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Medical Care Costs of Breast Cancer in Privately Insured Women Aged 18–44 Years

Benjamin T. Allaire, MS[1], **Donatus U. Ekwueme, PhD, MS**[2], **Gery P. Guy Jr., PhD, MPH**[2], **Chunyu Li, PhD, MD**[2], **Florence K. Tangka, PhD, MS**[2], **Katrina F. Trivers, PhD, MSPH**[2], **Susan A. Sabatino, MD, MPH**[2], **Juan L. Rodriguez, MPH, MS**[2], and **Justin G. Trogdon, PhD**[3]

[1]RTI International, Research Triangle Park, North Carolina

[2]Division of Cancer Prevention and Control, CDC, Atlanta, Georgia

[3]Department of Health Policy and Management, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Abstract

Introduction—Breast cancer in women aged 18–44 years accounts for approximately 27,000 newly diagnosed cases and 3,000 deaths annually. When tumors are diagnosed, they are usually aggressive, resulting in expensive treatment costs. The purpose of this study is to estimate the prevalent medical costs attributable to breast cancer treatment among privately insured younger women.

Methods—Data from the 2006 MarketScan® database representing claims for privately insured younger women were used. Costs for younger breast cancer patients were compared with a matched sample of younger women without breast cancer, overall and for an active treatment subsample. Analyses were conducted in 2013 with medical care costs expressed in 2012 U.S. dollars.

Results—Younger women with breast cancer incurred an estimated $19,435 (SE=$415) in additional direct medical care costs per person per year compared with younger women without breast cancer. Outpatient expenditures comprised 94% of the total estimated costs ($18,344 [SE= $396]). Inpatient costs were $43 (SE=$10) higher and prescription drug costs were $1,048 (SE= $64) higher for younger women with breast cancer than in younger women without breast cancer. For women in active treatment, the burden was more than twice as high ($52,542 [SE=$977]).

Conclusions—These estimates suggest that breast cancer is a costly illness to treat among younger, privately insured women. This underscores the potential financial vulnerability of women in this age group and the importance of health insurance during this time in life.

Address correspondence to: Benjamin T. Allaire, MS, RTI International, 3040 Cornwallis Road, PO Box 12194, Research Triangle Park NC 27709-2194. ballaire@rti.org.

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Introduction

Approximately 27,000 newly diagnosed breast cancer cases and 3,000 deaths occur annually in women younger than age 45 years.[1] Breast cancer and its subsequent treatment pose several distinct challenges for women aged between 18 and 44 years (hereinafter referred to as younger women).[2] When breast cancer presents in this age group, the tumors are often large and aggressive, requiring expensive treatment, conferring worse prognosis than in older women.[3] Breast cancer tumors that are “triple negative” (negative for the estrogen, progesterone, and HER-2/neu receptors) are both more costly to treat[4] and more prevalent in younger women than in older women.[3,5,6]

Breast cancer treatment may also be associated with a variety of side effects, including changes in reproductive health, treatment-induced early menopause, and changes to sexual function, which may be distinct from the concerns of an older population.[3,7,8] The risk of early menopause may be as high as 35% for younger women undergoing chemotherapy.[9] Approximately 30% of women aged 40 years and younger have reported that fertility concerns played a role in their breast cancer treatment decisions and recent evidence has suggested that 10% of women may choose to undergo fertility preservation.[10] Furthermore, privately insured women aged 65 and younger may incur substantial and expensive chemotherapy-related side effects.[11]

In addition, younger women with breast cancer are more likely to exhibit symptoms of depression than older breast cancer patients,[12] more prone to emotional distress and anxiety, [13] and are more likely to utilize mental health services.[14] Previous research has shown that the odds of mental health care use among younger women diagnosed with breast cancer are more than six times higher than the odds among those aged ≥65 years.[15]

Taken together, these factors—aggressive cancer, adverse health effects of treatment, and increased utilization of mental healthcare services—suggest that breast cancer in younger women may result in a substantial financial burden for patients and their families. This study estimated the annual direct medical care costs attributable to breast cancer among privately insured younger women. The direct medical costs express the total amount of medical spending ascribed to breast cancer among younger women. Prevalent cost estimates are presented, reflecting costs in a single year among younger women with breast cancer across the entire treatment spectrum. Prevalence costs can be useful for informing the design of insurance benefits, eligibility criteria for public programs, and budgeting for future costs.[16] This paper reports the costs by type of service and also identifies women in active treatment during the year. Although many studies have focused on the Medicare population[17] and on the privately insured population aged 65 years and younger,[11,18] to the authors’ knowledge, no studies have previously examined breast cancer treatment costs in this younger population.

