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Bone Health Issues in Breast Cancer Survivors: A Medicare Current Beneficiary Survey (MCBS) Study

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Abstract

Purpose—Breast cancer treatments (chemotherapy and hormone therapy) can cause a rapid loss in bone mineral density, leading to osteoporosis and fractures later in life. Fortunately, preventative measures (vitamin D, exercise, etc.) can delay bone loss if employed early enough. This study compares the prevalence of osteoporosis and osteoporosis-related discussions with physicians among female breast cancer survivors and females with no cancer history to determine if breast cancer patients are being correctly advised on their high risk of bone loss.

Methods—The 2003 Medicare Current Beneficiary Survey, a nationally representative sample of 550 women with a breast cancer history and 6,673 women with no cancer history aged ≥ 65, was used. The first set of dependent variables collected information on bone health (osteoporosis, falls, and fractures). The second set of dependent variables collected information on bone health discussions with their physician. Multivariate logistic regression models were used to evaluate whether breast cancer was independently associated with bone health issues.

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Results—After adjustment for confounders, a breast cancer diagnosis was found to be associated with a higher prevalence of an osteoporosis diagnosis over their lifetime (adjusted odds ratio [OR_{adj}] = 1.32, 95% confidence interval [95% CI]=1.08-1.61) and falls in the previous year (OR_{adj}=1.23, 95% CI=1.01-1.51) compared to respondents without a cancer diagnosis. However, breast cancer respondents were not more likely than respondents without a cancer diagnosis to discuss osteoporosis with their physician (OR_{adj}=1.20, 95% CI=0.96-1.50) or be told they are at high risk for osteoporosis (OR_{adj}=1.41, 95% CI=0.95-2.10).

Conclusions—A breast cancer diagnosis was associated with an increased prevalence of osteoporosis and falls. Nevertheless, breast cancer respondents were not more likely to discuss osteoporosis with their physician nor were they more likely to be considered high risk for osteoporosis. Increased dialogue between physician and breast cancer patient pertaining to bone loss are needed.

Background

Breast cancer is the leading type of cancer among women in the United States, with an estimated 207,090 new invasive cases in 2010 [1]. Survival rates for breast cancer continue to rise due to increasingly efficacious screening, early detection, and treatment [2]. Due to increasing survival, more than 2 million breast cancer survivors live in the United States today [3]. As the number of breast cancer survivors continues to grow and the length of survival expands, numerous long-term side effects of their treatment, such as osteoporosis, are becoming a priority for this group [4].

Up to 80% of breast cancer patients experience bone loss, often termed “cancer-treatment-induced bone loss (CTIBL),” during treatment [5-7]. While postmenopausal women without cancer lose an average of 1% of their bone mineral density (BMD) annually, women receiving treatment for breast cancer can lose 2% to 8% of their BMD annually [8-10]. The primary cause of CTIBL is hypogonadism, which results from cancer therapies such as chemotherapy and endocrine therapy. As levels of endogenous estrogen swiftly decline due to breast cancer treatment, rapid loss of BMD often results [11]. Breast cancer patients also have a higher rate of falls compared to those who are cancer-free [12, 13]. Due to higher rates of bone loss and falls, breast cancer patients have up to a 5-fold increase in fracture risk compared to their cancer-free counterparts [14, 15].

Although breast cancer patients experience CTIBL and a higher rate of fractures than women without cancer, it is unknown what discussions doctors have with these patients about the risk of bone loss and what can be done to prevent it. Those discussions are of particular importance because of the need for regular assessments (DXA and bone metabolism biomarkers) in order to monitor bone health. CTIBL, falls, and fractures can be minimized and/or prevented through supplementation with vitamin D and calcium [16, 17] and behavioral changes such as increased weight-bearing exercise [18]. The aims of this study were to: 1) to compare the rate of osteoporosis and falls between those who reported a previous diagnosis of breast cancer and those without cancer, and 2) compare the rate of discussions with their physician about issues pertaining to bone health. It was not an aim of this study is to determine the rate of cancer-related skeletal events among breast cancer survivors, as this was not possible with this dataset.. The 2003 Medicare Current Beneficiary

Survey, which mainly sampled those 65 years old, asked beneficiaries detailed questions pertaining to bone health discussions with their physicians, along with self-reported information on osteoporosis and falls. We used this nationally representative sample to: 1) estimate the independent association of a breast cancer diagnosis with bone health/falls and 2) compare the prevalence of physician discussions about bone loss (osteoporosis), falls, and bone mineral density assessments between those with and without a personal history of breast cancer. We hypothesized that women with breast cancer histories would be more likely than women without cancer histories to report discussing bone health with their physicians based on the high prevalence of CTIBL among these women.

