Published in final edited form as:

Ann Behav Med. 2013 February ; 45(1): 57–68. doi:10.1007/s12160-012-9406-1.

Worry about cancer progression and low perceived social support: Implications for quality of life among early-stage breast cancer patients

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Abstract

Background—Worry about cancer progression and perceived social support can affect cancer survivors' quality of life (QOL).

Methods—In 480 early-stage breast cancer survivors, we examined how worry about cancer progression and perceived social support six months after definitive surgery were associated with QOL (RAND 36-item Health Survey) at six-, 12-, and 24-month follow-up.

Results—At six months post-surgery, higher worry was associated with worse QOL for five of eight subscales. Lower social support was associated with worse QOL for four subscales. The negative effects of worry and limited social support dissipated for four subscales (worry) and two subscales (social support) by 12-month follow-up and for all subscales by 24-month follow-up. Social support at six months moderated the relationship between T2 worry and T4 emotional well-being; post-hoc tests did not clarify the nature of the interaction.

Conclusion—Early-stage breast cancer survivors who worry about cancer progression and/or have low social support may experience lower levels of QOL that can take several months to resolve.

Keywords

quality of life; breast cancer; social support; worry; progression

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Conflict of Interest Statement: The authors have no conflict of interest to disclose.

The medical community has acknowledged that medical treatments and decisions should not be based solely on mortality outcomes, but also should consider the physical, emotional, and social sequelae of a cancer diagnosis and its treatments (1–3). These quality of life (QOL) outcomes may be especially important for diseases with good prognoses, such as early-stage breast cancer, which offers patients the opportunity to live for many more years than diseases diagnosed at more advanced stages. In the year 2000, localized disease accounted for 93% of all breast cancers diagnosed in the United States, and five-year survival was approximately 98% for women diagnosed with localized breast cancer (4). As of 2008, there were over 2.6 million breast cancer survivors living in the U.S. Thus, anything that could reduce the QOL of survivors of ductal carcinoma in situ or early-stage invasive breast cancers represents a significant public health problem. We examined the unique and combined effects of two psychological factors that could affect QOL of ductal carcinoma in situ and early stage breast cancer survivors: worry about cancer progression and perceived social support.

Fear of cancer recurrence and/or worries about progression are prevalent among breast cancer patients, including those diagnosed with ductal carcinoma in situ and other early-stage disease (3, 5, 6). These fears are often associated with higher emotional distress and poorer QOL (3, 5–7) that can last for several years (8). Worry about breast cancer progression has been reported as one of breast cancer patients' most problematic survivorship concerns (9). One study reported that 32% of cancer survivors were “strongly” or “very strongly” distressed by their fear of progression (5).

In the case of women who have been diagnosed with early-stage breast cancer, these fears are especially concerning. Like women with advanced disease, women with ductal carcinoma in situ and early-stage invasive breast cancer can experience a recurrence. However, their objective risk of recurrence is lower than the risk of women diagnosed with late-stage disease. Nevertheless, despite their objectively lower risk of recurrence, women with ductal carcinoma in situ and early-stage breast cancers have extremely high perceptions of risk and fears of recurrence (10, 11). These misperceptions and fears may lead women to make medical decisions that are not fully informed (10). Considering the enormous number of women who have survived ductal carcinoma in situ or early-stage invasive breast cancer whose QOL may be affected by worry about progression, the need to understand the relationship between worry about progression and QOL over time is clear. However, most of the studies to date have been cross-sectional, and/or have examined these issues more than one year after diagnosis (5, 6, 9, 11). Thus, questions remain regarding the longitudinal effects of worry about progression on QOL among recently-diagnosed women.

Unlike fear of recurrence and worry about progression, the perceived availability of social support (i.e., “the degree to which interpersonal relationships serve particular functions” (12) p. 705) is associated with better QOL among breast cancer survivors (3). This benefit has been shown for women who were newly diagnosed with invasive breast cancer (13) and for women who were diagnosed with invasive breast cancer more than five years prior to study implementation (14, 15). However, like the studies examining worry about progression, these social support studies were cross-sectional. In addition, none focused specifically on patients diagnosed with *in situ* and early-stage invasive disease, and only one recruited women who had been diagnosed within the year following their diagnosis (13).

An added complication to examining the relationship between QOL and worry about progression/fear of recurrence and social support is the potential for an interaction effect between worry and social support. A growing body of cross-sectional research supports this notion. For example, Lewis and colleagues reported that the negative relationship between intrusive thoughts about cancer and QOL was attenuated only among women with higher

social support (15). Likewise, Liu and colleagues found that social support and fear of recurrence were each negatively correlated two years after diagnosis (11). In another study, high perceived risk was associated with lower QOL, but only if trust in the follow-up care provider was low (7). Although this latter study did not find an interaction between *worry* and trust, the overarching message of these three studies suggests that concerns about cancer progression and recurrence in general might interact with other psychosocial variables to affect QOL. To the extent that worrying about cancer progression is interpreted as stressful for patients, and high perceived social support lessens the effects of stress (16), it could be that worrying about cancer progression is less detrimental to QOL among patients with higher perceived social support. In other words, social support might moderate the relationship between worry and QOL. Such an effect would be represented by a significant interaction between social support and worry.

