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# Economic Burden of Chronic Conditions Among Survivors of Cancer in the United States

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ASSOCIATED CONTENT

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**Final approval of manuscript:** All authors
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AUTHORS' DISLCSURES OF POTENTIAL CONFLICTS OF INTEREST

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## Abstract

**Purpose—**The prevalence of cancer survivorship and chronic health conditions is increasing. Limited information exists on the economic burden of chronic conditions among survivors of cancer. This study examines the prevalence and economic effect of chronic conditions among survivors of cancer.

**Methods—**Using the 2008 to 2013 Medical Expenditure Panel Survey, we present nationally representative estimates of the prevalence of chronic conditions (heart disease, high blood pressure, stroke, emphysema, high cholesterol, diabetes, arthritis, and asthma) and multiple chronic conditions (MCCs) and the incremental annual health care use, medical expenditures, and lost productivity for survivors of cancer attributed to individual chronic conditions and MCCs. Incremental use, expenditures, and lost productivity were evaluated with multivariable regression.

**Results—**Survivors of cancer were more likely to have chronic conditions and MCCs compared with adults without a history of cancer. The presence of chronic conditions among survivors of cancer was associated with substantially higher annual medical expenditures, especially for heart disease ($4,595; 95% CI, $3,262 to $5,927) and stroke ($3,843; 95% CI, $1,983 to $5,704). The presence of four or more chronic conditions was associated with increased annual expenditures of $10,280 (95% CI, $7,435 to $13,125) per survivor of cancer. Annual lost productivity was higher among survivors of cancer with other chronic conditions, especially stroke ($4,325; 95% CI, $2,687 to $5,964), and arthritis ($3,534; 95% CI, $2,475 to $4,593). Having four or more chronic conditions was associated with increased annual lost productivity of $9,099 (95% CI, $7,224 to $10,973) per survivor of cancer. The economic impact of chronic conditions was similar among survivors of cancer and individuals without a history of cancer.

**Conclusion—**These results highlight the importance of ensuring access to lifelong personalized screening, surveillance, and chronic disease management to help manage chronic conditions, reduce disruptions in employment, and reduce medical expenditures among survivors of cancer.

## INTRODUCTION

The prevalence of chronic conditions is increasing in the United States.[1] More than one quarter of all adults (26%) and nearly two thirds of adults age ≥ 65 years (61%) have multiple (two or more) chronic conditions (MCCs).[1] Chronic conditions are particularly common among the estimated 14.5 million people who have received a cancer diagnosis (survivors of cancer), nearly three quarters of whom (72%) are age ≥ 60 years.[2] MCCs in this population have wide-ranging implications for treatment decision making, health care use, disease management, and quality of life.[3]

Survivors of cancer also face economic hardship as a result of limitations in employment, reduced income, and increased out-of-pocket health care costs.[4–9] Among survivors of cancer, 32% reported limitations in daily activities, 25% reported that cancer interfered with their ability to perform required tasks, and 42% of employed survivors reported changing their work schedule because of cancer.[10] People with other chronic conditions report similar health and functional impairments that negatively affect their ability to work and increase their health care expenses. However, limited information is available on the economic burden of MCCs,[11–13] particularly among survivors of cancer.

Understanding the prevalence and burden of chronic conditions is an important consideration for national efforts, such as those by the US Department of Health and Human Services (HHS) to optimize health and quality of life among the growing population of people with MCCs.[14–16] This information can help improve patient care and care delivery and minimize the social and economic burden of lost productivity and health care costs.

The objectives of this study were to examine the prevalence of chronic conditions among adult survivors of cancer and people without a history of cancer and to estimate the effect of chronic conditions on health care use, medical care costs, and productivity loss among survivors of cancer in the United States.

## METHODS

### Data

The data source for these analyses was the 2008 to 2013 Medical Expenditure Panel Survey (MEPS) Household Component. MEPS representatives contacted a nationally representative sample of the US civilian noninstitutionalized population to collect detailed information on demographic characteristics, health status, health insurance, health care use and expenditures, and employment. In-person interviews were conducted with one person who responded for all members of the household. During the study years included in our analysis, the annual response rate ranged from 52.8% to 59.3%. Information from the Medical Provider Component was used to supplement, verify, or replace information provided by household respondents on the health services received and the cost of these services.[17] A detailed description of MEPS is available elsewhere.[18,19]

### Analytic Sample

A survivor of cancer was defined as any person who has ever been diagnosed with cancer. We identified 10,293 survivors of cancer based on the question, “Has a doctor or other health provider ever told you that you have a cancer or malignancy of any kind?” The comparison group consisted of the remaining 135,151 adults who did not report a history of cancer. Similar to previous studies, people diagnosed solely with nonmelanoma skin cancer were not classified as survivors of cancer and were put in the comparison group.[8,20]

Descriptive statistics were calculated for survivors of cancer and people without a history of cancer and compared using $\chi^2$ statistics. Sociodemographic characteristics of survivors of cancer at the time of the survey included time since diagnosis, cancer site, age, sex, race/ethnicity, educational attainment, marital status, health status, health insurance status, family

income, and the presence of chronic conditions. Chronic conditions included all those specified as priority conditions by MEPS and were identified through a series of questions about whether a physician or other health care professional ever told the person that he or she had any of the following: arthritis, asthma, diabetes, emphysema, heart disease (including coronary heart disease, angina, myocardial infarction, and other unspecified heart disease), high blood pressure, stroke, or high cholesterol. The prevalence of each condition was estimated among survivors of cancer and people without a history of cancer. The prevalence of MCCs was examined by summing the number of chronic conditions reported by each person (zero, one, two, three, or four or more conditions). All adjusted analyses controlled for survey year, age, sex, race/ethnicity, marital status, and education. Analyses were conducted using Stata, version 14.0 (StataCorp, College Station, TX).