Methods

Data Sources

We used cross-sectional data from the 2003 Medicare Current Beneficiary Survey, a nationally representative in-person survey of randomly sampled Medicare beneficiaries that was conducted by the Federal Centers for Medicare and Medicaid Services. Participants completed a baseline interview and three follow-up interviews per year during a 4-year period. New participants enter into a longitudinal cohort each year. Because of the cross-sectional nature of this study, the data used were either from a baseline or from a follow-up survey depending on when the respondent entered the longitudinal cohort. Data were collected through personal interviews with the beneficiary or a proxy chosen by the beneficiary if she was physically or mentally unable to do the interview. The “Access to Care” files used in these analyses contained information collected in the fall interview (September through December of 2003) concerning access to care, satisfaction with care, and usual source of care. The file also contains demographic and health insurance data as well as data on health status and functioning, including numerous questions on bone health.

Study Population

The participants in this study were drawn from respondents who completed the Access to Care module from the 2003 Medicare Current Beneficiary Survey, conducted by Centers for Medicare and Medicaid Services from its Medicare enrollment file. Respondents for the Medicare Current Beneficiary Survey were selected from the Medicare enrollment file to be representative of the Medicare population as a whole. Participants were selected by using a stratified, multistage, area probability sample design. The response rate for the Medicare Current Beneficiary Survey was approximately 70% [19]. For this study, we restricted our analysis to female Medicare beneficiaries who lived in the community.

Dependent Variables

The first set of dependent variables consists of self-reported bone health outcomes. Patients reported whether they suffered a fall (previous year), suffered a severe fall requiring medical help (previous year), suffered a hip fracture (ever), and/or have been diagnosed with osteoporosis by their doctor (ever), all of which were treated as dichotomous dependent measures. Participants also reported the number of falls if they reported falling in the previous year, which was categorized (0, 1, 2, 3).

The second set of dependent variables pertains to bone health discussions between the participant and her physicians, and all of these variables were treated as dichotomous dependent measures. Individuals were classified as having talked with a doctor about osteoporosis if they answered “yes” to the question: “Have you ever talked with your doctor or other health professional about osteoporosis?” and were high-risk for bone loss according to a doctor if they answered “yes” to the question: “Has a doctor or other health professional ever told you that you are at high risk for osteoporosis?” Individuals were determined to have had a BMD assessment if they answered “yes” to the question: “Have you ever had a Bone Mass or Bone Density Measurement test?” and were aware of such a test if they answered “yes” to the question: “Before today, had you ever heard of this test?”

The last set of dependent variables pertains to discussions between the participant and her physicians about falls and fall prevention, and all of these variables were treated as dichotomous dependent measures. Individuals were classified as having talked with a doctor about falls if they answered “yes” to the question: “Did you talk to a doctor or other medical professional about (that fall/any of those falls)?” If the participants reported talking with a doctor about a fall, then they were asked 2 follow-up questions: “Did the health care provider talk with you to understand why you fell?” and “Did the health care provider talk with you about how to prevent future falls?”

Independent Variables

The main independent variable of interest was self-reported personal history of breast cancer. Females who responded “yes” to the following question: “Has a doctor ever told you that you had any kind of cancer, malignancy, or tumor other than skin cancer?” and further indicated the tumor was found in the breast were considered to have a personal history of breast cancer. All other women who responded “no” to the following question: “Has a doctor ever told you that you had any kind of cancer, malignancy, or tumor other than skin cancer?” were considered to have no personal history of any cancer. We excluded those who reported a personal history of cancer in any other body part. We also excluded women who reported a personal history of breast cancer in the past year due to the lower likelihood they would have had enough time to discuss osteoporosis with their physicians. Additional covariates that were considered potential confounders identified from the literature included age, race or ethnicity, general health status, body mass index (BMI), smoking status, marital status, income, and education.

