DOI:10.1093/jnci/djt024
Advance Access publication February 21, 2013

ARTICLE

Racial Disparities in Posttraumatic Stress After Diagnosis of Localized Breast Cancer: The BQUAL Study

Neomi Vin-Raviv, Grace Clarke Hillyer, Dawn L. Hershman, Sandro Galea, Nicole Leoce, Dana H. Bovbjerg, Lawrence H. Kushi, Candyce Kroenke, Lois Lamerato, Christine B. Ambrosone, Heidis Valdimorsdottir, Lina Jandorf, Jeanne S. Mandelblatt, Wei-Yann Tsai, Alfred I. Neugut

Manuscript received October 3, 2012; revised January 14, 2013; accepted January 18, 2013.

Correspondence to: Alfred I. Neugut, MD, PhD, Columbia University Medical Center, 722 W 168th St, Rm 725, New York, NY 10032 (e-mail: ain1@columbia.edu).

Background Little is known about the development of posttraumatic stress disorder (PTSD) over time among women diagnosed with breast cancer. This study examines changes in PTSD symptoms in the first 6 months after diagnosis and assesses racial/ethnic differences in PTSD symptomatology over time.

Methods We recruited women with newly diagnosed breast cancer, stages I to III, from three sites in the United States. Three telephone interviews were conducted: baseline at about 2 to 3 months after diagnosis, first follow-up at 4 months after diagnosis, and second follow-up at 6 months after diagnosis. We measured traumatic stress in each interview using the Impact of Events Scale; recorded sociodemographic, tumor, and treatment factors; and used generalized estimating equations and polytomous logistic regression modeling to examine the associations between variables of interest and PTSD.

Results Of 1139 participants, 23% reported symptoms consistent with a diagnosis of PTSD at baseline, 16.5% at first follow-up, and 12.6% at the second follow-up. Persistent PTSD was observed among 12.1% participants, as defined by having PTSD at two consecutive interviews. Among participants without PTSD at baseline, 6.6% developed PTSD at the first follow-up interview. Younger age at diagnosis, being black (odds ratio [OR] = 1.48 vs white, 95% confidence interval [CI] =1.04 to 2.10), and being Asian (OR = 1.69 vs white, 95% CI = 1.10 to 2.59) were associated with PTSD.

Conclusions Nearly one-quarter of women newly diagnosed with breast cancer reported symptoms consistent with PTSD shortly after diagnosis, with increased risk among black and Asian women. Early identification of PTSD may present an opportunity to provide interventions to manage symptoms.

J Natl Cancer Inst;2013;105:563–572

A growing body of evidence suggests that the experience of being diagnosed with breast cancer, a potentially life-threatening event, is associated with substantial psychological distress (1–3). Posttraumatic stress disorder (PTSD) is a psychiatric diagnosis characterized by the development of re-experiencing, avoidance, and increased arousal symptoms after exposure to a traumatic event (4). In 1994, the trauma criteria for PTSD in the *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition* (DSM-IV) were expanded to include life-threatening illnesses, such as cancer (4). Since that time, PTSD has been investigated in a number of studies of breast cancer survivors; these typically small-scale studies have yielded estimates of prevalence ranging from 0% (5,6) to 32% (7,8).

A number of studies have identified risk factors for PTSD after a diagnosis of cancer, including demographic, social, psychosocial, and clinical characteristics, such as socioeconomic status (9–11), less education (10,11), poor social support (12–15), prior individual psychological disturbances (10), younger age at diagnosis (9,11,12,16–19), type of surgery (10,15), lymph node involvement (10,15), stage of disease (12), and less time since treatment (13).

Racial disparities have been a concern in breast cancer, generally focused on differences in survival outcomes (20), but some studies have also suggested that the risk of PTSD may also be different across racial/ethnic groups (21,22). For example, Roberts and colleagues (22) found that the risk of PTSD after being exposed to various life traumas among blacks was 1.22 (95% confidence interval [CI] = 1.02 to 1.43), whereas among Asian women the risk was lower (odds ratio [OR] = 0.67, 95% CI = 0.45 to 0.99) in comparison with whites in their sample of more than 34 000 individuals representative of the US noninstitutionalized, civilian population aged 18 years and older. After a cancer diagnosis as the traumatic event, a higher rate of PTSD has been reported for blacks diagnosed with

prostate cancer (23) and non-Hodgkins lymphoma (24) than for whites with the same diagnoses, but this issue has received little attention in breast cancer. Rates of PTSD after a diagnosis of breast cancer in Hispanic and Asian Americans have also received little research attention, although there is some evidence of generally lower emotional well-being among women in these minority groups compared with whites (25).

In this study, we investigate PTSD in data collected from a large prospective cohort of racially diverse breast cancer patients over a 6-month period after diagnosis based on three time points and explore the impact of demographic and clinical characteristics on PTSD, with a particular emphasis on race.

Methods

The details of the Breast Cancer Quality of Care Study (BQUAL) have been previously reported (26). Briefly, between 2006 and 2010, women with newly diagnosed, primary, invasive breast cancer, stages I to III, who were aged greater than 20 years were recruited after face-to-face or telephone contact from three sites around the United States (New York City at Columbia University Medical Center and Mount Sinai School of Medicine; Detroit at Henry Ford Health System; and northern California at Kaiser Permanente). Participants were enrolled shortly after diagnosis (within 12 weeks). After receiving the participants' names, contact information, and signed informed consent forms from each recruitment site, Columbia interviewers contacted the participants by telephone and confirmed eligibility. Reasons for exclusion included stage 0 or IV breast cancer, non-English speaking, prior history of any cancer with the exception of nonmelanoma skin cancer, substantial memory deficit, and lack of a telephone.

Each subject completed three interviews during which the questions from standardized questionnaires were administered over the phone. The baseline interview was conducted about 2 to 3 months after diagnosis and prior to the third cycle of chemotherapy, if chemotherapy was administered. The first follow-up was 4 months after diagnosis, and a second follow-up was 6 months after diagnosis. All questionnaires were administered by phone. The medical records were abstracted 6 to 18 months postdiagnosis to gather data related to the tumor and treatment.

All study-related procedures and materials were approved by the institutional review boards of each recruitment site and the US Army Medical Research and Materiel Command Office of Research Protections and Human Research Protection Office. Written informed consent and HIPAA authorization was obtained before initiation of study procedures.