### Health Care Use and Medical Expenditures

Several measures of health care use were examined among survivors of cancer based on the reported use of health care services in the past year. These measures were the number of ambulatory visits, including office-based provider and outpatient visits; number of emergency room visits; number of inpatient hospital nights; and number of prescription medications. Generalized linear models with a negative binomial distribution and a log link were used to estimate the number of ambulatory visits and prescription medications. Two-part models were used to estimate emergency room visits and inpatient hospital stays, given the large number of observations without any use of these services. The first part of the model used logistic regression to predict the probability of any use, and the second part estimated use with a generalized linear model with a negative binomial distribution and a log link among those with use. Total annual medical expenditures for all health care services were estimated using generalized linear models with a gamma distribution and a log link. Separate models were used to evaluate incremental health care use and medical care expenditures for each of the chronic conditions plus the incremental effect of MCCs. All medical expenditures were adjusted to 2013 US dollars using the Personal Health Care Expenditure Price Index.[21]

### Productivity Loss

Productivity loss was examined by assessing employment disability, missed work days, and additional days spent in bed among survivors of cancer. Employment disability was defined as being unable to work because of illness or injury. Lost productivity from employment disability was transformed to days by multiplying the adjusted percentage of people who reported employment disability by 260, the number of work days per year. Missed work days were defined as the number of days (half-day or more) of work that people who were employed missed because of illness, injury, or mental or emotional problems. Lost household productivity was assessed by determining the number of additional missed days, other than work or school, in which at least a half-day was spent in bed because of illness or injury. Multivariable logistic regression modeling was used to estimate employment disability, whereas generalized linear models with a negative binomial distribution and a log link were used to estimate missed work days and additional days spent in bed. Separate models were used to evaluate lost productivity for each of the chronic conditions and for the incremental effect of MCCs.

Total costs from productivity loss were calculated as the sum of productivity loss from employment disability, missed work days, and additional days spent in bed. Productivity loss from employment disability was estimated by multiplying the adjusted percentage of people who reported employment disability by the median annual wage in 2013 ($35,080) from the Bureau of Labor Statistics.[22] Lost productivity from missed work days was estimated by multiplying the adjusted mean number of missed days by the cost per day using the median hourly wage ($16.87) from the US Bureau of Labor Statistics.[22] Because MEPS does not differentiate between missed full and partial days, we assumed each missed work day to be 6 hours. Lost household productivity was calculated by multiplying the mean number of additional days spent in bed by the value of daily household productivity ($43.37 per day)[23] adjusted to 2013 US dollars using the Consumer Price Index.[24]

### Multivariable Analyses

Analyses examining the effect of chronic conditions on health care use, medical expenditures, and lost productivity among survivors of cancer were restricted to survivors of cancer. Additional analyses were performed to examine whether the economic burden of chronic conditions differed among survivors of cancer and individuals without a history of cancer. In these models, an additional dichotomous variable was included to identify survivors of cancer, and an interaction term between the dichotomous variable and chronic conditions variables that provides the incremental impact of chronic conditions related to cancer survivorship. Similar to previous studies,[25] these models were estimated using linear regression to aid in interpretation.

All adjusted estimates are presented as predictive margins, which standardizes these estimates to the covariate distribution of the overall population.[26] Statistical significance was set at $P \leq .05$, using two-tailed tests. Model goodness of fit was assessed with the Hosmer-Lemeshow test. All analyses used MEPS person-level weights to account for the complex study design and to reflect the probability of selection and adjustments for nonresponse and poststratification to provide nationally representative estimates.

## RESULTS

### Characteristics of Survivors of Cancer and People Without a History of Cancer

Compared with people without a history of cancer, survivors of cancer were more likely to be older, female, non-Hispanic white, married, and in poorer health (Table 1). Among adult survivors of cancer younger than age 65 years, the presence of four or more chronic conditions was most common among those with Medicaid (17.1%), followed by the uninsured (14.7%) and those with private insurance (11.0%; data not shown). Among survivors of cancer age ≥ 65 years, having four or more chronic conditions was more common among people with Medicare and public insurance (31.5%) than among those with Medicare and private insurance (28.6%) or Medicare only (26.5%). Among survivors of cancer, the most common cancer sites were the breast (18.3%) and prostate (13.9%). Nearly one third of survivors of cancer (30.1%) were diagnosed within the past 4 years, whereas 39.2% were diagnosed ≥ 10 years before the survey (Table 2).

### Prevalence of Chronic Conditions

Table 3 lists the unadjusted and adjusted prevalence of chronic conditions among survivors of cancer and people without a history of cancer. The unadjusted and adjusted prevalence estimates highlight the importance of controlling for differences (eg, age) between the two populations. Survivors of cancer were more likely than people without a history of cancer to have each chronic condition; after adjustment, the most common conditions for both groups were high blood pressure (35.7% *v* 32.7%, respectively), high cholesterol (35.0% *v* 30.5%, respectively), and arthritis (29.4% *v* 24.9%, respectively). Survivors of cancer were more likely to have MCCs, with 12.7% reporting four or more conditions compared with 9.5% of people without a history of cancer.

### Health Care Use and Medical Care Costs

Among survivors of cancer, having a chronic condition, particularly MCCs, was associated with increased health care use (Table 4). Survivors of cancer with four or more chronic conditions had 10.5 additional ambulatory visits (95% CI, 8.7 to 12.3 visits; $P < .001$), 0.1 additional emergency room visits (95% CI, 0.03 to 0.1 visits; $P = .002$), and 50.1 additional prescription medications (including refills) (95% CI, 45.3 to 54.9 medications; $P < .001$) per year compared with survivors of cancer without chronic conditions.

Among survivors of cancer, several chronic conditions were associated with higher medical expenditures. Heart disease ($4,595; 95% CI, $3,262 to $5,927) and stroke ($3,843; 95% CI, $1,983 to $5,704) were associated with the largest annual expenditures ($P < .001$ for both). Annual medical care costs were $10,280 (95% CI, $7,435 to $13,125) higher among survivors of cancer with four or more chronic conditions than among survivors with no chronic conditions ($P < .001$). The incremental effect of chronic conditions on health care use and expenditures was similar among survivors of cancer and individuals without a history of cancer (Appendix Table A1, online only).

