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Quality of Life among Women Recently Diagnosed with Invasive Breast Cancer: The Pathways Study

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Abstract

Purpose—Few studies have assessed quality of life (QOL) of women diagnosed with breast cancer within the first few weeks of their initial diagnosis. We describe QOL among 950 women recently diagnosed with invasive breast cancer.

Methods—Starting in January 2006, we invited women aged ≥ 21 years who were diagnosed with first primary invasive breast cancer within Kaiser Permanente Northern California (KPNC) to enroll in the Pathways Study, a prospective study of breast cancer survivorship. QOL was measured using the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B), along with sociodemographic and social support information. Clinical characteristics were obtained from the KPNC cancer registry and electronic medical record. We used multivariable linear regression models to identify factors associated with QOL scores calculated from the FACT-B.

Results—The mean age $\pm$ SD of the sample was 59.6 years (± 11.9 years), and the mean time $\pm$ SD from diagnosis until interview was 8.0 weeks (± 3.2 weeks). Younger age at diagnosis was associated with lower scores in all QOL domains ($p < 0.01$), and later stage at diagnosis was associated with lower scores in all domains ($p < 0.05$) except for social well-being. Higher levels of social support were associated with higher QOL except for physical well-being ($p < 0.05$). These associations were stronger within two months of breast cancer diagnosis.

Conclusion—Quality of life as influenced by a diagnosis of breast cancer is an important factor in cancer survivorship. Age, stage at diagnosis, and social support are key factors in this important variable.

Keywords

quality of life; FACT-B; social support; breast cancer; survival; age; stage

INTRODUCTION

Excluding skin cancer, breast cancer is the most common cancer and the second leading cause of cancer death among women in the U.S [1]. Through most of the 1990's, its incidence rate increased at an average annual rate of about 0.5% per year [2], although the rate has decreased at an annual rate of about 3.5% in recent years [1]. Conversely, mortality rates have decreased steadily since 1990, at an average annual rate of 2 to 3.3%. As a result, there are almost 2.5 million women who have been diagnosed with breast cancer living in the US today, and this number is expected to increase to 3.4 million by 2015 [3]. How best to live with and improve the quality of life (QOL) of this growing population of women is thus becoming of great public health importance.

As well-documented in previous studies, a cancer diagnosis can have immediate effects on a person's mental health status, and subsequent adaptation to coping with a diagnosis can vary substantially [4,5]. Furthermore, during the first year after diagnosis, women with breast cancer face substantial disruption in their QOL [6,7], and younger women tend to suffer more from psychosocial effects compared to older women [7–9].

Most studies on QOL after breast cancer have been conducted among women at least four months [10–14] to upwards of five [15] to 10 years [16] following cancer diagnosis or definitive surgery, and sometimes after the completion of treatment [9,17]. Few studies have assessed the QOL of women diagnosed with breast cancer within the first few weeks of their initial diagnosis [18]. The early psychosocial adaptation to a diagnosis of breast cancer may influence important survivorship issues, such as undergoing and complying with treatment [19–21], coping mechanisms [20,22], and long-term prognosis [23–25].

In this paper, we describe QOL and factors associated with QOL in the immediate post-diagnosis period among 950 women who were recently diagnosed with all stages of breast cancer. Information was collected on average within two months of diagnosis, and these women are currently being followed in a prospective study of breast cancer prognosis. These data provide insight into psychosocial and clinical factors that may influence the future course of the breast cancer experience in women.

METHODS

The Pathways Study is an ongoing, prospective cohort study actively recruiting women recently diagnosed with invasive breast cancer from the Kaiser Permanente Northern California (KPNC) patient population, as described elsewhere [26]. As of September 30, 2009, 2,839 patients have been enrolled since recruitment began in January 2006. Briefly, cases are ascertained rapidly on a daily basis by automatic scanning of electronic pathology reports with subsequent verification of cancer diagnosis and patient notification by a medical record analyst. Eligibility criteria include: current KPNC membership; at least 21 years of age at diagnosis; diagnosis of first primary invasive breast cancer (all stages); no prior history of cancer other than non-melanoma skin cancer; ability to speak English, Spanish, Cantonese, or Mandarin; and residence within a 65-mile radius of a field interviewer. Passive consent is obtained from the patient's physician of record by an email notification indicating our intention to contact the patient for study recruitment. Written informed consent is obtained from all participants before they are enrolled in the study, typically at the beginning of the in-person baseline interview. The study was approved by the Institutional Review Boards of KPNC and all collaborating institutions.

Data Collection

During the baseline interview, information is collected on race/ethnicity, marital status, educational attainment, household income, employment status, and native or foreign born status. In addition to QOL and social support, information on other areas such as food intake, physical activity, and use of alternative therapies are also obtained.

Health-related QOL—The Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) [27] Version 3 is administered during the baseline interview to assess health-related QOL. The FACT-B consists of five subscales: physical well-being (PWB), functional well-being (FWB), emotional well-being (EWB), social/family well-being (SWB), and breast cancer-specific concerns (BCS). A total FACT-B score is calculated by summing the individual subscale scores. The instrument has a total of 36 statements asking respondents to rate how true each statement is for the last seven days. Response scales range from 0 (not at all) to 4 (very much). The scale reliability estimates for each of the FACT-B domains and overall functional index were all acceptable (Cronbach's $\alpha \geq 0.70$ and item-total correlations < 0.30). Furthermore, the instrument has been well validated elsewhere [27,28].

Social support—The Medical Outcomes Study (MOS) Social Support Survey [29] is administered during the baseline interview to assess various dimensions of perceived social support. The MOS Social Support survey consists of 19 functional support items separated into four dimensions: emotional/informational support, tangible support, positive social interaction, and affectionate support. Response choices for each item ranges from 1 (none of the time) to 5 (all of the time). The scale reliability estimates for each of the MOS domains and overall support index were all acceptable (Cronbach's $\alpha \geq 0.70$ and item-total correlations < 0.30). The instrument also has been validated [29].

