Published in final edited form as:

Breast Cancer Res Treat. 2013 June ; 139(2): 515–527. doi:10.1007/s10549-013-2477-2.

Social networks, social support mechanisms, and quality of life after breast cancer diagnosis

Candyce H Kroenke, ScD, MPH^a, Marilyn L. Kwan, PhD^a, Alfred I. Neugut, MD, PhD^b, Isaac J. Ergas^a, Jaime D. Wright^c, Bette J. Caan, DrPH^a, Dawn Hershman, MD^b, and Lawrence H. Kushi, ScD^a

^aKaiser Permanente, Division of Research, Oakland, CA, 94612.

^bColumbia University College of Physicians and Surgeons and Mailman School of Public Health, New York, NY 10032.

^cGraduate Theological Union, Berkeley, CA.

Abstract

Purpose—We examined mechanisms through which social relationships influence quality of life (QOL) in breast cancer survivors.

Methods—This study included 3,139 women from the Pathways Study who were diagnosed with breast cancer from 2006-2011 and provided data on social networks (presence of spouse or intimate partner, religious/social ties, volunteering, and numbers of close friends and relatives), social support (tangible, emotional/informational, affection, positive social interaction), and quality of life (QOL), measured by the FACT-B, approximately two months post-diagnosis. We used logistic models to evaluate associations between social network size, social support, and lower vs. higher than median QOL scores. We further stratified by stage at diagnosis and treatment.

Results—In multivariate-adjusted analyses, women who were characterized as socially isolated had significantly lower FACT-B (OR=2.18, 95%CI:1.72-2.77), physical well-being (WB) (OR=1.61, 95%CI:1.27-2.03), functional WB (OR=2.08, 95%CI:1.65-2.63), social WB (OR=3.46, 95%CI:2.73-4.39), and emotional WB (OR=1.67, 95%CI:1.33-2.11) scores and higher breast cancer symptoms (OR=1.48, 95%CI:1.18-1.87), compared with socially integrated women. Each social network member independently predicted higher QOL. Simultaneous adjustment for social networks and social support partially attenuated associations between social networks and QOL. The strongest mediator and type of social support that was most predictive of QOL outcomes was “positive social interaction”. However, each type of support was important depending on outcome, stage, and treatment status.

Conclusions—Larger social networks and greater social support were related to higher QOL after a diagnosis of breast cancer. Effective social support interventions need to evolve beyond social-emotional interventions and need to account for disease severity and treatment status.

Address for correspondence: Candyce H. Kroenke Kaiser Permanente Division of Research 2101 Webster Oakland, CA 94612
Candyce.h.kroenke@kp.org 510-627-2170.

The authors declare that they have no financial conflicts of interest.

Keywords

Social networks; social relationships; breast cancer; quality of life; FACT-B; women

Introduction

Social networks are defined as the web of social relationships that surround an individual[1]. The most commonly examined aspect of social networks with regard to breast cancer outcomes has been social network size, i.e., the number of network members. Previous studies have found that larger networks (i.e., greater social integration) are associated with better survival [2-7] and better quality of life (QOL) after breast cancer. In the Nurses' Health Study (NHS) of 708 women diagnosed with any breast cancer stage, Michael and colleagues found that socially integrated women had better health-related quality of life after diagnosis[8]. However, they did not evaluate possible mechanisms of this association. Most previous studies have focused on associations between social support and QOL outcomes, particularly emotional QOL [9-12], without separately considering the influence of social networks on outcomes. Moreover, most previous studies are small, and many have not evaluated associations with physical QOL.

Surprisingly little work has evaluated what aspects of social networks are critical in prolonging survival or improving QOL outcomes after breast cancer diagnosis. Despite this absence of research, social support interventions have been frequently used in breast cancer survivors; these have mostly involved peer support groups of other survivors which are designed to provide social-emotional support, the emotionally sustaining quality of a relationship, to participants. However, while some interventions have improved QOL[13], others have diminished it[14, 15], and none has improved survival[13-17]. Adverse outcomes may reflect a lack of prior knowledge about relationships in women's naturally occurring networks[15], lack of attention to the differing needs of women by disease severity, and lack of knowledge about mechanisms and how social relationships might improve post-diagnosis outcomes. Work is needed which evaluates what aspects of social connection influence breast cancer outcomes.

Therefore, in a prospective cohort study of 3,139 women diagnosed with invasive breast cancer, we evaluated associations between social networks (the presence of a spouse or intimate partner, number of close friends and relatives, volunteer participation, and religious/social participation), social support mechanisms, and QOL outcomes. We hypothesized that larger social networks, particularly larger networks of "close" friends and relatives, would be related to better QOL in women diagnosed with breast cancer. We also hypothesized that emotional/informational support would predict and mediate associations of social networks and social and emotional QOL scores, consistent with results that social-emotional support can help with social and emotional well-being, but that tangible support would predict and mediate associations with physical, breast, and functional QOL measures, a hypothesis suggested by Kroenke and colleagues[4].

METHODS

Study population

The Pathways Study is a prospective cohort study designed to assess the effects of lifestyle and molecular factors on breast cancer recurrence and mortality. Women with invasive breast cancer have been recruited from the Kaiser Permanente Northern California (KPNC) patient population since January 2006. Details have previously been reported[18]. Briefly, cases are ascertained rapidly by scanning of electronic pathology reports. Eligibility criteria for the study include current KPNC membership, being at least 21 years of age at diagnosis, and having a first primary invasive breast cancer with no prior history of cancer other than non-melanoma skin cancer. Participants must speak English, Spanish, Cantonese, or Mandarin and reside within a 65-mile radius of a field interviewer. Passive consent was obtained from the patient's physician of record to contact the patient for study recruitment. Written informed consent was obtained from all participants. The study was approved by all Institutional Review Boards.

Recruitment is ongoing. As of September 30, 2011, 3,566 patients were enrolled. We excluded women with incomplete information on social network members (described below) (N=259), social support variables (N=58), and quality of life (N=110). We considered excluding women who were missing data on stage and treatment (e.g., chemotherapy, radiation, hormonal). However, there was no qualitative difference in associations including or excluding these women, so we retained them in the analysis. Our final sample included 3,139 women.

Women excluded from the analysis were less likely to have a college education (44% vs. 49%) or receive lumpectomy (47% vs. 54%) and were more likely to have a comorbid condition (16% vs. 10%), but they did not differ on stage at diagnosis, or other variables characterizing disease severity, treatment or lifestyle (e.g., physical activity, smoking, body mass index). The mean time from pathology-confirmed diagnosis to baseline interview was 2.01 months (SD 0.73).