### Productivity Loss

The presence of chronic conditions was associated with higher productivity loss in survivors of cancer, particularly those with MCCs (Table 5). Compared with survivors of cancer without chronic conditions, survivors of cancer with four or more chronic conditions reported an additional 56.1 days (95% CI, 45.7 to days) of productivity loss because of employment disability, 7.4 additional missed work days (95% CI, 4.5 to 10.3 days), and 18.0 additional lost household productivity days (95% CI, 13.6 to 22.4 days) each year ($P < .001$ for all). Annual lost productivity costs among survivors of cancer with four or more chronic conditions were $9,099 (95% CI, $7,224 to $10,973) higher than survivors with no chronic conditions ($P < .001$).

The majority of chronic conditions were associated with more days lost because of employment disability and lost household productivity. Stroke ($4,325; 95% CI, $2,687 to $5,964) and arthritis ($3,534; 95% CI, $2,475 to $4,593) were associated with the highest annual costs ($P < .001$ for both). The incremental effect of chronic conditions on lost productivity was largely the same among survivors of cancer and individuals without a history of cancer (Appendix Table A2).

## DISCUSSION

This study demonstrates that survivors of cancer are more likely than individuals without a history of cancer to have other chronic conditions, with 12.7% reporting four or more chronic conditions in addition to cancer. Among survivors of cancer, chronic conditions, particularly MCCs, were associated with increased health care use, medical expenditures, and lost productivity. Having four or more chronic conditions was associated with $10,280 in annual excess medical expenditures and $9,099 in excess lost productivity costs. The incremental economic burden of chronic conditions was similar among survivors of cancer and individuals without a history of cancer. However, the increased prevalence of chronic conditions among survivors of cancer and their affect underscore the importance of ongoing efforts to improve survivorship care planning and employer wellness programs to minimize the negative effects of MCCs.

Although previous studies have found that chronic conditions are associated with higher medical expenditures, more employment limitations, and lost productivity among survivors of cancer,[25,27] our study is the first, to our knowledge, to estimate the resulting lost productivity costs. We found that chronic conditions among survivors of cancer were associated with substantial lost productivity costs from employment disability, missed work days, and days spent in bed because of poor health. Our estimates of annual lost productivity costs associated with MCCs are of similar magnitude to those for excess medical expenditures, suggesting that future evaluations of interventions to manage chronic conditions include measures of productivity as outcomes.

Given the medical care needs of survivors of cancer, particularly those with chronic conditions, access to lifelong personalized screening and surveillance is needed. A higher prevalence of MCCs among survivors of cancer with Medicaid likely reflects eligibility rules that expand coverage to individuals in poor health, such as the medically needy and disabled. In addition, the higher rate of chronic conditions among survivors of cancer without health insurance underscores the importance of insurance in ensuring access to appropriate health care among this population. The Affordable Care Act (ACA) has made insurance available to more people by setting up a Health Insurance Marketplace and by providing states the opportunity to expand Medicaid. Additional components of the ACA, such as preventing insurance companies from denying coverage or charging more for pre-existing conditions, have also helped ensure access to health insurance among survivors of cancer with chronic conditions. In addition, cancer survivors with Medicare benefit from the elimination of the coverage gap in Medicare Part D to help make their prescription drugs more affordable.

The increased prevalence and burden of chronic conditions among survivors of cancer highlight the importance of chronic disease management in improving quality of life and reducing the need for care.[28] Community-based chronic disease self-management programs linked to clinical services can give survivors of cancer with chronic conditions the knowledge and skills to manage their conditions.[28] Effective self-management programs can improve quality of life and health status, while reducing health care use and improving productivity.[29–31] Our study found that the presence of MCCs among survivors of cancer is

associated with increases in the number of prescribed medications. To improve adherence and knowledgeable use of medication, reminders and patient education can be used to reduce adverse drug effects, medication errors, and chronic disease progression.[15]

The National Academy of Medicine (formally known as the Institute of Medicine) has highlighted the complexities and need for care coordination for people with MCCs, given evidence that patients who receive care for a single chronic condition may not receive care for other, unrelated conditons.[31] As part of its national initiative on MCCs, HHS released a strategic framework for maximizing care coordination and improving the health and quality of life of people with MCCs.[15] HHS also partnered with the National Academy of Medicine to identify principles and action steps to improve clinical practice guidelines for patients with MCCs and to increase the focus on patient-centered care.[14]

The ACA has accelerated efforts to coordinate and manage care for people with MCCs through models such as accountable care organizations and patient-centered medical homes.[16] Several models are being examined, such as the COME HOME program, which uses a community oncology medical home model to actively integrate changes in infrastructure, clinical, and payment systems to deliver better patient-centered, coordinated, and comprehensive care.[16,32] In addition, the ACA established a Medicaid Health Home plan that states can use to establish health homes for people with MCCs, with the goal of improving care coordination and reducing costs among populations most in need.[16,33]

Our study found that the presence of chronic conditions among survivors of cancer is associated with lower worker productivity. To help curb increasing health care costs and increase worker productivity, many businesses offer workplace wellness programs. These programs are designed to support healthy behaviors and improve health outcomes among employees and have been shown to be cost beneficial, with a positive return on investment.[34] Workplace health promotion efforts among survivors of cancer could focus on encouraging screening for secondary cancers and reducing chronic disease risk factors, such as tobacco use, physical inactivity, and poor nutrition. Despite their potential health benefits and cost savings, such programs are underused.[34] Increased efforts in this area are needed for survivors of cancer, given their increased risk of developing other chronic conditions and secondary cancers.[35–37]