Methods

In this study, data from the MarketScan® database representing claims in 2006 (January 1 to December 31, 2006) were used, and the analyses were conducted in 2013.[19] These data

represented the most recent version available to the authors at the initiation of this study. Marketscan's Commercial Claims Database is one of the nation's largest administrative claims database of privately insured individuals. The database included de-identified, person-specific outpatient, inpatient, and retail pharmaceutical claims from approximately 100 large payers, representing millions of covered lives. The claims included visit-level information, including dates of service, diagnosis and procedure codes, and payments. The enrollment files contained the universe of individuals enrolled in health insurance plans at any time during the study period, even those without a claim, which allowed assessment of the duration of enrollment. No restrictions were made on the basis of enrollment. Further, the database contains demographic information of the enrollees, including age, gender, employment, and the first three digits of their ZIP code. The three-digit ZIP code was used to provide state identifiers for all 50 states and the District of Columbia.

ICD-9-CM codes were used to identify women with breast cancer. Women with breast cancer were those with

1. a malignant neoplasm of the female breast (174);
2. carcinoma in situ of breast (233.0);
3. a history of malignant conditions classifiable to the breast (V10.3); or
4. prescription for aromatase inhibitors.[20,21]

Beneficiaries with any inpatient or long-term care claims with any of these ICD-9-CM codes were identified as breast cancer patients. Beneficiaries were also identified as having breast cancer if there were at least two outpatient claims with these ICD-9-CM codes on different days, which excluded screening codes for breast cancer. The aromatase inhibitors exemestane (Aromasin); anastrozole (Arimidex); and letrozole (Femara) were identified in the prescription drug file by their National Drug Code.

In subsample analyses, the authors identified younger women with breast cancer in the active treatment phase of care by utilizing the ICD-9-CM diagnosis codes, ICD-9-CM procedure codes, Healthcare Common Procedure Coding System codes, and Diagnosis-Related Group codes used in Appendix A of Hassett et al.[11] for chemotherapy and radiation. Because most breast cancer patients receive either chemotherapy or radiation,[22] women were considered in active treatment if they had a code for either.

The payment variables included all payments to providers associated with the administration of care, including out-of-pocket payments. Approximately one quarter of the MarketScan population was enrolled for less than a full year. As a result, payments were annualized by dividing by the fraction of the enrollment year. All costs were adjusted to 2012 U.S. dollars using a gross domestic product deflator.[23]

All comorbidities were defined using ICD-9-CM codes for claims at any point during 2006. This study included a modified Charlson Comorbidity Index that excluded diagnosis codes for cancers: any malignancy, leukemia and lymphoma, and metastatic solid tumors.[24] However, it controlled separately for the following cancers using indicator variables: ovarian, colorectal, lung, cervical, melanoma, leukemia, and lymphoma. Because the

Charlson Comorbidity Index includes many comorbidities that are most relevant to an older population, 12 additional conditions that were either prevalent or expected to be high cost among younger women (e.g., pregnancy, injuries, hypertension) were included as covariates in the multivariable models for this study.

Statistical Analysis

The authors propensity score matched younger women with breast cancer from the database to younger women without breast cancer. The propensity score estimates the probability of being in the breast cancer group based on the patient characteristics using predicted probabilities via a probit regression. The predicted values from the probit regression summarize multiple patient characteristics into a single propensity score, with similar scores indicating overlap in patient characteristics.[25] The probit model included age, employment, state, the Charlson Comorbidity Index exclusive of cancer, indicators for the six other types of cancer, and the 12 additional comorbidities relevant to this population of younger women. Nearest neighbor matching was used to pair a breast cancer patient with a non–breast cancer comparison woman. Because covariate balance may not hold for subsets of the matched sample, the authors rematched using nearest neighbor matching for both the active treatment groups.[26]

As is often the case with medical expenditure data, the samples included some individuals with extremely high expenditures (1% of patients have costs more than ten times the sample mean).[27] Less than 0.1% of breast cancer patients had zero expenditures, raising identification concerns with two-part model approaches for all expenditure categories. Almost all breast cancer patients had no inpatient expenditures (98%), and 16% had no drug expenditures.