Data collection

Clinical data—Data on number of positive lymph nodes, American Joint Committee on Cancer (AJCC) stage, breast surgery (lumpectomy, mastectomy), chemotherapy and radiation therapy were obtained from the KPNC Cancer Registry (KPNCCR)[19]. Data are collected, coded, and added to the KPNCCR approximately four months post-diagnosis to allow for the completion of treatment. Breast surgery and radiation therapy data were also supplemented by other KPNC electronic data sources. Information on adjuvant hormonal therapy was abstracted from outpatient pharmacy records.

Social networks—Social networks included four components: a spouse or intimate partner, number of close friends and relatives, religious/social ties, and community ties. Women were asked, "What is your current marital status? (married, divorced, living as married, separated, widowed, or never married)." Women were also asked, "How many close friends and relatives do you have?" and women were allowed to provide a number.

Questions regarding community and religious/social ties were derived from an adapted version of the Arizona Activity Frequency Questionnaire (AAFQ)[20]. As a measure of community ties, women were asked, “Did you do weekly volunteer work in the past year? (yes, no)” As a proxy measure of religious participation, women were asked, “On average, how often did you attend religious, social or service club meetings, sporting events, concerts, movies or shows?” Response options to these questions included: 1) never or less than 1 time per month, 2) 1-3 times per month, 3) 1-2 times per week, 4) 3-5 times per week, and 5) more than 5 times per week. Because this question included both religious and social participation, this will be denoted religious/social participation throughout.

The creation of the social networks variable was based on the Berkman-Syme Social Network Index (B-SNI)[21], including similar network members. Moreover, as with the B-SNI, we weighted close friends and relatives more heavily than other components in the computation of the score. However, because we did not have information on frequency of contact for friends and relatives, the score does not reflect this dimension. Social network size was computed as the sum of: 1) being married or having an intimate partner, 2) any religious/social participation, 3) any community participation, and 4) quartile of numbers of close friends and relatives. From this, we generated three categories representing women who were defined to be: socially isolated, moderately integrated, and socially integrated. In previous work[4], the most socially isolated women included approximately 10% of the sample. To ensure sufficient power and since the scoring did not enable selection of the 10% most isolated, we defined the 15% with the smallest networks as “socially isolated” and generated the other two categories by dividing women by median network size. Analyses of tertiles did not produce qualitatively different results.

Social support—We used the 19-item Medical Outcomes Study (MOS) Social Support Survey, a multidimensional social support survey developed for patients with chronic conditions, to assess perceived social support, including emotional/informational support, tangible support, positive social interaction, and affectionate support[22]. Each woman was asked how true each statement was during the past 7 days for items including, for example, whether she had “someone you can count on to listen to you when you need to talk” (emotional/informational support), “someone to help with daily chores if you were sick” (tangible support), “someone to have a good time with” (positive social interaction), or “someone who shows you love and affection” (affectionate support). Responses ranged from “none of the time” to “all of the time”. The reliability for each of the sub-scales and overall index were excellent (Cronbach’s alpha 0.89–0.96) in our sample. Using factor analysis (SAS PROC FACTOR), with orthogonal rotation, we confirmed the factor structure in these data reported by Sherbourne[22] (data not shown).

Quality of life—We used the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) Version 3, an instrument designed to measure multidimensional quality of life in breast cancer patients, to assess QOL at the baseline interview and 24 month follow-up[23]. The FACT-B includes 36 statements asking respondents to rate how true each statement is for the last 7 days including, for example, “One or both of my arms are swollen or tender” (BCS), “I have pain” (PWB), “I get emotional support from my family” (SWB), “I worry

about dying” (EWB), and “I am able to work (include the work at home)” (FWB). Responses range from 0 (not at all) to 4 (very much). Five subscales were derived from those statements: physical well-being (PWB, Cronbach’s alpha=0.86), functional well-being (FWB, Cronbach’s alpha=0.84), emotional well-being (EWB, Cronbach’s alpha=0.77), social/family well-being (SWB, Cronbach’s alpha = 0.72), and breast cancer-specific concerns (BCS, Cronbach’s alpha=0.64). The TOI-PFB physical function score was computed by summing the PWB, BCS (reversed), and FWB subscales (Cronbach’s alpha=0.89). A general score was calculated by summing all subscales except the BCS (FACT-G, Cronbach’s alpha=0.91); the total FACT-B score was calculated by including BCS (reversed) in the sum (Cronbach’s alpha=0.90). Thus, the summary scores (FACT-B, FACT-G, and TOI-PFB) are comprised of five scales (BCS, PWB, SWB, EWB, FWB) describing symptoms related to breast cancer and levels of well-being. The instrument has been extensively validated in different race/ethnic groups and languages.

To enable computation of risk of adverse outcomes, we dichotomized QOL outcomes as higher vs. lower than median levels of each of these variables and specified adverse outcomes as lower than median levels of the outcome (reversed for BCS).

Covariates—Data on socio-demographics (race/ethnicity, education, marital status, household income), weight, height, and lifestyle (smoking, physical activity), were collected by trained staff who conducted in-home interviews.

Body mass index (BMI) was computed from self-reported height and weight and missing values were supplemented by concurrent data from KPNC electronic data sources. Physical activity in MET (metabolic equivalent)-hours/week was assessed from the AAFQ[20]. For pre-cancer comorbidity, we abstracted common conditions by ICD-9 codes from the electronic data sources and used these data to calculate the Charlson comorbidity index[24]. Based on the distribution of comorbidity scores, we dichotomized scores as 0–1 versus two or more. Smoking was assessed as current, past, or never. We employed covariates based on a priori considerations of factors well known to be related to QoL and breast cancer outcomes after diagnosis.

Statistical analyses

Using analysis of covariance, we regressed potential confounding variables against categories of social network size, adjusted for continuous age.

Analyses of social networks and outcomes—We used logistic regression (PROC LOGISTIC) to evaluate associations between level of social integration and the risk of having lower than median levels of QOL scores. We also used linear regression to evaluate associations of categories of social network members, with linear QOL scores. Linear QOL scores and subscores were approximately normal and thus transformation was unnecessary. We conducted tests for linear trend using continuous variables and computing Wald statistics. Results adjusted for age and months between diagnosis and baseline social assessment were compared with those adjusted for multiple covariates. We considered several covariates thought *a priori* to be important predictors of QOL which might confound

associations based upon previous literature, etc. We also evaluated associations between specific social network members and QOL scores.

Analyses of social support mechanisms—We wanted to examine social support mechanisms through which social networks may influence QOL outcomes in breast cancer survivors. Therefore, we evaluated the models described above, adjusting additionally and simultaneously for tertiles (approximate) of the four MOS social support subcomponents, to see if associations of social networks with QOL outcomes were attenuated and to further evaluate independent associations of social support types with QOL outcomes.

