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Health care expenditures associated with depression in adults with cancer

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Abstract

Background—The rates of depression in adults with cancer have been reported as high as 38%–58%. How depression affects overall health care expenditures in individuals with cancer is an under-researched area.

Objective—To estimate excess average total health care expenditures associated with depression in adults with cancer by comparing those with and without depression after controlling for demographic, socioeconomic, access to care, and other health status variables.

Methods—Cross-sectional data on 4,766 adult survivors of cancer from 2006–2009 of the nationally representative household survey, Medical Expenditure Panel Survey (MEPS), were used. The patients were older than 21 years. Cancer and depression were identified from the patients' medical conditions files. Dependent variables consisted of total, inpatient, outpatient, emergency department, prescription drugs, and other expenditures. Ordinary least square (OLS) on logged dollars and generalized linear models with log-link function were performed. All analyses (SAS 9.3 and STATA12) accounted for the complex survey design of the MEPS.

Results—Overall, 14% of individuals with cancer reported having depression. In those with cancer and depression, the average annual health care expenditures were \$18,401 compared with \$12,091 in those without depression. After adjusting for demographic, socio-economic, access to care, and other health status variables, those with depression had about 31.7% greater total expenditures compared with those without depression. Total, outpatient, and prescription expenditures were higher in individuals with depression than in those without depression. Individuals with cancer and depression were significantly more likely to use emergency departments (adjusted odds ratio, 1.46) compared with their counterparts without depression.

Limitations—Cancer patients who died during the reporting year were excluded. The financial burden of depression may have been underestimated because the costs of end-of-life care are high. The burden for each cancer type was not analyzed because of the small sample size.

Conclusion—In adults with cancer, those with depression had higher health care utilization and expenditures compared with those without depression.

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Diagnosis of cancer in adults is often accompanied by negative emotional health, distress, anxiety, and fear of death,¹ which is why co-occurring depression is not uncommon in adults with cancer. Previous studies have documented high rates of depression in this population,²⁻⁴ ranging from 58% in hospitalized terminally ill patients with mixed cancers⁵ to 38% in patients with pancreatic cancer.⁶ Co-occurring depression and cancer may affect the morbidity of cancer patients⁷⁻¹¹ – those with depression and cancer are less likely to follow treatment regimens,¹²⁻¹⁴ and more likely to have other comorbidities such as diabetes, cardiovascular disease, and musculoskeletal conditions.^{15, 16} All of these factors may lead to increased health care utilization and expenditures in those with depression compared with those without depression. It is plausible that cancer patients with depression may not adhere to cancer treatments,^{8, 17} thereby increasing their health care expenditures.

Despite the comorbidity burden of depression, there is scant literature examining the incremental cost burden of depression in adults with cancer. A study that investigated the prevalence and incremental expenditures of depression in elderly patients (>65 years) with prostate cancer patients used data from the 1995–2003 Surveillance, Epidemiology and End Results (SEER) cancer registry (13 SEER sites) linked with Medicare claims.¹⁸ That study found that 8.5% of the patients were diagnosed with depression after their cancer diagnosis. It also found that the elderly patients with depression during treatment were more likely to have emergency department visits (adjusted odds ratio [AOR], 4.45), hospitalizations (AOR, 3.22), outpatient visits (AOR, 1.71), and higher medical care expenditures (AOR, 1.52) during the first year of treatment, compared with their counterparts without depression. Although this study highlighted the excess health care expenditures associated with depression in cancer patients, it included only elderly men aged 66 years or older and enrolled in fee-for-service Medicare. The study results were limited by their lack of generalizability. Another study that analyzed claims data of all military health care beneficiaries with cancer found that 12.6% had depression after cancer diagnosis and co-occurring depression was associated with higher health care utilization and higher annual health care expenditures (\$16,212) in cancer patients with depression compared with those without depression (\$7,728).¹⁹ The study was not able to control for factors such as other comorbidities, which can also affect health care expenditures, and thus might have overestimated the excess expenditures associated with depression. Moreover, the study included military populations and may therefore not be representative of the US population. To date, no clear and aggregated picture has emerged in the United States about the magnitude of health care expenditures associated with depression in younger adult cancer survivors who are older than 21 years. It is not known whether individuals with cancer and depression have greater health service utilization and higher health care expenditures compared with those without depression, after controlling for health status variables.