Our study has limitations. First, the reliance on household-reported data introduces potential reporting biases and may reduce the reliability of some measures. However, studies have shown agreement between household reports and medical records,[38,39] including prescription drug use.[40,41] Second, our results only apply to the noninstitutionalized civilian adult population. Third, population-based household surveys generally underestimate rare and short-survival, high-cost cancers; they mainly consist of data from long-term survivors of common adult cancers many years after diagnosis.[42,43] Fourth, the MEPS does not have information on stage of cancer diagnosis or the full cancer treatment history, which may be associated with developing other chronic conditions. Fifth, our measures of lost productivity are limited and not condition specific. However, we measured lost productivity the same way for survivors of cancer and individuals without a history of cancer and examined each measure separately. Improving longitudinal measures of lost productivity is an important

area for future research. Sixth, the cross-sectional design of the study limits causal analysis. Seventh, although we control for several sociodemographic differences between survivors of cancer and individuals without a history of cancer, there may be unmeasured factors that we are unable to account for. Finally, we likely underestimated the burden of chronic conditions among survivors of cancer because we did not include patient and caregiver time and transportation costs for medical appointments and additional aspects of productivity loss.[44]

Chronic conditions are more common among survivors of cancer and are associated with increased medical expenditures and lost productivity. Access to lifelong personalized screening, surveillance, and chronic disease self-management may be effective in managing chronic conditions, reducing medical expenditures, and minimizing disruptions in employment among survivors of cancer.

## Acknowledgments

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the US Department of Health and Human Services.

## Appendix

**Table A1.**

Additional Medical Care Expenditures and Use by Select Services Among Survivors of Cancer Compared With Individuals Without a History of Cancer

| | Total Medical Expenditures | | | Ambulatory Visits* | | | Emergency Room Visits | | | Inpatient Nights | | | Prescription Medications | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Condition | Additional Cost ($) | 95% CI | *P* | No. of Additional Visits | 95% CI | *P* | No. of Additional Visits | 95% CI | *P* | No. of Additional Nights | 95% CI | *P* | No. of Additional Prescriptions | 95% CI | *P* |
| Model 1: Conditions | | | | | | | | | | | | | | | |
| High blood pressure | −509 | −1,926 to 907 | .479 | −0.5 | −1.1 to 1.0 | .934 | −0.02 | −0.06 to 0.02 | .329 | −0.05 | −0.4 to 0.3 | .796 | 1.5 | −0.2 to 3.1 | .075 |
| High cholesterol | −348 | −1,657 to 961 | .601 | −0.2 | −1.2 to 0.8 | .667 | −0.04 | −0.07 to 0.002 | .049 | −0.1 | −0.2 to 0.1 | .001 | −0.2 | −1.8 to 1.3 | .758 |
| Arthritis | −363 | −1,922 to 1,196 | .647 | 0.2 | −0.8 to 1.2 | .677 | −0.03 | −0.08 to 0.01 | .131 | −0.05 | −0.4 to 0.3 | .754 | −0.8 | −2.5 to 0.8 | .339 |
| Heart disease† | 978 | −580 to 2,536 | .217 | 1.0 | −0.2 to 2.3 | .094 | 0.03 | −0.02 to 0.08 | .266 | 0.4 | −0.03 to 0.9 | .067 | 0.6 | −1.8 to 3.0 | .635 |
| Diabetes | −226 | 2,142 to 1,689 | .816 | −0.8 | −2.2 to 0.5 | .228 | 0.01 | −0.06 to 0.07 | .818 | 0.4 | −0.3 to 1.1 | .269 | 1.2 | −1.6 to 4.1 | .382 |
| Asthma | 977 | 1526 to 3,481 | .442 | −0.01 | −1.6 to 1.6 | .991 | 0.04 | −0.04 to 0.13 | .294 | −0.1 | −0.7 to 0.5 | .773 | 3.4 | −0.3 to 7.1 | .072 |
| Stroke | −448 | −3,522 to 2626 | .774 | −0.6 | −3.1 to 1.8 | .606 | −0.02 | −0.13 to 0.08 | .654 | 0.1 | −0.9 to 1.1 | .790 | 0.1 | −4.3 to 4.5 | .961 |
| Emphysema | −1,241 | −3,552 to 1,071 | .291 | −0.6 | −2.8 to 1.6 | .599 | −0.11 | −0.2 to 0.01 | .062 | −0.4 | −1.1 to 0.4 | .359 | −1.5 | −6.7 to 3.7 | .567 |
| Model 2: No. of conditions | | | | | | | | | | | | | | | |
| 1 | −732 | −3,297 to 1,833 | .574 | 0.6 | −0.7 to 1.9 | .389 | −0.1 | −0.1 to 0.004 | .035 | −0.1 | −0.5 to 0.2 | .473 | 1.0 | −0.3 to 2.3 | .118 |
| 2 | −780 | −2,999 to 1,439 | .489 | 1.0 | −0.3 to 2.2 | .127 | −0.1 | −0.1 to 0.001 | .047 | −0.1 | −0.5 to 0.3 | .611 | 1.8 | 0.3 to 3.3 | .021 |
| 3 | −865 | −2,964 to 1,235 | .418 | 0.4 | −1.1 to 1.8 | .631 | −0.1 | −0.2 to 0.04 | .002 | 0.2 | −0.3 to 0.7 | .545 | 0.4 | −1.7 to 2.5 | .698 |
| ≥ 4 | −705 | 3,049 to 1,640 | .554 | 0.6 | 0.9 to 2.2 | .414 | −0.04 | − 0.1 to 0.3 | .226 | 0.2 | −0.4 to 0.8 | .577 | 0.9 | −1.8 to 3.7 | .506 |

NOTE. All models are estimated using ordinary least square regression controlling for cancer status, survey year, age, sex, race/ethnicity, marital status, education, and other comorbid conditions. Results reflect the interaction term between cancer status and chronic condition status. All measures reported are per person. All monetary amounts are converted to 2013 dollars using the Personal Health Care Expenditure Price Index.[21]

*Ambulatory visits include office-based provider visits and outpatient visits.

†Heart disease includes coronary heart disease, angina, myocardial infarction, and other heart disease.