We were also interested in examining if certain types of social support after adjustment for social networks were more important for QOL outcomes, depending on whether women had early or late stage disease and whether they were undergoing treatment thought to affect QOL most in the short-term. Thus, we conducted stratified analyses by stage at diagnosis (early (in situ, localized, and regional with lymph nodes only) vs. late (regional, distant, metastases, or systemic)) and by treatment with chemotherapy (yes vs. no).

RESULTS

Baseline characteristics

Women with larger social networks had higher education and income and a healthier lifestyle with higher levels of physical activity and lower BMI and likelihood of current smoking. However, social network size was unrelated to reproductive factors, cancer stage, or treatment. As would be expected given that social networks were defined by these variables, women with larger social networks were more likely to be married, have a living parent, have greater numbers of siblings and children, and engage in religious/social participation and volunteering. These women were also more likely to report providing caregiving (Table 2). The Spearman correlation between the MOS social support variable and social network size was $r=0.37$, $p<0.001$.

Social networks and quality of life

Women who were socially isolated were significantly more likely to have lower than median QOL scores in both minimally and multiply adjusted models (Age-adjusted models and Multivariate-adjusted models I, Table 3) than women who were socially integrated (Table 3). Each social network member significantly predicted QOL scores. Having more close friends and relatives, in particular, was related to higher QOL (Table 4).

For all QOL measures, adjusting for social support mechanisms attenuated associations of social networks and outcomes, but social networks were still related to several outcomes (Multivariate-adjusted models II, Table 3).

Social support and quality of life

For the FACT-B, the FACT-G and SWB, each type of social support was significantly related to outcomes (Table 4). For the other subscales, types of social support related differently to outcomes. Positive social interaction was significantly related to every QOL

measure. Emotional/informational support was related to higher FWB, SWB, and EWB, as well as the summary scores. In contrast, higher tangible support was related to reduced odds of low PWB, SWB, FACT-B, and FACT-G scores.

Positive interaction appeared more helpful with PWB among women who weren't receiving chemotherapy ($p<0.001$) vs. those who did ($p=0.82$, $p\text{-interaction}=0.04$) (Table 5). Stratified by cancer stage, tangible support was more strongly related to physical QOL measures (i.e., TOI-PFB, BCS, PWB) in women with late vs. early stage cancer (Table 5). Interestingly, though low affection predicted worse QOL (FACT-B, OR=1.33, 95% CI:1.07-1.66; FACT-G, OR=1.38, 95% CI:1.08-1.77) scores in those with early stage cancer, low affection appeared related to better QOL outcomes in those with late stage cancer (FACT-B, OR=0.65, 95% CI: 0.30-1.42, $p\text{-interaction}=0.06$; FACT-G, OR=0.82, 95% CI: 0.27-1.79, $p\text{-interaction}=0.07$).

DISCUSSION

In this analysis of 3,139 breast cancer survivors, larger social networks were associated with higher QOL, consistent with our hypothesis and with previous results. Moreover, each type of social support was predictive of overall QOL. However, emotional/informational support, the most commonly considered benefit of social relationships, was related to higher social and emotional well-being only. Tangible support was important for physical outcomes, particularly among women with late stage disease. By contrast, positive social interaction was related to all QOL domains. Interestingly, among women with late stage cancer, affection appeared related to lower QOL. Neither emotional/informational support nor tangible support explained associations. In fact, significant associations of social network size and QOL outcomes, adjusted for types of social support, suggest that there are other important mechanisms through which naturally occurring networks influence QOL outcomes after a breast cancer diagnosis. These findings are the first to examine social support mechanisms in helping to understand why larger social networks are related to better QOL outcomes in breast cancer survivors.

Little research has explored the association between social networks and QOL outcomes in survivors. Investigators employing social interventions have presumed that social-emotional support is the critical mechanism through which social relationships afford better outcomes. However, in these data, emotional/informational support predicted better psychological but not physical QOL, suggesting that this type of support is not likely to mediate associations with physical health or survival.

Large social networks may increase the odds that women will have friends and family to rely on for instrumental daily activities (e.g., rides to the hospital, trips to the pharmacy, assistance with exercise, or provision of healthy meals[25, 26]). Tangible support was important for some outcomes, most notably for physical and social well-being and was related in particular to the ability to meet family needs (data not shown). However, our findings suggested that tangible support was most important for QOL outcomes among women with late stage cancer, suggesting that help with chores, trips to the doctor, etc. may be most beneficial to women who are coping with severe disease.

The strongest associations were observed for “positive interaction” and QOL. Given that this dimension was defined by the availability of someone with whom to have fun, relax, and get one’s mind off things for a while, it is possible that positive social interaction may enable women to forget for a while the distress of being a cancer patient, and the physiological effects last beyond the actual interaction. In these data, of the four dimensions of social support, only positive social interaction was related to lower levels of nausea, pain, needed bed rest, and higher levels of energy ($P = 0.01$), suggesting QOL benefits of face-to-face interaction with people with whom a person can forget oneself. Research is needed to explore the relationship between social interaction and illness management.

Interestingly, among women with late stage cancer, though positive social interaction improved QOL, high amounts of affection appeared to diminish QOL. Although speculative, these findings suggest that the physicality of affection might be problematic for women with late stage disease or that the burdens of maintaining a brave front socially[27] by distancing loved ones and avoiding discussing the challenges of cancer with well-meaning friends, acquaintances, or even medical staff[28, 29] may become burdensome for women, which may reduce QOL[30].

Though adjustment for social support mechanisms substantially attenuated associations of social networks with QOL, associations between social network size and QOL remained significant after adjustment for social support variables, suggesting that other important mechanisms through which social networks operate may influence outcomes. Future research should evaluate whether larger social networks improve QOL through lifestyle and related factors, such as diet, physical activity and weight, which are related to breast cancer survival[31-44]. However, in these data, adjustment for lifestyle factors had little effect on associations; social support mechanisms better explained associations between social networks and QOL. Other potential mechanisms to explore include effects on adherence to treatment and follow-up screening. Work is also needed to evaluate potential strategies by personality type, particularly the introversion-extroversion dimension, which is related to preferences regarding level of social connectedness. The greatest benefit of social interventions may or may not accrue to women who are least likely to participate; effective strategies may need to take personality into account.

A strength of the study was the ability to evaluate associations of social networks, social support and QOL outcomes during the adjuvant treatment period, which may enable more accurate assessment of the effects of social relationships on outcomes compared with post-treatment assessment. Another strength was the capacity to evaluate different types of social support as well as both general and breast-cancer specific aspects of QOL. A limitation of the study included the measure of religious participation, which also included other types of activities. However, these activities also reflected social participation which was of interest here.