In many studies examining worry about cancer recurrence/progression or social support, patients had completed treatment several years prior to study enrollment (6, 7, 15). However, identifying patients who may be particularly vulnerable to experiencing limited QOL during the latter stages of treatment might enable clinicians to intervene medically or by offering additional psychosocial support resources. A potentially important early timepoint is several months after surgery. At this point, barring lingering treatment side effects or need for additional treatment, patients' incisions have healed, the severity of surgery-related side effects has diminished (17), and the decrements in QOL experienced immediately after diagnosis, surgery and the initiation of adjuvant treatment have had several months to rebound (18–20). Many women may be beginning to refocus their physical and emotional energies on their regular activities, but they still may need social support for lingering side effects of treatment and continuing cancer surveillance (21, 22). Anecdotal reports from clinicians and cancer patients indicate that after completion of treatment, interactions with healthcare personnel and other support providers decrease, leaving some survivors feeling "alone and lost" (23, 24) during the critical "re-entry" phase of recovery (25). Thus, limitations in QOL that are associated with worries about progression and low perceived social support during the transition from patient to survivor, even after their QOL has had time to recover from the diagnosis and surgery experiences, may signify a particularly vulnerable subgroup of patients.

The present study examined the cross-sectional and longitudinal interrelationships among worry about cancer progression, perceived social support, and QOL among early-stage breast cancer patients who had completed definitive surgery and were followed for two years. We hypothesized that higher levels of worry about cancer progression and lower perceived social support six months after surgery would be associated with poorer QOL both cross-sectionally and over time. We also explored the possibility that social support would moderate the relationship between worry and QOL. Specifically, the detrimental relationship between worry and QOL would be weaker among women with higher levels of social support and stronger among women with lower levels of social support. To the best of our knowledge, this is the first study to examine how worry about cancer progression and perceived social support act separately and interactively in relation to QOL among women who recently completed treatment for ductal carcinoma in situ or early invasive breast cancer.

Methods

Patients and Procedure

Data for this study were obtained from a larger cohort study that included women with ductal carcinoma in situ, early invasive breast cancer, and age-matched controls without a personal breast cancer history. The remainder of the manuscript will focus only on the

patients, because the question assessing worry about cancer progression was irrelevant for the controls. For details about the age-matched controls, see (26).

Women who were newly diagnosed with first primary early-stage breast cancer (stages 0-IIA) between October 2003 and June 2007 were recruited at the Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine and at Saint Louis University School of Medicine. Eligible participants were English speaking, had completed definitive surgical treatment, and were at least 40 years old. We limited our sample to women age 40 and older because screening mammography is recommended for women in this age group (27), and ductal carcinoma in situ is primarily identified using mammography (28). Patients were excluded if they had a history of ductal carcinoma in situ or early invasive breast cancer, received neoadjuvant chemotherapy (i.e., to shrink large tumors prior to surgery), or were 65 years of age or older and demonstrated cognitive impairment (i.e., a weighted score > 10 on the Orientation-Memory-Concentration Test) (29). The Institutional Review Boards at both institutions approved the study.

Patients who consented were asked to complete four computer-assisted telephone interviews 4–6 weeks (T1), 6 months (T2), 1 year (T3), and 2 years (T4) following definitive surgery.

Measures

QOL was measured with the RAND 36-Item Health Survey 1.0 (30, 31). It consists of 36 items measuring eight domains of QOL: physical functioning (Standardized Cronbach's $\alpha = .91$), emotional well being ($\alpha = .85$), role limitations as a result of physical problems ($\alpha = .92$), role limitations due to emotional problems ($\alpha = .86$), pain ($\alpha = .83$), general health perception ($\alpha = .77$), energy/fatigue ($\alpha = .90$), and social functioning ($\alpha = .88$). Each subscale is scored from 0 (poorest QOL) to 100 (best QOL).

Worry about cancer progression was assessed with a single item from the Functional Assessment of Cancer Therapy-Breast version 4, inquiring whether, in the past 7 days, participants “worry that [my] condition will get worse.” The response options ranged from 1 (not at all) to 5 (very much). Other research has also examined this item in isolation of the remaining scale items to examine the effects of worry about progression on QOL (9).

Perceived availability of social support was measured using the 19-item Medical Outcomes Study Social Support Survey ($\alpha = .97$) (12). Response choices range from 1 (none of the time) to 5 (all the time); mean total scores are computed with higher scores indicating greater perceived availability of social support.

History of depression was determined at enrollment by asking patients if a doctor ever told them that they had depression or they received medication or psychotherapy for depression. An affirmative response to either or both questions indicated a history of depression.

Trait anxiety was assessed with the State-Trait Anxiety Inventory ($\alpha = .93$) (32).

Clinical data regarding cancer stage at diagnosis (based on pathology) and adjuvant treatments were obtained from pathology reports and medical records.