Clinical characteristics—Data on estrogen receptor (ER) and progesterone receptor (PR) status and human epidermal growth factor receptor 2 (Her2) expression are obtained from the KPNC Cancer Registry (KPNCRR) [30] and other KPNC databases. Results from additional testing for equivocal HER2 expression are not reported to the KPNCRR, but are obtained directly from the KPNC regional cytogenetics lab. Using KPNC electronic medical records, data on breast surgery (lumpectomy, mastectomy) were obtained using ICD-9 (85.20–85.23, 85.33–85.48) and CPT-4 (19120–19240, 19301–19307, 19340–19342) procedural codes.

Statistical Analysis

The present analysis includes information from the first 950 women enrolled in the cohort with complete QOL, social support, and covariate data. The majority of women were enrolled within two months (eight weeks) of diagnosis ($n=652$, 69%, mean $\pm$ SD = 8.0 ± 3.2 weeks) and had not started chemotherapy ($n=793$, 83%).

The FACT-B was scored according to the Functional Assessment of Chronic Illness Therapy website (David Cella, Ph.D.) [31]. The MOS Social Support Survey was scored as described on the RAND Health website (Cathy Sherbourne, Ph.D. and Anita Stewart, Ph.D.) [32].

Sociodemographic and clinical characteristics, and measures of social support, were summarized using tabulations for categorical variables and means and standard deviations for continuous variables. P-values were calculated using one-way analysis of variance (ANOVA). Multivariable linear regression models [33] were estimated separately for each FACT-B domain (PWB, FWB, EWB, SWB, and BCS) and total FACT-B score to identify characteristics that were most strongly associated with these QOL scores. Associations were adjusted for other sociodemographic and clinical predictors of interest and MOS Social Support domains.

RESULTS

The characteristics of the study population are included in Table 1. The average age at breast cancer diagnosis was 59.6 years. The majority of study participants were white (71%) and married or living as married (63%). The women were highly educated, with 85% reporting education beyond high school and 21% a post-graduate education. More than half of the women were employed and reported a household income greater than \$50,000 per year. A sizeable percentage of women (16.5%) were born outside the US, but among those more than 80% had lived in the US for more than 21 years. As expected, the majority of the women had an early stage at diagnosis, with 50.3% diagnosed with an AJCC Stage I tumor. Only 1.4% of women had a stage IV tumor. Almost 60% of women had a lumpectomy only, while 37.6% had a mastectomy and 2.6% had no breast surgery. The majority of women (82.5%) had tumors that were hormone receptor positive (ER+ and/or PR+), while most (81.1%) had tumors that were negative for expression of HER2 protein (HER2-). Overall, 10.8% of women were diagnosed with triple negative breast cancer (ER-/PR-/HER2-).

The mean FACT-B scores for each individual QOL domain and overall, as well as the distribution of the scores by selected sociodemographic factors, clinical characteristics, and MOS social support domains, are shown in Table 2. Our mean scores were comparable to those among participants in another study of recently-diagnosed breast cancer patients within KPNC [C.P. Somkin – personal communication]. Among demographic characteristics, older age at diagnosis of breast cancer appeared to be related to higher scores in all QOL domains except for social/family well-being. White women and black women consistently had higher domain scores, except for social/family well-being and functional well-being. Being married or living as married was associated with higher social/family well-being and functional well-being scores, yet being a widow was related to even higher physical well-being, emotional well-being, and overall FACT-B scores. Higher household income was associated with higher social/family well-being and functional well-being, while no clear association emerged between the domains by education or employment. Characteristics for nativity (born in US) and acculturation (number of years living in the US), were associated with higher FACT-B scores for physical well-being, emotional well-being, breast cancer specific concerns, and overall.

Associations with clinical characteristics are also shown in Table 2. In general, being diagnosed with less advanced breast cancer, AJCC Stages I and II, was associated with higher FACT-B scores for physical well-being, emotional well-being, functional well-being, breast cancer specific concerns, and overall. Women with either ER+ and/or PR+ tumors had higher emotional well-being, breast cancer specific concerns, and overall scores, while having triple negative breast cancer was not associated with any QOL domain, despite women with HER2 – tumors having a higher emotional well-being score compared to women with HER2+ tumors. Women who had no breast surgery or a lumpectomy only had higher physical well-being, functional well-being, breast cancer specific concerns, and overall FACT-B scores relative to women who had a mastectomy. All social support domains were associated with each QOL domain such that a higher social support score was related to a higher QOL score.

Table 3 presents multivariable regression models for each domain of the FACT-B, adjusting for the other covariates of interest. Age and AJCC stage showed the greatest and most consistent associations with QOL. Younger age at diagnosis was associated with lower scores in all five QOL domains ($p < 0.01$), and higher stage at diagnosis was associated with lower scores in all domains ($p < 0.05$) except for social well-being ($p = 0.55$). Being widowed was associated with higher QOL overall ($p = 0.017$) and in the areas of physical well-being ($p = 0.017$) and emotional well-being ($p = 0.049$). Employment, years lived in the US if non-US born, and HER2 status were not related to any of the outcomes.

Being non-white ($p=0.0042$) and being married ($p=0.017$) were associated with worse physical well-being. Less years of education ($p=0.0094$) was related to lower social/family well-being, while being married ($p=0.049$) was related to lower emotional well-being. Being Hispanic or Asian ($p=0.018$), being born outside the US ($p=0.03$), and having a mastectomy ($p=0.024$) were associated with lower breast cancer specific concerns scores.

Higher levels of social support as measured by the MOS emotional/informational, tangible, affectionate, and positive domains were associated with higher overall QOL ($p<0.05$). The social support domains were also associated with higher scores for all FACT-B subscales ($p<0.05$) except for physical well-being.

Table 4 presents multivariable regression models for overall FACT-B score stratified by time since diagnosis (≤ 2 months and >2 months), adjusting for all covariates of interest. Younger age and higher AJCC stage were again the strongest predictors of lower QOL, yet the effect of stage was attenuated after two months post-diagnosis. In addition, being widowed and having higher levels of social support were associated with higher QOL during the first two months, but not after two months, post-diagnosis.