A concern is that social networks might be conflated with physical health. That is, women who are physically healthier may be more likely to participate socially. However, when we stratified by disease severity or by receipt of chemotherapy, associations were still apparent. Moreover, the positive association of tangible support with QOL in those with late stage

cancer is consistent with a positive influence of social relationships on outcomes independent of ability to attend social events. Another limitation included the use of an unvalidated measure of social networks. However, we have used similar measures in other work [45, 46] and results for the individual network components and outcomes are consistent with previous results obtained using similar variables from the Berkman-Syme scale[4]

In summary, larger social networks were related to higher QOL in women with breast cancer. Positive social interaction was the most important independent predictor and mediator of associations with QOL. Tangible support was a strong predictor of physical QOL in women with late stage cancer. Significant associations of social network size and QOL, adjusted for social support, suggest that there are other mechanisms through which naturally occurring networks influence breast cancer outcomes. Work is needed which replicates and expands upon these findings. Nonetheless, these findings suggest that the most important points of leverage for social interventions in promoting QOL might focus on mechanisms besides social-emotional support and that effective social support interventions might be tailored to account for disease severity and treatment status.

Acknowledgments

This study was supported by the National Institutes of Health, National Cancer Institute Grant #2R01 CA105274

References

1. Berkman, L.; Glass, TA. Social integration, social networks, social support, and health. In: Berkman, L.; Kawachi, I., editors. *Social epidemiology*. Oxford University Press; New York, NY: 2000.
2. Beasley JM, Newcomb PA, Trentham-Dietz A, Hampton JM, Ceballos RM, Titus-Ernstoff L, Egan KM, Holmes MD. Social networks and survival after breast cancer diagnosis. *J Cancer Surviv*. 2010; 4(4):372–380. [PubMed: 20652435]
3. Chou AF, Stewart SL, Wild RC, Bloom JR. Social support and survival in young women with breast carcinoma. *Psychooncology*. 2010
4. Kroenke CH, Kubzansky LD, Schernhammer ES, Holmes MD, Kawachi I. Social networks, social support, and survival after breast cancer diagnosis. *J Clin Oncol*. 2006; 24(7):1105–1111. [PubMed: 16505430]
5. Reynolds P, Boyd PT, Blacklow RS, Jackson JS, Greenberg RS, Austin DF, Chen VW, Edwards BK. The relationship between social ties and survival among black and white breast cancer patients. National Cancer Institute Black/White Cancer Survival Study Group. *Cancer Epidemiol Biomarkers Prev*. 1994; 3(3):253–259. [PubMed: 8019376]
6. Waxler-Morrison N, Hislop TG, Mears B, Kan L. Effects of social relationships on survival for women with breast cancer: a prospective study. *Soc Sci Med*. 1991; 33(2):177–183. [PubMed: 1887281]
7. Pinquart M, Duberstein PR. Associations of social networks with cancer mortality: a meta-analysis. *Crit Rev Oncol Hematol*. 2011; 75(2):122–137. [PubMed: 19604706]
8. Michael YL, Berkman LF, Colditz GA, Holmes MD, Kawachi I. Social networks and health-related quality of life in breast cancer survivors: a prospective study. *J Psychosom Res*. 2002; 52(5):285–293. [PubMed: 12023125]
9. So WK, Leung DY, Ho SS, Lai ET, Sit JW, Chan CW. Associations between social support, prevalent symptoms and health-related quality of life in Chinese women undergoing treatment for breast cancer: A cross-sectional study using structural equation modelling. *Eur J Oncol Nurs*. 2012

10. Salonen P, Tarkka MT, Kellokumpu-Lehtinen PL, Koivisto AM, Aalto P, Kaunonen M. Effect of social support on changes in quality of life in early breast cancer patients: a longitudinal study. *Scand J Caring Sci*. 2012
11. Lewis JA, Manne SL, DuHamel KN, Vickburg SM, Bovbjerg DH, Currie V, Winkel G, Redd WH. Social support, intrusive thoughts, and quality of life in breast cancer survivors. *J Behav Med*. 2001; 24(3):231–245. [PubMed: 11436544]
12. Sammarco A. Perceived social support, uncertainty, and quality of life of younger breast cancer survivors. *Cancer Nurs*. 2001; 24(3):212–219. [PubMed: 11409065]
13. Goodwin PJ, Leszcz M, Ennis M, Koopmans J, Vincent L, Guthrie H, Drysdale E, Hundleby M, Chochinov HM, Navarro M, et al. The effect of group psychosocial support on survival in metastatic breast cancer. *N Engl J Med*. 2001; 345(24):1719–1726. [PubMed: 11742045]
14. Cousson-Gelie F, Bruchon-Schweitzer M, Atzeni T, Houede N. Evaluation of a psychosocial intervention on social support, perceived control, coping strategies, emotional distress, and quality of life of breast cancer patients. *Psychol Rep*. 2011; 108(3):923–942. [PubMed: 21879639]
15. Helgeson VS, Cohen S, Schulz R, Yasko J. Group support interventions for women with breast cancer: who benefits from what? *Health Psychol*. 2000; 19(2):107–114. [PubMed: 10762094]
16. Spiegel D, Butler LD, Giese-Davis J, Koopman C, Miller E, DiMiceli S, Classen CC, Fobair P, Carlson RW, Kraemer HC. Effects of supportive-expressive group therapy on survival of patients with metastatic breast cancer: a randomized prospective trial. *Cancer*. 2007; 110(5):1130–1138. [PubMed: 17647221]
17. Gellert GA, Maxwell RM, Siegel BS. Survival of breast cancer patients receiving adjunctive psychosocial support therapy: a 10-year follow-up study. *J Clin Oncol*. 1993; 11(1):66–69. [PubMed: 8418244]
18. Kwan ML, Ambrosone CB, Lee MM, Barlow J, Krathwohl SE, Ergas IJ, Ashley CH, Bittner JR, Darbinian J, Stronach K, et al. The Pathways Study: a prospective study of breast cancer survivorship within Kaiser Permanente Northern California. *Cancer Causes Control*. 2008; 19(10):1065–1076. [PubMed: 18478338]
19. Oehrli, MD.; Quesenberry, CP.; Leyden, W. Annual Report on Trends, Incidence, and Outcomes. Kaiser Permanente Northern California Cancer Registry; Nov.. 2006 2006
20. Staten LK, Taren DL, Howell WH, Tobar M, Poehlman ET, Hill A, Reid PM, Ritenbaugh C. Validation of the Arizona Activity Frequency Questionnaire using doubly labeled water. *Med Sci Sports Exerc*. 2001; 33(11):1959–1967. [PubMed: 11689750]
21. Berkman LF, Syme SL. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *Am J Epidemiol*. 1979; 109(2):186–204. [PubMed: 425958]
22. Sherbourne CD, Stewart AL. The MOS social support survey. *Soc Sci Med*. 1991; 32(6):705–714. [PubMed: 2035047]
23. Brady MJ, Cella DF, Mo F, Bonomi AE, Tulsky DS, Lloyd SR, Deasy S, Cobleigh M, Shiimoto G. Reliability and validity of the Functional Assessment of Cancer Therapy-Breast quality-of-life instrument. *J Clin Oncol*. 1997; 15(3):974–986. [PubMed: 9060536]
24. 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. [PubMed: 3558716]
25. Hirschman KB, Bourjolly JN. How do tangible supports impact the breast cancer experience? *Soc Work Health Care*. 2005; 41(1):17–32. [PubMed: 16048854]
26. Woloshin S, Schwartz LM, Tosteson AN, Chang CH, Wright B, Plohan J, Fisher ES. Perceived adequacy of tangible social support and health outcomes in patients with coronary artery disease. *J Gen Intern Med*. 1997; 12(10):613–618. [PubMed: 9346457]
27. Ganz PA. Quality of Life Across the Continuum of Breast Cancer Care. *Breast J*. 2000; 6(5):324–330. [PubMed: 11348391]
28. Macguire, P. Quality of life of cancer patients and their relatives. In: David Morris, D.; Kearsley, J.; Hacon Williams, CJ., editors. *Cancer: A comprehensive clinical guide*. Harwood Academic Publishers; Amsterdam, Netherlands: 1998.
29. Wilkinson S. Factors which influence how nurses communicate with cancer patients. *J Adv Nurs*. 1991; 16(6):677–688. [PubMed: 1869716]