Statistical Analysis

These analyses examined the interrelationships among worry about cancer progression, perceived social support, and QOL among early-stage breast cancer patients who were diagnosed six months previously and followed-up one and two years later. We analyzed cross-sectional and longitudinal data, using the worry and social support data from the T2 interview (i.e., six months after all patients had completed definitive surgery) for reasons

described above. We used QOL data from T2 for the cross-sectional analyses and QOL data from the T2, T3, and T4 interviews for the longitudinal analyses. The eight RAND QOL subscales were the dependent variables of interest. Worry about cancer progression, perceived social support, and their interaction at T2 were the explanatory variables of primary interest. We controlled for variables that are often associated with QOL after a diagnosis of breast cancer (3), including trait anxiety, depression history, age at diagnosis, race, education, cancer stage, type of surgical treatment, and receipt of adjuvant treatment (i.e., chemotherapy, radiation, and/or hormone therapy).

Worry and perceived social support were highly skewed and did not approach a normal distribution after data transformation. Because nearly 70% of patients had not worried about cancer progression at all, we dichotomized this variable into a no-worry group and a group that reported any worry. Perceived social support was categorized based on quartile values to allow for non-linear effects. Spearman rank-order correlation (r_s) was performed to evaluate the correlation between worry about cancer progression and perceived social support.

For the cross-sectional analyses, least squared means for the QOL subscale scores and p values were calculated using multivariate analysis of variance (MANOVA) and multivariate analysis of covariance (MANCOVA) (33, 34). All eight QOL subscales were entered simultaneously as dependent variables. To evaluate whether the associations between worry about cancer progression and QOL varied by perceived social support, an eight-category interaction term between worry (two categories) and social support (four categories) was included as a predictor. If the MANCOVA indicated that a predictor was statistically significant, follow-up ANCOVAs were conducted to determine which QOL subscale(s) were driving the association. We then followed up on significant relationships between social support and QOL subscales by conducting Tukey post-hoc tests to determine which social support quartiles differed significantly from each other. Any significant interactions between worry and social support were explored using planned contrasts that tested the effect of worry within each of the four social support quartiles.

The same general strategy was used for the longitudinal analyses that sought to determine whether worry, social support, and their interaction at T2 were associated with QOL at T2, T3, and T4. We used separate repeated measures MANCOVAs for each of the eight QOL subscales. For each MANCOVA, the dependent variables were T2, T3, and T4 scores for the appropriate QOL subscale (e.g., General Health at T2, T3, and T4). Predictors and covariates were the same as in the cross-sectional analysis, as was the strategy to explore interactions. All analyses were performed using SAS statistical software version 9.3 (SAS Institute, Cary, NC). Statistical tests were two-sided, and $p < .05$ was considered significant.

Results

Of 772 eligible patients, 549 (71%) completed the baseline interview 4–6 weeks after surgery (T1). Of these, 537 (98%) completed 6-month (T2) and 514 (94%) completed 24-month interviews (T4). There were no significant differences between participants and non-participants according to marital status, $p = .07$, cancer stage, $p = .84$, or type of surgery, $p = .10$. Participants were slightly younger than non-participants, $p < .05$ ($M_{\text{participants}} = 58.3$ years, $SD = 10.6$ years; $M_{\text{non-participants}} = 60.6$ years, $SD = 12.6$ years). Participants were also more likely to be White than non-participants, $p < .001$ (79.2% vs. 63.8%). Only participants who completed all the measures of interest at the T2, T3, and T4 interviews were included in the analyses. We excluded one patient with subsequent contralateral breast cancer at the T2 interview. Thus, data from 480 patients were analyzed. Participants who completed all the measures of interest were more likely to be white (89% vs. 80%, $p < .05$).

and had better scores for emotional well-being (80.8 vs. 73.2, $p < .05$), social functioning (82.6 vs. 73.7, $p < .05$), and role limitations due to physical problems (62.2 vs. 50.0, $p < .05$) at T2 than participants who did not complete all the measures of interest.

As indicated in Table 1, most participants were White, had at least some college education, did not have a history of clinical depression prior to the first interview at T1, were diagnosed with early invasive breast cancer, had not worried at all in the past seven days about their cancer progressing, and reported relatively high levels of social support. Inter-correlations among all variables assessed at the T2 interview are shown in Table 2. Worrying about cancer progression was associated with lower social support, higher trait anxiety, and having a history of depression. Older women reported higher social support and less worry and trait anxiety.

Cross-sectional Analyses at 6-months Following Surgery

The unadjusted MANOVA that included only worry, social support, and their eight-category interaction identified significant multivariate main effects for worry (Wilks' $\lambda = .89$, $F[8, 465] = 7.2$, $p < .001$) and social support ($\lambda = .75$, $F[24, 1349] = 6.0$, $p < .001$) but not for the interaction ($\lambda = .94$, $F[24, 1349] = 1.2$, $p = .22$). The follow-up univariate ANOVAs indicated that women who had worried at least "a little" about their cancer progressing had lower QOL on each of the subscales except pain and physical functioning, whereas higher social support was associated with better QOL on each of the subscales (Table 3).