DISCUSSION

In this study of QOL in the immediate post-diagnosis period among women diagnosed with breast cancer, QOL was associated with several sociodemographic and clinical characteristics, as well as measures of social support. Younger age at diagnosis and more advanced stage of breast cancer were related to lower QOL while having higher levels of social support were positively related to QOL. The effects of these factors except age were greater in the immediate post-diagnosis period, underscoring the impact of the diagnosis on disrupting one's life. Our study is one of the larger studies to examine QOL among women with breast cancer in the immediate post-diagnosis period, and our results confirm findings that younger women with breast cancer have lower QOL than older women with breast cancer during this period.

Most previous studies that have examined QOL among women with breast cancer were conducted among women who were at least four months after the cancer diagnosis. By this time, women will have begun their initial course of therapy and have had some time to adjust to their condition. There have been few studies that have examined QOL within a few weeks of a woman receiving her diagnosis. One study in India [18] among 251 women diagnosed with breast cancer and undergoing definitive breast surgery (86% mastectomy or 14% breast conserving treatment) found a significant reduction in physical well-being, functional well-being, and breast cancer specific concerns before and up to 30 days after surgery. No significant change was noted for social well-being and emotional well-being. Although our study population (overall FACT-B score $\pm$ SD: 110.82 ± 19.0) is not directly comparable with this sample of Indian women (overall FACT-B score $\pm$ SD: 85.5 ± 13.2), similar to our results, the authors also observed lower QOL among younger women and women with more advanced breast cancer.

Among studies that have evaluated QOL beyond the first four months relative to the breast cancer diagnosis, most have found no relationships between QOL and sociodemographic or medical factors. Instead, psychosocial factors appear to be most influential. In one study by Avis et al. [12] of 202 breast cancer patients aged 50 years and younger, more problems with respect to partner relationships, sexual functioning, and body image, and less adaptive coping strategies, were related to overall QOL assessed four to 42 months post-diagnosis. In another study of 103 younger breast cancer patients [10], sexual functioning, social support, and social/family well-being were also observed to affect QOL within six months post-diagnosis. In a study by Ganz et al. [11] of 691 breast cancer patients aged 65 years and older, age at diagnosis,

surgery, and treatment did not affect overall QOL from three months up to 17 months post-surgery, while the presence of co-morbid conditions was a major contributor. Among 804 women recurrence-free at least two years post-diagnosis, Bowen et al. [13] found that not working outside the home, being retired or disabled, and being unemployed were associated with poorer physical functioning compared to currently working. Race/ethnicity was associated with QOL such that black women experienced poorer physical functioning yet higher mental health compared to white women. A recent cross-sectional study by Janz et al. among early-stage breast cancer survivors (344 Latinas, 386 blacks, 726 whites) also reported racial/ethnic differences in QOL [14]. Blacks had higher emotional well-being than whites, and lower acculturated Latinas had lower functional well-being, emotional well-being, and breast cancer specific concerns compared to whites. Similar to our study, the authors observed worse QOL among younger women and women with more advanced breast cancer. Interestingly, racial/ethnic differences for physical and emotional well-being were only observed among older women at least 50 years of age with lower acculturated Latinas having the lowest scores.

The Pathways Study is one of the first studies to examine the role of sociodemographic and clinical factors on QOL outcomes during the immediate period (on average two months) after receiving a breast cancer diagnosis. Importantly, the sample of 950 women surveyed is one of the largest to date, and follow-up data collection is currently being conducted at six months and 24 months since the baseline interview, thereby allowing future opportunities to evaluate change in QOL as women progress further through their survivorship experience.

Our assessment of QOL around the time of a breast cancer diagnosis is most likely a measure of the stress that accompanies the news of having been recently diagnosed with a serious illness. A woman's physical and emotional functioning during this challenging period could impact her long-term QOL as a breast cancer survivor [5,20]. Our observation of younger age at diagnosis being related to poorer QOL might be explained by younger women, in general, having a worse prognosis, experiencing greater disruption in their daily lives, work schedules, family responsibilities, and financial stability [34,35], and facing for the first time the physical and emotional changes which accompany a diagnosis of a serious illness [15]. In contrast, among older women, chronic conditions are more prevalent and expected, and perhaps news of having cancer does not impact them as strongly given other concurrent co-morbidities or experiences of peers.

Many observed associations were expected to be related to lower QOL, such as being diagnosed with more advanced stage cancer, undergoing a mastectomy, having lower socioeconomic status (education and income), and being a minority. Interestingly, within the minorities, we found that being either Hispanic or Asian was associated with lower QOL than being black. The literature comparing QOL among minority groups is limited, and the recent study by Janz et al. reported that lower acculturated Latinas had poorer functional well-being, emotional well-being, and breast cancer specific concerns compared to higher acculturated Latinas and blacks [14]. Regarding the effect of acculturation on QOL in our study, we observed that being non-US born, which can serve as a crude proxy measure of acculturation, was associated with lower breast cancer specific concerns. Perhaps individuals with lower acculturation have more difficulty understanding the medical information provided to them in the breast cancer care setting, which has been suggested in previous studies for Latina women [36,37].

We also observed that being married was associated with lower physical and emotional well-being, even after adjustment for social support, compared to being widowed. Perhaps a cancer diagnosis can have disruptive effects on a marriage resulting from the patient's added anxiety and stress being projected onto her partner, who is already coping with his own distress [5, 38]. The effects of the diagnosis on care-giving aspects of a relationship would also be felt more acutely by women who are married, although as we observed, greater social support is

associated with higher QOL. Alternatively, women who are widowed may be less likely to report negative factors related to their QOL after having gone through the bereavement process. Indeed, a recent study found that women who are widowed or never married were less likely to report severe symptoms resulting from their breast cancer than married women [39].

In the analyses presented here, we did not include data on co-morbidities such as depression, diabetes, and other chronic conditions that could impact QOL. However, future analyses could incorporate information on such conditions. We did not assess effects from adjuvant therapy since the focus of the analysis was on examining predictors of QOL in the early post-diagnosis period, which is a period when most women have not started their adjuvant therapy. Given our study design, we are not able to collect information on QOL of the women before their breast cancer diagnosis to examine change in QOL that accompanies a cancer diagnosis.