**Table A2.**

Additional Lost Productivity and Source of Lost Productivity Among Survivors of Cancer Compared With Individuals Without a History of Cancer

| | Total | | | Employment Disability | | | Missed Work Days | | | Lost Household Productivity* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Condition | Additional Cost ($) | 95% CI | *P* | No. of Additional Days | 95% CI | *P* | No. of Additional Days | 95% CI | *P* | No. of Additional Days | 95% CI | *P* |
| Model 1: Conditions | | | | | | | | | | | | |
| High blood pressure | 84 | −939 to 1,107 | .598 | 1.1 | −4.7 to 6.9 | .703 | −0.7 | −2.1 to 0.6 | .295 | 0.2 | −2.3 to 2.6 | .890 |
| High cholesterol | −666 | −1,543 to 212 | .093 | −4.2 | −8.9 to 0.5 | .079 | −0.4 | −1.9 to 1.1 | .615 | −1.3 | −3.4 to 0.7 | .206 |
| Arthritis | −87 | −1,063 to 888 | .819 | −0.1 | −5.3 to 5.1 | .967 | −0.5 | −2.1 to 1.0 | .483 | −0.4 | −3.1 to 2.3 | .767 |
| Heart disease† | −555 | −1,647 to 536 | .241 | −3.9 | −9.9 to 2.1 | .206 | −0.8 | −2.3 to 0.8 | .338 | 1.0 | −1.9 to 3.9 | .500 |
| Diabetes | 5 | −1,427 to 1,438 | .844 | −1.4 | −9.3 to 6.5 | .727 | 1.1 | −0.7 to 2.9 | .241 | 2.0 | −2.2 to 6.2 | .353 |
| Asthma | 2,056 | 188 to 3,923 | .013 | 13.4 | 2.8 to 24.1 | .014 | 0.2 | −2.0 to 2.5 | .844 | 5.2 | 0.5 to 9.9 | .031 |
| Stroke | −828 | −3,131 to 1,475 | .431 | −6.8 | −19.0 to 5.5 | .280 | −1.2 | −4.7 to 2.2 | .474 | 4.8 | −2.1 to 11.7 | .172 |
| Emphysema | −931 | −3,834 to 1,972 | .627 | −4.0 | −20.8 to 12.9 | .642 | −2.3 | −5.8 to 1.2 | .205 | −3.8 | −10.3 to 2.6 | .242 |
| Model 2: No. of conditions | | | | | | | | | | | | |
| 1 | 267 | −727 to 1,262 | .488 | 2.1 | −3.3 to 7.6 | .438 | −0.2 | −1.7 to 1.2 | .756 | 0.0 | −2.6 to 2.6 | .993 |
| 2 | 320 | −767 to 1,408 | .530 | 2.8 | −3.3 to 8.9 | .366 | −0.2 | −1.9 to 1.4 | .775 | −0.8 | −3.0 to 1.4 | .475 |
| 3 | −307 | −1,501 to 887 | .536 | −3.2 | −9.6 to 3.3 | .337 | 0.6 | −1.5 to 2.6 | .600 | 1.5 | −1.1 to 4.0 | .252 |
| ≥ 4 | −667 | −2,212 to 879 | .550 | −3.9 | −12.8 to 5.0 | .390 | −2.5 | −4.3 to 0.7 | .006 | 2.6 | 1.2 to 6.3 | .177 |

NOTE. All monetary amounts are in 2013 US dollars. Total lost productivity is the sum of lost productivity from employment disability, missed work days, and lost household productivity. Lost productivity from employment disability is the product of the adjusted percentage of people unable to work as a result of illness or injury and 260 (number of workdays in the year); cost is the median annual wage ($35,080) and the adjusted percentage of people unable to work as a result of illness or injury. Lost productivity from lost workdays is the value of the median national daily wage ($16.87 per hour × 6 hours = $101.22 per day) multiplied by the adjusted number of days lost from work. Lost household productivity is the value of daily home productivity ($43.37) multiplied by the adjusted number of day spent in bed. Regression analyses controlled for survey year, age, sex, race/ethnicity, marital status, education, and other comorbid conditions. Results reflect the interaction term between cancer status and chronic condition status.

*Lost household productivity was not included in 2013 Medical Expenditure Panel Survey. Results for this variable are for 2008 to 2012.

†Heart disease includes coronary heart disease, angina, myocardial infarction, and other heart disease.

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**Table 1.**

Demographic Characteristics of Survivors of Cancer and People Without a History of Cancer: Medical Expenditure Panel Survey, 2008 to 2013