Adjusting for covariates in the MANCOVAs also resulted in significant main effects for worry (Wilks' $\lambda = .94$, $F[8, 455] = 4.1$, $p < .0001$) and social support ($\lambda = .86$, $F[24, 1320] = 2.9$, $p < .0001$) but not for the interaction ($\lambda = .94$, $F[24, 1320] = 1.2$, $p = .24$). Follow-up univariate ANCOVAs indicated that worrying about progression was associated with lower QOL across all subscales except pain, physical functioning, and role limitations due to physical problems (Table 3). Higher social support was associated with better scores for general health, emotional well-being, role limitations due to emotional problems, and social functioning (Table 3). Post-hoc comparisons of the first (lowest) and fourth (highest) quartile of social support for these four QOL subscales were also significant (Table 4). The post-hoc tests (see Table 4) also indicate that QOL was significantly higher among women in the second quartile compared with the first (lowest) quartile of social support for emotional well-being, role limitations due to emotional problems, and social functioning subscales. The differences in QOL between the second and third quartiles and between the third and fourth quartiles (except for the general health subscale) were not significant.

The cross-sectional adjusted MANCOVAs did not yield a significant worry x social support interaction for any of the QOL subscales. However, there was the suggestion of an interaction for emotional well-being ($p = .08$; Table 3). Exploratory analyses showed that worrying about recurrence was associated with emotional well-being scores that were 10.3 points lower among women who reported the lowest levels of social support ($M_{\text{no worry}} = 78.9$, $M_{\text{worry}} = 68.6$). In contrast, worrying was associated with emotional well-being scores that were only 4.6 points lower among women in the second quartile of social support ($M_{\text{no worry}} = 84.3$, $M_{\text{worry}} = 79.7$). Worry-based differences in emotional well-being scores among women in the third and fourth quartiles of social support were negligible ($M_{\text{no worry}} = 80.2$, $M_{\text{worry}} = 78.9$) and ($M_{\text{no worry}} = 82.9$, $M_{\text{worry}} = 80.1$), respectively.

Longitudinal Analyses

The repeated measures MANCOVA results (Table 5) indicated that the effects of worry about progression and perceived social support on QOL changed over time, even adjusted for trait anxiety, depression history, age at diagnosis, race, education, cancer stage, type of

surgical treatment, and type and receipt of adjuvant treatment. In addition, there was a statistically significant longitudinal interaction between T2 worry and T2 social support on well-being.

Follow-up ANCOVAs indicated that the effects of T2 worry and social support on energy/fatigue, role limitations due to emotional problems, role limitations due to physical problems, and social functioning (see Table 3) were no longer statistically significant by the T3 interview (Table 5). However, lower general health at T3 was associated with having higher worry at T2 ($F[1, 462] = 11.3, p < .001, \omega^2_{\text{partial}} = .02, M_{\text{no worry}} = 71.9, M_{\text{worry}} = 65.6$) and lower social support at T2 ($F[3, 462] = 3.3, p < .05, \omega_{\text{partial}} = .01, M_{q1} = 67.0, M_{q2} = 65.4, M_{q3} = 68.9, M_{q4} = 73.6$). The effect of lower T2 social support on emotional well-being was also significant at T3 ($F[3, 462] = 5.1, p < .005, \omega^2_{\text{partial}} = .025, M_{q1} = 78.3, M_{q2} = 81.0, M_{q3} = 85.0, M_{q4} = 84.1$). There were no significant effects of T2 worry ($F[3, 462] = 0.3, p = .61, \omega^2_{\text{partial}} = .00$) or the interaction between T2 worry and T2 social support ($F[3, 462] = 2.6, p = .05, \omega^2_{\text{partial}} = .01$) on T3 emotional well-being. Exploratory examination of means indicated that the differences in emotional well-being scores between women who did and did not worry were no larger than 4.2 points for any of the social support quartiles (i.e., $M_{\text{no worry}} = 83.1, M_{\text{worry}} = 78.9$ for the second quartile).

The detrimental cross-sectional main effects of T2 worry and low perceived social support on the QOL subscales dissipated completely by T4 (Table 5). The lower scores on many QOL subscales at T2 among women who worried increased to levels comparable to women who did not worry at all by T4. The case with social support was similar. The low QOL experienced by women in the lowest two quartiles of social support at T2 increased to the levels seen in women in the top two quartiles of support by T4.

Statistically significant differences emerged at T4 in two cases. First, women who reported any worry at T2 experienced slightly *higher* social functioning at T4 compared to women who did not worry at all ($F[1, 462] = 5.2, p < .05, \omega^2_{\text{partial}} = .01, M_{\text{no worry}} = 85.1, M_{\text{worry}} = 89.5$). The second instance was in regards to a significant interaction between T2 worry and social support on T4 emotional well-being ($F[1, 462] = 2.8, p < .05, \omega^2_{\text{partial}} = .02$). However none of the post-hoc contrasts used to explore the interaction were statistically significant, which precludes identifying the nature of the interaction. The largest difference in mean emotional well-being between women who did and did not worry was 4.4 points (i.e., $M_{\text{no worry}} = 79.1, M_{\text{worry}} = 83.5$ for the first quartile). The means and standard errors of each variable for each subscale at each timepoint can be obtained from the corresponding author.

