total annual cancer-attributable absenteeism costs ranged from $14.9 million in Wyoming to $915.9 million in California (median = $115.9 million) in 2010 dollars.

DISCUSSION

Our findings indicated that in the median state, US workers treated for cancer missed an average of 6.1 days of work per year because of cancer during 2004 to 2008 and that the annual state-level cost of cancer-related absenteeism to employees and employers ranged from $14.9 million in Wyoming to $915.9 million in California.

Estimates of cancer treatment costs are important in estimating the total economic costs of cancer.[12,20–25] Nevertheless, these estimates do not reflect the complete picture of the economic burden of cancer because they do not include cancer-related productivity costs from sick leave, ineffective presence in the workplace, disability, premature death, and intangible costs associated with psychological pain and stress by cancer patients. Results of several studies[4–9,26,27] have shown substantial absenteeism associated with cancer, and the indirect costs of cancer (including absenteeism) has generally been shown to be greater than the direct costs of cancer.[2] The National Institutes of Health estimated that in 2007 the overall cost of cancer in the United States was $226.8 billion: $103.8 billion for direct medical costs (all cancer-related health expenditures) and $123.0 billion for indirect costs attributable to the lost productivity of workers who die from cancer before the age of 65 years, which does not include absenteeism among survivors.[2] The sum of our state-level absenteeism costs equals $8.1 billion or approximately 6.5% of the costs of premature cancer mortality.

Hansen et al[28] conducted a study to examine whether physical fatigue, depression, anxiety, and cognitive limitations were differentially associated with work limitations in breast cancer survivors in comparison to a noncancer group of employed workers. Their study indicated that cancer survivors reported greater work limitations than a noncancer comparison group and that the breast cancer survivor group reported more time off. Hansen et al[28] examined the individual contributions of symptom burden on work limitations, but they did not estimate the number of days missed, nor the dollar value of missed workdays to the employer and employee.

Other studies have also shown substantial absenteeism associated with other chronic diseases.[29–31] Waehrer et al[29] estimated and compared costs (including employer productivity losses and other indirect costs such as victim productivity losses and administrative costs) of occupational injury and illnesses within the health services sector. They reported high and variable costs within the health services sector across occupations, industries, sex, race, and types of nonfatal injuries and illnesses. Ozminkowski et al[30] estimated relative medical expenditures, absenteeism costs, and short-term disability benefit cost burden of rheumatoid arthritis (RA) for nine major US employers and employees by comparing costs for workers with RA versus a matched group of workers who did not have RA. They found that employees with RA had higher average absenteeism cost. Carls et al[31] estimated the impact of medication adherence on absenteeism and short-term disability among employees with chronic diseases. Their study results indicated that nonadherent working patients with chronic diseases realized between 1.7 and 7.1 more days absent from work than adherent employees. All these studies confirm the link between chronic diseases and missed workdays.

Our estimates of the average number of days per year that employees with cancer were absent from work because of their cancer were somewhat lower than previous estimates. For example, across all cancer sites, Finkelstein et al[7] estimated that individuals undergoing *active* cancer care missed an average of 22.3 more workdays per year than those without cancer. Fu et al[8] estimated that privately employed women with breast cancer had an average of 14 days of absenteeism and 46 days of short-term disability attributable to their breast cancer in the *first year* after diagnosis. There are at least three reasons that our estimates of cancer-attributable days of absenteeism tended to be lower than the estimates from other studies. First, we minimized potential double-counting of days missed when multiple diseases were included in the regression model.[16] Second, our estimates of cancer-related absenteeism were based on all types of cancer combined (including nonmelanoma skin cancer) rather than on specific types of cancer. Cancers of specific sites are likely to lead to more absenteeism (eg, breast cancer) or less absenteeism (eg, nonmelanoma skin cancer) than the average for all types of cancer combined. Had we excluded nonmelanoma skin cancer from our analysis, the prevalence estimates could have dropped by about 29% (2.6% to 1.8%) and the mean days missed could have increased by about 28% (9.3 to 11.9). Third, because we did not have information on MEPS respondents' timing of diagnosis or cancer stage, our absenteeism estimates were the average for all treatment phases and stages. Per-person estimates from the MEPS may not fully reflect the high-intensity initial and last year of life phases. Nevertheless, different stages are treated with different intensity of treatment and modality, leading to differences in absenteeism. Fourth, our estimates are an average across all employed persons, both full-time and part-time. We used average daily earnings for an entire day's work, on the basis of average hourly earnings across all employed persons (full-time and part-time). The inclusion of part-time workers may have lowered estimates of absenteeism and wages relative to studies that only included full-time workers.

With almost half of all cancer diagnoses occurring among US residents younger than 65 years,[10] it is clear that cancer-related absenteeism cost has a significant economic impact on US employees and employers. Our findings underscore the need for increased investments in cancer prevention and control programs. Through prevention and early detection, such investments are likely to increase worker productivity and reduce the costs associated with worker absenteeism.