Therefore, the primary objective of this study was to estimate excess health care utilization and expenditures associated with depression in adult cancer survivors older than 21 years, after controlling for demographic, socio-economic, access to care, other co-occurring conditions, and health status variables.

Methods

Study design and data source

This study adopted a cross-sectional study design. The data were derived from the Medical Expenditure Panel Survey (MEPS), a nationally representative survey of households that has been conducted annually 1996 by the Agency for Healthcare Research and Quality (AHRQ) since 1996. The MEPS Household Component provides nationally representative data on demographic characteristics, socio-economic status, medical and mental health conditions, health status, use of medical care services, charges and payments, access to care, satisfaction with care, health insurance coverage and other.²⁰

Study sample

The MEPS collects information about a selected group of medical conditions that have been specified as priority conditions by the AHRQ.²¹ Cancer is one of the priority conditions. We identified individuals with cancer by using clinical classification codes (11–44) from the MEPS medical condition files for 2006–2009. Clinical classification codes are converted from patient self-reported medical conditions, such as report of a diagnosis and conditions linked with medical events. To give an aggregated picture of the US cancer population, we included all types of cancers, tumors, or malignancies in the MEPS, such as breast, prostate, colon, rectum and anus, lung, bronchus, head and neck, stomach, liver, pancreas, other GI organs, bone and connective tissues, melanomas of skin, bladder, kidney and renal pelvis, brain and nervous system, thyroid, Hodgkin and non-Hodgkin lymphomas, and so on.

Our study sample included living adults with cancer who were older than 21 years. We excluded adults who died during the reporting year because we were not able to capture the entire year's expenditures for those people, and we were able to avoid the challenge of comparing part-year expenditures with full-year expenditures. To gain adequate sample size, we pooled data from 2006–2009 in the MEPS. The final study sample consisted of 4,766 adults with cancer.

Dependent variables

Health care expenditures—Total health care expenditures are the sum of all direct actual third-party payments made to the providers for services rendered plus the out-of-pocket spending by the individual or family during the calendar year. For example, payments by private insurance, Medicare, Medicaid, and other sources along with out-of-pocket spending by the individual or family are added to derive total health care expenditures. To capture complete health care expenditures, the MEPS acquired expenditures by major sources of payment such as Medicare, Medicaid, private insurance, Veterans Administration, CHAMPVA (Civilian Health and Medical Program of the Department of Veterans Affairs), TRICARE (health care program for uniformed service members), other federal sources (Indian health service, Military treatment facilities and others), and other state and local sources.

In addition, the MEPS also provides annual expenditures by type of medical services, including inpatient and outpatient care, emergency department visits, prescriptions, home

health care, durable medical equipment, dental care, eye care, and others. Other types of health care included ambulance services, orthopedic items hearing devices, prostheses, bathroom aids, medical equipment, disposable supplies, alterations/modifications to the home, and miscellaneous items or services that were obtained, purchased, or rented during the year.²⁰

Health care utilization—Because the survey included information on hospital care provided for each type of setting (inpatient stays and emergency department visits), we classified health care utilization into inpatient use (Yes/No) or emergency department use (Yes/No). In this study, we categorized types of services as Inpatient (Yes/No), Outpatient (Yes/No), Emergency Department (Yes/No), Prescription Drug (Yes/No), and Other Health Care Services (Yes/No), which included home health care, dental, vision, durable medical equipment, and other miscellaneous items.

Key independent variable: presence of depression—We identified individuals with depression by using ICD-9-CM codes (296: episodic mood disorders; 311: depressive disorders) and clinical classification codes (657: mood disorders). Binary variable was created to indicate the presence of depression. Adults who did not report depression but who used antidepressants were classified under No Depression category.

