

The Personal Financial Burden of Cancer for the Working-Aged Population

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A diagnosis of cancer is a life-changing event that leads to major alterations in the physical and psychological health of patients with cancer. Those diagnosed as having symptomatic tumors are often sick and unable to work. Asymptomatic patients diagnosed through screening may not be ill but are likely to experience treatment-related adverse effects that may interfere with the ability to work. In either case, the cancer diagnosis leads to increased medical expenditures and, for those in the labor market, may lead to a decreased ability to work and maintain one's primary source of health insurance given that most workers today obtain insurance through their employer.¹⁻⁵

The focus of this study is to provide nationally representative estimates of the effect of cancer care on the following 3 important outcomes for the working-aged population: employment, out-of-pocket (OOP) medical expenditures, and workdays missed because of illness or injury. Previous studies of the costs of cancer have focused exclusively on medical costs¹⁻³ or productivity costs^{6,7} or have been limited in geographic coverage.⁵

Although our estimates are based on cross-sectional prevalence rather than incidence, we use information on the types of cancer care received to quantify the effects for those actively being treated for cancer and for those in subsequent treatment phases. To our knowledge, this is the first study to report population-based nationally representative estimates of the effect of cancer on medical expenditures and labor market outcomes. These results allow for quantifying the cost implications of different treatment phases after a positive cancer diagnosis and can be used to assess the financial implications of how proposed changes to current healthcare financing and delivery will affect the roughly 10.5 million Americans living with cancer and the 1.4 million who are likely to be diagnosed in any given year.⁸

METHODS

Pooled data from the 2000-2005 Medical Expenditure Panel Survey (MEPS) were used for the analysis. The MEPS is a nationally representative survey of the civilian noninstitutionalized population administered by the Agency for Healthcare Research and Quality. The MEPS provides data on participants' utilization of medical services and corresponding medical costs. It quantifies total annual medical spending, including insurance spending and annual OOP

Objective: To present nationally representative estimates of the effect of cancer care on out-of-pocket medical expenditures and lost productivity for the working-aged population.

Study Design: Secondary data analysis.

Methods: Pooled data from the Medical Expenditure Panel Survey were used for the analysis. We constructed the following 4 respondent groups for comparison during the analysis period: (1) respondents with no cancer, and (among those who reported having cancer) (2) respondents with active cancer care, (3) respondents with follow-up cancer care, and (4) respondents with no cancer care. Using regression analysis, we estimated the effect of being in each of the cancer care groups on out-of-pocket medical expenditures, the probability of being employed, and the annual number of workdays missed because of illness or injury.

Results: Being actively treated for cancer increases the mean annual out-of-pocket medical expenditures by \$1170 compared with not having cancer. Less intensive cancer care is associated with lower medical expenditures (but still higher than for those without cancer). Respondents undergoing active cancer care were less likely to be employed full-time. Among respondents who were employed, those undergoing active cancer care missed 22.3 more workdays per year than those without cancer.

Conclusion: Changes to the health system need to consider not only how to reduce inappropriate medical utilization but also how to ensure that those diagnosed as having cancer and other serious medical conditions will not be doubly burdened with poor health and high medical expenditures.

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Take-Away Points

Increased out-of-pocket medical expenditures and the potential for reduced earnings suggest that a cancer diagnosis will lead to financial hardship at a time when an individual's health and earning potential are most at risk.

- Respondents undergoing active cancer care were less likely to be employed full-time compared with those not having cancer.
- Among respondents who were employed, those undergoing active cancer care missed 22.3 more workdays per year than those without cancer.
- Changes to the health system need to consider not only how to reduce inappropriate medical utilization but also how to ensure that those diagnosed as having cancer will not be doubly burdened with poor health and high medical expenditures.

ditures, (2) the probability of being employed, and (3) the annual number of workdays missed because of illness or injury. A 2-part regression model was used for OOP medical expenditures. The first part of the 2-part model used logistic regression analysis to predict the probability of any OOP expenditures, and the second part analyzed OOP expenditures among those with any

spending. The latter includes copayments, deductibles, and payments for noncovered services. The costs captured by the MEPS represent payments (not charges) from the payer to the provider. These are obtained through a combination of self-report and validation from payers (eg, private insurers). All US dollar amounts were inflated to 2005 using the medical care Consumer Price Index.⁹ The data also include information on each respondent's health insurance status, source of payment, employment status and wages, and demographic characteristics (eg, race/ethnicity, sex, and education). Because we focused on medical expenditures and labor market outcomes, the study sample was restricted to working-aged participants (age range, 25-64 years) (N = 89,520).