Discussion

We observed that, six months following definitive surgery (i.e., the T2 interview), approximately 30 percent of early-stage breast cancer patients reported worrying at least “a little” about their breast cancer progressing. After adjusting for a variety of important covariates, including trait anxiety, cross-sectional analyses revealed that worry was associated with lower scores in multiple domains of QOL at T2: general health, emotional well-being, energy/fatigue, role limitations due to emotional problems, and social functioning. Women who reported the lowest levels of perceived social support also reported lower QOL scores on multiple domains at T2: general health, emotional well-being, role limitations due to emotional problems, and social functioning. Worry about progression and perceived social support at 6 months post-surgery were not significantly associated with pain, physical functioning, or role limitations due to physical problems at that time.

Some of the associations among worry, social support, and QOL lasted at least six months longer (i.e., they were detected at the one-year follow-up interview [T3]). The associations at T2 between general health and each of worry about progression and perceived social support were both still apparent at T3, whereas only the positive association between emotional well-being and social support was still apparent at T3. However, by two years after definitive surgical treatment (T4), all significant negative effects of greater worry and lower social support on all subscales had dissipated. The modest positive longitudinal association of T2 worry on better social functioning at T4 might be due to increased care-seeking and/or coping efforts among women who reported worrying at least “a little.” However, we do not have data available to test this hypothesis, and the effect was not seen for other emotion-based subscales such as emotional well-being. Future research might explore this observed relationship further.

Although few analyses exploring the possibility that T2 social support might moderate the relationship between T2 worry and emotional well-being were statistically significant, exploration of mean differences suggested that women who reported worrying about their cancer progressing *and* who had limited social support six months after definitive surgery might temporarily experience lower levels of emotional well-being. In the cross-sectional adjusted analyses, which yielded nonsignificant MANCOVA and ANCOVA results, women reporting the lowest levels of social support who also reported any worry had 4-point to 10-point lower emotional well-being scores at T2 than women in these lower social support quartiles who reported no worry. In contrast, the longitudinal adjusted MANCOVA and ANCOVAs indicated that the interaction was significant at the T4 interview. However, post-hoc analyses did not provide conclusive data regarding the nature of the interaction. Examination of the adjusted means suggested that women who worried about progression and who reported having very little social support at T2 might have had *better* emotional well-being relative to women who did not worry. Due to the ambiguous nature of findings, we recommend viewing the effects of the interaction on QOL as an intriguing hypothesis-generating opportunity.

The variance accounted for by worry, social support, and their interaction for the significant cross-sectional effects at T2 ranged from 1% (e.g., energy/fatigue) to 5% (Table 3), which is considered a small effect (35). However, the difference in adjusted means between groups was not negligible. For example, there was an eight-point difference in general health scores between women who did and did not worry (Table 3). Using standard error estimates to approximate the minimally important differences, we see that even some small differences in QOL (e.g., 3–5 points) may be clinically important (36, 37). Large differences that may not have reached statistical significance, such as the 10-point difference in emotional well-being at T2 between women who did vs. did not worry but also reported limited social support, might be useful as hypothesis-generating data for future research that is powered to test such hypotheses.

The fact that T2 worry and social support were not associated with 5 of the 8 subscales over time, and only 2 of the 3 remaining subscales were significant at T3 (see Table 5) suggests that participants may have learned to cope with their worry about progression. Alternatively, social support needs might lessen over time. Either of these possibilities would be expected to result in diminishing the negative association between QOL and each of worry and low social support. Additional research could examine whether either of these possible scenarios can explain these findings. If appropriate, research could also inform the development and implementation of strategies that facilitate the healing process among the subgroup of more vulnerable patients who worry about progression but who perceive having very limited social support available to them.

It is also important to note that the scores for many of the QOL subscales exceeded scores based on population norms (38). However, unlike this cohort study, the study from which the population norms were obtained did not require several assessments over a two-year time span. People who are able and willing to participate in a cohort study may be healthier than members of the general population. This hypothesis is somewhat supported by comparing T4 QOL scores for patients and healthy controls (see Electronic Supplementary Material, Table 1) (20). In general, QOL scores for both patients and healthy controls are better than the QOL scores for the normed population.

Despite the transitory and sporadic nature of the effects of worry about progression and perceived social support on certain QOL subscales among early-stage breast cancer survivors, readers should not infer that it is not necessary to attend to these issues in the clinical setting during patients' receipt of adjuvant treatment. Because we conducted secondary analysis of data with interviews scheduled at 6-month and 12-month intervals, it is unknown whether the effects of worry and social support on various QOL subscales had dissipated within a shorter period of time. Future research could examine changes in QOL using shorter interim time points, perhaps as frequently as one month.