| | Survivors of Cancer (n = 10,293) | | People Without a History of Cancer (n = 135,151) | | |
|---|---|---|---|---|---|
| **Characteristic** | **%** | **95% CI** | **%** | **95% CI** | ***P*** |
| Age, years | | | | | < .001 |
| 18-39 | 7.2 | 6.4 to 8.0 | 41.7 | 40.8 to 42.5 | |
| 40-44 | 3.9 | 3.4 to 4.6 | 9.1 | 8.8 to 9.3 | |
| 45-49 | 5.4 | 4.8 to 6.1 | 9.2 | 8.9 to 9.5 | |
| 50-54 | 7.9 | 7.0 to 8.9 | 9.9 | 9.5 to 10.2 | |
| 55-59 | 10.2 | 9.3 to 11.1 | 8.4 | 8.2 to 8.7 | |
| 60-64 | 12.7 | 11.6 to 13.8 | 6.9 | 6.6 to 7.3 | |
| 65-69 | 12.5 | 11.4 to 13.6 | 5.0 | 4.8 to 5.3 | |
| 70-74 | 11.9 | 11.0 to 12.9 | 3.4 | 3.3 to 3.6 | |
| 75-79 | 10.2 | 9.2 to 11.2 | 2.6 | 2.4 to 2.8 | |
| ≥ 80 | 18.2 | 16.3 to 20.3 | 3.7 | 3.4 to 4.0 | |
| Sex | | | | | < .001 |
| Male | 42.1 | 40.5 to 43.7 | 48.9 | 48.5 to 49.2 | |
| Female | 57.9 | 56.3 to 59.5 | 51.1 | 50.8 to 51.5 | |
| Race/ethnicity | | | | | < .001 |
| Non-Hispanic white | 84.5 | 83.1 to 85.8 | 65.4 | 63.5 to 67.2 | |
| Non-Hispanic black | 7.1 | 6.3 to 7.9 | 11.9 | 10.7 to 13.2 | |
| Hispanic | 5.5 | 4.8 to 6.3 | 15.3 | 13.7 to 16.9 | |
| Non-Hispanic other | 3.0 | 2.3 to 3.9 | 7.5 | 6.5 to 8.5 | |
| Education | | | | | .002 |
| Less than high school graduate | 14.5 | 13.4 to 15.7 | 16.2 | 15.6 to 16.9 | |
| High school graduate | 30.7 | 29.1 to 32.3 | 28.6 | 27.9 to 29.4 | |
| Some college or more | 54.5 | 52.6 to 56.4 | 54.7 | 53.6 to 55.7 | |
| Marital status | | | | | < .001 |
| Married | 57.5 | 55.1 to 59.8 | 52.4 | 51.5 to 53.3 | |
| Not married | 42.5 | 40.2 to 44.9 | 47.6 | 46.7 to 48.5 | |
| Health status | | | | | < .001 |
| Excellent/very good | 40.2 | 38.6 to 41.7 | 60.0 | 59.2 to 60.8 | |
| Good | 32.0 | 30.7 to 33.3 | 27.7 | 27.1 to 28.3 | |
| Fair/poor | 27.6 | 26.3 to 29.0 | 12.2 | 11.9 to 12.6 | |
| Health insurance | | | | | |
| Age < 65 years | | | | | < .001 |
| Any private | 73.6 | 71.5 to 75.6 | 70.3 | 69.0 to 71.4 | |
| Public only | 15.6 | 14.0 to 17.3 | 10.8 | 10.2 to 11.5 | |
| Uninsured | 10.8 | 9.5 to 12.3 | 18.9 | 18.0 to 19.9 | |
| Age ≥ 65 years | | | | | < .001 |
| Medicare and private | 55.3 | 52.5 to 58.1 | 50.1 | 48.4 to 51.8 | |

| Characteristic | Survivors of Cancer (n = 10,293) | | People Without a History of Cancer (n = 135,151) | | *P* |
|---|---|---|---|---|---|
| | % | 95% CI | % | 95% CI | |
| Medicare and public | 8.5 | 7.4 to 9.8 | 11.0 | 10.0 to 12.1 | |
| Medicare only | 35.4 | 32.8 to 38.0 | 37.3 | 35.9 to 38.8 | |
| Family income | | | | | < .001 |
| Poor (< 100% FPL) | 10.9 | 10.1 to 11.8 | 12.6 | 12.0 to 13.3 | |
| Near poor (100% to 200% FPL) | 20.0 | 18.8 to 21.3 | 17.9 | 17.4 to 18.5 | |
| Not poor (> 200% FPL) | 69.1 | 67.4 to 70.7 | 69.5 | 68.5 to 70.4 | |

Abbreviation: FPL, federal poverty level.

**Table 2.**

Characteristics of Survivors of Cancer: Medical Expenditure Panel Survey, 2008 to 2013

| Characteristic | Survivors of Cancer (N = 10,293) | |
|---|---|---|
| | % | 95% CI |
| Cancer site * | | |
| Bladder | 2.1 | 2.2 to 3.1 |
| Blood/leukemia/lymphoma | 4.5 | 3.9 to 5.2 |
| Breast | 18.3 | 17.1 to 19.7 |
| Cervix | 7.2 | 6.5 to 8.1 |
| Colorectal | 6.3 | 5.6 to 7.1 |
| Kidney | 1.5 | 1.2 to 1.9 |
| Lung | 2.9 | 2.5 to 3.4 |
| Melanoma | 9.0 | 8.1 to 10.0 |
| Ovary | 1.6 | 1.3 to 2.0 |
| Prostate | 13.9 | 12.8 to 15.1 |
| Thyroid | 2.3 | 1.9 to 2.9 |
| Uterus | 4.2 | 3.7 to 4.8 |
| Other | 32.1 | 30.6 to 33.6 |
| Time since cancer diagnosis, years † | | |
| 0-4 | 30.1 | 28.5 to 31.7 |
| 5-9 | 21.6 | 20.4 to 22.8 |
| 10-19 | 22.0 | 20.6 to 23.4 |
| ≥ 20 | 17.2 | 16.0 to 18.5 |
| Missing | 9.1 | 7.8 to 10.5 |
| Mean, years | 10.8 | 10.5 to 11.2 |

* Percentages sum to greater than 100% as a result of some individuals reporting more than one cancer diagnosis.

† Time since diagnosis was not available in the 2013 Medical Expenditure Panel Survey public use file. The results for time since diagnosis reflect 2008 to 2012 data (n = 8,617).

**Table 3.**

Prevalence of Chronic Conditions Among Survivors of Cancer and People Without a History of Cancer: Medical Expenditure Panel Survey, 2008 to 2013