Other independent variables—Demographic variables included gender (women, men), categories of age in years (22–49, 50–64, 65), race/ethnicity (white, African American, Latino, and other), marital status (married, widowed, separated/divorced, and never married) and area of residence (metro and nonmetro). Socioeconomic factors were categorized by education (less than high school, high school, and above high school), and poverty status. The poverty status variable available from the MEPS was defined as poor (<100% federal poverty line), near poor (100% to < 200%), middle income (200% to < 400%), and high income (> 400%) and represented family income in relation to the federal poverty line (based on family size and composition).

Health status was measured with standard scales of perceived physical and mental health. Perceived physical and mental health status were categorized into excellent/very good, good, fair/ poor. Lifestyle risk factors were indicated by body mass index categories (BMI; normal or underweight, overweight, and obese) and current smoking (Yes/No). Health care expenditures are often influenced by the presence of chronic physical conditions such as arthritis, chronic obstructive pulmonary disease (COPD), gastro esophageal reflux disease (GERD), other endocrine disease, osteoporosis, and mental health conditions such as depression and anxiety. Therefore, we also included the total number of co-occurring chronic conditions as one of the independent variables.

Statistical analysis

In our statistical analysis, chi-square tests were conducted to assess the univariate association between presence of depression and an individual's characteristics. We performed t tests to assess significant differences in expenditures in individuals with and without depression. Health care expenditures were converted to 2009 dollars based on the

consumer price index for medical care services from the bureau of labor statistics.²² Average and standard error of expenditures for outpatient use and prescription drug use were compared by presence or absence of depression. The average and standard error of expenditures for users of specific health care services (inpatient, emergency department and other health service uses) were also compared.

Because expenditure data are positively skewed, a natural logarithm transformation was used to normalize health care expenditures.²³ Ordinary least squares (OLS) regressions on logged expenditures were conducted to determine the excess expenditures associated with depression after controlling for gender, race/ethnicity, age, marital status, metro status, education, employment, poverty status, health insurance coverage, usual source of care, perceived physical and mental health, cardiovascular disease, number of other conditions, anxiety, BMI categories, smoking status, and year of observation. Parameter estimates of categorical independent variables from OLS regression model could be interpreted as percentage change for each unit of change in the independent variable (ie, percentage change = $e^{\beta}-1$).²⁴ In secondary analyses, generalized linear models (GLM) with log-link function and Gaussian distribution were used to estimate cost. Because the GLM performs transformation of the mean cost directly instead of transforming cost data, the reverse transformation will generate no bias in the estimated mean cost. To calculate the incremental expenditures associated with depression, we added the intercept and the coefficient for depression and exponentiated the sum to directly arrive at expenditures for adult cancer survivors with depression. We exponentiated the intercept term to calculate expenditures for cancer patients without depression. The differences in these 2 estimates were reported as incremental average cost (ie, arithmetic mean) associated with depression in adult cancer survivors.

Multivariable logistic regression models were used to determine the association between depression and the likelihood of using inpatient services, emergency department and other services. In this article, AORs and 95% confidence intervals (CIs) of depression were reported. In addition, we conducted OLS regression of inpatient, emergency department, and other expenditures only in users. The sample design of the MEPS data is complex with stratification, clustering and multistage selection. All analyses using both SAS 9.3 and STATA 12 accounted for this complex survey design.

Results

Description of the study sample

The study sample consisted of 4,766 adults reported with cancer during 2006–2009. Fourteen percent (weighted) of adult cancer survivors reported depression. In cancer patients with depression, we found that 76.3% used antidepressants. Univariate associations of individual characteristics with the presence of depression are shown in Table 1. Except for race/ethnicity, age, health insurance type, and usual source of care, all characteristics were significantly associated with presence of depression. For example, 17% of women reported depression, compared with 10% of men. Fewer individuals with excellent and very good mental health status reported depression (8.7%), compared with individuals with good (11.4%) or fair/poor (26.1%) health status. More individuals with cardiovascular disease

(CVD) – including diabetes, hypertension, and heart disease – reported depression (15.3%), compared with those without CVD (12.0%).