LIMITATIONS

The MEPS, our primary data source, has at least four notable limitations that may have affected our estimates: (1) its results are subject to sampling error, which creates uncertainty around the estimates; (2) its participants' reports of their cancer status were not verified by chart review; (3) its small sample sizes precluded us from stratifying our estimates of cancer costs by type of cancer; and (4) cancer stage is not included in the survey. Our definition of treated prevalence was based on treatment in the prior year; as a result, our estimates likely represent a higher cost population than estimates that include people who have not sought treatment recently.

Moreover, because we generated state estimates from a national model, differences in our estimates of state-level absenteeism costs were primarily a reflection of differences in population size and the distribution of demographic characteristics rather than differences in cancer prevalence or work practices. Although we adjusted state-level estimates of treated prevalence rates to account for regional differences in these rates, our results probably understate the true differences in state-level work patterns. Our adjustments for regional differences used stepwise regression, which is atheoretical when selecting explanatory variables for an outcome. We were only interested in identifying the number of dimensions among age, sex, and region for which our data would support stratifying treated cancer prevalence.

Another limitation to our cost estimates is that they do not reflect the overall indirect costs of cancer, which, in addition to the costs of cancer-related absenteeism, include their permanent exit from the labor force through retirement or death and their potentially lower productivity while at work, as well as costs attributable to time away from work among caregivers of cancer patients.

CONCLUSIONS

This study adds to the current literature describing the absenteeism cost related to cancer. Our results showed that the median annual state-level cost estimates of cancer-related absenteeism were substantial, $115.9 million in 2010 dollars. State-level estimates of cancer-attributable absenteeism costs can complement state-level estimates of other cancer costs to provide a more comprehensive picture of the financial impact of cancer in a state population. Absenteeism from cancer costs states through lost wages, taxes, and output. The implications of this work suggest that more work to reduce the morbidity burden of cancer could lower the economic burden of cancer substantially. Strategies to reduce cancer morbidity include increased primary prevention—through vaccines and risk factor modifications, detection of cancers at an early stage when treatments are most likely and less costly, and delivery of effective treatments. This study highlights the need for such interventions given the high costs of cancer and provides an important baseline for understanding the impact of cancer prevention and control efforts on cancer-related absenteeism costs at the state level. Decision makers can use the information as a basis to compare the costs and benefits of interventions to determine the best way of allocating resources among competing priorities.

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Learning Objectives

- Summarize the new state-level data on missed work days attributable to cancer, along with their contribution to the total societal cost of cancer.
- Identify median absence days associated with cancer and related costs, along with the extent of variation between states.
- Discuss the study implications for efforts to reduce the burden of morbidity associated with cancer

TABLE 1

Incident Rate Ratios for Workdays Missed From Negative Binomial Regression Using Medical Expenditure Panel Survey, 2004 to 2008

	Workdays Missed (*n* = 59,368)	
Variable	**Incidence Rate Ratio**	***P***
Conditions		
Cancer	2.87	0.00
Hypertension	1.28	0.00
CHD	2.03	0.00
Stroke	4.15	0.00
CHF	1.90	0.03
Other heart disease	1.45	0.00
Diabetes	1.50	0.00
Arthritis	1.94	0.00
Asthma	1.58	0.00
Depression	1.89	0.00
HIV	4.10	0.00
Cholesterol	1.04	0.51
Injury	3.56	0.00
Pneumonia	3.13	0.00
COPD	1.63	0.00
Mental health/substance abuse	1.55	0.00
Pregnancy	9.95	0.00
Back condition	2.12	0.00
Skin condition	1.29	0.00
Renal failure	3.35	0.00
Age		
Age	1.05	0.00
Age squared	1.00	0.00
Sex		
Male*	1.00	–
Female	1.25	0.00
Race/ethnicity		
White non-Hispanic*	1.00	–
Black	1.20	0.00
White Hispanic	0.93	0.12
Other race/ethnicity	1.02	0.66
Education		
Missing degree status	1.16	0.50
Less than high school	1.16	0.03
High school	1.25	0.00

	Workdays Missed (*n* = 59,368)	
Variable	**Incidence Rate Ratio**	***P***
College degree*	1.00	–
Graduate degree	0.97	0.58
Other degree	1.15	0.02
Younger than 16 y	1.10	0.65
Household income		
Less than 100% of poverty line	1.27	0.00
100–200% of poverty line	1.06	0.22
200–400% of poverty line*	1.00	–
Greater than 400% of poverty line	0.83	0.00
Insurance†		
Medicaid	0.94	0.59
Uninsured	1.36	0.01
Private insurance	1.16	0.17
Other insurance	0.91	0.32
Family size	0.93	0.00
Occupation		
Professional occupations	1.00	0.94
Management/business/finance	0.94	0.33
Sales	0.99	0.85
Clerical	1.15	0.04
Construction/extraction/maintenance	1.19	0.01
Production/transportation/material moving	1.23	0.00
Service industry occupation	1.07	0.28
Farming/fishing/forestry	1.01	0.95
Military	0.45	0.03
Unclassified	0.81	0.14
Missing occupation status*	1.00	–
Year		
2004	1.02	0.61
2005	1.01	0.91
2006	1.04	0.37
2007	0.96	0.32
2008*	1.00	–
Constant	0.26	0.01

*Reference category.