Statistical Analyses

The goals of our analyses were to assess the independent relationships of a breast cancer diagnosis to bone health discussions with physicians, adverse bone health outcomes (osteoporosis, fracture), and falls in community-dwelling adults. Baseline differences in the covariates age and BMI were evaluated by Student's t-test, while the differences in the covariates race/ethnicity, marital status, education, income, general health status and smoking status were evaluated by χ^2 tests of proportions between the non-cancer and breast cancer groups. Variables used in parametric tests were first test for their distribution and shown to be normally distributed.

Multivariate logistic regression was used to determine the association of breast cancer with each dependent variable in our study (i.e., osteoporosis, fall, severe fall, hip fracture, talk with a doctor about osteoporosis, at high-risk for osteoporosis, ever had a BMD test, ever heard of a BMD test, talking with a doctor about fall, understanding the fall, and fall prevention). Each outcome was examined in a separate model. Covariates included age (continuous), BMI (continuous), marital status, race/ethnicity, education, income, general health status, and smoking status. Model selection was performed in a stepwise, backward manner. First, all model terms (independent variable and covariates) were added to the logistic model. Covariates that were not significant ($p > 0.05$) in the model were removed one at a time, beginning with the covariate with the greatest p -value. The final models represent the OR and 95% CI for the corresponding predictor variable, adjusted for the covariates found to be significant in the model.

Because the Medicare Current Beneficiary Survey uses a stratified, multistage sampling scheme and oversamples certain population groups, each person had an unequal probability of being included in the survey. To obtain nationally representative population estimates, we conducted the analyses with SAS Survey Procedures (version 9.2; SAS Institute, Inc, Cary, NC) and used the Medicare Current Beneficiary Survey cross-sectional weight to adjust for the complex multistage sample design and the number of non-responses. The University of Rochester's Institutional Review Board approved these analyses with exempt status.

Results

Table 1 displays the characteristics of 550 women with a breast cancer history and 6,673 women with no cancer history in regard to the selected covariates. Both the means and proportions are weighted using the cross-sectional weight to adjust for the sample design. Those with a breast cancer history and those with no cancer history were similar in regard to BMI, income, and general health status. However, individuals with a breast cancer history were significantly more likely ($p < 0.05$) to be older, Caucasian, widowed, have a higher education level, and have a positive smoking history than individuals not reporting a cancer diagnosis.

The crude and adjusted odds ratios and corresponding 95% confidence intervals for the association between self-reported bone health outcomes and falls by breast cancer status are shown in Table 2. Women with a history of breast cancer reported being diagnosed with osteoporosis (33.4%) more frequently than women with no cancer history (27.7%) ($OR_{adj}=1.32$; 95% CI 1.08–1.61). A significant difference was noted between women with breast cancer (29.6%) and women without cancer (25.0%) for the occurrence of a fall in the last year ($OR_{adj}=1.23$; 95% CI 1.01–1.51), but not for a severe fall in the last year ($OR_{adj}=1.15$; 95% CI 0.85–1.56), or a hip fracture in their lifetime ($OR_{adj}=0.87$; 95% CI 0.58–1.31). There was also no significant difference between the two groups in the number of individuals who suffered the most falls (≥ 3) in the previous year ($OR_{adj}=1.22$; 95% CI 0.83–1.79).

Table 3 displays the crude and adjusted odds ratios and corresponding 95% confidence intervals for the relationship between bone health discussions between the participant and

her physicians by breast cancer status. Women with a history of breast cancer were significantly more likely to report ever having a BMD assessment in their lifetime ($OR_{adj}=1.53$; 95% CI 1.26–1.87). No significant differences between women with a breast cancer history and women without a cancer history were found for ever talking to a doctor about osteoporosis ($OR_{adj}=1.20$; 95% CI 0.96–1.50), being told they were at high-risk for osteoporosis ($OR_{adj}=1.41$; 95% CI 0.95–2.10), or ever hearing of a BMD test ($OR_{adj}=1.30$; 95% CI 0.96–1.78).