30. Pennebaker, JW.; Chung, CK. Expressive writing, emotional upheavals, and health. In: Friedman, H.; Silver, R., editors. Foundations of health psychology. Oxford University Press; New York: 2007.
31. Kwan ML, Weltzien E, Kushi LH, Castillo A, Slattery ML, Caan BJ. Dietary patterns and breast cancer recurrence and survival among women with early-stage breast cancer. *J Clin Oncol*. 2009; 27(6):919–926. [PubMed: 19114692]
32. Kroenke CH, Fung TT, Hu FB, Holmes MD. Dietary patterns and survival after breast cancer diagnosis. *J Clin Oncol*. 2005; 23(36):9295–9303. [PubMed: 16361628]
33. Holmes MD, Chen WY, Feskanich D, Kroenke CH, Colditz GA. Physical activity and survival after breast cancer diagnosis. *JAMA*. 2005; 293(20):2479–2486. [PubMed: 15914748]
34. Holmes MD, Murin S, Chen WY, Kroenke CH, Spiegelman D, Colditz GA. Smoking and survival after breast cancer diagnosis. *Int J Cancer*. 2007; 120(12):2672–2677. [PubMed: 17278091]
35. Thivat E, Therondel S, Lapirot O, Abrial C, Gimbergues P, Gadea E, Planchat E, Kwiatkowski F, Mouret-Reynier MA, Chollet P, et al. Weight change during chemotherapy changes the prognosis in non metastatic breast cancer for the worse. *BMC Cancer*. 2010; 10:648. [PubMed: 21108799]
36. Nichols HB, Trentham-Dietz A, Egan KM, Titus-Ernstoff L, Holmes MD, Bersch AJ, Holick CN, Hampton JM, Stampfer MJ, Willett WC, et al. Body mass index before and after breast cancer diagnosis: associations with all-cause, breast cancer, and cardiovascular disease mortality. *Cancer Epidemiol Biomarkers Prev*. 2009; 18(5):1403–1409. [PubMed: 19366908]
37. Li CI, Daling JR, Porter PL, Tang MT, Malone KE. Relationship between potentially modifiable lifestyle factors and risk of second primary contralateral breast cancer among women diagnosed with estrogen receptor-positive invasive breast cancer. *J Clin Oncol*. 2009; 27(32):5312–5318. [PubMed: 19738113]
38. Dal Maso L, Zucchetto A, Talamini R, Serraino D, Stocco CF, Vercelli M, Falcini F, Franceschi S. Effect of obesity and other lifestyle factors on mortality in women with breast cancer. *Int J Cancer*. 2008; 123(9):2188–2194. [PubMed: 18711698]
39. Caan BJ, Kwan ML, Hartzell G, Castillo A, Slattery ML, Sternfeld B, Weltzien E. Pre-diagnosis body mass index, post-diagnosis weight change, and prognosis among women with early stage breast cancer. *Cancer Causes Control*. 2008; 19(10):1319–1328. [PubMed: 18752034]
40. Kroenke CH, Chen WY, Rosner B, Holmes MD. Weight, weight gain, and survival after breast cancer diagnosis. *J Clin Oncol*. 2005; 23(7):1370–1378. [PubMed: 15684320]
41. Enger SM, Greif JM, Polikoff J, Press M. Body weight correlates with mortality in early-stage breast cancer. *Arch Surg*. 2004; 139(9):954–958. discussion 958–960. [PubMed: 15381612]
42. Daling JR, Malone KE, Doody DR, Johnson LG, Gralow JR, Porter PL. Relation of body mass index to tumor markers and survival among young women with invasive ductal breast carcinoma. *Cancer*. 2001; 92(4):720–729. [PubMed: 11550140]
43. Vatten LJ, Foss OP, Kvinnsland S. Overall survival of breast cancer patients in relation to preclinically determined total serum cholesterol, body mass index, height and cigarette smoking: a population-based study. *Eur J Cancer*. 1991; 27(5):641–646. [PubMed: 1828977]
44. Mohle-Boetani JC, Grosser S, Whittemore AS, Malec M, Kampert JB, Paffenbarger RS Jr. Body size, reproductive factors, and breast cancer survival. *Prev Med*. 1988; 17(5):634–642. [PubMed: 3237661]
45. Kroenke CH, Quesenberry C, Kwan ML, Sweeney C, Castillo A, Caan BJ. Social networks, social support, and burden in relationships, and mortality after breast cancer diagnosis in the Life After Breast Cancer Epidemiology (LACE) study. *Breast Cancer Res Treat*. 2013; 137(1):261–271. [PubMed: 23143212]
46. Kroenke CH, Michael Y, Tindle H, Gage E, Chlebowski R, Garcia L, Messina C, Manson JE, Caan BJ. Social networks, social support and burden in relationships, and mortality after breast cancer diagnosis. *Breast Cancer Res Treat*. 2012

Table 1

Selected baseline characteristics* by category of social network size, Pathways (N=3,139).