†Insurance categories are not mutually exclusive.

CHD, coronary heart disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; HIV, human immunodeficiency virus; y, years.

TABLE 2

State-Level Estimates of Average Annual Treated Cancer Prevalence Rates, Days of Work Missed Because of Cancer, and Cancer-Related Absenteeism Costs During 2004 to 2008*

State	Treated Cancer Prevalence Rate,%	Average Annual Number of Workdays Missed per Employed Residents With Cancer	Total Number of Annual Workdays Missed Because of Cancer	Total Annual Cancer-Related Absenteeism Cost, Million $
Alabama	4.4	6.2	524,539	126.4
Alaska	3.3	6.0	70,518	17.5
Arizona	4.2	6.0	666,176	165.2
Arkansas	4.5	6.1	316,197	76.5
California	3.8	6.0	3,726,439	915.9
Colorado	3.8	6.0	522,825	129.1
Connecticut	4.5	6.1	450,845	109.0
Delaware	4.5	6.2	99,415	24.0
District of Columbia	4.1	6.1	64,602	15.1
Florida	5.1	6.2	2,108,964	513.5
Georgia	3.7	6.1	1,016,925	242.6
Hawaii	4.5	6.1	141,147	35.1
Idaho	4.0	6.0	157,395	39.2
Illinois	3.7	6.2	1,328,230	310.8
Indiana	3.8	6.3	668,260	157.2
Iowa	4.2	6.3	320,838	76.0
Kansas	3.9	6.2	289,571	68.2
Kentucky	4.4	6.2	482,730	116.6
Louisiana	4.2	6.1	483,083	115.9
Maine	4.9	6.2	182,330	44.6
Maryland	4.2	6.2	637,044	152.9
Massachusetts	4.5	6.1	830,786	199.8
Michigan	4.0	6.3	1,080,661	254.9
Minnesota	3.9	6.2	551,638	130.3
Mississippi	4.2	6.2	316,196	75.8
Missouri	4.0	6.3	634,139	149.2
Montana	4.6	6.1	112,746	28.4
Nebraska	3.9	6.2	184,386	43.5
Nevada	3.9	6.0	272,970	68.0
New Hampshire	4.5	6.1	174,862	42.6
New Jersey	4.4	6.1	1,099,225	265.3
New Mexico	4.2	6.1	213,074	52.8
New York	4.4	6.1	2,464,358	591.8
North Carolina	4.2	6.1	1,017,731	244.6
North Dakota	4.2	6.2	68,022	16.1
Ohio	4.0	6.3	1,246,113	293.5

State	Treated Cancer Prevalence Rate,%	Average Annual Number of Workdays Missed per Employed Residents With Cancer	Total Number of Annual Workdays Missed Because of Cancer	Total Annual Cancer-Related Absenteeism Cost, Million $
Oklahoma	4.3	6.1	397,721	96.1
Oregon	4.4	6.1	426,211	106.1
Pennsylvania	4.8	6.1	1,624,511	394.4
Rhode Island	4.6	6.1	134,531	32.4
South Carolina	4.4	6.2	507,582	122.3
South Dakota	4.1	6.3	84,843	20.1
Tennessee	4.4	6.2	702,399	169.5
Texas	3.7	6.1	2,443,337	584.0
Utah	3.2	5.9	239,192	58.2
Vermont	4.7	6.2	85,282	20.8
Virginia	4.2	6.1	865,665	208.1
Washington	4.1	6.1	719,538	178.5
West Virginia	4.9	6.2	217,513	53.1
Wisconsin	4.0	6.2	606,030	143.4
Wyoming	4.2	6.0	59,302	14.9
Median	4.2	6.1	482,730	115.9

*Analyses adjusted for the following variables: age; age squared; sex; race/ethnicity; education; family income; health insurance status; survey year; and indicators variables for cancer, arthritis, asthma, back problems, congestive heart failure, chronic obstructive pulmonary disease, coronary heart disease, depression, diabetes, dyslipidemia, HIV/AIDS, hypertension, injuries, other cardiovascular disease, other mental health/substance abuse, pneumonia, pregnancies, renal failure, skin disorders, and stroke.