Study Variables

Demographic and Clinical Characteristics. Participants were queried about age, race, education, annual household income, and marital status. Tumor characteristics from the medical record included American Joint Committee on Cancer stage (I, II, III), tumor grade (well, moderately, poorly differentiated), nodal status (positive or negative), estrogen receptor/progesterone receptor status (positive or negative), human epidermal growth factor receptor 2 (HER2) status (positive or negative), breast surgery history (lumpectomy, mastectomy, or no surgery), and comorbidity data from 12 months before through 3 months after diagnosis. The Charlson Comorbidity Index (27) score was then calculated (none vs one or more comorbidities).

Posttraumatic Stress Disorder. PTSD symptoms were assessed at all three time points using the Impact of Event Scale (IES) (28). The IES is one of the most commonly used measures of PTSD among adults and has been shown to perform well as a screening instrument (29,30). The 15-item version of the IES measures two of the three symptom clusters of PTSD, intrusive and avoidance experienced over the past 7 days. Each item has a scoring range of 0 (not at all), 1 (seldom), 3 (sometimes), or 5 (often). The term "distressing event" was replaced by the term "breast cancer." The range of scores for the IES is 0 to 75. A cutoff score of 24 has demonstrated a perfect (1.00) sensitivity and acceptable specificity (0.82) against the DSM-IV criteria (30). Thus, we defined an IES total score greater than or equal to 24 as PTSD. We also defined those who had PTSD on two consecutive interviews as having persistent PTSD.

Statistical Analysis

Comparisons of categorical variables between women with and without PTSD at each time point were conducted using χ^2 tests. To assess the associations between patient and clinical characteristics and risk of PTSD over time, from baseline until 6 months, we used generalized estimating equations with an unstructured working covariance matrix to account for the correlation because of multiple observations per patient. All women completing at least one assessment were included in this portion of the analysis. Any variables that were found to be univariably associated with PTSD at the P less than .10 level at any of the three time points were included in the multivariable model. The multivariable model did not assess time by covariable interactions because all variables were measured only at baseline and, with the exception of age, would not change over time. Lastly, to assess the relationship between patient and disease characteristics and the persistence of PTSD, we used polytomous logistic regression. Participants were classified by the number of times they met the criteria for PTSD (0 times, 1 time, or 2 times), using those who never met criteria for PTSD (0 times) as the reference group. The multivariable model again included any variables that were found to be univariably associated with PTSD at the P less than .10 level. For the polytomous model, the proportional odds assumption was assessed by the Score test. It was found to violate this assumption ($P = .04$), so a generalized logit model was used instead. All analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC). A P value of less than .05 was considered statistically significant, and all statistical tests were two-sided.

Results

We identified and contacted 1479 women with newly diagnosed nonmetastatic breast cancer between May 2006 and June 2010. Of these, 122 (8.2%) refused to participate, and 212 (14.3%) were found to be ineligible. Of the 1145 women who participated, 1139 women completed the IES interview at baseline (99.4%), 1109

at the second interview (96.9%), and 1076 at the third interview (94.0%). In total, 1059 (92.5%) respondents completed all three interviews.

Table 1 shows the demographic and clinical characteristics of the study sample at each of the three time points, separated into those meeting criteria for PTSD and those who did not. At all three time points, women diagnosed at a younger age (aged <50 years) had a higher likelihood of PTSD. Asian and black women were the largest groups with PTSD both at baseline (29.3% and 28.2%, respectively; $P = .03$) and at the second time point, although at the second time point, black women had higher PTSD than Asian women (23.6% vs 20.0%; $P < .01$). The New York site had the most women with PTSD only at baseline (22.2%; $P < .01$). Positive lymph node status was associated with increased PTSD both at baseline (28.7%; $P = .01$) and at the second time point (16.8%; $P = .03$). Both stage III (23.9%; $P = .01$) and HER2-positive status (19.8%; $P = .03$) were associated with higher PTSD only at the third time point (Table 1).

Of the 1139 participants, 262 (23.0%) had PTSD at the baseline time point. At the second and third time points, 183 (16.5%) and 136 (12.6%), respectively, were found to have PTSD (Table 1). Figure 1 demonstrates the course of PTSD over the study time points. Of those with PTSD at baseline, less than half (124, 48.3%) continued to have PTSD at the second time point. Of those, 71 (57.3%) had PTSD at the third time point. Among 877 participants without PTSD at baseline, 58 (6.6%) developed PTSD at the second time point, and of those, 14 (24.1%) continued to report PTSD symptoms at the third time point. Overall, 138 (12.1%) women had PTSD on two consecutive time points; we defined them as having persistent PTSD.

Among the participants, 247 (21.5%) responded moderately or greater to one or more single items on the IES at baseline. At the first time point, 192 (16.8%) women responded moderately or greater to at least one item on the IES. At the second time point, 177 (15.5%) women responded moderately or greater to at least one item on the IES.

In the generalized estimating equations–adjusted model (Table 2), treatment at Columbia University Medical Center/Mount Sinai School of Medicine (OR = 1.58 vs Kaiser Permanente Northern California, 95% CI = 1.11 to 2.23), younger age at diagnosis (aged <50 years) (OR = 2.15 vs aged ≥70, 95% CI = 1.38 to 3.37), and race/ethnicity among Asian women (OR = 1.69 vs white, 95% CI = 1.10 to 2.59) and black women (OR = 1.48 vs white, 95% CI = 1.04 to 2.10) were associated with PTSD. No association was found between clinical characteristics and PTSD.

In the multivariable polytomous logistic regression analysis (Table 3), when comparing women with PTSD at one time point to women who never met criteria for PTSD during the study, we did not observe any association between demographic or clinical characteristics and PTSD. When comparing women who met criteria for PTSD at two or more time points to women who never met criteria for PTSD during the study, we found that younger age at diagnosis (aged <50 years) (OR = 2.98, 95% CI = 1.58 to 5.62), black race (OR = 1.84, 95% CI = 1.15 to 2.92), and Asian race (OR = 1.84, 95% CI = 1.01 to 3.37) were associated with PTSD.

In addition, as a sensitivity analysis, we conducted the same analyses with a cutoff of 27 (23) and obtained similar results (data not shown).