These features of the data suggested that ordinary least squares estimates may be biased. To account for the bias, annual expenditures were predicted using two nonlinear model specifications. First, because so few patients lacked expenditures, total and outpatient expenditures were predicted using a generalized linear model for all patients to account for skewness. Second, the inpatient and drug expenditures were predicted with a two-part model to adjust for the substantial number of zero inpatient and drug expenditure.[28] The first part of the two-part model was a logistic regression to predict the probability of any medical expenditure. The second part was a generalized linear model composed of individuals with positive expenditures. Tests of the data indicated that using a gamma distribution with a log link in the generalized linear model was appropriate in all specifications.[28] Marginal effects of breast cancer were calculated using recycled predictions, and the delta method was used to compute SEs. All analyses were conducted in Stata, version 12.1.

Results

This study found 9,912 younger women with breast cancer and > 3.5 million without breast cancer. Table 1 presents the summary statistics for the breast cancer sample, all potential comparisons, and the matched comparison sample. The breast cancer group was older than the non-matched comparison group; almost 74% of the breast cancer group was aged 39–44 years compared with only 29% of the non-matched comparison group. Breast cancer

patients had higher rates of comorbid conditions, incurred much higher medical care costs, and were diagnosed with more chronic disorders such as hypertension and dyslipidemia than patients without breast cancer. Younger women with breast cancer were significantly more likely to exhibit depression (5.9% vs 3.9%) and have mental health or substance abuse issues (13.1% vs 9.8%).

After matching, the two samples balanced on all covariates. The unadjusted differences in total annual medical care costs per woman were more than five times larger ($27,833 vs $4,831) for a younger woman with breast cancer than for a matched woman without breast cancer (Table 1). Inpatient costs were <$100 for each group.

Table 2 presents the results for the active and not active treatment subsamples. Of the 9,912 breast cancer women, 3,065 (31%) were on active treatment. The mean total costs for the active treatment subsample were $68,096, more than ten times larger than the costs for the matched comparison sample and six times larger than breast cancer patients not on active treatment ($10,026). All covariates, including state indicators (not shown), balanced at the 95% level.

Estimates from nonlinear specifications, broken down by type of service, are displayed in Table 3. Total costs attributable to breast cancer for the average privately insured younger woman were $19,435 (SE=$415). Outpatient expenditure was the largest component of medical spending attributable to breast cancer, estimated at $18,344 (SE=$396), comprising 94% of total costs. Relative to outpatient costs, inpatient and prescription drug costs were much smaller at $43 (SE=$10) and $1,048 (SE=$64), respectively.

Women in active treatment incurred $52,542 (SE=$977) in additional medical expenditures per person, of which $50,291 (SE=$932) represented outpatient costs. Drug costs for women in active treatment were also more than twice the matched comparison sample ($2,170 [SE=$185]).

Discussion

In this study, the annual excess direct medical care costs for breast cancer among privately insured younger women was estimated to be $19,435 per woman per year. Women in active treatment had a much larger burden, $52,542. These findings demonstrate the substantial economic burden among privately insured women aged 18–44 years with breast cancer.

Similar to previous studies,[29] outpatient costs were the largest component of costs, comprising 94% of the total costs. Meanwhile, inpatient costs were the smallest component, comprising less than 1% of the total costs. Many breast cancer treatments occur in an outpatient setting such as hormonal therapies, lumpectomy, radiation therapy, and neoadjuvant and adjuvant chemotherapies.[18]

The direct medical care cost estimates reported here represent only a portion of the total financial burden of breast cancer in this population. The cost estimates presented in this study do not take into account all the economic cost that younger women incurred to receive medical care. These activities may include lost earning potential, time spent traveling to and

from care, waiting for appointments, consulting with physicians and other providers, child and dependent care costs, and leisure time. The activities forgone or incurred in receipt of medical care have been recommended for inclusion in economic studies of health interventions.[30] Excluding these activities may result in an understimate of the economic burden associted with breast cancer treatment among younger women.