Medical conditions are identified in the MEPS medical condition files based on self-reports of conditions affecting the respondent within the interview year. Medical conditions are classified using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes based on self-reported conditions that were transcribed by professional coders. In addition to ICD-9-CM codes, the MEPS medical conditions files report clinical classification codes that aggregate ICD-9-CM codes into clinically meaningful categories.¹⁰ We defined cancer using clinical classification codes 11 through 43 and code 45. Because of differences in care and prognosis, nonmelanoma skin cancer was included as a regressor but was not included in our cancer estimates.

We constructed the following 4 respondent groups for comparison during the analysis period: (1) respondents who did not report having cancer (n = 87,580); and (among those who reported having cancer) (2) respondents with a claim for active cancer care (ie, inpatient stay, chemotherapy, radiation therapy, surgery, or prescription for antineoplastic agents) during the survey year (n = 679); (3) respondents with a claim for follow-up cancer care, defined as any claim for a service not listed as active care with a cancer diagnosis (n = 968); and (4) respondents without a claim for cancer care during the survey year (n = 293).

Using regression analysis, we estimated the effect of being in each of the cancer care groups on (1) OOP medical expen-

OOP expenditures. To select the appropriate cost estimation model for the second part of the 2-part model, we used the algorithm for choosing among alternative nonlinear estimators recommended by Manning and Mullahy.¹¹ Results of those tests led us to use a generalized linear model with log link and gamma variance function. The analysis sample for OOP expenditures totaled 69,107. A logistic model was used to estimate the effect of cancer care on the probability of being employed at some point in the survey year. The annual number of workdays missed because of illness or injury was defined as the number of times the respondent lost a half day or more from work because of illness, injury, or mental or emotional problems and was modeled using a negative binomial model. The analysis sample for the number of workdays missed was restricted to the employed (n = 65,692).

In addition to the cancer indicators, the models controlled for potentially costly or prevalent medical conditions and demographic variables. Regression analyses included the following comorbidities as independent variables: nonmelanoma skin cancer, heart disease, congestive heart failure, hypertension, stroke, high cholesterol, human immunodeficiency virus/AIDS, diabetes mellitus, injuries, pneumonia, chronic obstructive pulmonary disease, asthma, depression, other mental health or substance abuse disorders, arthritis, pregnancy, back problems, and renal failure.

Consistent with prior studies, regression analyses also included the following demographics as independent variables: age, age squared, sex, study year indicators, census region (Northeast [referent], Midwest, South, or West), race/ethnicity (white [referent], black, Hispanic, Asian, or other), education (education missing, less than high school, high school diploma, or beyond high school [referent]), and primary source of insurance, defined as coverage during any part of the year (uninsured [referent], Medicaid, private insurance, or other).

As a sensitivity check, we also examined our outcomes using propensity score matching, which selects comparison groups for each cancer category from the set of individuals without cancer based on the estimated propensity of being

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Table 1. Out-of-Pocket Medical Expenditures and Employment by Cancer Treatment Category Among Respondents of the 2000-2005 Medical Expenditure Panel Survey