Discussion

This study is one of the first to evaluate the course of PTSD over time after a breast cancer diagnosis. Our data suggest that nearly a quarter of women met criteria for PTSD during the first 2 to 3 months after diagnosis and, consistent with the literature, the prevalence of PTSD gradually declined over the next 3 months. Asians (OR = 1.69, 95% CI = 1.10 to 2.59) and blacks (OR = 1.48, 95% CI = 1.04 to 2.10) were more likely to meet criteria for PTSD as assessed by the IES than were whites. There was an even higher racial disparity with regard to repeated evidence of PTSD, with the odds ratio for persistent PTSD at 1.84 for blacks vs whites (95% CI = 1.15 to 2.92) and 1.84 for Asians vs whites (95% CI = 1.01 to 3.37).

Cancer is a multifactorial trauma that includes different experiences, such as diagnosis of the disease, different treatments, and possibly recurrence; all serve as potential traumatic stressors. Previous studies that examined the association between cancer and PTSD largely focused on diagnosis or on pre/post-treatment, whereas others focused on recurrence of the disease (31). In the current study, participants were enrolled shortly after diagnosis (within 12 weeks), which allowed for the capture of trauma from both the diagnosis and the primary treatment process.

Interestingly, Asians and blacks have been reported to be at increased risk of PTSD associated with trauma exposure in acute care medical settings (32). Few studies examined racial disparities in PTSD among cancer populations. Smith and colleagues (24), in their study of 886 non-Hodgkins lymphoma survivors, found that blacks had higher average PTSD scores than whites (29.1 vs 26.4; $P = .06$). Race had a P value of .07 in the logistic regression model, with nonwhites having 1.7 times greater odds of partial/full PTSD than whites. Purnell and colleagues (23) investigated 317 prostate cancer patients who completed the IES; the prevalence rate of PTSD among blacks was 35% vs 14% for whites.

Several demographic factors may confound the association between racial disparities and PTSD in this cohort, including lower income (9–11,18) and less education (9–11,18). Black women are at higher risk for many of those factors related to PTSD, including preexisting psychiatric disorders, lower socioeconomic status, being poor, and lower educational level, in comparison with white women (33). However, in the current study, we did not observe an association between PTSD and lower education or lower income, although these relationships may be mediated by prior trauma exposures (31), and the racial disparities were present after controlling for these other variables.

Seng and colleagues (34) identified three categories of factors among black women that may explain racial disparities in PTSD: patient factors (eg, less use of health-care system, higher rates of chronic medical conditions because of expression of somatic or psychological symptoms), provider/system factors (eg, less access to health care), and interaction factors between patient and system (eg, nondisclosure of trauma history leading to misclassification of the disorder). They explored the impact of those factors on

Table 1. Demographic and clinical characteristics of participants of Breast Cancer Quality of Care Study, May 2006 to June 2010 (n = 1139) by level of posttraumatic stress disorder (PTSD) assessed at three intervals during the first 6 months after diagnosis*

	Baseline			Time point 2			Time point 3		
	PTSD (n = 262, 23.0%)	No PTSD (n = 877, 77.0%)		PTSD (n = 183, 16.5%)	No PTSD (n = 926, 83.5%)		PTSD (n = 136, 12.6%)	No PTSD (n= 940, 87.4%)	
Characteristic	No. (%)	No. (%)	*P*	No. (%)	No. (%)	*P*	No. (%)	No. (%)	*P*
Recruitment site			<.01			.06			.48
KPNC	174 (20.6)	669 (79.4)		124 (15.1)	699 (84.9)		96 (11.9)	708 (88.1)	
CUMC/MSSM	59 (37.1)	100 (62.9)		35 (22.6)	120 (77.4)		22 (15.2)	123 (84.8)	
HFHS	29 (21.2)	108 (78.8)		24 (18.3)	107 (81.7)		18 (14.2)	109 (85.8)	
Age at diagnosis, y			<.01			.01			.01
<50	87 (32.5)	181 (67.5)		62 (89.8)	190 (75.4)		46 (18.7)	200 (81.3)	
50–59	76 (22.0)	269 (78.0)		56 (16.5)	283 (83.5)		45 (13.7)	283 (86.3)	
60–69	69 (20.6)	266 (79.4)		46 (13.9)	285 (86.1)		30 (9.4)	289 (90.6)	
≥70	30 (15.7)	161 (84.3)		19 (10.2)	168 (89.8)		15 (8.2)	168 (91.8)	
Race			.03			.08			<.01
White	161 (20.5)	623 (79.5)		111 (14.4)	658 (85.6)		71 (9.4)	685 (90.6)	
Black	51 (28.2)	130 (71.8)		37 (21.6)	134 (78.4)		37 (23.6)	120 (76.4)	
Hispanic	14 (24.1)	44 (75.9)		10 (17.9)	46 (82.1)		7 (13.2)	46 (86.8)	
Asian	29 (29.3)	70 (70.7)		21 (21.9)	75 (78.1)		19 (20.0)	76 (80.0)	
Other	7 (41.2)	10 (58.8)		4 (23.5)	13 (76.5)		2 (13.3)	13 (86.7)	
Education			.26			.62			.56
≤ High school grad	70 (26.0)	199 (74.0)		48 (18.3)	214 (81.7)		33 (13.2)	217 (86.8)	
College	129 (23.1)	430 (76.9)		87 (16.0)	455 (84.0)		70 (13.4)	453 (86.6)	
Graduate School	63 (20.3)	248 (79.7)		47 (15.5)	257 (84.5)		33 (10.9)	269 (89.1)	
Annual household income			.32			.88			.78
<25 000	41 (29.5)	98 (70.5)		27 (19.6)	111 (80.4)		20 (15.0)	113 (85.0)	
25 000–49 000	57 (23.1)	190 (76.9)		40 (16.6)	201 (83.4)		25 (11.1)	201 (88.9)	
50 000 –89 000	80 (22.6)	274 (77.4)		55 (16.1)	286 (83.9)		45 (13.7)	284 (86.3)	
≥90 000	70 (20.5)	272 (79.5)		52 (15.7)	280 (84.3)		39 (11.8)	293 (88.2)	
Unknown	14 (24.6)	43 (75.4)		9 (15.8)	48 (84.2)		7 (12.5)	49 (87.5)	
Marital Status			.36			.13			.20
Single	52 (28.1)	133 (71.9)		37 (20.8)	141 (79.2)		29 (17.0)	142 (83.0)	
Married	115 (21.8)	413 (78.2)		70 (13.7)	440 (86.3)		54 (10.8)	445 (89.2)	
Widowed	18 (18.7)	78 (81.3)		20 (20.6)	77 (79.4)		9 (9.7)	84 (90.3)	
Separated/divorced	37 (18.7)	115 (75.7)		24 (15.7)	129 (84.3)		19 (12.9)	128 (87.1)	
Unknown	40 (24.3)	138 (77.5)		32 (18.7)	139 (81.3)		25 (15.1)	141 (84.9)	
AJCC Stage			.09			.85			.01
I	118 (20.4)	460 (79.6)		92 (16.3)	474 (83.7)		67 (12.1)	486 (87.9)	
II	104 (25.0)	312 (75.0)		68 (17.0)	333 (83.0)		40 (10.4)	345 (89.6)	
III	29 (30.8)	65 (69.2)		17 (18.1)	77 (81.9)		22 (23.9)	70 (76.1)	
Unknown	11 (21.6)	40 (78.4)		6 (12.5)	42 (87.5)		7 (15.2)	39 (84.8)	
Grade			.31			.21			.18
Well differentiated	56 (21.2)	208 (78.8)		37 (14.4)	220 (85.6)		25 (9.8)	230 (90.2)	
Moderately differentiated	112 (21.6)	407 (78.4)		77 (15.2)	430 (84.8)		59 (12.1)	430 (87.9)	
Poorly differentiated	74 (26.9)	201 (73.1)		53 (19.9)	213 (80.1)		41 (16.1)	214 (83.9	
Unknown	20 (24.7)	61 (75.3)		16 (20.2)	63 (79.8)		11 (14.3)	66 (85.7)	