Depression and unadjusted health care expenditures

The average total health care expenditures and average expenditures by type of health care services in all adult cancer survivors and users are summarized in Table 2. Because a large number of adult cancer survivors had zero expenditure for inpatient, emergency department visits, and other services, we present these expenditures only in users. In all adults, the average total annual health care expenditures were 52% higher in cancer survivors with depression (\$18,401), compared with cancer survivors without depression (\$12,091). Annual prescription drug expenditures were 106% higher in adults with depression (\$4,461), compared with those without depression (\$2,164). Significant difference was also observed for outpatient expenditures. In users of inpatient services, average expenditures were 11% higher for individuals with cancer who were depressed (\$22,586), compared with individuals without depression (\$20,314). Significant differences in average health expenditures in those with and without depression were also observed for users of emergency department services (\$1,438 and \$1,283, respectively) and other health care services (\$2,072 and \$1,357).

Depression and adjusted health care expenditures

The ordinary least square regression on log-transformed total health care expenditures was performed to identify excess expenditures associated with depression. Results from OLS regression on log-transformed dollars are summarized in Table 3. After adjusting gender, age, race/ethnicity, metro status, education, poverty status, health insurance status, perceived physical and mental health, cardiovascular disease, number of other conditions, anxiety, BMI, smoking status, and year of observation, adult cancer survivors with depression had 31.7% ($\beta = 0.275$, $e^{\beta} - 1 = 0.317$) greater total expenditures compared with those without depression. Outpatient and prescription expenditures were higher for adults cancer survivors with depression compared with those without depression (16.2% and 107.1%, respectively).

Results from GLM with log-link function also showed that total expenditures for cancer survivors with depression was \$2,213 higher than for those without depression. Total expenditures for individuals with depression were estimated to be \$11,496 and total expenditures for those without depression were estimated as \$9,283. Similarly, prescription expenditures were \$913 higher for cancer survivors with depression compared with those without depression. No significant differences in estimated average outpatient expenditures were found in adult cancer survivors with and without depression.

Depression and health care utilization

The results from AORs and 95% CIs of depression on inpatient use, emergency department use, and other services use from multivariable logistic regressions are shown in Table 4. Compared with their counterparts without depression, individuals with cancer and depression were significantly more likely to have emergency department visits (AOR, 1.46; 95% CI, 1.17–1.82). Inpatient and other service uses were not significantly associated with depression. In users of inpatient, emergency department, and other services, adjusted

expenditures for those with depression were significantly greater than those without depression. For example, in patients who used inpatient services, depression was associated with 14% greater inpatient expenditures. Similarly, in patients who used emergency department services, depression was associated with 10% greater emergency department expenditures.

Discussion

We used the MEPS database, a nationally representative survey of the US noninstitutionalized civilian population, to estimate excess expenditures and health care use in adult cancer survivors. The rate of depression in our study sample (14%) is close to the prevalence rate of depression (12.6%) in cancer survivors of all cancer types in a military health system.¹⁹ However, our estimated rate of depression is higher than the prevalence rate of depression (8.5%) in elderly prostate cancer patients from SEER-cancer registries.¹⁸ These differences are plausible because depression may vary by age, gender, and cancer type. Depression prevalence was reported to be as high as 38% in pancreatic cancer patients, 14%–40% in breast cancer patients, and 4.7%–33% in lung cancer patients.²

In our study, we found that the presence of depression was associated with greater unadjusted and adjusted average total expenditures (31.7%) as well as outpatient and prescription drug expenditures (16.2% and 107.1%, respectively). These findings are consistent with those in 2 aforementioned studies.^{18, 19} Presence of depression was associated with 110% higher expenditures in military beneficiaries. Findings from our study confirm the excess burden of depression for third-party payors as well as families. Because many of the recent policy efforts have focused on containing cost,^{25, 26} future research should examine whether treating depression may result in cost reductions for cancer survivors with depression.

The current findings highlight the need for routine depression screening in cancer patients and the treatment of depression before it becomes severe. Because there is much uncertainty about how to treat depression in patients with cancer,^{27, 28} oncologists and physicians might not prioritize its treatment while they are managing the patient with cancer. Indeed, a cancer diagnosis is considered a major life-changing event, and the focus on the disease often consumes the patients and the oncologist, and awareness of and concerns about depression may be crowded out.^{29–31}

It is complicated to know definitively whether treating depression leads to a reduction in health costs. Our literature review suggests that depression treatment may or may not reduce health care expenditures in individuals with chronic conditions.^{32–36} Although these studies are not specific to cancer, future research needs to examine whether depression treatment in adults with cancer and depression results in reduced health care expenditures.