In summary, we found that younger age at diagnosis and more advanced stage of breast cancer were associated with lower QOL, while having adequate social support positively influenced QOL in the immediate post-diagnosis period of two months. Clinical evaluation and possible interventions regarding QOL immediately after a breast cancer diagnosis are important, the effects of which may alter subsequent adjustment and functioning as women move forward through treatment and into their long-term survivorship period. Our results point to the importance of considering quality of life concerns, not just as a consequence of treatment, but also as it is influenced by the diagnosis of cancer itself. These results suggest that while age and stage at diagnosis may modify the approaches clinicians take in preparing women for the social, psychological, and functional effects of breast cancer, attention should be paid to these issues in the immediate post-diagnosis period.

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Table 1

Demographic factors and clinical characteristics of Pathways participants (n=950)

	n	%
Demographic Factors		
Age at diagnosis (years)		
<50	206	21.7
50–59	292	30.7
60–69	269	28.3
≥70	183	19.3
mean (SD)		59.6 (11.9)
Race/ethnicity		
White	671	70.6
Black	61	6.4
Hispanic	101	10.6
Asian	87	9.2
Other	30	3.2
Partner status		
Married	561	59.1
Living as married	39	4.1
Widowed	99	10.4
Separated/Divorced	161	16.9
Single	88	9.3
Unknown	2	0.2
Education		
High school or less	145	15.3
Some college	357	37.6
College graduate	246	25.9
Post-graduate	202	21.2
Household income		
<\$25,000	94	9.9
\$25,000–49,999	186	19.6
\$50,000–89,999	292	30.7
≥\$90,000	272	28.6
Unknown	106	11.2
Employment		
Currently employed?	466	49.1
Born in US		
Yes	793	83.5
No	156	16.4

	n	%
Unknown	1	0.1
If non-US born, years lived in US		
≤21	34	21.8
22–31	35	22.4
32–43	29	18.6
≥44	31	19.9
Unknown	27	17.3
Clinical Characteristics		
AJCC stage		
Stage I	478	50.3
Stage II	291	30.6
Stage III	100	10.5
Stage IV	13	1.4
Unknown/NA	68	7.2
Hormone receptor status		
ER+/PR+	653	68.7
ER+/PR–	128	13.5
ER–/PR+	3	0.3
ER–/PR–	144	15.2
Unknown/NA	22	2.3
HER2 status		
Negative	770	81.1
Positive	115	12.1
Unknown	65	6.8
Triple negative tumor		
No	781	82.2
Yes	103	10.8
Unknown	66	7.0
Surgery		
None	25	2.6
Lumpectomy only	568	59.8
Mastectomy	357	37.6
Social Support	n	mean (SD)
MOS [*] social support		
Emotional	946	4.13 (0.76)
Tangible	946	4.12 (0.93)
Affectionate	945	4.45 (0.86)

	n	%
Positive interaction	945	4.29 (0.87)
Overall support	946	4.21 (0.72)

*
From Medical Outcomes Study [29]

Table 2

FACT-B domain scores by demographic factors, clinical characteristics, and MOS social support domains

	Physical Well-Being*			Social Well-Being*			Emotional Well-Being*			Functional Well-Being*			Breast Cancer Specific			Overall FACT-B*		
	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]
Overall	21.95	5.71	---	24.41	4.24	---	18.82	4.26	---	20.59	5.48	---	25.36	6.04	---	110.82	19.01	---
Age at diagnosis (years)																		
<50	19.90	6.69	<0.0001	24.01	4.34	0.30	17.59	4.40	<0.0001	19.84	5.45	0.039	23.12	6.35	<0.0001	104.01	20.33	<0.0001
50-59	21.34	5.51		24.60	4.43		18.19	4.48		20.33	5.31		24.48	6.37		109.05	18.90	
60-69	23.16	5.29		24.28	4.19		19.72	3.75		21.10	5.56		26.95	5.24		115.11	17.55	
≥70	23.57	4.39		24.75	3.86		19.89	3.89		21.11	5.59		27.02	5.06		115.87	16.53	
Race/ethnicity																		
White	22.66	5.16	<0.0001	24.53	4.12	0.70	19.00	3.99	0.045	20.88	5.34	0.17	26.06	5.71	<0.0001	112.86	18.08	<0.0001
Black	21.06	5.96		24.39	4.22		19.37	4.42		20.14	5.83		25.57	6.11		111.35	19.06	
Hispanic	20.33	6.60		24.12	4.56		18.05	4.51		19.77	5.79		23.15	6.07		104.76	20.04	
Asian	19.82	6.85		23.93	4.64		17.88	5.72		19.78	5.56		22.73	7.21		103.53	21.23	
Other	19.85	6.87		24.16	4.73		18.90	3.39		20.27	6.37		24.13	5.55		107.19	19.29	
Partner status																		
Married	21.69	5.94	0.0072	24.72	3.76	0.0098	18.76	4.22	0.015	20.83	5.29	0.12	25.30	6.09	0.11	110.86	18.84	0.036
Living as married	22.24	6.06		25.09	4.06		17.95	4.34		21.09	5.32		25.99	6.24		111.82	21.59	
Widowed	23.72	4.25		24.34	5.05		20.21	4.14		20.86	5.95		26.70	5.06		115.86	18.33	
Separated/Divorced	22.16	5.36		23.32	5.30		18.43	4.25		19.84	6.02		24.91	6.25		109.47	19.74	
Single	21.37	5.62		24.11	3.88		18.75	4.37		20.04	5.10		24.86	5.98		108.02	17.02	
Education																		
High school or less	22.54	5.07	0.30	23.68	4.82	0.052	18.87	4.60	0.82	20.36	5.73	0.27	25.58	5.93	0.26	110.59	18.98	0.91
Some college	21.88	5.61		24.28	4.58		18.87	4.17		20.22	5.77		25.27	5.84		110.38	19.23	
College graduate	21.47	6.41		24.87	3.75		18.92	4.35		20.95	5.24		24.85	6.44		110.89	19.61	
Post-graduate	22.25	5.38		24.60	3.65		18.56	4.06		20.98	5.04		25.97	5.94		111.68	17.96	
Household income																		
			0.20			0.0018			0.33						0.0036			0.060