The magnitude of the overall estimates is smaller than the $42,401 per person annual treatment cost estimate reported by Fu and Jhaveri[18] among a sample of privately insured women aged 18–64 years. There are a number of possible explanations for the differences in the estimates. Fu and Jhaveri focused on first-year costs only, which may be closer to the present estimate of those women in active treatment. The prevalence cost estimates reflect a cross section of annual attributable costs among women receiving breast cancer–related treatment at all phases of care across the cancer survivorship spectrum, from diagnosis through post-treatment care. Among cancer patients, previous studies have shown that expenditures are highest in the first year following diagnosis and at the end of life, and lowest in the intermediate phase.[31]

Limitations

This study has some limitations. First, although the sample is quite large, it represents a small portion of patients with commercial health insurance. However, the prevalence of breast cancer among the study population generally reflects the U.S. prevalence of breast cancer for this age group (results available on request).[32] Second, the study lacked some sociodemographic characteristics (e.g., race and income) and information on cancer stage at diagnosis. Lack of this information limited the authors' ability to report costs by subgroups and stage at diagnosis. Third, complications of treatment, such as mental health conditions, may be counted as comorbidities in the analysis, which would potentially underestimate the incremental costs of breast cancer. Fourth, the authors could not account for women in the survivorship phase of cancer care that may not be identified by the algorithm. Finally, the study did not control for insurance type, which may produce an uncertain bias in the results.

Conclusions

Despite these limitations, this study provides the first estimates of the direct medical care costs attributable to breast cancer for privately insured younger women. The results suggest that, in addition to the mortality impact,[33] the medical care cost of breast cancer among younger women with breast cancer is high. The results also highlight the importance of health insurance coverage for younger women to avoid potential financial hardship.

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Table 1

Summary Statistics for Younger Women With or Without Breast Cancer Aged 18–44 Years, 2006

Variable	Women with breast cancer	Women without breast cancer (before matching)	Women without breast cancer (after matching)	*p*-value for differences (BC versus matched controls)
Observations (*n*)	9,912	3,503,113	9,912	
Costs ($; M [SE])[a]				
Annualized total costs	27,833 (445)	2,889 (4)	4,831 (165)	< **0.01**
Annualized outpatient costs	25,516 (426)	2,212 (3)	3,798 (154)	< **0.01**
Annualized inpatient costs	96 (11)	31 (0)	43 (5)	< **0.01**
Annualized prescription drug costs	2,221 (66)	645 (1)	989 (29)	< **0.01**
Age (years)				0.48
18–23	0.5	18.7	0.5	
24–28	5.2	14.6	5.0	
29–33	11.6	17.0	11.5	
34–38	21.5	20.4	20.6	
39–44	61.2	29.3	62.4	
Employment				0.19
Employed, full-time	71.0	67.7	72.2	
Employed, part-time	1.5	1.8	1.5	
Charlson Index[b]				0.85
Charlson score of zero	88.8	92.1	88.9	
Charlson score of one	9.5	7.0	9.6	
Charlson score greater than one	1.6	0.9	1.5	
Comorbidities in 2006				
Ovarian cancer	0.6	0.1	0.7	0.71
Colorectal cancer	0.3	0.03	0.3	0.69
Lung cancer	0.8	0.02	0.8	0.65
Cervical cancer	0.4	0.3	0.4	0.82
Skin cancer	1.6	0.4	1.6	0.80
Leukemia and lymphoma	0.7	0.1	0.6	0.87
Hypertension	8.1	5.2	8.3	0.57
Dyslipidemia	8.8	5.5	9.3	0.58
Pneumonia	1.2	0.6	1.4	0.55
Asthma	2.8	2.9	2.8	0.72
Depression	5.3	3.9	5.4	0.93
Back problems	15.6	11.1	16.1	0.11
Skin disorders	20.3	13.7	21.1	0.75
Injuries	22.9	14.1	23.4	0.06
Pregnancy	11.8	10.5	12.4	0.85

Variable	Women with breast cancer	Women without breast cancer (before matching)	Women without breast cancer (after matching)	*p*-value for differences (BC versus matched controls)
Arthritis	13.6	8.3	14.2	0.12
Mental health/substance abuse	12.2	9.8	12.3	0.65

Note: Values are percentages unless otherwise noted. Summary statistics are presented for younger women with breast cancer and propensity score–matched comparison sample. Boldface indicates a statistically significant difference from the breast cancer sample ($p < 0.05$).