	Social network size			p-trend
	Socially integrated	Moderately integrated	Socially isolated	
N (%)	1,462 (46.5)	1,219 (38.8)	482 (15.1)	
Family history of breast cancer (%)	21.4	19.9	19.3	0.51
Any comorbidity (%)	8.9	11.0	14.8	<0.001
Demographic variables				
Age (mean years)	59.6	59.2	60.3	0.28
Race/Ethnicity (%)				
Caucasian	68.4	66.2	59.3	0.01 [†]
African-American	10.2	7.0	6.5	
Asian	10.6	12.0	14.9	
Hispanic	11.6	11.8	12.2	
Other	2.9	3.0	3.3	
Income <\$25K (%)	6.0	10.1	19.1	<0.001
Education college (%)	53.8	47.1	40.2	<0.001
Severity of disease				
Stage				
I (%)	51.8	54.2	53.4	0.80 [†]
II (%)	35.5	35.0	34.3	
III (%)	10.9	9.4	10.1	
IV (%)	1.9	1.4	2.2	
Nodal involvement (%)	33.0	30.0	31.6	0.28
ER positive (%)	81.8	83.8	80.6	0.24
HER-2-neu positive (%)	13.4	11.8	15.2	0.21
Treatment				
Chemotherapy (%)	47.5	44.6	44.2	0.21
Radiation (%)	36.3	34.3	35.8	0.60
Lumpectomy (%)	52.9	55.9	52.8	0.23
Mastectomy (%)	28.5	25.9	29.3	0.20
Hormone treatment (%)	40.9	40.1	41.0	0.92
Behavioral factors				
Body mass index (kg/m ²)	28.1	28.0	29.0	0.001
Physical activity (MET hr/wk)	33.2	28.1	23.2	0.001
Current smokers (%)	7.0	13.8	15.5	<0.001
Reproductive factors				
Postmenopausal (%)	70.8	72.4	70.1	0.28
Age at menarche < 12 y (%)	22.0	23.3	23.1	0.72
OC use (%)	74.8	74.8	71.2	0.23
Social variables				

	Social network size			
	Socially integrated	Moderately integrated	Socially isolated	p-trend
Provide caregiving (%)	33.7	29.7	24.9	<0.001
Living mother (%)	41.4	38.1	40.4	0.12
Living father (%)	26.2	24.9	22.3	0.22
Number of children (mean)	2.3	2.1	2.0	<0.001
Number of sisters (mean)	1.4	1.2	1.3	0.05
Number of brothers (mean)	1.4	1.3	1.3	0.04
Married (%)	77.0	48.8	24.1	<0.001
Religious participation (%)	89.1	62.9	30.3	<0.001
Volunteering (%)	42.8	15.3	2.7	<0.001

* Except for age, all variables age-adjusted

[†] Mantel-Haenszel χ^2 test

Table 2

Relative odds of lower than median values of quality of life scores at baseline by categories of social integration in the Pathways study (N=3,139)

	Socially integrated	Moderately integrated	Socially isolated	p-value
N (%)	1,462 (46.5)	1,219 (38.8)	482 (15.1)	
Functional Assessment Cancer Therapy-General (Fact-G)	633	642	298	
Age-adjusted	1.00	1.47	2.59	<0.001
95% CI		(1.26-1.71)	(2.08-3.24)	
Multivariate-adjusted I [*]	1.00	1.44	2.31	<0.001
95% CI		(1.22-1.69)	(1.82-2.93)	
Multivariate-adjusted II [†]	1.00	1.11	1.27	0.03
95% CI		(0.94-1.32)	(0.98-1.65)	
Functional Assessment Cancer Therapy-Breast (Fact-B)	622	651	287	
Age-adjusted	1.00	1.57	2.43	<0.001
95% CI		(1.34-1.83)	(1.95-3.04)	
Multivariate-adjusted I [*]	1.00	1.54	2.18	<0.001
95% CI		(1.11-1.82)	(1.72-2.77)	
Multivariate-adjusted II [†]	1.00	1.21	1.21	0.01
95% CI		(1.02-1.45)	(0.93-1.57)	
Trial Outcome Index-Physical/Functional/Breast (TOI-PFB)	630	603	272	
Age-adjusted	1.00	1.30	2.07	<0.001
95% CI		(1.11-1.52)	(1.66-2.59)	
Multivariate-adjusted I [*]		1.30	1.94	<0.001
95% CI		(1.10-1.54)	(1.53-2.46)	
Multivariate-adjusted II [†]	1.00	1.08	1.26	0.05
95% CI		(0.91-1.29)	(0.98-1.63)	
Breast Cancer Symptoms (BCS)	650	610	248	
Age-adjusted	1.00	1.25	1.55	<0.001
95% CI		(1.07-1.46)	(1.25-1.92)	
Multivariate-adjusted I [*]	1.00	1.26	1.48	<0.001
95% CI		(1.07-1.48)	(1.18-1.87)	
Multivariate-adjusted II [†]	1.00	1.09	1.03	0.09
95% CI		(0.92-1.29)	(0.81-1.32)	
Physical Well-Being (PWB)	679	601	267	
Age-adjusted	1.00	1.11	1.69	<0.001
95% CI		(0.95-1.30)	(1.36-2.10)	
Multivariate-adjusted I [*]	1.00	1.11	1.61	<0.001
95% CI		(0.94-1.31)	(1.27-2.03)	

	Socially integrated	Moderately integrated	Socially isolated	p-value
Multivariate-adjusted II [†]	1.00	0.99	1.24	0.31
95% CI		(0.84-1.17)	(0.97-1.59)	
Social Well-Being (SWB)	510	651	315	
Age-adjusted	1.00	2.15	4.09	<0.001
95% CI		(1.84-2.52)	(3.37-5.13)	
Multivariate-adjusted I *	1.00	2.02	3.46	<0.001
95% CI		(1.72-2.37)	(2.73-4.39)	
Multivariate-adjusted II [†]	1.00	1.49	1.76	<0.001
95% CI		(1.25-1.77)	(1.35-2.30)	
Emotional Well-Being (EWB)	621	599	248	
Age-adjusted	1.00	1.32	1.72	<0.001
95% CI		(1.13-1.55)	(1.39-2.14)	
Multivariate-adjusted I *	1.00	1.34	1.67	<0.001
95% CI		(1.14-1.58)	(1.33-2.11)	
Multivariate-adjusted II [†]	1.00	1.13	1.11	0.08
95% CI		(0.95-1.34)	(0.87-1.43)	
Functional Well-Being (FWB)	577	599	270	
Age-adjusted	1.00	1.49	2.30	<0.001
95% CI		(1.27-1.74)	(1.85-2.86)	
Multivariate-adjusted I *	1.00	1.48	2.08	<0.001
95% CI		(1.26-1.74)	(1.65-2.62)	
Multivariate-adjusted II [†]	1.00	1.18	1.19	0.05
95% CI		(0.99-1.40)	(0.92-1.53)	

