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Social networks and survival after breast cancer diagnosis

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Abstract

Introduction—Evidence has been inconsistent regarding the impact of social networks on survival after breast cancer diagnosis. We prospectively examined the relation between components of social integration and survival in a large cohort of breast cancer survivors.

Methods—Women (N=4,589) diagnosed with invasive breast cancer were recruited from a population-based, multi-center, case-control study. A median of 5.6 years (Interquartile Range 2.7–8.7) after breast cancer diagnosis, women completed a questionnaire on recent post-diagnosis social networks and other lifestyle factors. Social networks were measured using components of the Berkman-Syme Social Networks Index to create a measure of social connectedness. Based on a search of the National Death Index, 552 deaths (146 related to breast cancer) were identified. Adjusted hazard ratios (HR) and 95% confidence intervals (CI) were estimated using Cox proportional hazards regression.

Results—Higher scores on a composite measure of social connectedness as determined by the frequency of contacts with family and friends, attendance of religious services, and participation in community activities was associated with a 15–28% reduced risk of death from any cause (p-trend=0.02). Inverse trends were observed between all-cause mortality and frequency of attendance at religious services (p-trend =0.0001) and hours per week engaged in community activities (p-trend =0.0005). No material associations were identified between social networks and breast cancer-specific mortality.

Conclusions—Engagement in activities outside the home was associated with lower overall mortality after breast cancer diagnosis.

Keywords

cancer; oncology; breast cancer; survival; mortality; social networks

Introduction

Evidence suggests that social networks may be associated with reduced overall mortality[1]. Improvements in breast cancer detection and treatment have led to a growing number of cancer

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survivors, resulting in a need to elucidate strategies for improving outcomes, including lifestyle factors. A recent meta-analysis of 87 studies summarizing the literature on the association between social networks and cancer survival reported having high levels of perceived social support, larger social networks, and being married were associated with decreases in risk ratios for mortality of 25%, 20%, and 12%, respectively [2]. Relationships varied by cancer site, with stronger associations of number of social contacts observed in studies of breast cancer [2].

The impact of social networks on breast cancer specific survival has been insufficiently studied: a systematic review suggested characteristics associated with better breast cancer prognosis include social support, marriage, minimizing, and denial; however, the role of these factors has not been supported in all studies [3]. Previous observational studies were based on selected populations, did not have adequate information on potential confounders, or had limited power [4–12], leading to inconclusive results [3]. A few randomized controlled trials have been conducted to investigate the role of social networks, including social supports, in breast cancer survival, but the results have been mixed. These studies, however, may not have simulated natural social networks or have intervened at the appropriate time point [13–16].

The biological and social mechanisms for the role of social networks require further study [17,18]. There are several potential pathways by which social networks may reduce mortality. Social networks may alleviate depressive symptoms [19,20], promote adoption of health behaviors through peer support [21–23], and/or improve resistance to infection through reduction in stress [24–26]. Social networks could impact cancer outcomes by influencing stage at detection or progression by affecting treatment decisions. Recent reports suggest social networks are a key factor in seeking cancer screening [27,28], which could lead to detection at earlier stages and improved prognosis. Five of seven studies from a recent review supported the hypothesis that social networks influences cancer progression [29].

In order to better understand how social networks relate to survival after a breast cancer diagnosis, we examined the relation of social networks and survival in a large, population-based cohort of breast cancer survivors. Data collected enabled us to evaluate whether the type, number, and frequency of social contacts have any discernable impact on breast cancer outcomes.