(Table continues)

Table 1. (Continued)

	Baseline			Time point 2			Time point 3		
	PTSD (n = 262, 23.0%)	No PTSD (n = 877, 77.0%)		PTSD (n = 183, 16.5%)	No PTSD (n = 926, 83.5%)		PTSD (n = 136, 12.6%)	No PTSD (n= 940, 87.4%)	
Characteristic	**No. (%)**	**No. (%)**	***P***	**No. (%)**	**No. (%)**	***P***	**No. (%)**	**No. (%)**	***P***
Node Status			.01			.03			.23
Positive	96 (28.7)	238 (71.3)		55 (16.8)	273 (83.2)		48 (15.0)	272 (85.0)	
Negative	163 (20.4)	636 (79.6)		125 (16.1)	651 (83.9)		87 (11.6)	665 (88.4)	
Unknown	3 (50.0)	3 (50.0)		3 (60.0)	2 (40.0)		1 (25.0)	3 (75.0)	
ER/PR receptor status			.25			.16			.15
Positive	204 (22.2)	714 (77.8)		140 (15.6)	755 (84.4)		102 (11.7)	770 (88.3)	
Negative	54 (25.6)	157 (74.4)		40 (19.5)	165 (80.5)		33 (16.8)	163 (83.2)	
Unknown	4 (40.0)	6 (60.0)		3 (33.3)	6 (66.7)		1 (12.5)	7 (87.5)	
HER2 status			.18			.19			.03
Positive	38 (28.6)	95 (71.4)		28 (21.9)	100 (78.1)		24 (19.8)	97 (80.2)	
Negative	195 (22.7)	662 (77.3)		130 (15.5)	706 (84.5)		98 (12.1)	712 (87.9)	
Unknown	29 (19.5)	120 (80.5)		25 (17.2)	120 (82.8)		14 (9.7)	131 (90.3)	
Breast Surgery			.03			.24			.38
Lumpectomy	149 (21.5)	544 (78.5)		106 (15.8)	563 (84.2)		79 (12.1)	575 (87.9)	
Mastectomy	108 (24.7)	329 (75.3)		74 (17.1)	358 (82.9)		55 (13.3)	360 (86.7)	
No surgery/ unknown	5 (55.6)	4 (44.4)		3 (37.5)	5 (62.5)		2 (28.6)	5 (71.4)	
Charlson Comorbidity Index			.24			.39			.98
0	215 (23.2)	710 (76.8)		147 (16.4)	752 (83.6)		111 (12.7)	764 (87.3)	
≥1	43(21.0)	162 (79.0)		33 (16.4)	168 (83.6)		24 (12.4)	170 (87.6)	
Unknown	4 (44.4)	5 (55.6)		3 (33.3)	6 (66.7)		1 (14.3)	6 (85.7)	

* Two-sided χ^2 tests were used to test statistical significance. AJCC = American Joint Committee on Cancer; CUMC/MSSM = Columbia University Medical Center/Mount Sinai School of Medicine in New York City; ER = estrogen receptor; HER2 = human epidermal growth factor receptor 2; HFHS = Henry Ford Health System in Detroit, Michigan; KPNC = Kaiser Permanente of Northern California; PR = progesterone receptor.