Our study findings also highlighted excess burden in terms of emergency department use and expenditures associated with depression because adult cancer survivors were more likely to use emergency department services. These results are similar to findings seen earlier in the literature that breast, lung and colon cancer Medicare beneficiaries with

depressive syndrome were more likely to use acute medical services such as emergency department (AOR, 2.12–3.16).³⁷ There are some plausible explanations for the findings. A study found that cancer patients with depressive disorder and depressive symptoms had a higher risk of attempting suicide compared with those without depression.³⁸ Adults who are at immediate risk for attempting suicide require emergency care and prompt treatment for depression. In addition, adults with cancer who are depressed are less likely to be adherent to medications.^{12–14} The nonadherence may result in worse cancer prognosis and poor outcomes, thereby leading to more emergency department visits.³⁹

In addition, depression was not associated with a greater likelihood of use of inpatient services, but it was associated with greater inpatient expenditure for inpatient services. Inpatient expenditures in adult cancer survivors were 14% higher in those with depression compared with those without depression. These findings suggest that those with depression may have greater length of hospital stay or burden of illness that may contribute to increased expenditures when they are hospitalized. In a study not specific to cancer and based on the Longitudinal Aging Study Amsterdam, it was found that depression was associated with greater lengths of hospital stay compared with those without depression.⁴⁰ Although the association between depression and length of stay was partly explained by other variables such as comorbid conditions, functional status, alcohol use, and smoking, depression was independently associated with greater lengths of inpatient stay. Similar findings were observed in a Western Australian study that used a prospective cohort of men.⁴¹ Our study included extensive adjustments for perceived physical and mental health, cardiovascular disease, number of other conditions, anxiety, and BMI. However, we cannot rule out the possibility that patients with depression may have complex comorbidities compared with those without depression and that some of the increased expenditures associated with depression could be a result of these complexities.

Our study findings need to be interpreted in the light of its strengths and limitations. We used a nationally representative sample of adult cancer survivors, adjusted for a comprehensive list of factors that may affect health care expenditures. We extended the existing literature by examining type of health care utilization and its relationship to presence of depression. There are some limitations that may affect the interpretation of the study results. First, the study used a cross-sectional study design. We reported co-occurring rate of depression in individuals with cancer. Findings from a previous study demonstrated that individuals with cancer may be at an elevated risk for depression.³ Second, we included all cancer types in our analysis to provide an aggregate view of excess financial burden of depression in cancer survivors. We were not able to analyze the burden for each cancer type because of the small sample size. Third, depression was from self-report in the MEPS database. There is no diagnostic instrument used by the MEPS to validate the depression diagnosis. It may be possible that depression was underestimated and those with depression may be classified in the no depression group. Because of a misclassification issue, our estimates of incremental burden of depression in individuals with cancer may be conservative. Fourth, we analyzed data only for living cancer patients. Those who died during the reporting year were excluded. As the costs of end-of-life care are high, we might have underestimated the financial burden of depression.

Our study has important implications for clinicians, scientists, and policy makers. As far as we know, it is the first study to provide a national estimate of depression prevalence in cancer patients, and the health care expenditures and utilization associated with depression. The findings suggest that future policy efforts are needed to reduce excess health care expenditures associated with depression in cancer patients. The efforts include screening for depressive symptoms, preventing major depression, and timely treatment for depression. The findings also emphasize the importance of the coordination of care in psycho-oncology. All cancer centers accredited by the American College of Surgeon's Commission on Cancer are required to have a plan to integrate psychosocial services into their cancer care.⁴² It is expected that much training and consultation are needed for oncologists to develop their integration programs. Future research is also needed to assess the effectiveness of treatments in this comorbidity population.