	Physical Well-Being*			Social Well-Being*			Emotional Well-Being*			Functional Well-Being*			Breast Cancer Specific			Overall FACT-B*		
	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]
<\$25K	21.45	6.26		23.37	5.29		18.05	5.04		18.62	6.71		24.65	6.71		105.58	23.06	
\$25–49K	22.65	5.15		23.83	4.89		19.20	4.10		20.62	5.33		25.98	5.61		112.60	17.99	
\$50–89K	22.23	6.34		24.38	4.00		18.76	4.12		21.05	5.15		25.28	6.18		111.13	18.69	
≥\$90K	21.56	5.94		25.16	3.30		18.84	4.09		20.92	5.06		25.47	5.86		111.77	17.55	
Employment			0.23			0.42			0.60			0.10			0.023			0.44
Currently employed	21.72	5.72		24.57	4.17		18.68	4.18		20.95	5.11		24.83	6.04		110.55	18.06	
Not employed	22.20	5.67		24.23	4.32		18.95	4.31		20.27	5.77		25.89	5.96		111.21	19.82	
Born in US			0.0001			0.52			0.0009			0.21			<0.0001			0.0004
Yes	22.32	5.49		24.48	4.18		19.05	4.00		20.70	5.43		25.76	5.83		111.98	18.39	
No	20.16	6.43		24.05	5.56		17.66	5.25		20.08	5.74		23.36	6.66		105.35	20.95	
If non-US born, years lived in US (quartiles)			<0.0001			0.30			0.0002			0.23			0.0002			0.0001
≤21	17.71	7.29		22.87	5.99		16.13	6.36		18.53	6.26		21.84	6.67		97.92	23.73	
22–31	19.63	6.86		24.27	4.21		19.98	5.77		20.63	5.71		22.91	8.25		104.41	22.05	
32–43	20.98	6.40		24.78	3.51		18.54	3.86		21.29	5.42		24.04	5.24		109.57	16.40	
≥44	23.28	4.40		24.56	3.81		19.31	3.26		21.17	5.11		26.85	4.62		116.30	15.25	
AJCC stage			<0.0001			0.70			<0.0001			0.0066			<0.0001			<0.0001
Stage I	23.02	5.16		24.21	4.35		19.28	4.10		21.13	5.28		26.00	5.75		113.02	18.09	
Stage II	21.29	5.75		24.56	4.20		18.43	4.25		20.25	5.66		24.92	6.25		109.70	19.40	
Stage III	18.70	6.59		24.44	4.19		17.02	4.95		18.86	5.61		22.73	6.61		101.51	20.24	
Stage IV	22.54	5.88		24.75	2.98		17.69	4.19		20.08	7.47		26.34	5.53		111.40	20.43	
Hormone receptor status			0.51			0.76			0.030			0.093			0.036			0.036
ER+/PR+	22.10	5.77		24.52	4.12		19.02	4.27		20.86	5.42		25.68	5.93		112.03	18.95	
ER+/PR –	22.05	5.36		24.28	4.19		18.44	4.42		20.33	5.86		25.37	5.59		109.73	17.43	
ER –/PR+	17.83	8.72		24.27	6.47		14.67	4.51		24.33	2.08		23.61	5.18		97.36	9.75	
ER –/PR –	21.39	5.90		24.01	4.84		18.14	4.11		19.72	5.49		23.89	6.83		106.53	20.34	
HER2 status			0.052			0.35			0.031			0.96			0.11			0.12

	Physical Well-Being*			Social Well-Being*			Emotional Well-Being*			Functional Well-Being*			Breast Cancer Specific			Overall FACT-B*		
	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]	mean	SD	p-value [†]
Negative	22.18	5.57		24.49	4.13		18.93	4.21		20.61	5.52		25.56	6.00		111.45	18.70	
Positive	21.02	6.41		24.23	4.58		17.86	4.86		20.46	5.52		24.55	6.23		107.51	20.65	
Triple negative tumor			0.26			0.31			0.46			0.35			0.076			0.27
No	22.03	5.74		24.48	4.13		18.85	4.39		20.70	5.51		25.57	5.94		111.31	18.89	
Yes	22.08	5.34		24.30	4.64		18.35	3.63		19.86	5.47		24.45	6.66		108.36	19.53	
Surgery			0.0033			0.78			0.16			0.0008			<0.0001			0.0018
None	22.76	5.14		23.90	5.34		19.46	4.42		20.87	6.14		27.17	6.20		114.65	20.71	
Lumpectomy only	22.45	5.61		24.37	4.17		18.99	4.22		21.12	5.40		26.10	5.94		112.54	18.92	
Mastectomy	21.11	5.83		24.53	4.20		18.53	4.27		19.72	5.48		24.04	5.97		107.96	18.72	
MOS* social support: Spearman correlation coefficient (p-value)																		
Emotional	0.11 (0.0010)			0.43 (<0.0001)			0.24 (<0.0001)			0.28 (<0.0001)			0.22 (<0.0001)			0.31 (<0.0001)		
Tangible	0.13 (0.0002)			0.37 (<0.0001)			0.18 (<0.0001)			0.24 (<0.0001)			0.18 (<0.0001)			0.27 (<0.0001)		
Affectionate	0.11 (0.0009)			0.40 (<0.0001)			0.16 (<0.0001)			0.26 (<0.0001)			0.21 (<0.0001)			0.30 (<0.0001)		
Positive Interaction	0.15 (<0.0001)			0.43 (<0.0001)			0.21 (<0.0001)			0.33 (<0.0001)			0.23 (<0.0001)			0.35 (<0.0001)		
Overall Support	0.15 (<0.0001)			0.48 (<0.0001)			0.25 (<0.0001)			0.32 (<0.0001)			0.25 (<0.0001)			0.36 (<0.0001)		

* From FACT-B = Functional Assessment of Cancer Therapy-Breast Cancer [27]; MOS = Medical Outcomes Study [29]