Methods

As previously described [30–32], study participants were recruited from three consecutive population-based case-control studies of invasive breast cancer conducted between 1988 and 2001 in New Hampshire, Massachusetts, and Wisconsin. Cases were enrolled in the survivorship cohort after participating in the case-control study. Following an initial vital status search to identify decedents, the survivorship cohort was constructed of all women living with a history of breast cancer who completed a mailed questionnaire that captured information on factors of interest including social networks. A total of 4,589 women were included in the analysis following exclusions for metastatic breast cancer at initial diagnosis (n=34); unknown disease stage at diagnosis (n=615); or recurrence of breast cancer before completion of the questionnaire (n=553). The vital status of women was documented up to December 31, 2005 by a search of the National Death Index [33]. Women were followed a median of 5.6 (inter-quartile range 2.7–8.7) years after the breast cancer diagnosis. This study was approved by the institutional review boards at both the Harvard School of Public Health and the University of Wisconsin.

Social networks were assessed using a modified version of the Berkman-Syme Social Networks Index, a composite measure of four types of social connection: marital status (married versus not); social integration (number and frequency of contacts with children, close relatives,

confidant and close friends); frequency of attending religious meetings or services; and membership in other community organizations [34,35]. Summary scores were constructed using previously published methodology [35] assessing 1) network size: number of members in the network; 2) frequency of contacts: estimation of members seen at least once per month; and 3) overall social connectedness: number of frequent (at least once per month) social contacts with confidants or close friends, and/or attendance of religious or community services.

Hazard rate ratios and 95% confidence intervals were estimated using Cox proportional hazards regression. Adjusted models accounted for potential confounding factors at diagnosis, interval between diagnosis and enrollment in the cohort study, and characteristics at the time of social networks assessment, and weight change from pre-diagnosis to after treatment).

Results

Of the 4,589 women included in the analysis, approximately two-thirds of the women (n=2,995) had localized disease at diagnosis. During follow-up, 552 died after completing the questionnaire, 146 from breast cancer.

Table 1 shows participant characteristics by category of overall social connectedness. Those at higher categories of social connectedness were more likely to be married, have children, be non-smokers, and have a history of chemotherapy and tamoxifen treatment (Table 1).

Social network size and the number of regular (at least once per month) social contacts were not associated with overall or breast-cancer specific survival (Table 2). However, the composite measure of social connectedness that incorporated both number of regular contacts and frequency of social activities was inversely associated with overall (p=0.02), but not breast cancer specific (p=0.93), survival.

Among specific types of social contacts, increased participation in religious or community activities was significantly associated with improved overall survival (Table 3). Attending religious gatherings more than once a week (n=670, 14%) was associated with a 34% (95% CI = 10%–51%, p-trend=0.0001) reduction in death from any cause when compared to no religious participation (n=1125, 25%). Greater community participation, as measured in hours per week, was also associated with improved overall survival (p-trend=0.0005).

Weaker and no significant trends were observed for breast cancer-specific survival. Number of close friends, relatives, or confidants, and number of contacts with such persons had no impact on overall survival rates, nor did marital status. Cancer support group participation, either in the past or currently, had no association with mortality after breast cancer.

Discussion

In this large cohort of breast cancer survivors, we found some evidence for an association between social connectedness and overall mortality. Whereas participation in community and religious activities was significantly associated with lower overall mortality, such interactions had no material influence on breast cancer specific mortality. The number of close friends, relatives and living children, the frequency of contacts with significant others, and marital status had no significant impact on subsequent breast cancer-specific or overall survival rates.

The current findings are consistent with some, but not all, previous studies that addressed the impact of social networks on breast cancer outcome, as reviewed by Falagas *et al* [3]. Of nine published studies, four reported a survival advantage associated with one or more index of social networks [4–7] whereas five reported no association [8–12]. All of the null studies had limited power to detect associations (<250 participants). A recent meta-analysis combining

data from 87 studies of social support, social networks, and marital status and cancer outcomes reported stronger inverse associations with cancer mortality among breast cancer survivors compared with other cancer sites [2]. Possible mechanisms suggested included that those with social networks would be more inclined to seek and/or follow through with treatment. Social networks may also favorably change hormone concentrations, thereby preferentially acting on hormonal cancers [2]. An alternative explanation is that more studies have been conducted in breast cancer relative to other sites, thereby providing sufficient power to detect weak associations between social networks and survival relative to other sites.