Our findings about the importance of worry and social support for QOL are consistent with observations of other investigations of QOL among breast cancer survivors (6, 14, 39). However, our research is unique in three ways. First, other research involved women with more advanced cancer stages (6, 15), and not women with ductal carcinoma in situ and early invasive breast cancer. Because early-stage breast cancer patients comprise the largest proportion of breast cancer survivors, and their long-term survival—especially among women with ductal carcinoma in situ—is quite good (40, 41), their QOL needs represent a significant public health challenge (3). Indeed at the first interview, 20% of these study participants reported elevated state anxiety (42) and 17% reported elevated depressed mood (43). Both elevated state anxiety and elevated depressed mood are positively associated with perceived risk of recurrence (42, 43) and negatively associated with QOL (44). Moreover, ductal carcinoma in situ patients often overestimate their risk of recurrence (10, 42), in spite of their very good prognosis.

Second, our study began with interviews of newly diagnosed breast cancer patients who had completed definitive surgical treatment six months prior to the interview, whereas previous research regarding buffering effects of social support focused on cancer survivors whose diagnosis was more than three years prior to the study (e.g., 6, 14, 15). However, early identification of potentially vulnerable subgroups of patients might facilitate appropriate development and implementation of interventions. In addition, because QOL and psychosocial variables such as worry, anxiety, and social support may affect treatment adherence (45–47), it is desirable to examine these factors among women who were more recently diagnosed and who may still be undergoing adjuvant treatment. Unlike radiation therapy and chemotherapy, which are more limited in duration, hormonal therapies, such as tamoxifen and aromatase inhibitors, are generally prescribed for five years or more, and adherence is not optimal (48). Because nonadherence to adjuvant hormonal therapy is associated with increased mortality (48), attending to psychosocial factors associated with treatment adherence early in the survivorship journey may translate to improved clinical and QOL outcomes.

Third, prior research focused broadly on intrusive thoughts of cancer (6, 15) or stressful life events in general (14), rather than specifically on worry about cancer progression. Intrusive thoughts and stressful life events may include worry about cancer progression or may be assessed specifically in the context of a particular event (e.g., breast cancer diagnosis). The literature suggests that all three concepts are related, yet unique constructs. For example, the

Impact of Events Scale, one measure of intrusive thoughts (49), is used in a specific context such as having been diagnosed with breast cancer and includes items such as, “I had dreams about it” and “I felt irritable and angry.” Stressful life events can include stressors as diverse as the death of a spouse and going on vacation (50). Furthermore, these constructs might be related to QOL in different ways (3, 6, 39). One study (6) found that fear of cancer progression was strongly positively correlated with intrusive cognitions in breast cancer survivors ($r = .63$). Yet, despite this strong correlation, there remained variation in intrusive cognitions that was unaccounted for by fear of progression. In the present study, we distinguished between women who did not worry at all about cancer progression and women who worried at least “a little.” Only 16 of the 480 women reported that they worried “quite a bit,” and only two worried “very much.” This makes it unlikely that our measure of worry about progression was actually measuring intrusive thoughts (49, 50).

Limitations and future directions

This study included only women age 40 and older with ductal carcinoma in situ or early invasive breast cancer. Therefore, our results may not be generalizable to younger women or to women diagnosed with more advanced breast cancers, who often have different treatment experiences. Differences in prognoses between women with early-stage and women with more advanced breast cancers would also be expected to be associated with differences in worry about progression between these two groups of patients. Future research might examine such differences.

A second limitation is that the variability in worry about progression was limited in these early-stage breast cancer survivors. Because 70% of the sample reported “no worry at all,” and we further limited the variability in responses by dichotomizing the worry variable, additional significant findings could have been obscured. Worry was also assessed using a single-item measure and might not have captured women’s experiences as well as a multi-item scale. However, the relatively robust cross-sectional main effects of worry and social support across QOL subscales suggest that categorizing women according to the presence or absence of worry was meaningful despite the attenuated distribution.

There are also a few more minor considerations. First, some readers might be concerned about conceptual overlap between emotional well-being and worry. Examining Table 2 shows a statistically significant correlation between these two variables ($-.30$) that was similar to the relationship between worry and general health ($-.29$). However, the modest size of the correlation indicates that ample variance remains unaccounted. Thus, worry cannot be considered a mere proxy for well-being. Second, participants who completed the T4 interview had better scores on some QOL subscales at T2 than participants who did not complete the T4 interview. Therefore, it is possible that our final sample was healthier and had more positive experiences than patients who did not complete all four interviews. Third, our study examined only perceived social support. Other measures of social support (e.g., *received* support or social network size) might not have the same relationships with worry and QOL.