State indicator variables were included in the match; none were significantly different than the breast cancer sample at the 5% level.

[a] All costs are per capita and were adjusted to 2012 U.S. dollars.

[b] This Charlson Index excludes cancers.

BC, breast cancer.

Table 2

Summary Statistics for Younger Women With or Without Breast Cancer Aged 18–44 Years, Active Treatment Subsample, 2006

Variable	Women with breast cancer (active treatment)	Women with breast cancer (not on active treatment)	Women without breast cancer (after matching to active treatment group)	*p*-value for differences (BC versus matched controls)
Observations (*n*)	3,065	6,847	3,065	
Costs ($; M [SE])[a]				
Annualized total costs	68,096 (1,077)	10,026 (174)	6,019 (314)	**<0.01**
Annualized outpatient costs	64,271 (1,029)	8,377 (163)	4,820 (286)	**<0.01**
Annualized inpatient costs	140 (18)	77 (13)	39 (8)	**<0.01**
Annualized prescription drug costs	3,685 (196)	1,573 (37)	1,161 (69)	**<0.01**
Age (years)				0.83
18–23	0.2	0.7	0.2	
24–28	1.3	6.9	1.2	
29–33	6.4	13.9	6.6	
34–38	22.3	21.2	21.2	
39–44	69.8	57.4	70.8	
Employment				0.73
Employed, full-time	69.6	71.7	70.2	
Employed, part-time	1.7	1.5	1.4	
Charlson Index[b]				0.85
Charlson score of zero	86.3	90.0	86.2	
Charlson score of one	11.6	8.6	11.9	
Charlson score greater than one	2.1	1.4	1.9	
Comorbidities in 2006				
Ovarian cancer	1.0	0.5	0.8	0.37
Colorectal cancer	0.7	0.1	0.7	0.94
Lung cancer	2.1	0.3	2.0	0.75
Cervical cancer	0.6	0.3	0.5	0.76
Skin cancer	2.7	1.2	2.6	0.81
Leukemia and lymphoma	1.6	0.4	1.5	0.80
Hypertension	10.4	7.1	10.6	0.87
Dyslipidemia	8.8	8.8	9.6	0.31
Pneumonia	2.1	0.9	2.5	0.34
Asthma	2.6	2.9	2.4	0.54
Depression	6.0	4.9	6.8	0.25
Back problems	17.0	15.0	17.3	0.74
Skin disorders	22.5	19.3	23.3	0.48

Variable	Women with breast cancer (active treatment)	Women with breast cancer (not on active treatment)	Women without breast cancer (after matching to active treatment group)	*p*-value for differences (BC versus matched controls)
Injuries	31.7	19.0	32.5	0.52
Pregnancy	3.6	15.5	3.5	0.90
Arthritis	15.9	12.5	16.9	0.33
Mental health/substance abuse	15.1	11.0	15.8	0.41

Note: Values are percentages unless otherwise noted. Summary statistics are presented for younger women with breast cancer and propensity score–matched comparison sample.

Boldface indicates a statistically significant difference from the breast cancer sample ($p < 0.05$).
State indicator variables were included in the match; none were significantly different than the breast cancer sample at the 5% level.

[a]All costs are per capita and were adjusted to 2012 U.S. dollars.

[b]This Charlson Index excludes cancers.

BC, breast cancer

Table 3

Annual Direct Medical Costs Attributable to Breast Cancer in Younger Women by Type of Service

	Annualized medical care costs per woman ($2012)	Annualized medical care costs per woman in active treatment ($2012)
Type of service	**Estimate (SE)**	**Estimate (SE)**
Total costs	**19,435 (415)**	**52,542 (977)**
Outpatient	**18,344 (396)**	**50,291 (932)**
Inpatient	**43 (10)**	**80 (17)**
Prescription	**1,048 (64)**	**2,170 (184)**

Note: Total costs and outpatient costs used a generalized linear model, whereas inpatient and prescription drug costs were estimated using a two-part model. SEs were derived using the delta method.

Boldface indicates statistical significance at the 1% level.