| | Unadjusted | | | | | Adjusted* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Survivors of Cancer (n = 10,293) | | People Without a History of Cancer (n = 135,151) | | | Survivors of Cancer (n = 10,293) | | People Without a History of Cancer (n = 135,151) | | |
| Condition | % | 95% CI | % | 95% CI | *P* | % | 95% CI | % | 95% CI | *P* |
| Model 1: conditions | | | | | | | | | | |
| High blood pressure | 57.1 | 55.3 to 58.9 | 30.7 | 30.1 to 31.3 | < .001 | 35.7 | 34.3 to 37.2 | 32.7 | 32.2 to 33.1 | < .001 |
| High cholesterol | 54.8 | 53.1 to 56.5 | 28.7 | 28.2 to 29.2 | < .001 | 35.0 | 33.7 to 36.3 | 30.5 | 30.0 to 30.9 | < .001 |
| Arthritis | 51.2 | 22.5 to 23.6 | 23.0 | 22.5 to 23.6 | < .001 | 29.4 | 28.2 to 30.6 | 24.9 | 24.5 to 25.3 | < .001 |
| Heart disease† | 32.0 | 30.5 to 33.5 | 12.7 | 12.3 to 13.1 | < .001 | 17.4 | 16.5 to 18.3 | 13.9 | 13.5 to 14.2 | < .001 |
| Diabetes | 17.5 | 16.3 to 18.8 | 8.5 | 8.3 to 8.8 | < .001 | 10.6 | 9.8 to 11.3 | 9.1 | 8.8 to 9.3 | < .001 |
| Asthma | 11.4 | 10.5 to 12.3 | 9.1 | 8.8 to 9.4 | < .001 | 11.9 | 10.9 to 12.8 | 9.1 | 8.8 to 9.4 | < .001 |
| Stroke | 10.2 | 9.3 to 11.2 | 3.1 | 3.0 to 3.3 | < .001 | 4.6 | 4.2 to 5.1 | 3.5 | 3.4 to 3.7 | < .001 |
| Emphysema | 6.9 | 6.1 to 7.7 | 1.9 | 1.7 to 2.0 | < .001 | 3.3 | 2.9 to 3.7 | 2.1 | 1.9 to 2.2 | < .001 |
| Model 2: No. of conditions | | | | | | | | | | |
| 0 | 14.5 | 13.4 to 15.8 | 45.1 | 44.4 to 45.7 | < .001 | 34.1 | 32.3 to 36.0 | 42.9 | 42.4 to 43.4 | < .001 |
| 1 | 18.3 | 17.1 to 19.6 | 22.6 | 22.2 to 23.0 | < .001 | 21.0 | 19.7 to 22.3 | 22.3 | 21.9 to 22.7 | .068 |
| 2 | 21.1 | 19.8 to 22.4 | 14.5 | 14.2 to 14.9 | < .001 | 14.9 | 14.0 to 15.9 | 15.1 | 14.7 to 15.5 | .759 |
| 3 | 19.5 | 18.2 to 20.8 | 9.4 | 9.1 to 9.6 | < .001 | 11.0 | 10.2 to 11.7 | 10.1 | 9.8 to 10.4 | .044 |
| ≥ 4 | 26.6 | 25.2 to 27.9 | 8.5 | 8.1 to 8.8 | < .001 | 12.7 | 11.9 to 13.4 | 9.5 | 9.2 to 9.8 | < .001 |

*Predicted margins from a logistic regression model controlling for survey year, age, sex, race/ethnicity, marital status, and education.

†Heart disease includes coronary heart disease, angina, myocardial infarction, and other unspecified heart disease.

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**Table 4.**

Additional Medical Care Expenditures and Use Among Survivors of Cancer With Chronic Conditions Compared With Survivors of Cancer Without Chronic Conditions: Medical Expenditure Panel Survey, 2008 to 2013

| | Total Medical Expenditures | | Ambulatory Visits* | | Emergency Room Visits | | Inpatient Nights | | Prescription Medications | |
|---|---|---|---|---|---|---|---|---|---|---|
| Condition | Additional Costs, $ (95% CI) | *P* | No. of Additional Visits (95% CI) | *P* | No. of Additional Visits (95% CI) | *P* | No. of Additional Nights (95% CI) | *P* | No. of Additional Prescriptions (95% CI) | *P* |
| Model 1: Conditions | | | | | | | | | | |
| High blood pressure | 726 (−682 to 2,134) | .315 | 0.8 (−0.2 to 1.8) | .113 | 0.01 (−0.01 to 0.04) | .406 | 0.1 (−0.2 to 0.4) | .422 | 13.5 (11.7 to 15.4) | < .001 |
| High cholesterol | −96 (−1,453 to 1,260) | .889 | 0.99 (0.1 to 1.9) | .041 | −0.02 (−0.1 to 0.01) | .117 | 0.02 (−0.3 to 0.3) | .905 | 6.5 (4.5 to 8.5) | < .001 |
| Arthritis | 3,145 (1,677 to 4,613) | < .001 | 4.3 (3.4 to 5.3) | < .001 | 0.01 (−0.01 to 0.03) | .408 | −0.1 (−0.4 to 0.2) | .455 | 9.6 (7.7 to 11.5) | < .001 |
| Heart disease† | 4,595 (3,262 to 5,927) | < .001 | 3.4 (2.4 to 4.4) | < .001 | 0.1 (0.03 to 0.1) | < .001 | 0.12 (−0.2 to 0.4) | .418 | 9.5 (7.6 to 11.4) | < .001 |
| Diabetes | 3,281 (1,918 to 4,644) | < .001 | 1.4 (0.4 to 2.5) | .006 | 0.003 (−0.02 to 0.03) | .757 | 0.2 (−0.1 to 0.6) | .174 | 15.2 (13.0 to 17.5) | < .001 |
| Asthma | 2,797 (754 to 4,840) | .008 | 3.0 (1.6 to 4.4) | < .001 | 0.03 (−0.002 to 0.1) | .071 | −0.2 (−0.6 to 0.2) | .305 | 9.1 (6.3 to 12.0) | < .001 |
| Stroke | 3,843 (1,983 to 5,704) | < .001 | 0.6 (−1.0 to 2.2) | .451 | 0.1 (0.04 to 0.1) | < .001 | 0.4 (0.001 to 0.7) | .049 | 6.1 (3.4 to 8.8) | < .001 |
| Emphysema | 2,755 (925 to 4,585) | .003 | 0.1 (−1.5 to 1.7) | .872 | 0.01 (−0.03 to 0.1) | .505 | 0.4 (0.1 to 0.8) | .022 | 10.0 (6.6 to 13.5) | < .001 |
| Model 2: No. of conditions | | | | | | | | | | |
| 1 | 626 (−2,534 to 3,787) | .698 | 3.4 (1.5 to 5.4) | <.001 | −0.02 (−0.1 to 0.03) | .480 | 0.3 (−0.3 to 0.9) | .293 | 15.7 (11.8 to 19.5) | < .001 |
| 2 | 3,321 (409 to 6,233) | .026 | 6.3 (4.6 to 8.0) | <.001 | 0.04 (−0.003 to 0.1) | .066 | 0.2 (−0.3 to 0.7) | .519 | 29.4 (25.6 to 33.1) | < .001 |
| 3 | 5,571 (2,803 to 8,339) | < .001 | 7.7 (5.9 to 9.5) | <.001 | 0.04 (−0.01 to 0.1) | .108 | 0.3 (−0.2 to 0.8) | .254 | 37.8 (33.3 to 42.2) | < .001 |
| ≥ 4 | 10,280 (7,435 to 13,125) | < .001 | 10.5 (8.7 to 12.3) | < .001 | 0.1 (0.03 to 0.1) | .002 | 0.4 (−0.1 to 0.9) | .084 | 50.1 (45.3 to 54.9) | < .001 |