Variable	No Evidence of Cancer (n = 87,580)	Active Cancer Care (n = 679)	Follow-Up Cancer Care (n = 968)	No Cancer Care (n = 293)
Proportion paying out of pocket, %	76.1	99.0 ^a	98.1 ^a	90.1 ^a
Out-of-pocket medical expenditures, mean (SD), 2005 US\$	540 (1280)	1730 (2710) ^a	1180 (2970) ^a	860 (1340) ^a
Employment				
Employed, %	83.3	73.5 ^a	75.9 ^a	76.5 ^a
Workdays missed, mean (SD)	4.1 (14.3)	20.8 (37.6) ^a	5.5 (13.9) ^b	4.4 (11.3)
Demographics				
Age, mean (SD), y	42.6 (10.6)	50.0 (10.1) ^a	48.7 (10.5) ^a	45.8 (11.1) ^a
Sex, %				
Female	53.2	69.1 ^a	73.3 ^a	79.5 ^a
Male	46.8	30.9 ^a	26.7 ^a	20.5 ^a
Race/ethnicity, %				
White	56.1	71.4 ^a	72.8 ^a	71.7 ^a
Black	13.9	12.2	8.4 ^a	7.8 ^a
Hispanic	24.2	11.5 ^a	14.9 ^a	16.7 ^a
Asian	4.1	2.9	2.6 ^b	2.0 ^c
Other	1.7	1.9	1.3	1.7
Education, %				
Missing	0.4	0.1	0.1	0.0
<High school	19.8	11.8 ^a	12.6 ^a	16.4
High school complete	49.0	51.0	47.0	51.9
≥College	30.8	37.1 ^a	40.3 ^a	31.7
Insurance, %				
Medicaid	9.7	14.3 ^a	11.3	12.6 ^c
Private	69.0	75.4 ^a	75.5 ^a	69.3
Other insurance	1.1	2.5 ^a	2.6 ^a	0.7
Uninsured	20.2	7.8 ^a	10.6 ^a	17.4
Comorbidities, %				
Nonmelanoma skin cancer	7.5	14.1 ^a	13.4 ^a	13.0 ^a
Heart disease	4.0	10.5 ^a	9.4 ^a	9.2 ^a
Congestive heart failure	0.2	0.6 ^c	1.0 ^a	0.7
Hypertension	14.4	26.1 ^a	22.5 ^a	19.5 ^b
Stroke	0.4	1.5 ^a	1.0 ^a	1.0 ^c
High cholesterol	7.8	15.3 ^a	13.9 ^a	10.9 ^b
Human immunodeficiency virus/AIDS	0.2	0.3	0.2	0.0
Diabetes mellitus	5.6	9.6 ^a	6.7	7.2
Injuries	17.2	19.9 ^c	20.7 ^a	15.7
Pneumonia	1.2	3.2 ^a	2.1 ^b	2.0
Chronic obstructive pulmonary disease	3.9	5.9 ^a	6.4 ^a	6.8 ^a
Asthma	3.8	6.0 ^a	6.9 ^a	7.8 ^a
Depression	1.2	2.2 ^b	1.2	2.7 ^b
Other mental health or substance abuse disorders	10.0	18.4 ^a	17.0 ^a	17.4 ^a
Arthritis	10.1	16.6 ^a	19.2 ^a	16.7 ^a
Pregnancy	3.7	1.5 ^a	2.0 ^a	4.4
Back problems	11.4	15.0 ^a	15.9 ^a	13.0
Renal failure	0.2	0.6 ^a	0.2	0.3

^aStatistically different from the noncancer group at the 99% level.

^bStatistically different from the noncancer group at the 95% level.

^cStatistically different from the noncancer group at the 90% level.

Table 2. Regression Analysis Results for Out-of-Pocket Medical Expenditures, Employment, and Workdays Missed Among Respondents With Cancer Relative to Respondents Without Cancer^a

Dependent Variable	Mean (SE)		
	Active Cancer Care	Follow-Up Cancer Care	No Cancer Care
Out-of-pocket medical expenditures, 2005 US\$	1170 (160) ^b	430 (60) ^b	240 (90) ^c
Employment, yes or no	-0.033 (0.017) ^d	-0.018 (0.014)	-0.009 (0.025)
Workdays missed	22.3 (3.4) ^b	1.3 (0.7) ^c	-0.6 (0.4)

^aAll regression analyses control for nonmelanoma skin cancer, heart disease, congestive heart failure, hypertension, stroke, high cholesterol, human immunodeficiency virus AIDS, diabetes mellitus, injuries, pneumonia, chronic obstructive pulmonary disease, asthma, depression, other mental health or substance abuse disorders, arthritis, pregnancy, back problems, renal failure, age, age squared, sex, race/ethnicity (white [referent], black, Hispanic, Asian, or other), education (education missing, less than high school, high school diploma, or beyond high school [referent]), census region (Northeast [referent], Midwest, South, or West), and study year indicators. The employment and missed workdays models also include controls for primary source of insurance (uninsured [referent], Medicaid, private insurance, or other).