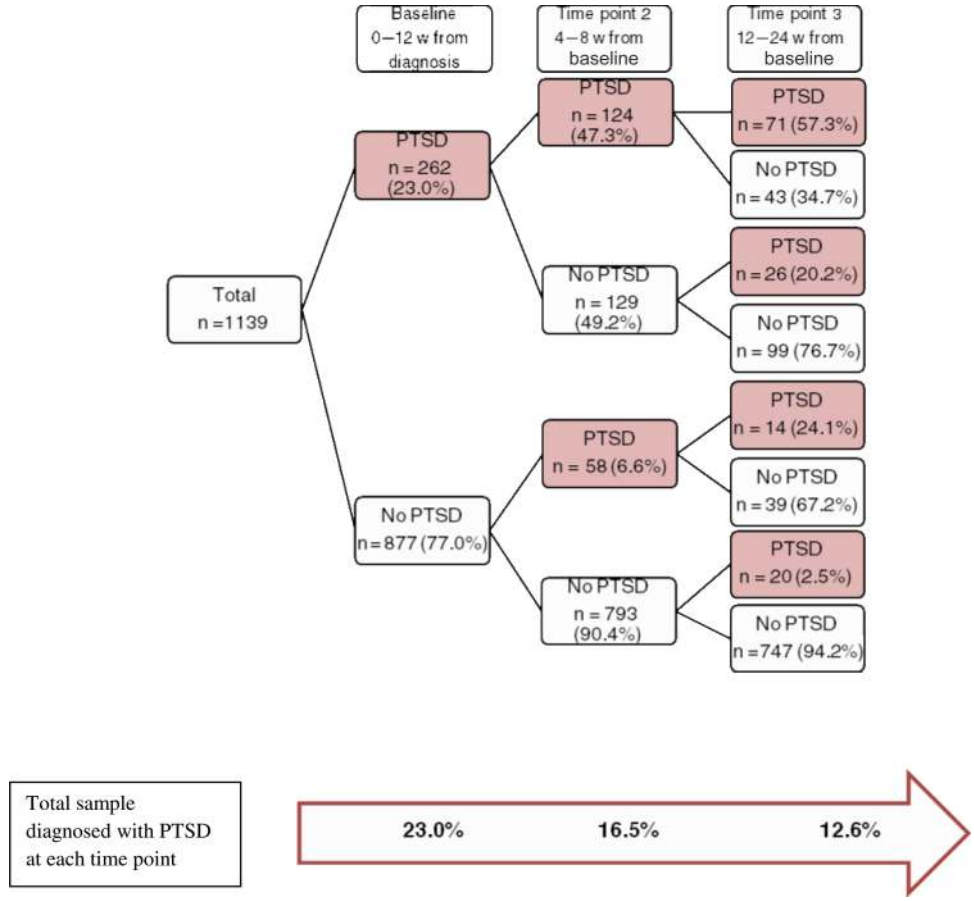

Figure 1. Posttraumatic stress disorder (PTSD) patterns among participants in the Breast Cancer Quality of Care Study, May 2006 to June 2010 (n = 1139). Note that the number at each interview does not add up to the number at the previous interview because all participants did not complete all interviews. We had 35 missing observations at time point 2 and 45 at time point 3.

the differential prevalence of PTSD diagnoses between black and white women; among the three categories, they found associations with continuous insurance coverage, which was 40% less frequent among black women. In cancer populations, insurance status has been also reported to be associated with cancer-related PTSD among non-Hodgkins lymphoma survivors (24). In this study, most of the patients came from managed health care plans and were insured, so we could not explore the impact of insurance on PTSD.

Additionally, we found that women diagnosed before age 50 years were more likely to have repeated evidence of PTSD (OR = 2.98, 95% CI = 1.58 to 5.12). Our finding that younger age at diagnosis was statistically significantly associated with PTSD is consistent with prior studies (11,31,35). Furthermore, a recent review that examined quality of life, depression, anxiety, and stress perception among young breast cancer survivors concluded that younger women with breast cancer experienced more emotional distress than their older counterparts or than the general age-matched population without cancer (36). The possible reasons for greater emotional distress among younger women include the impact of breast cancer on their lifestyle and careers, fertility issues, and changes in libido and sexuality (37). Previous studies suggested that young women may have fewer adaptive coping skills (38–40). It is also possible that older adults are more resilient, especially with respect to emotional problems and problem solving, than younger women (41).

Persons with PTSD have substantially worse quality of life than those without. Thus, a higher rate of PTSD among blacks and Asians may make their survivorship experience more difficult. Furthermore, PTSD may interfere with compliance, as reported for treatment for cardiovascular disease and stroke (42–45). It is possible that a higher rate of PTSD in black or Asian breast cancer patients may lead to lower compliance to subsequent chemotherapy, radiotherapy, and hormonal therapy. Such undertreatment would reduce the survival of these women, and thus PTSD may be a contributing factor to the observed racial disparities in breast cancer survival. In addition, numerous studies have observed neuroendocrine dysregulation among individuals with PTSD (46). Neuroendocrine levels have powerful effects on the activity of the immune system, and increasing evidence suggests that individuals with PTSD have altered immune activity, including lower levels of natural killer cell activity and higher levels of circulating inflammatory markers (47). Given the role of the immune system in cancer progression, the biological alterations associated with PTSD might contribute to cancer progression and survival.

We found no association between PTSD and a number of clinical factors, including stage, grade, nodal status, estrogen receptor/progesterone receptor status, HER2 status, or Charlson Comorbidity Index. These findings are consistent with the

Table 2. Unadjusted and adjusted generalized estimating equations logistic regression models predicting posttraumatic stress disorder among participants of Breast Cancer Quality of Care Study, May 2006 to June 2010 (n = 1139)*

Characteristic	Unadjusted OR (95 % CI)	*P*	Adjusted OR (95 % CI)	*P*
Time				
Baseline	1.00 (referent)		1.00 (referent)	
Time point 2	0.66 (0.57 to 0.77)	<.01	0.65 (0.56 to 0.77)	<.01
Time point 3	0.50 (0.42 to 0.59)	<.01	0.49 (0.41 to 0.58)	<.01
Recruitment site				
KPNC	1.00 (referent)		1.00 (referent)	
CUMC/MSSM	1.89 (1.38 to 2.59)	<.01	1.58 (1.11 to 2.23)	.01
HFHS	1.12 (0.76 to 1.65)	.58	1.21 (0.81 to 1.81)	.36
Age at diagnosis, y				
<50	2.63 (1.75 to 3.97)	<.01	2.15 (1.38 to 3.37)	.01
50–59	1.66 (1.10 to 2.51)	.02	1.47 (0.96 to 2.25)	.07
60–69	1.38 (0.90 to 2.09)	.14	1.28 (0.83 to 1.96)	.26
≥70	1.00 (referent)		1.00 (referent)	
Race				
White	1.00 (referent)		1.00 (referent)	
Black	1.74 (1.25 to 2.42)	.01	1.48 (1.04 to 2.10)	.03
Hispanic	1.32 (0.80 to 2.16)	.28	1.07 (0.63 to 1.82)	.80
Asian	1.77 (1.18 to 2.65)	.01	1.69 (1.10 to 2.59)	.02
Other	2.07 (0.84 to 5.11)	.11	2.07 (0.78 to 5.47)	.14
AJCC stage				
I	1.00 (referent)		1.00 (referent)	
II	1.14 (0.88 to 1.49)	.32	0.98 (0.74 to 1.29)	.88
III	1.62 (1.07 to 2.44)	.02	1.28 (0.82 to 2.15)	.28
Unknown	1.01 (0.51 to 1.97)	.99	0.85 (0.41 to 1.78)	.67
HER2 status				
Negative	1.00 (referent)		1.00 (referent)	
Positive	1.49 (1.03 to 2.14)	.03	1.34 (0.91 to 1.96)	.13
Unknown	0.89 (0.60 to 1.31)	.56	0.88 (0.58 to 1.32)	.53
Breast Surgery				
Lumpectomy	1.00 (referent)		1.00 (referent)	
Mastectomy	1.15 (0.90 to 1.48)	.26	0.99 (0.76 to 1.28)	.92
No surgery/ unknown	3.53 (1.06 to 11.81)	.04	3.64 (0.95 to 13.90)	.06

* AJCC = American Joint Committee on Cancer; CI = confidence interval; CUMC/MSSM = Columbia University Medical Center/Mount Sinai School of Medicine in New York City; HER2 = human epidermal growth factor receptor 2; HFHS = Henry Ford Health System in Detroit, Michigan; KPNC = Kaiser Permanente of Northern California; OR = odds ratio.

literature, which found few associations between clinical variables in cancer and PTSD (8,31,35).