An analysis of Nurses' Health Study (NHS) data by Kroenke *et al* [7] also based on the Berkman-Syme Index found that the number of close friends and relatives as reported prior to breast cancer diagnosis was associated with improved survival subsequent to breast cancer diagnosis even after adjusting for breast cancer stage at diagnosis. In contrast to present findings, participation in religious and community activities had no important influence on breast cancer or overall survival. Differences in results in the NHS and current study could be related to differences in the age (NHS women were about 10 years older) or economic levels (the NHS was comprised of nurses who were presumably more educated) between the study populations, and the timing of collection of social network data with respect to the breast cancer diagnosis (data collected two years post diagnosis in the NHS versus six years for the current study). For example, having larger numbers of friends and close relatives could be associated with better treatment compliance, accounting for the inverse association with number of friends and relatives noted in the NHS. In contrast, numbers of friends and relatives may be less important after treatment is completed. As with our results, Kroenke *et al* reported religious and community participation was significantly associated with improved all-cause survival after diagnosis.

Randomized controlled trials assessing the impact of improved social support on breast cancer survival have produced mixed results. An initial randomized controlled trial that enrolled 86 women with metastatic breast cancer reported a mean doubling in survival time after weekly group therapy for one year [13]. However, subsequent trials in similar populations have suggested that while group therapy may improve quality of life, it does not prolong survival [14–16].

One possible explanation for the mixed findings from previous studies is measurement error in the assessment of social networks. Previous research, including the current study, ranked women on the number of close relationships and marital status. A recent study found that the quality, rather than quantity, of close relationships was associated with improved survival among ninety breast cancer survivors; a composite measure of marital confiding and close relationships had a strong inverse effect (RR= 0.41 (95% CI 0.21–0.80)) [6]. In measuring the quality of social networks, it may be important to account for specific informational, instrumental, and emotional support being provided by members of the network [29].

Taken together with previous studies, the available evidence suggests that social networks, as measured by the number of close relationships, may have an influence on survival after a breast cancer diagnosis. After accounting for confounders, women in the highest category of social connectedness had a 28% (95% CI, -4%-51%, p-trend 0.02) lower risk of overall mortality compared to those in the lowest category of social connectedness. There was an observed benefit for increased community and religious participation, a finding that may reflect better health and extended longevity of women able to engage in activities outside the home (e.g. reverse-causation). Moreover, the suggestions of higher death rates observed in women that had regular visits from larger numbers of their children ($p=0.05$), which may be surrogate for declining health or physical incapacity, is also consistent with a confounding influence of

general health on the results, despite adjustment for smoking, BMI, and other predictors of mortality.

The reduced risk of overall mortality with increasing levels of social connectedness was likely driven by cardiovascular disease-specific mortality. In analyses restricted to mortality from cardiovascular disease in this cohort (n=123), there was a suggestion of reduced risk of cardiovascular disease-specific mortality among those in the highest category of overall social connectedness (scores=21–26) compared to those with low scores (5–12) (Adjusted HR=0.41, 95% CI 0.16 to 1.04, p-trend 0.01). This is consistent with recent reports that increasing levels of social engagement confer protection against stroke in women [37] and cardiovascular mortality in men [38].

The present analysis had some limitations. Not all eligible women responded to the study invitation, and respondents were generally more highly educated and demonstrated a healthier profile; i.e. fewer current smokers, greater proportion of BMI values in the normal range than those who did not participate [39]. Thus, although this is the only study to target a population-wide cohort of breast cancer survivors, results may not be applicable to all breast cancer survivors. In addition, women were enrolled several years after breast cancer diagnosis and those with more rapidly fatal, aggressive breast cancers would have been underrepresented in the study cohort. Finally, few women reported having no friends or close relatives, and the majority were married. This may have reduced power to detect associations at extreme levels of social isolation.