The crude and adjusted odds ratios and corresponding 95% confidence intervals for the association between fall discussions between the participant and her physician by breast cancer status are shown in Table 4. Women with a history of breast cancer were not more likely to discuss falls with their doctor than women without a cancer history ($OR_{adj}=0.98$; 95% CI 0.70–1.38). There was also no significant difference between the two groups in having the physician try to understand why the participant fell ($OR_{adj}=0.71$; 95% CI 0.42–1.21) and discussing fall prevention with their physician ($OR_{adj}=1.13$; 95% CI 0.67–1.89) among women who reported a fall in the previous year.

Discussion

In a nationally representative sample of those 65 and older, women with a breast cancer diagnosis were significantly more likely to report having osteoporosis than women with no cancer diagnosis. This result is consistent with the few other studies that reported an increased risk of osteoporosis among women diagnosed with breast cancer [5, 20]. There was a statistically significant increase in falls in the previous year for women diagnosed with breast cancer compared to women without a cancer diagnosis, which is consistent with other studies showing women with breast cancer were more likely to report falls than cancer-free women [12, 13]. These results add evidence to the small body of literature showing women with breast cancer are more likely to report osteoporosis and falls than women without cancer.

Fractures can have a profound effect on mortality; up to 25% of female hip fracture patients die within one year of suffering a fracture [21, 22]. In addition to increased mortality, over 30% of survivors will become permanently disabled, and approximately 20% of survivors will need long-term care in a nursing home [23, 24]. Approximately two-thirds of hip fracture patients do not return to their pre-fracture level of functioning [25]. Fractures can limit daily activities such as climbing stairs, getting dressed, cooking, and taking medications [26]. Fractures also have a profound effect on quality of life; patients report significant sleep problems, depression, and fear of another fracture [27, 28].

Despite the fact that women with a history of breast cancer were more likely to report having a diagnosis of osteoporosis and falling in the previous year, they were not more likely to have had bone health discussions with their physicians. Women with breast cancer were also not more likely than cancer-free women to have discussed osteoporosis with their doctor or to be classified as high-risk for osteoporosis, with only 43% of breast cancer patients having talked about osteoporosis with their doctor and only 23% of those women having been told they were at high-risk for developing osteoporosis. The results were similar

in regards to falls; even though women with breast cancer reported falling more often, they were no more likely to discuss falls with their doctor than women without cancer.

A lack of bone health and fall discussions with a physician can be problematic for breast cancer patients and survivors, especially because of their higher rate of osteoporosis and falls. Previous research has shown a strikingly high number of breast cancer survivors (> 75%) with osteoporosis go undiagnosed [5]. Physician discussions are necessary in order to diagnose osteoporosis and begin treatment to avoid complications such as fractures. Additionally, women with breast cancer who do not discuss bone issues with their physicians are not being told they are at high-risk for osteoporosis. That means breast cancer survivors miss a chance to discuss preventive measures against CTIBL; treatment of CTIBL in a prophylactic manner leads to greater success than delayed treatment [11, 29]. Simple over-the-counter interventions such as vitamin D supplementation [16, 30] and behavioral interventions such as weight-bearing exercise [18, 31] reduce bone loss and prevent fractures. Researchers and clinicians emphasize that patient education and management strategies are essential for the proper treatment of CTIBL [32, 33]. Our findings highlight the need for dialogue between breast cancer survivors and their health care providers to avoid CTIBL-related complications.