A key strength of our study was the availability of a prospectively collected, large sample of breast cancer patients recruited at the time of diagnosis or shortly after from multiple institutions with different health-care systems around the United States. In addition, there was an excellent response rate to all three IES interviews and the use of standardized measures.

Our study had limitations as well. First, previous studies have established that lifetime exposure to traumatic events is associated with PTSD (48–50). The highest prevalences of traumatic events were observed in the Detroit area studies, ranging from 87.2% (51) to 89.6% (52) in a predominantly black population. Traumatic life events in the past and a history of psychological disturbance are also well-established predictors for cancer-related PTSD (8,31,35) and may contribute to higher levels of PTSD among blacks (33,53). Our interviews did not collect information on these factors, and we were, therefore, unable to consider the effect they may have had on our models. Second, in this study, most of the patients came from managed health-care plans and were insured, so the generalizability to uninsured patients remains to be established.

Finally, we applied the IES scale as a broad indictor for PTSD. Although the majority of studies in breast cancer populations have used the IES scale (10,31,54), the clinical cutoff levels for IES have not been uniform (10). Few studies have examined the prevalence of PTSD in cancer populations and compared them with the general population, and those studies generally used the PTSD Checklist–Civilian Version assessment (55,56). To our knowledge, no one has examined PTSD as measured by the IES over time in cancer patients and compared them with the general population. In the one study we found that examined IES scores in a general population sample, Lukaschek and colleagues (48) reported a 1.7% PTSD prevalence in Germany. Finally, no study has compared the use of the IES scale in blacks vs whites, so there is at least some possibility that the observed differences may reflect differences stemming from response to the scale rather than true biologic differences. We did control for educational level and income, which should mitigate some of this possibility.

In conclusion, in this prospective cohort study of women with early-stage breast cancer, we found PTSD among approximately 25% of the women shortly after diagnosis; when examining patterns of PTSD, we found that the prevalence of PTSD decreased over time. The main factors associated with PTSD were younger

Table 3. Multivariable polytomous logistic regression models predicting categories of posttraumatic stress disorder (PTSD) among participants of Breast Cancer Quality of Care Study, May 2006 to June 2010 (n = 1059)*

	PTSD at one time point	PTSD at two or more time points
Characteristic	**OR (95% CI)**	**OR (95% CI)**
Recruitment site		
KPNC	1.00 (referent)	1.00 (referent)
CUMC/MSSM	1.63 (0.99 to 2.68)	1.45 (0.87 to 2.42)
HFHS	1.15 (0.64 to 2.05)	1.31 (0.74 to 2.30)
Age at diagnosis, y		
<50	1.74 (0.97 to 3.14)	2.98 (1.58 to 5.62)
50–59	1.12 (0.64 to 1.97)	1.46 (0.78 to 2.74)
60–69	0.99 (0.56 to 1.76)	1.35 (0.72 to 2.53)
≥70	1.00 (referent)	1.00 (referent)
Race		
White	1.00 (referent)	1.00 (referent)
Black	0.91 (0.53 to 1.55)	1.84 (1.15 to 2.92)
Hispanic	1.24 (0.58 to 2.65)	1.08 (0.45 to 2.57)
Asian	1.38 (0.76 to 2.53)	1.84(1.01 to 3.37)
Other	1.90 (0.49 to 7.39)	3.04 (0.87 to 10.57)
AJCC stage		
I	1.00 (referent)	1.00 (referent)
II	1.28 (0.87 to 1.89)	0.95 (0.63 to 1.42)
III	1.58 (0.85 to 2.95)	1.57 (0.83 to 2.96)
Unknown	0.23 (0.05 to 1.09)	0.89 (0.35 to 2.28)
HER2 status		
Negative	1.00 (referent)	1.00 (referent)
Positive	1.07 (0.61 to 1.86)	1.45 (0.86 to 2.44)
Unknown	1.00 (0.59 to 1.71)	0.90 (0.50 to 1.59)
Breast Surgery		
Lumpectomy	1.00 (referent)	1.00 (referent)
Mastectomy	1.38 (0.95 to 2.01)	0.87 (0.59 to 1.29)
No surgery/unknown	7.16 (0.94 to 54.30)	3.83 (0.53 to 27.54)

* AJCC = American Joint Committee on Cancer; CI = confidence interval; CUMC/MSSM = Columbia University Medical Center/Mount Sinai School of Medicine in New York City; HER2 = human epidermal growth factor receptor 2; HFHS = Henry Ford Health System in Detroit, Michigan; KPNC = Kaiser Permanente of Northern California; OR = odds ratio.

age and being Asian or black. These potential risk factors can be identified at the time of diagnosis and may present an opportunity to provide early prevention and intervention to minimize PTSD symptomatology (57). This approach may improve the quality of patients' lives and may also have an indirect impact on the observed racial disparity in breast cancer survival.