Identification of factors that improve the health and longevity of breast cancer survivors is an important public health challenge. Our study supports the hypothesis that social networks reduce the likelihood of death from any cause among breast cancer survivors...

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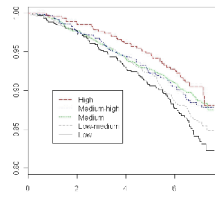


Figure 1.
Adjusted Overall Survival Curves by Level of Overall Social Connectedness

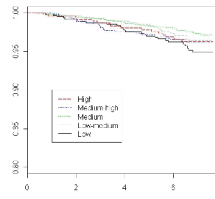


Figure 2.
Adjusted Breast-Cancer Specific Survival Curves by Level of Overall Social Connectedness

Table 1

Participant characteristics by category of social connectedness

Characteristic ²	Category of Overall Social Connectedness ¹				-Mean (SD) or % ³
	Low (5-12) 620	Low-Medium (13-15) 1171	Medium (16-18) 1377	Medium-High (19-20) 709	
N					
Characteristic²					
Age, y	59 (9)	58 (10)	59 (10)	59 (10)	59 (9)
Time since diagnosis, y	6 (3)	6 (3)	6 (3)	6 (1)	6 (3)
BMI at social support assessment, kg/m ²	25.4 (4.8)	25.7 (5.1)	25.5 (4.7)	25.95 (4.7)	25.7 (4.5)
Education					
Less than high school	8	9	8	8	7
High School	43	42	44	45	40
Some college	23	23	23	24	27
College graduate	25	27	24	23	25
Smoker	26	20	16	12	8
Marital Status					
Yes	62	70	70	71	70
No	38	30	29	28	28
Parity					
Nulliparous	19	15	10	9	6
1 to 2	42	42	37	32	29
3 to 5	36	38	48	49	52
≥6	3	4	5	9	12
Post-menopausal	75	69	73	73	76
Localized disease	63	65	66	66	65
Treatment					
Radiation	49	50	52	49	48
Chemotherapy	31	34	32	31	37
Tamoxifen	55	57	61	59	60

- ¹ Summary score estimating relative frequency of contact with confidants, frequency of attending religious services, frequency of attending community group(s), and number of children, relatives, and friends seen at least once per month[35]
- ² Characteristics assessed at breast cancer diagnosis unless otherwise noted.
- ³ Percents don't sum to 100% due to missing values.

Hazard rate ratios (and 95% confidence intervals) for all-cause and breast cancer mortality according to composite measures of social connectedness.