This study has several limitations that should be considered when interpreting the results. The study was cross-sectional, and we could not directly determine if breast cancer was the cause of increased rates of osteoporosis. There was no information on the time from diagnosis, disease characteristics, and treatment received for the women who reported a breast cancer diagnosis. It is possible that bone health discussions with physicians significantly varied for breast cancer survivors by disease stage, treatment regimens, and/or date of diagnosis. Future studies could expand upon our results by examining the proportion of physician discussions among breast cancer survivors by disease type (age at diagnosis, stage, and hormone receptor status) and treatment (chemotherapy, type of hormone therapy). This would help identify the sub-groups of breast cancer survivors that have the most need for increased dialogue with health care providers pertaining to CTIBL. A third limitation was the self-reported nature of assessment in the Medicare Current Beneficiary Survey. We were unable to verify self-reported BMD assessments, osteoporosis diagnoses, or hip fractures with medical records. However, the validity of a self-reported BMD assessment is high, and the validity of self-reported osteoporosis diagnosis is moderate [34]. Additionally, a greater proportion of participants report receiving a BMD assessment than discussing osteoporosis with their provider. This seems counterintuitive, as one would logically assume the topic of osteoporosis would be discussed with prescribing a BMD assessment. Future studies need to make a concerted effort to accurately assess which bone health tests were performed and which discussions with physicians took place. Lastly, because the Medicare Beneficiary Database Survey is comprised mainly of individuals 65 years old or older, the results cannot be generalized to younger breast cancer patients.

Despite these limitations, this study shows that women with a breast cancer diagnosis were significantly more likely than women without cancer to report a diagnosis of osteoporosis and falling in the previous year. Women with breast cancer were also significantly more likely to report having a BMD assessment than women who did not report any cancer

diagnosis. However, this study found that these breast cancer survivors were not more likely to discuss osteoporosis, be classified as high-risk for osteoporosis, or discuss falls and fall prevention with their doctors than cancer-free women. This is one of the first studies to characterize the prevalence of such discussions between breast cancer survivors and physicians and to compare them to a cancer-free reference group. These results highlight the need for increased dialogue about bone health and falls between breast cancer survivors and their health care providers. Such discussions would allow for the better detection of bone loss, the employment of preventive measures against bone loss, and the proper treatment for osteoporosis. Future studies should look to confirm these results and expand these findings to various sub-groups of breast cancer survivors.

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Table 1

Demographics by Breast Cancer Status

	No Cancer		Breast Cancer		p-value
	n	W%	n	W%	
Age					
< 65 Years Old	907	12.0%	36	5.2%	
65-74 Year Old	2,349	43.5%	164	36.7%	
75-84 Year Old	2,339	32.6%	255	44.9%	
85 Years Old	1,078	11.9%	95	13.2%	<0.01
BMI					
< 20 kg/m ²	919	13.1%	59	10.0%	
20-25 kg/m ²	2,167	31.7%	179	32.2%	
25-30 kg/m ²	2,002	30.7%	177	31.3%	
> 30 kg/m ²	1,585	24.5%	135	26.5%	0.25
Race/Ethnicity					
White	5,560	83.3%	491	88.8%	
Black	726	11.1%	39	7.7%	
Hispanic	171	2.3%	8	1.2%	
Other	199	3.3%	11	2.3%	0.02
Marital Status					
Married	2,490	41.1%	207	40.3%	
Widowed	3,024	42.4%	266	46.8%	
Separated/Divorced	719	11.5%	55	9.8%	
Never Married	437	5.0%	22	3.1%	0.08
Education					
< HS	2,073	29.2%	138	24.7%	
HS Grad	2,700	41.5%	234	42.5%	
Some College	935	14.3%	79	13.9%	
College Grad	929	15.0%	99	18.9%	0.05
Income					
\$10,000/year	1,650	22.2%	115	20.6%	

	No Cancer		Breast Cancer		p-value
	n	W%	n	W%	
\$10,001-\$25,000/year	2,965	43.6%	247	43.6%	
\$25,001-\$50,000/year	1,657	27.7%	151	28.6%	
\$50,001/year	401	6.5%	37	7.2%	0.80
General Health Status					
Excellent	988	15.0%	79	14.7%	
Very Good	1,755	27.1%	135	24.2%	
Good	2,091	30.9%	188	35.2%	
Fair	1,267	18.7%	100	18.0%	
Poor	545	8.3%	47	7.9%	0.36
Smoking Status					
Never Smoker	3,744	55.4%	287	51.7%	
Former Smoker	2,172	32.9%	207	38.8%	
Current Smoker	735	11.7%	55	9.5%	0.02

W% is the weighted percentage

Table 2
Crude and adjusted odds ratios and 95% confidence intervals for self-reported bone health outcomes and falls by breast cancer status