References

1. Montazeri A. Health-related quality of life in breast cancer patients: a bibliographic review of the literature from 1974 to 2007. *J Exp Clin Cancer Res*. 2008;27(1):32.
2. Ganz PA. Psychological and social aspects of breast cancer. *Oncology (Williston Park, NY)*. 2008;22(6):642–646, 650; discussion 50, 53.
3. Mertz BG, Bistrup PE, Johansen C, et al. Psychological distress among women with newly diagnosed breast cancer. *Eur J Oncol Nurs*. 2012;16(4):439–443.
4. Vickberg SM, Bovbjerg DH, DuHamel KN, Currie V, Redd WH. Intrusive thoughts and psychological distress among breast cancer survivors: global meaning as a possible protective factor. *Behav Med*. 2000;25(4):152–160.
5. Matsuoka Y, Nakano T, Inagaki M, et al. Cancer-related intrusive thoughts as an indicator of poor psychological adjustment at 3 or more years after breast surgery: a preliminary study. *Breast Cancer Res Treat*. 2002;76(2):117–124.
6. Mundy EA, Blanchard EB, Cirenza E, Gargiulo J, Maloy B, Blanchard CG. Posttraumatic stress disorder in breast cancer patients following autologous bone marrow transplantation or conventional cancer treatments. *Behav Res Ther*. 2000;38(10):1015–1027.
7. Naidich JB, Motta RW. PTSD-related symptoms in women with breast cancer. *J Psychother Indepen Pract*. 2000;1:34–54.
8. Jim HS, Jacobsen P. Posttraumatic stress and posttraumatic growth in cancer survivorship: a review. *Cancer J*. 2008;14(6):414–419.
9. Cordova MJ, Andrykowski MA, Kenady DE, McGrath PC, Sloan DA, Redd WH. Frequency and correlates of posttraumatic-stress-disorder-like symptoms after treatment for breast cancer. *J Consult Clin Psychol*. 1995;63(6):981–986.
10. O'Connor M, Christensen S, Jensen AB, Moller S, Zachariae R. How traumatic is breast cancer? Post-traumatic stress symptoms (PTSS) and risk factors for severe PTSS at 3 and 15 months after surgery in a nationwide cohort of Danish women treated for primary breast cancer. *Br J Cancer*. 2011;104(3):419–426.
11. Koutrouli N, Anagnostopoulos F, Potamianos G. Posttraumatic stress disorder and posttraumatic growth in breast cancer patients: a systematic review. *Women & Health*. 2012;52(5):503–516.
12. Andrykowski MA, Cordova MJ, McGrath PC, Sloan DA, Kenady DE. Stability and change in posttraumatic stress disorder symptoms following breast cancer treatment: a 1-year follow-up. *Psychooncology*. 2000;9(1):69–78.
13. Andrykowski MA, Cordova MJ, Studts JL, Miller TW. Posttraumatic stress disorder after treatment for breast cancer: prevalence of diagnosis and use of the PTSD Checklist-Civilian Version (PCL-C) as a screening instrument. *J Consult Clin Psychol*. 1998;66(3):586–590.
14. Green BL, Krupnick JL, Rowland JH, et al. Trauma history as a predictor of psychologic symptoms in women with breast cancer. *J Clin Oncol*. 2000;18(5):1084.
15. Bleiker EMA, Pouwer F, van der Ploeg HM, Leer J-WH, Adèr HJ. Psychological distress two years after diagnosis of breast cancer: frequency and prediction. *Patient Educ Couns*. 2000;40(3):209–217.