[†] From one-way ANOVA

Table 3

Multivariable linear regression models examining FACT-B domains in relation to demographic factors, clinical characteristics, and MOS social support domains

	Physical Well-Being*				Social Well-Being*				Emotional Well-Being*			
	β	95% CI	p-value		β	95% CI	p-value		β	95% CI	p-value	
Age at diagnosis (years)												
<50	Ref	---	0.0001		Ref	---	0.0004		Ref	---	<0.0001	
50–59	0.94	−0.08, 1.96			0.72	0.07, 1.38			0.45	−0.27, 1.17		
60–69	2.27	1.17, 3.37			0.64	−0.07, 1.35			1.84	1.06, 2.62		
70	2.65	1.30, 4.00			1.85	0.98, 2.72			2.43	1.48, 3.39		
Race/ethnicity												
White	Ref	---	0.0042		Ref	---	0.79		Ref	---	0.88	
Black	−1.72	−3.23, −0.20			−0.08	−1.06, 0.90			0.48	−0.60, 1.56		
Hispanic	−1.66	−2.98, −0.35			−0.34	−1.16, 0.49			−0.19	−1.09, 0.71		
Asian	−1.40	−2.91, 0.10			−0.39	−1.38, 0.59			0.01	−1.06, 1.09		
Other	−2.41	−4.34, −0.48			0.48	−0.80, 1.77			0.30	−1.09, 1.68		
Partner status												
Married	Ref	---	0.017		Ref	---	0.61		Ref	---	0.049	
Living as married	0.64	−1.23, 2.51			0.26	−0.91, 1.44			−0.53	−1.82, 0.76		
Widowed	1.58	0.24, 2.93			0.06	−0.81, 0.94			1.17	0.22, 2.11		
Separated/Divorced	0.77	−0.35, 1.88			−0.19	−0.91, 0.53			0.28	−0.51, 1.07		
Single	1.12	−0.23, 2.47			0.63	−0.27, 1.52			1.00	0.04, 1.96		
Education												
High school or less	Ref	---	0.26		Ref	---	0.0094		Ref	---	0.094	
Some college	−1.14	−2.26, 0.02			0.71	−0.01, 1.43			−0.04	−0.83, 0.75		
College graduate	−0.82	−2.04, 0.40			1.36	0.57, 2.15			0.55	−0.31, 1.41		
Post-graduate	−0.88	−2.19, 0.42			0.93	0.08, 1.77			−0.39	−1.31, 0.52		
Household income												
<\$25K	Ref	---	0.15		Ref	---	0.97		Ref	---	0.23	

	Physical Well-Being*				Social Well-Being*				Emotional Well-Being*			
	β	95% CI	p-value		β	95% CI	p-value		β	95% CI	p-value	
\$25–49K	1.32	–0.17, 2.82			–0.07	–1.04, 0.91			1.25	0.18, 2.31		
\$50–89K	1.18	–0.30, 2.66			–0.22	–1.19, 0.76			0.87	–0.19, 1.92		
\$90K	0.59	–1.03, 2.21			–0.04	–1.10, 1.01			1.07	–0.08, 2.22		
Employment												
Not employed	Ref	---	0.53		Ref	---	0.55		Ref	---	0.99	
Currently employed	1.27	–0.70, 0.95			0.28	–0.25, 0.80			0.04	–0.54, 0.61		
Born in US												
Yes	Ref	---	0.46		Ref	---	0.93		Ref	---	0.34	
No	–1.43	–3.76, 0.91			0.26	–1.23, 1.76			–1.12	–2.76, 0.52		
If non-US born, years lived in US (quartiles)												
21	Ref	---	0.42		Ref	---	0.83		Ref	---	0.43	
22–31	0.06	–2.53, 2.66			0.73	–1.00, 2.46			–0.47	–2.37, 1.43		
32–43	1.21	–1.54, 3.96			0.81	–1.02, 2.63			0.67	–1.32, 2.65		
44	2.44	–0.40, 5.28			1.06	–0.80, 2.92			1.42	–0.62, 3.46		
AJCC stage												
Stage I	Ref	---	<0.0001		Ref	---	0.55		Ref	---	0.0001	
Stage II	–1.72	–2.58, –0.86			0.08	–0.48, 0.63			–0.74	–1.34, –0.13		
Stage III	–3.76	–5.05, –2.48			0.39	–0.45, 1.24			–1.92	–2.84, –1.00		
Stage IV	–1.01	–4.27, 2.26			0.83	–1.35, 3.00			–2.49	–4.87, –0.12		
Hormone receptor status												
ER+/PR+	Ref	---	0.76		Ref	---	0.59		Ref	---	0.42	
ER+/PR–	0.22	–0.86, 1.30			–0.49	–1.19, 0.22			–0.47	–1.24, 0.30		
ER–/PR+	–0.48	–8.17, 7.22			1.24	–2.90, 5.39			–3.35	–7.89, 1.19		
ER–/PR–	0.18	–0.87, 1.24			–0.28	–0.96, 0.40			–0.29	–1.04, 0.46		
HER2 status												
Negative	Ref	---	0.68		Ref	---	0.90		Ref	---	0.54	
Positive	–0.42	–1.55, 0.72			0.11	–0.62, 0.84			–0.32	–1.13, 0.48		

	Physical Well-Being*				Social Well-Being*				Emotional Well-Being*			
	β	95% CI	p-value		β	95% CI	p-value		β	95% CI	p-value	
Surgery												
None	Ref	---	0.74		Ref	---	0.21		Ref	---	0.34	
Lumpectomy only	-0.91	-3.31, 1.50			1.38	-0.23, 2.98			-0.89	-2.61, 0.82		
Mastectomy	-0.97	-3.40, 1.46			1.46	-0.16, 3.08			-0.55	-2.29, 1.18		
MOS – Emotional [†]	-0.05	-0.73, 0.64	0.89		0.98	0.53, 1.42	<0.0001		0.95	0.46, 1.43	0.0001	
MOS – Tangible [†]	0.41	-0.15, 0.95	0.15		0.56	0.20, 0.92	0.0024		0.50	0.10, 0.89	0.013	
MOS – Affectionate [†]	0.44	-0.28, 1.16	0.23		1.17	0.70, 1.64	<0.0001		-0.28	-0.79, 0.23	0.29	
MOS – Positive Interaction [†]	0.37	-0.36, 1.10	0.32		0.46	-0.02, 0.93	0.059		0.56	0.04, 1.08	0.034	
R²/No. of participants	0.18/877				0.32/927				0.20/935			