	No Cancer		Breast Cancer		Crude OR		Adjusted OR*	
	N	W %	N	W %	OR	95% CI	OR	95% CI
Osteoporosis								
No	4,539	72.3%	356	66.6%	1.00	Reference	1.00	Reference
Yes	1,771	27.7%	179	33.4%	1.30	1.07 - 1.59	1.32	1.08 - 1.61
*Adjusted for: Age and BMI.								
Fall								
No	4,652	75.0%	366	70.4%	1.00	Reference	1.00	Reference
Yes	1,628	25.0%	168	29.6%	1.25	1.03 - 1.54	1.23	1.01 - 1.51
*Adjusted for: Age, BMI, and Education.								
Severe Fall								
No	5,696	91.8%	477	90.3%	1.00	Reference	1.00	Reference
Yes	568	8.2%	56	9.7%	1.21	0.89 - 1.64	1.15	0.85 - 1.56
*Adjusted for: Age, BMI, and Education.								
Hip Fracture								
No	5,970	95.8%	507	95.7%	1.00	Reference	1.00	Reference
Yes	305	4.2%	28	4.3%	1.02	0.68 - 1.54	0.87	0.58 - 1.31
*Adjusted for: Age, BMI, and Education.								
Falls								
0	4,652	75.4%	366	70.7%	1.00	Reference	1.00	Reference
1	863	13.2%	95	17.7%	1.43	1.11 - 1.84	1.33	1.03 - 1.71
2	332	5.3%	31	5.1%	1.03	0.69 - 1.56	1.03	0.68 - 1.55
3	398	6.1%	39	6.5%	1.12	0.77 - 1.65	1.22	0.83 - 1.79
*Adjusted for: Age, BMI, and Education.								

Table 3
Crude and adjusted odds ratios and 95% confidence intervals for bone health discussions with physicians by breast cancer status

	No Cancer		Breast Cancer		Crude OR		Adjusted OR*	
	N	W %	N	W %	OR	95% CI	OR	95% CI
Ever talk to doctor about osteoporosis?								
No	2,950	60.3%	229	57.2%	1.00	Reference	1.00	Reference
Yes	1,747	39.7%	158	42.8%	1.14	0.91 - 1.42	1.20	0.96 - 1.50
*Adjusted for: Age, General Health, BMI, and Education.								
Told you were at high risk for osteoporosis?								
No	1,572	81.4%	137	77.2%	1.00	Reference	1.00	Reference
Yes	356	18.6%	40	22.8%	1.29	0.87 - 1.91	1.41	0.95 - 2.10
*Adjusted for: Age								
Ever had a BMD Assessment?								
No	3,195	49.2%	207	37.9%	1.00	Reference	1.00	Reference
Yes	2,993	50.8%	323	62.1%	1.59	1.31 - 1.93	1.53	1.26 - 1.87
*Adjusted for: Age, General Health, BMI, and Education.								
Ever heard of BMD Assessment?								
No	1,204	32.2%	67	26.6%	1.00	Reference	1.00	Reference
Yes	2,395	67.8%	179	73.4%	1.31	0.96 - 1.79	1.30	0.96 - 1.78
*Adjusted for: Age, Marital Status, and BMI.								

Table 4
Crude and adjusted odds ratios and 95% confidence intervals for fall discussions with physicians by breast cancer status

	No Breast Cancer		Breast Cancer		Crude OR		Adjusted OR*	
	N	W %	N	W %	OR	95% CI	OR	95% CI
Talk to professional about falls?								
No	853	50.7%	87	50.8%	1.00	Reference	1.00	Reference
Yes	855	49.3%	84	49.2%	1.00	0.71 - 1.41	0.98	0.70 - 1.38
*Adjusted for: Age								
Did professional try to understand fall?								
No	218	25.4%	26	32.0%	1.00	Reference	1.00	Reference
Yes	635	74.6%	55	68.0%	0.72	0.43 - 1.23	0.71	0.42 - 1.21
*Adjusted for: Age and Race								
Fall prevention								
No	333	39.3%	30	35.7%	1.00	Reference	1.00	Reference
Yes	518	60.7%	51	64.3%	1.17	0.70 - 1.95	1.13	0.67 - 1.89
*Adjusted for: Age and Race								