16. Cordova MJ, Studts JL, Hann DM, Jacobsen PB, Andrykowski MA. Symptom structure of PTSD following breast cancer. *J Trauma Stress*. 2000;13(2):301–319.
17. Epping-Jordan JE, Compas BE, Osowiecki DM, et al. Psychological adjustment in breast cancer: processes of emotional distress. *Health Psychol*. 1999;18(4):315–326.
18. Green BL, Rowland JH, Krupnick JL, et al. Prevalence of posttraumatic stress disorder in women with breast cancer. *Psychosomatics*. 1998;39(2):102–111.
19. Kornblith AB, Herndon JE, Weiss RB, et al. Long-term adjustment of survivors of early-stage breast carcinoma, 20 years after adjuvant chemotherapy. *Cancer*. 2003;98(4):679–689.
20. Maskarinec G, Sen C, Koga K, Conroy SM. Ethnic differences in breast cancer survival: status and determinants. *Womens Health (Lond Engl)*. 2011;7(6):677–687.
21. Asnaani A, Richey JA, Dimaite R, Hinton DE, Hofmann S. A cross-ethnic comparison of lifetime prevalence rates of anxiety disorders. *J Nerv Ment Dis*. 2010;198(8):551–555.
22. Roberts AL, Gilman SE, Breslau J, Breslau N, Koenen KC. Race/ethnic differences in exposure to traumatic events, development of post-traumatic stress disorder, and treatment-seeking for post-traumatic stress disorder in the United States. *Psychol Med*. 2011;41(1):71–83.
23. Purnell JQ, Palesh OG, Heckler CE, et al. Racial disparities in traumatic stress in prostate cancer patients: secondary analysis of a National URCC CCOP Study of 317 men. *Support Care Cancer*. 2011;19(7):899–907.
24. Smith SK, Zimmerman S, Williams CS, Preisser JS, Clipp EC. Post-traumatic stress outcomes in non-Hodgkin's lymphoma survivors. *J Clin Oncol*. 2008;26(6):934–941.
25. Ashing-Giwa KT, Lim JW. Examining emotional outcomes among a multiethnic cohort of breast cancer survivors. *Oncol Nurs Forum*. 2011;38(3):279–288.
26. Neugut AI, Clarke Hillyer G, Kushi LH, et al. The Breast Cancer Quality of Care Study (B-QUAL): a multi-center study to determine causes for non-compliance with breast cancer adjuvant therapy. *Breast J*. 2012;18(3)203–213.
27. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373–383.
28. Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. *Psychosom Med*. 1979;41(3):209–218.
29. Brewin CR. Systematic review of screening instruments for adults at risk of PTSD. *J Trauma Stress*. 2005;18(1):53–62.
30. Wohlfarth TD, van den Brink W, Winkel FW, ter Smitten M. Screening for posttraumatic stress disorder: an evaluation of two self-report scales among crime victims. *Psychol Assess*. 2003;15(1):101–109.
31. Gurevich M, Devins GM, Rodin GM. Stress response syndromes and cancer: conceptual and assessment issues. *Psychosomatics*. 2002;43(4): 259–281.
32. Santos MR, Russo J, Aisenberg G, Uehara E, Ghesquiere A, Zatzick DF. Ethnic/Racial diversity and posttraumatic distress in the acute care medical setting. *Psychiatry*. 2008;71(3):234–245.
33. Alim TN, Charney DS, Mellman TA. An overview of posttraumatic stress disorder in African Americans. *J Clin Psychol*. 2006;62(7):801–813.
34. Seng JS, Kohn-Wood LP, Odera LA. Exploring racial disparity in posttraumatic stress disorder diagnosis: implications for care of African American women. *J Obstet Gynecol Neonatal Nurs*. 2005;34(4):521–530.
35. Kangas M, Henry JL, Bryant RA. Posttraumatic stress disorder following cancer. A conceptual and empirical review. *Clin Psychol Rev*. 2002;22(4):499–524.
36. Howard-Anderson J, Ganz PA, Bower JE, Stanton AL. Quality of life, fertility concerns, and behavioral health outcomes in younger breast cancer survivors: a systematic review. *J Natl Cancer Inst*. 2012;104(5):386–405.
37. Thewes B, Butow P, Girgis A, Pendlebury S. The psychosocial needs of breast cancer survivors: a qualitative study of the shared and unique needs of younger versus older survivors. *Psychooncology*. 2004;13(3):177–189.
38. Kroenke CH, Rosner B, Chen WY, Kawachi I, Colditz GA, Holmes MD. Functional impact of breast cancer by age at diagnosis. *J Clin Oncol*. 2004;22(10):1849–1856.
39. Schnoll RA, Harlow LL, Stolbach LL, Brandt U. A structural model of the relationships among stage of disease, age, coping, and psychological adjustment in women with breast cancer. *Psychooncology*. 1998;7(2):69–77.
40. Compas BE, Stoll MF, Thomsen AH, Oppedisano G, Epping-Jordan JE, Krag D. Adjustment to breast cancer: age-related differences in coping and emotional distress. *Breast Cancer Res Treat*. 1999;54(3):195–203.
41. Gooding PA, Hurst A, Johnson J, Tarrier N. Psychological resilience in young and older adults. *Int J Geriatr Psychiatry*. 2012;27(3):262–270.
42. Shemesh E, Rudnick A, Kaluski E, et al. A prospective study of posttraumatic stress symptoms and nonadherence in survivors of a myocardial infarction (MI). *Gen Hosp Psychiatry*. 2001;23(4):215–222.
43. Shemesh E, Yehuda R, Milo O, Dinur I, Rudnick A, Vered Z, et al. Posttraumatic stress, nonadherence, and adverse outcome in survivors of a myocardial infarction. *Psychosom Med*. 2004;66(4):521–526.
44. Shemesh E, Lurie S, Stuber ML, Emre, et al.. A pilot study of posttraumatic stress and nonadherence in pediatric liver transplant recipients. *Pediatrics*. 2000;105(2):e29.
45. Kronish IM, Edmondson D, Goldfinger JZ, Fei K, Horowitz CR. Posttraumatic stress disorder and adherence to medications in survivors of strokes and transient ischemic attacks. *Stroke*. 2012;43(8):2192–2197.
46. Pervanidou P, Chrousos GP. Neuroendocrinology of post-traumatic stress disorder. *Prog Brain Res*. 2010;182:149–160.
47. Pace TW, Heim CM. A short review on the psychoneuroimmunology of posttraumatic stress disorder: from risk factors to medical comorbidities. *Brain Behav Immun*. 2011;25(1):6–13.
48. Lukaschek K, Kruse J, Emeny R, Lacruz M, Eisenhart Rothe A, Ladwig K-H. Lifetime traumatic experiences and their impact on PTSD: a general population study [published online ahead of print September 25, 2012]. *Soc Psychiatry Psychiatr Epidemiol.*
49. Creamer M, Burgess P, McFarlane A. Post-traumatic stress disorder: findings from the Australian National Survey of Mental Health and Well-being. *Psychol Med*. 2001;31(7):1237–1247.
50. Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the national comorbidity survey. *Arch Gen Psychiatry*. 1995;52(12):1048–1060.
51. Goldmann E, Aiello A, Uddin M, et al. Pervasive exposure to violence and posttraumatic stress disorder in a predominantly African American urban community: the Detroit neighborhood health study. *J Trauma Stress*. 2011;24(6):747–751.
52. Breslau N, Kessler RC, Chilcoat HD, Schultz LR, Davis GC, Andreski P. Trauma and posttraumatic stress disorder in the community: the 1996 Detroit area survey of trauma. *Arch Gen Psychiatry*. 1998;55(7):626–632.
53. Gillespie CF, Phifer J, Bradley B, Ressler KJ. Risk and resilience: genetic and environmental influences on development of the stress response. *Depress Anxiety*. 2009;26(11):984–992.
54. Kangas M, Henry JL, Bryant R. Predictors of posttraumatic stress disorder following cancer. *Health Psychol*. 2005;24(6):579–585.
55. Mehnert A, Koch U. Psychological comorbidity and health-related quality of life and its association with awareness, utilization, and need for psychosocial support in a cancer register-based sample of long-term breast cancer survivors. *J Psychosom Res*. 2008;64(4):383–391.
56. Mehnert A, Lehmann C, Graefen M, Huland H, Koch U. Depression, anxiety, post-traumatic stress disorder and health-related quality of life and its association with social support in ambulatory prostate cancer patients. *Eur J Cancer Care (Engl)*. 2010;19(6):736–745.
57. French-Rosas LN, Moye J, Naik AD. Improving the recognition and treatment of cancer-related posttraumatic stress disorder. *J Psychiatr Pract*. 2011;17(4):270–276.

Funding

This work was supported by a Department of Defense Breast Cancer Center of Excellence Award (BC043120 to AIN); a National Cancer Institute (NCI) R01 (CA105274 to DLH); a Department of Defense Center for Biobehavioral Breast Cancer Research award to LHK; an NCI R25 fellowship (CA094601 to NL); an Environmental Health Foundation fellowship (Jerusalem, Israel) to NV-R; a Department of Defense Center for Interdisciplinary Biobehavioral Research

on Genetic Factors in Breast Cancer award (DAMD-17-01-1-0334 to DHB); an NCI R01 (CA100598 to CBA); and an NCI R01 (CA124924 and 127617), U10 (CA 84131), and K05 (CA96940 to JSM). DLH and CBA are recipients of funding from the Breast Cancer Research Foundation.

Note

The study sponsors had no role in the design of the study; the collection, analysis, and interpretation of the data; the writing of the manuscript; and the decision to submit the manuscript for publication.

Affiliations of authors: Department of Epidemiology (NV-R, GCH, DLH, SG, AIN) and Department of Biostatistics (NL, W-YT), Mailman School of Public Health, and Department of Medicine (DLH, AIN) and Herbert Irving Comprehensive Cancer Center (DLH, W-YT, AIN), College of Physicians and Surgeons, Columbia University, New York, NY; Department of Psychiatry (DHB), Department of Psychology (DHB), Department of Behavioral & Community Health Sciences (DHB) and the University of Pittsburgh Cancer Institute (DHB), University of Pittsburgh, Pittsburgh, PA; Division of Research, Kaiser-Permanente of Northern California, Oakland, CA (LHK, CK); Department of Public Health Sciences, Henry Ford Health System, Detroit, MI (LL); Department of Cancer Prevention and Control, Roswell Park Cancer Institute, Buffalo, NY (CBA); Mt. Sinai School of Medicine, New York, NY (HV, LJ); Department of Oncology and Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, Washington, DC (JSM).