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TABLE 1

Description of adult cancer survivors by presence of depression in the Medical Expenditure Panel Survey, 2006–2009^a

| | Depression, no. of patients (wt. % 14.0) (n = 715) | No Depression, no. of patients (wt. % 86.0) (n = 4, 051) |
|-------------------------------|---|--|
| Gender ^{***} | | |
| Women | 477 (17.2) | 2,144 (82.8) |
| Men | 238 (10.2) | 1,907 (89.8) |
| Race/ethnicity | | |
| White | 547 (13.8) | 3,081 (86.2) |
| African American | 58 (10.3) | 442 (89.7) |
| Latino | 75 (15.6) | 373 (84.4) |
| Other | 35 (21.1) | 155 (78.9) |
| Age, y | | |
| 22–39 | 71 (15.0) | 369 (85.0) |
| 40–49 | 96 (16.5) | 389 (83.5) |
| 50–64 | 251 (15.4) | 1,235 (84.6) |
| 65 | 297 (12.4) | 2,058 (87.6) |
| Marital status ^{***} | | |
| Married | 357 (11.7) | 2,595 (88.3) |
| Widowed | 121 (16.3) | 585 (83.7) |
| Divorced/separated | 168 (21.8) | 534 (78.2) |
| Not married | 69 (14.4) | 337 (85.6) |
| Education ^{**} | | |
| Less than HS | 158 (17.1) | 732 (82.9) |
| HS | 225 (16.3) | 1,163 (83.7) |
| More than HS | 329 (12.1) | 2,136 (87.9) |
| Poverty status ^{***} | | |
| Poor | 117 (18.8) | 466 (81.2) |
| Near poor | 170 (17.2) | 746 (82.8) |
| Middle income | 190 (14.4) | 1,123 (85.6) |
| High income | 238 (11.8) | 1,716 (88.2) |
| Health insurance | | |
| Private | 414 (13.1) | 2,664 (86.9) |

| | Depression, no. of patients (wt. % 14.0) (n = 715) | No Depression, no. of patients (wt. % 86.0) (n = 4, 051) |
|------------------------------------|---|---|
| Public | 267 (15.9) | 1,200 (84.1) |
| None | 34 (17.2) | 187 (82.8) |
| Perceived health *** | | |
| Excellent/very good | 174 (8.7) | 1,731 (91.3) |
| Good | 178 (11.4) | 1,285 (88.6) |
| Fair/poor | 363 (26.1) | 1,035 (73.9) |
| CVD * | | |
| Yes | 461 (15.3) | 2,416 (84.7) |
| No | 254 (12.0) | 1,635 (88.0) |
| Other conditions *** | | |
| None | 232 (9.7) | 2,027 (90.3) |
| 1 | 217 (16.0) | 1,149 (84.0) |
| 2 | 172 (20.7) | 540 (79.3) |
| 3 | 94 (18.5) | 335 (81.5) |
| Perceived mental health *** | | |
| Excellent/very good | 215 (7.5) | 2,505 (92.5) |
| Good | 261 (18.3) | 1,151 (81.7) |
| Fair/poor | 239 (38.8) | 395 (61.2) |
| Anxiety *** | | |
| Yes | 182 (30.5) | 380 (69.5) |
| No | 533 (11.8) | 3,671 (88.2) |
| Body mass index *** | | |
| Underweight | 15 (11.8) | 76 (88.2) |
| Normal | 200 (12.5) | 1,317 (87.5) |
| Overweight | 218 (11.9) | 1,484 (88.1) |
| Obese | 260 (17.5) | 1,088 (82.5) |
| Smoking *** | | |
| Current smoker | 146 (22.5) | 440 (77.5) |
| Other | 525 (12.7) | 3,395 (87.3) |

CVD, cardiovascular disease, including diabetes, hypertension, and heart disease; HS, high school

^aBased on 4,766 adult cancer survivors older than 21 years. Asterisks represent significant group differences by depression status based on chi-square tests. Numbers may not add to 4,766 because of missing data in body mass index categories and smoking status.