	Functional Well-Being*				Breast Cancer Specific Concerns*				Overall FACT-B*			
	β	95% CI	p-value		β	95% CI	p-value		β	95% CI	p-value	
Age at diagnosis (years)												
<50	Ref	---	0.0024		Ref	---	<0.0001		Ref	---	<0.0001	
50–59	0.22	-.14			0.82	-0.19, 1.83			3.37	0.26, 6.48		
60–69	1.12	0.12, 2.11			2.85	1.75, 3.94			8.71	5.34, 12.09		
≥70	2.16	0.94, 3.38			3.40	2.06, 4.75			11.99	7.80, 16.19		
Race/ethnicity												
White	Ref	---	0.24		Ref	---	0.018		Ref	---	0.057	
Black	-0.50	-1.87, 0.88			-0.10	-1.60, 1.40			-1.21	-5.86, 3.44		
Hispanic	-1.33	-2.49, -0.17			-2.02	-3.32, -0.73			-5.70	-9.62, -1.52		
Asian	-0.74	-2.12, 0.64			-1.60	-3.12, -0.08			-4.56	-9.18, 0.05		
Other	-0.33	-2.11, 1.44			-1.20	-3.17, 0.77			-2.68	-8.72, 3.35		
Partner status												
			0.59				0.19				0.017	

	Functional Well-Being*				Breast Cancer Specific Concerns*				Overall FACT-B*			
	β	95% CI	p-value		β	95% CI	p-value		β	95% CI	p-value	
Married	Ref	---			Ref	---			Ref	---		
Living as married	0.18	-1.47, 1.83			0.83	-1.02, 2.67			0.86	-4.86, 6.59		
Widowed	0.58	-0.63, 1.79			0.83	-0.49, 2.15			5.33	1.11, 9.55		
Separated/Divorced	0.14	-0.87, 1.15			0.14	-0.98, 1.25			2.22	-1.24, 5.67		
Single	0.37	-0.86, 1.60			1.29	-0.05, 2.64			4.00	-0.21, 8.21		
Education				0.11			0.68				0.23	
High school or less	Ref	---			Ref	---			Ref	---		
Some college	-0.43	-1.45, 0.58			-0.35	-1.46, 0.75			-0.33	-3.79, 3.13		
College graduate	0.63	-0.48, 1.74			0.06	-1.15, 1.27			2.67	-1.10, 6.44		
Post-graduate	0.20	-0.98, 1.38			0.21	-1.08, 1.50			0.70	-3.33, 4.73		
Household income				0.21			0.28				0.086	
<\$25K	Ref	---			Ref	---			Ref	---		
\$25-49K	1.29	-0.07, 2.65			1.22	-0.27, 2.72			5.29	0.62, 9.96		
\$50-89K	1.41	0.06, 2.76			0.50	-0.99, 1.98			3.02	-1.62, 7.66		
$\geq$ \$90K	0.88	-0.59, 2.35			0.61	-1.00, 2.23			2.61	-2.47, 7.68		
Employment				0.067			0.43				0.45	
Not employed	Ref	---			Ref	---			Ref	---		
Currently employed	0.82	0.08, 1.56			-0.49	-1.30, 0.33			0.60	-1.92, 3.12		
Born in US				0.40			0.03				0.13	
Yes	Ref	---			Ref	---			Ref	---		
No	-0.75	-2.85, 1.36			-2.37	-4.67, -0.07			-5.59	-12.70, 1.51		
If non-US born, years lived in US (quartiles)				0.73			0.35				0.30	
$\leq$ 21	Ref	---			Ref	---			Ref	---		
22-31	0.93	-1.50, 3.36			-0.72	-3.37, 1.93			0.31	-7.56, 8.18		
32-43	0.66	-1.89, 3.20			-0.04	-2.82, 2.73			3.08	-5.34, 11.50		
$\geq$ 44	0.87	-1.75, 3.48			1.04	-1.85, 3.92			7.40	-1.32, 16.12		
AJCC stage				0.11			0.014				<0.0001	

	Functional Well-Being*			Breast Cancer Specific Concerns*			Overall FACT-B*		
	β	95% CI	p-value	β	95% CI	p-value	β	95% CI	p-value
Stage I	Ref	---		Ref	---		Ref	---	
Stage II	-0.80	-1.58, -0.02		-0.74	-1.60, 0.11		-3.51	-6.16, -0.85	
Stage III	-1.47	-2.65, -0.29		-2.14	-3.43, -0.85		-8.75	-12.69, -4.80	
Stage IV	-0.70	-3.75, 2.35		-0.70	-4.02, 2.62		-4.41	-14.31, 5.49	
Hormone receptor status			0.043			0.48			0.15
ER+/PR+	Ref	---		Ref	---		Ref	---	
ER+/PR-	-0.35	-1.34, 0.63		-0.21	-1.28, 0.87		-1.98	-5.30, 1.35	
ER-/PR+	5.44	-0.39, 11.26		0.66	-5.70, 7.01		3.41	-19.94, 26.75	
ER-/PR-	-0.57	-1.53, 0.38		-0.94	-1.99, 0.12		-2.85	-6.09, 0.39	
HER2 status			0.14			0.69			0.94
Negative	Ref	---		Ref	---		Ref	---	
Positive	0.66	-0.37, 1.68		0.09	-1.03, 1.20		-0.32	-3.80, 3.16	
Surgery			0.068			0.024			0.48
None	Ref	---		Ref	---		Ref	---	
Lumpectomy only	0.59	-1.61, 2.79		-0.90	-3.30, 1.50		-2.20	-9.49, 5.09	
Mastectomy	-0.26	-2.49, 1.96		-1.92	-4.34, 0.51		-3.40	-10.76, 3.96	
MOS – Emotional [†]	0.73	0.10, 1.35	0.022	0.88	0.19, 1.56	0.012	3.07	0.95, 5.19	0.0046
MOS – Tangible [†]	0.35	-0.15, 0.85	0.17	0.32	-0.24, 0.87	0.26	2.37	0.67, 4.07	0.0064
MOS – Affectionate [†]	-0.03	-0.69, 0.62	0.92	0.21	-0.51, 0.93	0.57	2.23	-0.03, 4.49	0.053
MOS – Positive Interaction [†]	1.78	1.11, 2.44	<0.0001	1.05	0.32, 1.78	0.0049	3.91	1.66, 6.16	0.0007
R²/No. of participants	0.22/939			0.23/928			0.33/848		