Table 2

Social Network Size ³	All-cause						Breast Cancer					
	N	Deaths	HR ¹	95% CI	HR ²	95% CI	Deaths	HR ¹	95% CI	HR ²	95% CI	
Small (5-9)	935	133	1.00		1.00		33	1.00		1.00		
Small-medium (9)	854	115	1.01	0.78 to 1.29	1.04	0.81 to 1.34	30	0.97	0.59 to 1.60	1.01	0.61 to 1.66	
Medium (10)	860	84	0.76	0.58 to 1.01	0.88	0.67 to 1.17	21	0.67	0.39 to 1.17	0.70	0.40 to 1.22	
Medium-large (11-12)	1,188	117	0.76	0.60 to 0.98	0.92	0.71 to 1.20	39	0.93	0.59 to 1.49	0.97	0.59 to 1.58	
Large (13-16)	564	68	0.94	0.70 to 1.27	1.33	0.97 to 1.82	19	0.98	0.56 to 1.73	1.07	0.59 to 1.96	
P-trend			0.08		0.55			0.80		0.98		
Number of social ties seen at least once per month⁴												
Low (3-5)	802	92	1.00		1.00		22	1.00		1.00		
Low-medium (6)	919	130	1.30	0.99 to 1.70	1.24	0.95 to 1.62	34	1.35	0.79 to 2.32	1.20	0.70 to 2.07	
Medium (7)	1,022	124	1.14	0.87 to 1.49	1.19	0.90 to 1.56	34	1.22	0.71 to 2.08	1.14	0.66 to 1.96	
Medium-high (8-9)	1,244	130	1.01	0.77 to 1.32	1.10	0.83 to 1.44	34	1.00	0.59 to 1.72	0.96	0.55 to 1.67	
High (10-13)	494	54	0.94	0.67 to 1.32	1.08	0.77 to 1.53	18	1.37	0.73 to 2.56	1.33	0.70 to 2.55	
P-trend			0.29		0.89			0.87		0.86		
Overall social connectedness⁵												
Low (5-12)	620	93	1.00		1.00		27	1.00		1.00		
Low-medium (13-15)	1,171	151	0.92	0.71 to 1.20	1.01	0.78 to 1.32	35	0.68	0.41 to 1.12	0.69	0.41 to 1.14	
Medium (16-18)	1,377	146	0.70	0.54 to 0.91	0.78	0.60 to 1.02	33	0.55	0.33 to 0.92	0.58	0.34 to 0.97	
Medium-high (19-20)	709	78	0.72	0.53 to 0.97	0.85	0.62 to 1.15	25	0.83	0.48 to 1.43	0.94	0.54 to 1.65	
High (21-26)	467	43	0.56	0.39 to 0.81	0.72	0.49 to 1.04	16	0.81	0.43 to 1.50	0.85	0.45 to 1.62	
P-trend			0.002		0.02			0.65		0.93		

¹ Hazard Ratios and 95% Confidence Intervals estimated from models adjusted for age at diagnosis and state of residence.

² Hazard Ratios and 95% Confidence Intervals estimated from models adjusted for factors at diagnosis (age, breast cancer stage, state of residence, menopausal status, smoking, hormone replacement therapy use, parity, education), interval between diagnosis and social support assessment, and factors at the time of social support assessment (treatment (radiation, chemotherapy, tamoxifen), physical activity (quintiles), BMI (quintiles), weight change from pre-diagnosis to follow-up).

³ Ranking of relative network size, including spouse/partner, confidants, children, and close relatives and friends.

⁴Ranking of relative number of children, relatives, and friends seen at least once per month.

⁵Summary score estimating relative frequency of contact with confidants, frequency of attending religious services, frequency of attending community group(s), and number of children, relatives, and friends seen at least once per month.[35]

Table 3

Hazard rate ratios (and 95% confidence intervals) for all-cause and breast cancer mortality according to components of social connectedness.