^bStatistically different from the noncancer group at the 99% level.

^cStatistically different from the noncancer group at the 95% level.

^dStatistically different from the noncancer group at the 90% level.

in each cancer care category.¹² Unlike regression models, propensity score matching restricts comparisons between respondents in our different groups to those with significant overlap in the independent variables. We estimated separate propensity scores for each cancer care group (ie, the probability of being in a cancer care group) using a probit model with the same set of explanatory variables as in the regression models. Nearest neighbor matches based on predicted propensity scores were used with 5 control matches for every respondent in the cancer care group. Contracting the number of matches to 1 and expanding the number of matches to 10 did not alter the results.

RESULTS

Without adjusting for confounders, the mean OOP expenditures are higher, employment is lower, and missed workdays are more frequent for those with cancer compared with those without cancer, and these are increased with more intensive cancer care (Table 1). The mean annual OOP medical expenditures for a respondent with cancer in the active care group were \$870 higher than those for a respondent in the no cancer care group (ie, those who once had cancer but are not currently receiving treatment) and \$1190 higher than those for a respondent without evidence of cancer. Respondents receiving active cancer care missed a mean of 16.7 more workdays per year than respondents without evidence of cancer (20.8 compared with 4.1 workdays). However, respondents with cancer differed from the noncancer group in other dimensions. They were more likely to be older, female, white, and insured and to have higher education and other comorbidities.

After controlling for observable differences between the cancer and noncancer samples, estimates from the 2-part regression model reveal that being actively treated for cancer increases the mean annual OOP medical expenditures by \$1170

compared with not having cancer (Table 2). Approximately 10% of actively treated patients with cancer are estimated to have OOP medical expenditures exceeding \$2000 (data not shown). Less intensive cancer care is associated with lower OOP medical expenditures, but they are still higher than expenditures for those without cancer (\$460 higher per year for patients receiving follow-up cancer care and \$290 higher per year for patients receiving no cancer care) (data not shown).

Regression analysis results also reveal that, compared with those without cancer, patients undergoing active cancer care have a 3.3% absolute (4.5% relative) decrease in the probability of employment. There are no statistically significant effects of cancer on employment for the other 2 cancer care groups. Among respondents who were employed, those undergoing active cancer care missed 22.3 more workdays per year than those without cancer (Table 2). Follow-up cancer care is associated with about 1 more workday missed per year compared with those without cancer.

The propensity matching model produces estimates that are slightly smaller than the regression model estimates for OOP expenditures and workdays missed and slightly larger in absolute value for employment, with point estimates not statistically significantly different from the regression estimates (Table 3). The primary patterns remain for individuals receiving active care for cancer: their OOP medical expenditures are higher than those for individuals without cancer (and these expenditures increase with the intensity of care received), and individuals who are employed miss significantly more days from work.

DISCUSSION

These results reveal the financial implications that are likely to result from a cancer diagnosis. Consider the case of a typical household earning roughly \$49,240 per year and pay-

Table 3. Propensity Score Matching Results for Out-of-Pocket Medical Expenditures, Employment, and Workdays Missed Among Respondents With Cancer Relative to Respondents Without Cancer

Dependent Variable	Mean (SE)		
	Active Cancer Care	Follow-Up Cancer Care	No Cancer Care
Out-of-pocket medical expenditures, 2005 US\$	900 (110) ^a	370 (100) ^a	180 (80) ^b
Employment, yes or no	-0.048 (0.018) ^a	-0.028 (0.020) ^c	-0.011 (0.027) ^c
Workdays missed	16.0 (1.9) ^a	0.6 (0.6)	-0.1 (1.0)

^aStatistically different from the noncancer group at the 99% level.
^bStatistically different from the noncancer group at the 95% level.
^cStatistically different from the noncancer group at the 90% level.

ing \$2630 (5% of their annual income) toward health insurance premiums, copayments, and deductibles.¹³ During years that include active cancer care, expected mean annual OOP medical expenditures increase by an additional \$1170 if 1 of the adults in the household is diagnosed as having cancer. Moreover, if the person is an hourly wage earner, self-employed, or otherwise experiences the financial loss resulting from the roughly 22 additional workdays missed (ie, does not receive paid sick leave), then annual income could be reduced to \$45,396. In this instance, the person’s increased annual healthcare bill now represents 8% of annual earnings, a significant share for almost every family. Although paid sick leave reduces the financial burden to the employee, the value of the lost work time remains unchanged, but the burden of payment shifts to the employer.