 $P < .001$

**
.001 $P < .01$

*
.01 $P < .05$

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TABLE 2

Mean and standard deviation of expenditures by type of service in adult cancer survivors with and without depression in the Medical Expenditure Panel Survey, 2006–2009^a

| | Depression | | No depression | |
|----------------------|-----------------|--------------------------------|-----------------|--------------------------------|
| | No. of patients | Expenditure, mean 2009 \$ (SE) | No. of patients | Expenditure, mean 2009 \$ (SE) |
| Total | 715 | 18,401 (1,216) | 4,051 | 12,091 (405) |
| Outpatient** | 715 | 6022 (416) | 4,051 | 5164 (226) |
| Prescription drugs** | 715 | 4461 (382) | 4,051 | 2164 (86) |
| In users | | | | |
| Inpatient*** | 196 | 22,586 (1,956) | 759 | 20,314 (1,138) |
| Emergency dept** | 209 | 1,438 (199) | 672 | 1,283 (89) |
| Other*** | 501 | 2,072 (201) | 2,717 | 1,357 (70) |

^aBased on 4,766 adult cancer survivors older than 21 years. Asterisks represent significant group differences by depression status based on t tests. Inpatient, emergency department, and other expenditures were restricted in users of each of the service types. Other expenditures included home health care, dental, vision, durable medical equipment, and other miscellaneous items.

 $P < .001$

**
 $.001 < P < .01$

TABLE 3

Intercept and co-efficient for depression from ordinary least squares and generalized linear models with log link in the Medical Expenditure Panel Survey, 2006–2009^a

| Type of expenditure | Beta intercept (SE) | Beta depression (SE) | Change |
|---|---------------------|----------------------|---------|
| <i>Ordinary least squares</i> | | | |
| Total | 7.824 (0.038)*** | 0.275 (0.017)*** | 31.7% |
| Outpatient | 6.951 (0.058)*** | 0.150 (0.022)*** | 16.2% |
| Prescription | 4.485 (0.055)*** | 0.728 (0.019)*** | 107.1% |
| <i>Generalized linear model with log link</i> | | | |
| Total | 9.136 (0.207)*** | 0.214 (0.094)* | \$2,213 |
| Outpatient | 8.468 (0.496)*** | -0.072 (0.271) | -\$329 |
| Prescription | 7.503 (0.396)*** | 0.408 (0.139)** | \$913 |

^aBased on 4,766 adult cancer survivors older than 21 years. Asterisks denote statistical significance in parameter estimates from ordinary least squares regressions on log-transformed 2009 dollars and generalized linear models on expenditures with log link. Percentage change in expenditures by depression status were calculated by exponentiating regression co-efficient and subtracting one ($e^{\beta}-1$). Absolute change in dollars was calculated as incremental change by exponentiating parameter estimates from generalized linear model with log link. All regression models adjusted for gender, age, race/ethnicity, metro status, education, poverty status, health insurance, perceived physical and mental health, cardiovascular disease, number of other conditions, anxiety, body mass index, smoking status, and year of observation.

P < .001

**
.001 P < .01

*
.01 P < .05

TABLE 4

Two-part models: AORs and 95% CIs for depression and intercept and co-efficient for depression from OLS on 2009 log-transformed dollars in the Medical Expenditure Panel Survey, 2006–2009^a

| Type of service | Logistic regression on Use, AOR [95% CI] | OLS on log-transformed \$ in users, beta (SE) | % change |
|-----------------|--|---|----------|
| Inpatient | 1.23 [0.97, 1.57] | 0.131 (0.000)*** | 14.0 |
| ED | 1.46 [1.17, 1.82]*** | 0.097 (0.000)*** | 10.2 |
| Other | 1.26 [0.99, 1.61] | 0.123 (0.018)*** | 13.1 |

^aBased on 4,766 adult cancer survivors older than 21 years. Asterisks denote statistical significance in parameter estimates from logistic regressions on use of services or ordinary least squares regressions on log-transformed 2009 dollars in users. Percentage change in expenditures by depression status were calculated by exponentiating regression co-efficient and subtracting one ($e^{\beta}-1$). All regression models adjusted for gender, age, race/ethnicity, metro status, education, poverty status, health insurance, perceived physical and mental health, cardiovascular disease, number of other conditions, anxiety, body mass index, smoking status, and year of observation.

AOR, adjusted odds ratio; CI, confidence interval; ED, emergency room; OLS, ordinary least squares

P < .001

**
.001 P < .01

*
.01 P < .05