	N	All-cause				Breast Cancer				
		Deaths	HR ²	95% CI	HR ³	Deaths	HR ²	95% CI	HR ³	95% CI
Religious participation										
Never	1,125	160	1.00	1.00	1.00	46	1.00	1.00	1.00	
< Once per month	461	52	0.78	0.57 to 1.06	0.89	16	0.85	0.48 to 1.51	0.87	0.49 to 1.54
1–3 times per month	455	49	0.66	0.48 to 0.92	0.74	9	0.51	0.25 to 1.04	0.57	0.28 to 1.19
Once a week	1,822	207	0.62	0.50 to 0.76	0.67	52	0.74	0.49 to 1.11	0.84	0.55 to 1.27
> Once a week	670	68	0.54	0.40 to 0.72	0.66	21	0.84	0.49 to 1.42	1.00	0.58 to 1.73
P-trend			<0.0001		0.0001		0.23			0.67
Community group participation										
None	1,980	269	1.00	1.00	1.00	65	1.00	1.00	1.00	
1–2 hours per week	1,233	137	0.82	0.66 to 1.01	0.93	48	1.20	0.82 to 1.74	1.31	0.89 to 1.93
3–5 hours per week	827	93	0.75	0.59 to 0.95	0.84	22	0.82	0.50 to 1.32	0.86	0.53 to 1.42
6–10 hours per week	286	24	0.49	0.33 to 0.75	0.58	4	0.43	0.16 to 1.19	0.44	0.16 to 1.23
11–15 hours per week	82	4	0.30	0.11 to 0.81	0.40	1	0.36	0.05 to 2.58	0.42	0.06 to 3.02
≥16 hours per week	91	4	0.36	0.13 to 0.96	0.39	2	0.62	0.15 to 2.55	0.58	0.14 to 2.38
P-trend			<0.0001		0.0005		0.07			0.11
Cancer support group participation										
Never	3,828	476	1.00	1.00	1.00	114	1.00	1.00	1.00	
In the past	423	36	0.94	0.67 to 1.33	1.06	18	1.32	0.80 to 2.19	1.22	0.73 to 2.05
Currently	257	21	0.82	0.53 to 1.28	1.00	10	1.37	0.71 to 2.62	1.15	0.59 to 2.24
Number of close relatives										
None	363	58	1.00	1.00	1.00	14	1.00	1.00	1.00	
1–2	1,484	198	0.92	0.68 to 1.23	0.95	51	0.84	0.47 to 1.53	0.82	0.45 to 1.49
3–5	1,559	157	0.74	0.55 to 1.00	0.81	45	0.71	0.39 to 1.29	0.70	0.38 to 1.29
6–9	633	76	0.91	0.65 to 1.29	1.09	20	0.77	0.38 to 1.52	0.73	0.36 to 1.48
≥10	515	54	0.80	0.55 to 1.15	0.98	16	0.77	0.37 to 1.57	0.77	0.37 to 1.61
P-trend			0.20		0.91		0.42			0.46
Number of close relatives seen at least once per month										

	All-cause						Breast Cancer					
	N/	Deaths	HR ²	95% CI	HR ³	95% CI	Deaths	HR ²	95% CI	HR ³	95% CI	
None	1,109	139	1.00		1.00		35	1.00		1.00		
1-2	1,745	231	1.11	0.90 to 1.37	1.13	0.91 to 1.39	58	1.06	0.70 to 1.62	0.99	0.65 to 1.51	
3-5	1,149	111	0.89	0.69 to 1.15	0.98	0.76 to 1.27	34	0.92	0.57 to 1.48	0.90	0.56 to 1.46	
6-9	376	44	1.00	0.71 to 1.41	1.12	0.79 to 1.58	9	0.74	0.35 to 1.54	0.74	0.35 to 1.56	
≥10	173	18	0.97	0.59 to 1.58	1.13	0.69 to 1.86	9	1.62	0.78 to 3.38	1.41	0.67 to 3.00	
P-trend			0.48		0.74			0.95		0.97		
Number of close friends												
None	133	19	1.00		1.00		4	1.00		1.00		
1-2	1,007	124	0.96	0.59 to 1.56	1.11	0.68 to 1.82	35	1.12	0.40 to 3.15	1.25	0.44 to 3.56	
3-5	1,971	228	0.87	0.55 to 1.40	1.06	0.65 to 1.71	64	1.06	0.39 to 2.92	1.24	0.45 to 3.46	
6-9	828	95	0.81	0.49 to 1.32	1.04	0.63 to 1.72	18	0.74	0.25 to 2.18	0.86	0.29 to 2.58	
≥10	621	78	0.84	0.51 to 1.39	1.19	0.71 to 1.99	25	1.40	0.49 to 4.01	1.71	0.58 to 5.01	
P-trend			0.21		0.69			0.82		0.53		
Number of close friends seen at least once per month												
None	311	37	1.00		1.00		9	1.00		1.00		
1-2	1,616	207	1.13	0.80 to 1.60	1.21	0.85 to 1.72	52	1.10	0.54 to 2.24	1.21	0.60 to 2.48	
3-5	1,766	204	0.97	0.69 to 1.38	1.13	0.79 to 1.61	56	1.09	0.54 to 2.20	1.27	0.62 to 2.59	
6-9	555	64	0.89	0.59 to 1.33	1.04	0.69 to 1.57	17	1.10	0.49 to 2.46	1.29	0.57 to 2.93	
≥10	294	30	0.81	0.50 to 1.32	1.05	0.64 to 1.71	11	1.35	0.56 to 3.26	1.50	0.61 to 3.67	
P-trend			0.05		0.54			0.62		0.40		
Number of children												
None	495	62	1.00		1.00		16	1.00		1.00		
1-2	1,869	214	0.95	0.72 to 1.26	0.87	0.61 to 1.23	62	1.01	0.59 to 1.76	0.93	0.48 to 1.80	
3-5	1,960	225	0.90	0.68 to 1.19	0.92	0.58 to 1.46	60	1.00	0.58 to 1.74	0.99	0.40 to 2.44	
≥6	232	40	1.19	0.80 to 1.78	1.22	0.71 to 2.11	6	0.91	0.35 to 2.35	0.90	0.27 to 2.98	
P-trend			0.98		0.49			0.89		0.89		
Number of living children seen at least once per month												
None	876	101	1.00		1.00		26	1.00		1.00		
1-2	2,391	271	1.09	0.87 to 1.37	1.12	0.86 to 1.45	72	1.00	0.64 to 1.57	0.93	0.56 to 1.55	
3-5	1,146	144	1.19	0.92 to 1.53	1.29	0.93 to 1.78	41	1.25	0.76 to 2.04	1.33	0.70 to 2.53	