* p-value, continuous variable

* Multivariate-adjusted I models adjusted for age (continuous), time between diagnosis and study entry, race/ethnicity (White (ref), African-American, Hispanic, Asian, other), education (<HS, HS, <college, college degree or greater), income (<\$25K, \$25-<\$70K, \$70K+(ref)), stage (I (ref), II, III, IV), estrogen receptor status (positive, negative (ref)), nodal status (positive, negative (ref)), surgery type (mastectomy (ref), lumpectomy, other), chemotherapy (yes, no (ref)), hormonal treatment (yes, no (ref)), radiation (yes, no (ref)), menopausal status (postmenopausal, premenopausal (ref)), parity (0, 1-2, 3 or more), comorbidity (any comorbidity defined by Charlson index, no (ref)), body mass index (BMI<25 (ref), 25-<30, 30+ kg/m²), smoking (never (ref), past, current), physical activity (quartiles, Q1=ref).

[†] MV-adjusted model 2 is adjusted additionally for social support mechanisms

Table 3

Social network members and quality of life outcomes

	N	Fact-B**	95% CI	Fact-G	95% CI	TOI-PFB	95% CI
Married*							
Yes	1,846	Ref		Ref		Ref	
No	1,348	-4.96	(-6.41, -3.52)	-3.90	(-5.04, -2.77)	-1.77	(-2.85, -0.69)
p-value		<0.001		<0.001		0.001	
Close friends and relatives							
>15	812	Ref		Ref		Ref	
10-15	1,120	-2.46	(-4.09, -0.83)	-1.75	(-3.03, -0.47)	-1.26	(-2.48, -0.03)
6-9	664	-6.20	(-8.06, -4.34)	-4.94	(-6.41, -3.48)	-3.32	(-4.72, -1.92)
0-5	598	-10.54	(-12.48, -8.60)	-8.86	(-10.39, -7.34)	-5.29	(-6.75, -3.83)
p-value, continuous		<0.001		<0.001		<0.001	
Any church participation							
Yes	2,230	Ref		Ref		Ref	
No	964	-1.78	(-3.20, -0.37)	-1.42	(-2.54, -0.30)	-0.90	(-1.96, 0.15)
p-value		0.01		0.01		0.09	
Any volunteering							
Yes	825	Ref		Ref		Ref	
No	2,369	-1.90	(-3.39, -0.42)	-1.43	(-2.60, -0.26)	-1.29	(-2.40, -0.19)
p-value		0.01		0.02		0.02	

* Multivariate-adjusted models adjusted for age (continuous), race/ethnicity (White (ref), African-American, Hispanic, Asian, other), education (<HS, HS, <college, college degree or greater), income (<\$25K, \$25-≤\$70K, \$70K+ (ref)), stage (I (ref), II, III, IV), estrogen receptor status (positive, negative (ref)), nodal status (positive, negative (ref)), surgery type (mastectomy (ref), lumpectomy, other), chemotherapy (yes, no (ref)), hormonal treatment (yes, no (ref)), radiation (yes, no (ref)), menopausal status (postmenopausal, premenopausal (ref)), parity (0, 1-2, 3 or more), comorbidity (any comorbidity defined by Charlson index, no (ref)), body mass index (BMI<25 (ref), 25-≤30, 30+ kg/m²), smoking (never (ref), past, current), physical activity (quartiles, Q1=ref).

** FACT-B=Functional Assessment Cancer Therapy-Breast; FACT-G=Functional Assessment Cancer Therapy-General; TOI-PFB=Trials Outcome Index-Physical/Functional/Breast

Table 4

Relative odds of lower than median values of quality of life scores at baseline by categories of social support in the Pathways study (N=3,139)

	High level of social support	Medium level of social support	Low level of social support	p-value
Tangible support, N (%)	1,311 (41.8)	891 (28.4)	937 (29.9)	
Range	19-20	16-18	4-15	
Functional Assessment Cancer Therapy- Breast (Fact-B)	1.00	1.21	1.35	0.02
95% CI		(0.98-1.50)	(1.06-1.73)	
Functional Assessment Cancer Therapy- General (Fact-G)	1.00	1.17	1.34	0.003
95% CI		(0.95-1.44)	(1.05-1.71)	
Trial Outcome Index-Physical/ Functional/Breast (TOI-PFB)	1.00	1.40	1.29	0.43
95% CI		(1.13-1.72)	(1.01-1.65)	
Breast Cancer Symptoms (BCS)	1.00	1.01	1.02	0.91
95% CI		(0.82-1.24)	(0.81-1.29)	
Physical Well-Being (PWB)	1.00	1.36	1.26	0.06
95% CI		(1.11-1.67)	(0.99-1.59)	
Social Well-Being (SWB)	1.00	1.09	1.67	<0.001
95% CI		(0.86-1.35)	(1.31-2.21)	
Emotional Well-Being (EWB)	1.00	1.13	1.14	0.11
95% CI		(0.92-1.39)	(0.90-1.44)	
Functional Well-Being (FWB)	1.00	1.14	1.02	0.99
95% CI		(0.92-1.41)	(0.80-1.30)	
Emotional/informational support, N (%)	1,085 (34.6)	1,047 (33.4)	1,007 (32.1)	
Range	37-40	32-36	8-31	
Functional Assessment Cancer Therapy- Breast (Fact-B)	1.00	1.14	1.51	<0.001
95% CI		(0.92-1.42)	(1.17-1.95)	
Functional Assessment Cancer Therapy- General (Fact-G)	1.00	1.18	1.56	<0.001
95% CI		(0.95-1.46)	(1.21-2.01)	
Trial Outcome Index-Physical/ Functional/Breast (TOI-PFB)	1.00	1.03	1.20	0.002
95% CI		(0.83-1.28)	(0.93-1.55)	
Breast Cancer Symptoms (BCS)	1.00	0.99	1.27	0.24
95% CI		(0.81-1.22)	(0.99-1.62)	
Physical Well-Being (PWB)	1.00	1.14	1.09	0.50
95% CI		(0.93-1.41)	(0.85-1.40)	
Social Well-Being (SWB)	1.00	0.94	1.71	0.001
95% CI		(0.76-1.18)	(1.33-2.21)	
Emotional Well-Being (EWB)	1.00	1.18	2.07	<0.001
95% CI		(0.95-1.45)	(1.62-2.66)	