* From FACT-B = Functional Assessment of Cancer Therapy-Breast Cancer [27]

[†] From MOS = Medical Outcomes Study [29]

Table 4

Stratified multivariable models examining overall FACT-B score by time from breast cancer diagnosis to study enrollment

	Overall FACT-B*				Overall FACT-B*			
	<2 months since diagnosis				>2 months since diagnosis			
	β	95% CI	p-value		β	95% CI	p-value	
Age at diagnosis (years)			0.0008				<0.0001	
<50	Ref	---			Ref	---		
50–59	3.90	0.20, 7.61			2.97	–3.05, 9.00		
60–69	7.53	3.52, 11.54			13.63	7.13, 20.13		
≥70	9.14	4.20, 14.08			19.77	11.57, 27.98		
Race/ethnicity			0.072				0.74	
White	Ref	---			Ref	---		
Black	1.11	–4.84, 7.06			–0.92	–8.91, 7.08		
Hispanic	–5.53	–10.21, –0.85			–5.82	–14.29, 2.66		
Asian	–6.03	–11.72, –0.34			–2.78	–11.37, 5.82		
Other	–2.11	–8.55, 4.33			–4.55	–22.63, 13.54		
Partner status			0.0039				0.97	
Married	Ref	---			Ref	---		
Living as married	–0.56	–7.14, 6.01			2.47	–9.78, 14.73		
Widowed	7.91	2.98, 12.84			1.94	–6.82, 10.70		
Separated/Divorced	2.90	–1.16, 6.96			0.99	–5.87, 7.85		
Single	4.58	–0.51, 9.68			3.25	–4.64, 11.15		
Education			0.11				0.26	
High school or less	Ref	---			Ref	---		
Some college	0.84	–3.19, 4.87			–3.85	–10.98, 3.28		
College graduate	4.33	0.02, 8.63			0.43	–7.52, 8.38		
Post-graduate	0.62	–4.06, 5.30			1.57	–6.68, 9.83		
Household income			0.061				0.17	

		Overall FACT-B*			Overall FACT-B*		
		≤2 months since diagnosis			>2 months since diagnosis		
		β	95% CI	p-value	β	95% CI	p-value
<\$25K	Ref	Ref	---		Ref	---	
	\$25–49K	8.40	2.83, 13.96		−0.55	−9.92, 8.83	
	\$50–89K	5.55	−0.02, 11.11		−1.66	−10.93, 7.61	
	≥\$90K	5.66	−0.44, 11.76		−2.55	−12.38, 7.28	
Employment				0.26			0.22
Not employed		Ref	---		Ref	---	
Currently employed		−0.59	−3.60, 2.42		2.99	−1.83, 7.81	
Born in US				0.43			0.17
Yes		Ref	---		Ref	---	
No		−3.73	−13.05, 5.59		−6.32	−18.27, 5.64	
If non-US born, years lived in US (quartiles)				0.19			0.19
≤21		Ref	---		Ref	---	
22–31		4.46	−5.97, 14.89		−0.35	−13.31, 12.60	
32–43		1.92	−9.54, 13.37		5.83	−7.76, 19.43	
≥44		12.79	1.52, 24.06		3.46	−11.77, 18.68	
AJCC stage				0.0045			0.10
Stage I		Ref	---		Ref	---	
Stage II		−2.45	−5.62, 0.72		−5.09	−10.21, 0.03	
Stage III		−7.43	−12.22, −2.65		−10.57	−17.96, −3.17	
Stage IV		−5.77	−18.32, 6.79		−2.53	−19.83, 14.76	
Hormone receptor status				0.13			0.41
ER+/PR+		Ref	---		Ref	---	
ER+/PR−		−0.89	−4.72, 2.94		−5.81	−12.79, 1.16	
ER−/PR+		12.97	−20.47, 46.40		13.68	−23.84, 51.20	
ER−/PR−		−2.29	−6.15, 1.57		−3.66	−9.92, 2.59	

		Overall FACT-B*			Overall FACT-B*		
		≤2 months since diagnosis			>2 months since diagnosis		
		β	95% CI	p-value	β	95% CI	p-value
HER2 status				0.97			0.92
Negative	Ref	---			Ref	---	
Positive	-0.50	-4.54, 3.54			-1.36	-8.45, 5.75	
Surgery				0.25			0.40
None	Ref	---			Ref	---	
Lumpectomy only	-6.02	-14.63, 2.59			9.46	-5.03, 23.95	
Mastectomy	-7.08	-15.75, 1.59			8.14	-6.60, 22.88	
MOS – Emotional [‡]	2.95	0.50, 5.39	0.018		4.35	-0.14, 8.83	0.057
MOS – Tangible [‡]	2.87	0.89, 4.85	0.0046		1.55	-1.96, 5.07	0.39
MOS – Affectionate [‡]	1.84	-0.85, 4.52	0.18		1.95	-2.65, 6.54	0.41
MOS – Positive Interaction [‡]	3.68	1.03, 6.33	0.0066		4.15	-0.35, 8.65	0.071
R²/No. of participants		0.36/579			0.38/269		

* From FACT-B = Functional Assessment of Cancer Therapy-Breast Cancer [27]

[‡] From MOS = Medical Outcomes Study [29]