NOTE. Total medical expenditures were estimated using a generalized linear model with a gamma distribution and a log link. Use for each service type was estimated using negative binomial regression. All regressions controlled for survey year, age, sex, race/ethnicity, marital status, education, and other comorbid conditions. All measures reported were per person. All monetary amounts were adjusted to 2013 US dollars using the Personal Health Care Expenditure Price Index.[21]

*Ambulatory visits included office-based provider visits and outpatient visits.

†Heart disease includes coronary heart disease, angina, myocardial infarction, and other unspecified heart disease.

**Table 5.**

Additional Lost Productivity and Source of Lost Productivity Among Survivors of Cancer With Chronic Conditions Compared With Survivors of Cancer Without Chronic Conditions: Medical Expenditure Panel Survey, 2008 to 2013

| | Total | | | Employment Disability | | | Missed Work Days | | | Lost Household Productivity* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Condition | Additional Cost ($) | 95% CI | *P* | No. of Additional Days | 95% CI | *P* | No. of Additional Days | 95% CI | *P* | No. of Additional Days | 95% CI | *P* |
| Model 1: Conditions | | | | | | | | | | | | |
| High blood pressure | 1,325 | 174 to 2,475 | .008 | 7.8 | 1.7 to 13.9 | .013 | 1.2 | −0.7 to 3.1 | .203 | 3.4 | 0.3 to 6.6 | .030 |
| High cholesterol | −293 | −1,141 to 656 | .699 | −1.8 | −6.3 to 2.8 | .447 | 0.5 | −1.6 to 2.5 | .668 | −2.4 | −5.3 to 0.6 | .111 |
| Arthritis | 3,534 | 2,475 to 4,593 | < .001 | 20.6 | 15.2 to 26.0 | < .001 | 4.6 | 2.5 to 6.7 | < .001 | 6.7 | 3.9 to 9.5 | < .001 |
| Heart disease† | 1,712 | 718 to 2,705 | < .001 | 9.3 | 4.4 to 14.1 | < .001 | 2.0 | −0.3 to 4.3 | .070 | 5.9 | 3.4 to 8.5 | < .001 |
| Diabetes | 1,639 | 498 to 2,781 | < .001 | 9.7 | 4.1 to 15.3 | < .001 | 1.6 | −0.7 to 4.0 | .186 | 3.8 | 0.4 to 7.2 | .026 |
| Asthma | 2,040 | 690 to 3,391 | < .001 | 12.1 | 4.8 to 19.3 | .001 | 1.7 | −0.4 to 3.8 | .101 | 5.5 | 1.8 to 9.2 | .003 |
| Stroke | 4,325 | 2,687 to 5,964 | < .001 | 23.3 | 16.1 to 30.4 | < .001 | 6.3 | 1.4 to 11.2 | .003 | 12.6 | 8.5 to 16.7 | < .001 |
| Emphysema | 3,299 | 1,614 to 4,984 | < .001 | 22.3 | 14.6 to 29.9 | < .001 | 0.3 | −4.3 to 4.9 | .889 | 6.1 | 1.6 to 10.5 | .005 |
| Model 2: No. of conditions | | | | | | | | | | | | |
| 1 | 2,026 | 276 to 3,777 | .003 | 12.9 | 3.2 to 22.6 | .010 | 1.5 | −0.8 to 3.7 | .193 | 3.1 | −1.7 to 8.0 | .213 |
| 2 | 4,214 | 2,439 to 5,988 | < .001 | 26.1 | 16.0 to 36.1 | < .001 | 4.2 | 1.8 to 6.5 | < .001 | 6.3 | 2.1 to 10.5 | .004 |
| 3 | 5,703 | 3,881 to 7,524 | < .001 | 33.6 | 23.5 to 43.7 | < .001 | 6.5 | 3.6 to 9.4 | < .001 | 11.7 | 7.9 to 15.4 | < .001 |
| ≥ 4 | 9,099 | 7,224 to 10,973 | < .001 | 56.1 | 45.7 to 66.4 | < .001 | 7.4 | 4.5 to 10.3 | < .001 | 18.0 | 13.6 to 22.4 | < .001 |

NOTE. All monetary amounts are in 2013 US dollars. Total lost productivity is the sum of lost productivity from employment disability, missed work days, and lost household productivity. Lost productivity from employment disability is the adjusted percentage of people unable to work because of illness or injury multiplied by 260 (number of work days in the year); cost is the median annual wage ($35,080) multiplied by the adjusted percentage of people unable to work because of illness or injury. Lost productivity from lost workdays is the median national daily wage ($16.87 per hour × 6 hours = $101.22 per day) multiplied by the adjusted number of days lost from work. Lost household productivity is the value of daily home productivity ($43.37) multiplied by the adjusted number of additional days spent in bed. Regression analyses controlled for survey year, age, sex, race/ethnicity, marital status, education, and other comorbid conditions.

*Lost household productivity was not included in the 2013 Medical Expenditure Panel Survey. Results for this variable are for 2008 to 2012.

†Heart disease includes coronary heart disease, angina, myocardial infarction, and other unspecified heart disease.