Lastly, these results stem from a secondary analysis of existing data from a larger cohort study, which was powered to test different hypotheses relating to differences in change in QOL by stage at diagnosis in comparison to same-aged controls without breast cancer (20). We explored herein the associations between QOL and each of worry and social support to generate new hypotheses for future study, which should examine more complex interrelationships among worry about progression, perceived social support, other psychosocial factors, and QOL. Results of such research might be useful for developing interventions targeted to those patients who report at least some worry about progression and who also have the lowest levels of social support. A study specifically focused on

identifying a possible threshold effect for social support among women who have very high levels of worry about breast cancer progression may be especially beneficial.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported by a grant from the National Cancer Institute and Breast Cancer Stamp Fund (R01CA102777) and by the National Cancer Institute Cancer Center Support Grant (P30 CA91842) to the Alvin J. Siteman Cancer Center at Washington University School of Medicine and Barnes-Jewish Hospital in St. Louis, Missouri. We thank our patient participants, the interviewers, and the Siteman Cancer Center's Health Behavior, Communication and Outreach Core (Mr. Jim Struthers) for data management services, and Pam Hunborg at Saint Louis University School of Medicine. We also greatly appreciate the many physicians who helped us recruit their patients for this study, including Drs. Barbara Monsees, Rebecca Aft, Jill Dietz, Julie Margenthaler, Virginia Herrmann, Timothy Eberlein, Matthew Ellis, Imran Zoberi, Marie Taylor, Michael Naughton, Antonella Rastelli, Donald Lombardi, Cynthia Ma, Loren Michel, and Rama Suresh at Washington University School of Medicine, and Dr. Eddie Hsueh at Saint Louis University School of Medicine. Lastly, we thank the review and editorial staff for the suggestions made about previous versions of this manuscript.

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Table 1

Participant characteristics (N = 480)

	n	%
Race		
Nonwhite	89	18.5
White	391	81.5
Education		
High school or lower	144	30.0
Some college or higher	336	70.0
Stage		
DCIS	161	33.5
Early invasive	319	66.5
Depression history		
Yes	169	35.2
No	311	64.8
Treatment		
Chemotherapy	119	24.8
Radiotherapy	288	60.0
Mastectomy	166	34.6
Lumpectomy	314	65.4
Hormone	246	51.3
Worry about progression (at 6-month follow-up)		
Not at all	335	69.8
A little	77	16.0
Somewhat	50	10.4
Quite a bit	16	3.3
Very much	2	0.4
Social support (at 6-month follow-up)	<u>Quartile range</u>	
1st quartile	1.1 to 3.95	
2nd quartile	4 to 4.68	
3rd quartile	4.74 to 4.95	
4th quartile	5	
	Mean	SD
Age	58.3	10.6
Social support	4.4	0.7
Trait anxiety	30.8	9.9
Quality of life (at 6-month follow-up)		
General health	69.0	21.2
Emotional well-being	80.8	16.2
Energy/fatigue	58.3	24.4
Pain	74.2	24.2
Physical functioning	77.5	24.6

	n	%
Limitations due to emotional problems	82.0	33.8
Limitations due to physical problems	62.2	43.3
Social functioning	82.6	25.0

Spearman correlation coefficients for the intercorrelations among all predictors, covariates, and outcome variables at 6-month follow-up

Table 2

	Worry	Social support	Trait anxiety	Age	Race	Education	Stage	Depression history	Chemotherapy	Radiotherapy	Surgery	Hormone therapy	General health	Emotional well-being	Energy/Fatigue	Pain	Physical Functioning	Limitations-emotional	Limitations-physical	Social functioning
Worry	-	-0.16	0.25	-0.16	0.07	-0.04	0.02	0.13	0.05	0.02	0.00	0.01	-0.29	-0.30	-0.20	-0.10	-0.05	-0.20	-0.16	-0.23
Social support		-	-0.43	0.11	0.00	0.01	0.03	-0.17	-0.01	0.04	0.00	-0.02	0.35	0.36	0.25	0.16	0.15	0.28	0.15	0.26
Trait anxiety			-	-0.24	-0.10	-0.11	-0.02	0.32	0.09	-0.05	0.04	-0.11	-0.48	-0.59	-0.45	-0.28	-0.32	-0.43	-0.34	-0.46
Age				-	-0.02	-0.16	0.09	-0.16	-0.25	0.06	-0.18	0.07	0.08	0.26	0.11	-0.05	-0.19	0.18	0.07	0.18
Race					-	0.10	0.01	0.16	-0.06	0.08	-0.06	0.10	0.14	0.06	0.04	0.10	0.18	0.08	0.11	0.08
Education						-	-0.01	0.04	0.09	-0.04	0.07	-0.09	0.09	0.05	0.07	0.10	0.21	-0.02	0.04	0.03
Stage							-	-0.06	0.41	0.07	-0.06	0.16	-0.05	0.01	-0.10	-0.09	-0.07	-0.03	-0.16	-0.13
Depression history								-	-0.01	0.03	-0.04	-0.04	0.24	-0.32	minus:0.25	minus:0.12	minus:0.10	minus:0.24	minus:0.14	minus:0.25
Chemotherapy									-	-0.08	0.05	-0.26	-0.09	-0.11	-0.21	-0.09	-0.03	-0.11	-0.31	-0.32
Radiotherapy										-	-0.81	0.20	0.06	0.03	0.04	0.08	0.07	0.02	0.14	0.08
Surgery											-	-0.19	-0.01	-0.03	0.01	0.00	-0.02	-0.05	-0.14	-0.04
Hormone therapy												-	0.07	0.07	0.13	0.06	0.09	0.09	0.13	0.17
General health													-	0.49	0.61	0.45	0.48	0.36	0.44	0.45
Emotional well-being														-	0.55	0.33	0.29	0.62	0.41	0.61
Energy/Fatigue															-	0.49	0.49	0.43	0.57	0.62
Pain																-	0.63	0.23	0.58	0.48
Physical Functioning																	-	0.23	0.55	0.45
Limitations-emotional																		-	0.39	0.54
Limitations-physical																			-	0.61
Social functioning																				-