	High level of social support	Medium level of social support	Low level of social support	p-value
Functional Well-Being (FWB)	1.00	1.08	1.84	<0.001
95% CI		(0.88-1.34)	(1.43-2.36)	
Positive interaction, N (%)	1,351 (43.0)	1,099 (35.0)	689 (22.0)	
Range	20	16-19	4-15	
Functional Assessment Cancer Therapy- Breast (Fact-B)	1.00	1.10	2.97	<0.001
95% CI		(0.88-1.39)	(2.17-4.08)	
Functional Assessment Cancer Therapy- General (Fact-G)	1.00	1.14	2.85	<0.001
95% CI		(0.90-1.43)	(2.08-3.91)	
Trial Outcome Index-Physical/ Functional/Breast (TOI-PFB)	1.00	0.97	2.21	<0.001
95% CI		(0.77-1.22)	(1.62-3.02)	
Breast Cancer Symptoms (BCS)	1.00	1.00	1.89	<0.001
95% CI		(0.80-1.25)	(1.40-2.55)	
Physical Well-Being (PWB)	1.00	0.95	1.63	<0.001
95% CI		(0.76-1.19)	(1.21-2.21)	
Social Well-Being (SWB)	1.00	1.30	2.50	<0.001
95% CI		(1.03-1.63)	(1.83-3.42)	
Emotional Well-Being (EWB)	1.00	1.09	1.50	<0.001
95% CI		(0.87-1.36)	(1.11-2.02)	
Functional Well-Being (FWB)	1.00	1.34	2.95	<0.001
95% CI		(1.07-1.69)	(2.16-4.01)	
Affection, N (%)	1,829 (58.3)		1,310 (41.7)	
Range	10		2-9	
Functional Assessment Cancer Therapy- Breast (Fact-B)	1.00		1.25	<0.001
95% CI			(1.00-1.55)	
Functional Assessment Cancer Therapy- General (Fact-G)	1.00		1.33	0.002
95% CI			(1.07-1.66)	
Trial Outcome Index-Physical/ Functional/Breast (TOI-PFB)	1.00		1.22	0.70
95% CI			(0.98-1.51)	
Breast Cancer Symptoms (BCS)	1.00		1.20	0.26
95% CI			(0.97-1.48)	
Physical Well-Being (PWB)	1.00		1.07	0.75
95% CI			(0.86-1.33)	
Social Well-Being (SWB)	1.00		1.74	<0.001
95% CI			(1.41-2.16)	
Emotional Well-Being (EWB)	1.00		1.01	0.89
95% CI			(0.81-1.25)	
Functional Well-Being (FWB)	1.00		1.09	0.52
95% CI			(0.88-1.35)	

*
p-value, continuous variable

**
FACT-B=Functional Assessment Cancer Therapy-Breast; FACT-G=Functional Assessment Cancer Therapy-General; TOI-PFB=Trial Outcome Index-Physical/Functional/Breast; BCS=breast cancer symptoms; PWB=physical well-being; SWB=social well-being; EWB=emotional well-being; FWB=functional well-being;

[†] Multivariate-adjusted models adjusted for age (continuous), time between diagnosis and study entry, race/ethnicity (White (ref), African-American, Hispanic, Asian, other), education (<HS, HS, <college, college degree or greater), income (<\$25K, \$25-<\$70K, \$70K+(ref)), stage (I (ref), II, III, IV), estrogen receptor status (positive, negative (ref)), nodal status (positive, negative (ref)), surgery type (mastectomy (ref), lumpectomy, other), chemotherapy (yes, no (ref)), hormonal treatment (yes, no (ref)), radiation (yes, no (ref)), menopausal status (postmenopausal, premenopausal (ref)), parity (0, 1-2, 3 or more), comorbidity (any comorbidity defined by Charlson index, no (ref)), body mass index (BMI<25 (ref), 25-<30, 30+ kg/m²), smoking (never (ref), past, current), physical activity (quartiles, Q1=ref).

Table 5

Relative odds of lower than median values of quality of life scores at baseline by categories of tangible social support, by cancer stage in the Pathways study (N=3,139)

	High level of tangible support	Medium level of tangible support	Low level of tangible support	p-value	p-interaction
Range	19-20	16-18	4-15		
Early stage[†], N	1,021	677	742		
Fact-B	1.00	1.17	1.28	0.11	
95% CI		(0.92-1.49)	(0.97-1.69)		
Fact-G	1.00	1.17	1.30	0.04	
95% CI		(0.92-1.48)	(0.99-1.71)		
TOI-PFB	1.00	1.43	1.18	0.26	
95% CI		(1.13-1.82)	(0.90-1.56)		
BCS	1.00	0.93	0.87	0.58	
95% CI		(0.74-1.17)	(0.67-1.14)		
PWB	1.00	1.39	1.23	0.17	
95% CI		(1.10-1.75)	(0.94-1.60)		
Late stage[†], N	149	96	87		
Fact-B	1.00	1.74	2.47	0.03	0.07
95% CI		(0.87-3.50)	(1.03-5.94)		
Fact-G	1.00	1.57	2.75	0.03	0.07
95% CI		(0.78-3.15)	(1.12-6.77)		
TOI-PFB	1.00	1.94	2.33	0.14	0.11
95% CI		(0.96-3.94)	(0.96-5.68)		
BCS	1.00	2.52	2.47	0.01	0.007
95% CI		(1.25-5.08)	(1.06-5.78)		
PWB	1.00	1.99	1.70	0.11	0.07
95% CI		(0.98-4.06)	(0.74-4.00)		

* p-value, continuous variable,

** p-interaction=p-value, test for interaction

[†] Early stage includes in situ, localized, and regional with lymph nodes only. Late stage cancer includes regional, distant, metastases or systemic.

FACT-B=Functional Assessment Cancer Therapy-Breast; FACT-G=Functional Assessment Cancer Therapy-General; TOI-PFB=Trials Outcome Index-Physical/Functional/Breast; BCS=breast cancer symptoms; PWB=physical well-being

Multivariate-adjusted models adjusted for age (continuous), time between diagnosis and study entry, race/ethnicity (White (ref), African-American, Hispanic, Asian, other), education (<HS, HS, <college, college degree or greater), income (<\$25K, \$25-<\$70K, \$70K+(ref)), stage (I (ref), II, III, IV), estrogen receptor status (positive, negative (ref)), nodal status (positive, negative (ref)), surgery type (mastectomy (ref), lumpectomy, other), chemotherapy (yes, no (ref)), hormonal treatment (yes, no (ref)), radiation (yes, no (ref)), menopausal status (postmenopausal, premenopausal (ref)), parity (0, 1-2, 3 or more), comorbidity (any comorbidity defined by Charlson index, no (ref)), body mass index (BMI<25 (ref), 25-<30, 30+ kg/m2), smoking (never (ref), past, current), physical activity (quartiles, Q1=ref), social networks, and social support mechanisms.