Our results are consistent with findings from a similar study¹⁴ that used data from the Health and Retirement Survey to quantify the financial and labor market outcomes resulting from the onset of serious medical conditions. That study reported that the onset of a serious illness was associated with an increase in OOP medical costs, a decrease in the likelihood of working, and a reduction in weekly hours worked. Our employment results are also consistent with findings reported by Bradley and coauthors¹⁵ that focused on labor market outcomes among Detroit, Michigan, area residents diagnosed as having breast or prostate cancer. They found that there was a dip in work and earnings 6 months after diagnosis but that employment was back up to prediagnosis levels by 1 year. Similarly, we found significant decreases in employment and increases in absenteeism only during years with active cancer care.

As already illustrated, a diagnosis of cancer can result in financial hardship at a time when an individual’s health and earning potential (through a decreased probability of employment) are reduced. Although families may be able to finance the costs via borrowing or savings, access to capital may prove difficult if the person diagnosed is the primary wage earner in the household. Moreover, our results suggest that the increased medical expenditures are likely to contin-

ue beyond the initial treatment year, possibly because of the costs of ongoing medical care and surveillance or potential increases in insurance premiums resulting from a cancer diagnosis. A cancer diagnosis may also limit insurance options in the future because insurance companies may deny coverage or charge exceedingly high rates for individuals who have had a recent cancer diagnosis.¹⁶

Looking ahead, the OOP expenditures associated with cancer care are likely to grow because of increases in the cost of procedures and drugs to treat cancer¹⁷ and the trend toward consumer-driven healthcare options such as health savings accounts and high-deductible health plans, which require greater levels of consumer cost sharing. In 2008, 6.1 million Americans were covered under these types of plans, almost 4 times as many as in 2005.¹⁸ Higher cost sharing could result in a larger financial burden for patients at a time when their ability to earn a living may be substantially reduced.

One possible solution to this problem that is consistent with consumer-driven healthcare is the broader dissemination of value-based insurance designs. Value-based insurance designs establish pricing schemes that encourage the use of “high-value” (highly cost-effective) prevention and disease management goods and services and discourage the use of low-value services.¹⁹ In value-based insurance designs, consumer cost sharing for high-value services is reduced (often to zero) to encourage their use, but cost sharing for low-value services is increased to discourage their use. An example of a high-value service is colorectal cancer screening,²⁰ while an example of a low-value service is radical prostatectomy for early-stage prostate cancer.²¹ This approach could reduce wasteful medical spending, while ensuring that those diagnosed as having serious medical conditions such as cancer will receive cost-effective care at a low OOP cost.

These analyses have strengths and limitations. The strengths include the single source of data for quantifying medical expenditures, employment, and work loss attributable to cancer. However, because the MEPS public use data files do not include information on copayments and deductibles, we could not quantify the effect of higher cost shar-

ing on these outcomes. The findings do not reflect cancer survivors who were employed but had reduced hours because of their health, which may underestimate the cost burden of cancer for these patients.²² Analysis of more specific cancer sites was not possible because of the small sample sizes within care categories. In addition, medical conditions in the MEPS are self-reported and can be used to quantify treated (or affected) prevalence only. There are likely to be individuals who had cancer at some point but, perhaps because of its long-term remission or the lack of required treatment, did not self-report it. The types of claims made within the study year were used as proxies for cancer treatment phase. Finally, the true burden of cancer includes costs for travel and child care, expenses incurred by caretakers, and nontangible amounts associated with psychological pain and stress.^{23,24} Future studies should include these additional measures of burden.

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