	All-cause						Breast Cancer					
	N/	Deaths	HR ²	95% CI	HR ³	95% CI	Deaths	HR ²	95% CI	HR ³	95% CI	
≥6	134	26	1.56	1.02 to 2.41	1.48	0.93 to 2.37	5	1.40	0.53 to 3.64	1.41	0.50 to 3.95	
P-trend			0.05		0.05			0.26		0.27		
Have confidant												
Yes	4128	483	1.00		1.00		130	1.00		1.00		
No	366	52	1.06	0.80 to 1.41	0.93	0.70 to 1.25	13	1.19	0.67 to 2.11	1.23	0.69 to 2.19	
Frequency of seeing confidant												
Daily	2,042	245	1.00		1.00		73	1.00		1.00		
Weekly	1,551	181	0.92	0.76 to 1.11	0.91	0.75 to 1.11	46	0.85	0.59 to 1.23	0.89	0.61 to 1.29	
Monthly	299	33	0.92	0.64 to 1.33	0.94	0.65 to 1.35	7	0.65	0.30 to 1.42	0.66	0.30 to 1.45	
Several times/year	188	18	0.72	0.45 to 1.17	0.76	0.47 to 1.22	0	na		na		
Once a year or less	25	3	0.90	0.29 to 2.82	1.11	0.35 to 3.51	0	na		na		
P-trend			0.18		0.26			0.01		0.01		
Currently Married												
Yes	3130	306	1.00		1.00		99	1.00		1.00		
No	1393	230	1.21	1.02 to 1.45	0.96	0.79 to 1.15	44	1.08	0.74 to 1.55	1.02	0.70 to 1.49	

¹Numbers do not sum to 4589 due to missing values.

²Hazard Ratios and 95% Confidence Intervals estimated from models adjusted for age at diagnosis and state of residence.

³Hazard Ratios and 95% Confidence Intervals estimated from models adjusted for factors at diagnosis (age, breast cancer stage, state of residence, menopausal status, smoking, hormone replacement therapy use, parity, education), interval between diagnosis and social support assessment, and factors at the time of social support assessment (treatment (radiation, chemotherapy, tamoxifen), physical activity (quintiles), BMI (quintiles), weight change from pre-diagnosis to follow-up).