Note. Correlation coefficients in **bold** were statistically significant at $p<.05$ or less. Categorical variables were coded as follows: Race [white=1, nonwhite=0]; Depression history [yes=1, no=0]; Stage [I=early invasive, 0=DCIS]; Surgery [I=mastectomy, 0= lumpectomy]; Chemotherapy [yes=1, no=0]; Radiotherapy [yes=1, no=0]; Hormone therapy [yes=1, no=0].

Table 3

Cross-sectional follow-up ANOVA/ANCOVA F-tests, *p*-values, effect size estimates ($\omega^2_{\text{partial}}$), means, and standard errors (in parentheses) for each quality of life subscale^a

	General health	Emotional well-being	Energy/fatigue	Pain	Physical functioning	Limitations (emotional problems)	Limitations (physical problems)	Social functioning
ANOVA (Unadjusted)								
Worry about cancer progressing								
F (1, 472)	30.8	36.0	14.3	2.6	0.5	13.4	8.8	18.9
p	<.0001	<.0001	<.001	0.11	.50	<.001	0.005	<.0001
ω ² _{partial}	.06	.07	.03	.00	.00	.03	.02	.04
Social support								
F (3, 472)	19.1	31.2	12.2	4.3	5.1	19.2	3.9	17.0
p	<.0001	<.0001	<.0001	0.01	<.005	<.0001	0.01	<.0001
ω ² _{partial}	.10	.16	.07	.02	.03	.10	.02	.09
Worry x social support interaction								
F (3, 462)	0.6	2.1	0.7	0.4	1.1	1.4	0.6	0.9
p	.59	.10	.56	.11	.35	.23	.65	.45
ω ² _{partial}	.00	.01	.00	.00	.00	.0	.00	.00
ANCOVA (Adjusted)								
Worry about cancer progressing								
F (1, 462)	18.8	13.9	4.3	0.8	0.0	4.4	3.5	7.2
p	< .0001	< .001	<.05	.91	.86	<.05	.06	<.01
ω ² _{partial}	.04	.03	.01	.00	.00	.01	.01	.01
Not at all	68.3 (1.6)	81.0 (1.1)	57.4 (1.9)	72.7 (2.0)	73.0 (1.9)	81.5 (2.6)	53.3 (3.4)	80.2 (1.8)
A little or more	60.2 (2.0)	76.1 (1.4)	52.7 (2.4)	70.5 (2.6)	72.6 (2.5)	74.9 (3.3)	45.8 (4.3)	74.3 (2.3)
Social support								
F (3, 462)	5.8	8.6	1.8	0.9	0.7	6.7	0.9	4.4
p	< .001	< .0001	.15	.44	.57	< .001	.44	< .005
ω ² _{partial}	.03	.05	.01	.00	.00	.03	.00	.02
Lowest quartile	59.6 (2.3)	72.6 (1.6)	50.9 (2.7)	70.8 (2.9)	71.2 (2.8)	66.9 (3.8)	51.5 (4.9)	71.1 (2.6)
2 nd quartile	62.6 (2.2)	80.8 (1.5)	57.5 (2.6)	69.5 (2.8)	71.5 (2.7)	83.0 (3.6)	49.7 (4.7)	89.9 (2.5)
3 rd quartile	63.4 (2.2)	79.3 (1.5)	54.7 (2.6)	71.1 (2.8)	75.3 (2.7)	76.5 (3.6)	44.1 (4.8)	76.1 (2.6)

	General health	Emotional well-being	Energy/fatigue	Pain	Physical functioning	Limitations (emotional problems)	Limitations (physical problems)	Social functioning
Highest quartile	71.2 (2.3)	81.4 (1.6)	57.1 (2.7)	75.0 (3.0)	73.1 (2.9)	86.4 (3.9)	52.9 (5.0)	80.9 (2.7)
Worry x social support interaction								
F (3, 462)	0.4	2.3	0.8	0.5	0.9	1.1	0.4	0.4
p	.73	.08	.50	.66	.46	.37	.74	.78
$\omega^2_{\text{partial}}$	.00	.01	.00	.00	.00	.00	.00	.00

^aANCOVA (but not ANOVA) results, least squares means, and standard errors are adjusted for age at diagnosis, race, education, trait anxiety, depression history, cancer stage, type of surgical treatment, and receipt of adjuvant treatment (i.e., chemotherapy, radiation, and/or hormone therapy). The effect size $\omega^2_{\text{partial}}$ represents a population estimate of the *unique* variance in the dependent variable accounted for by the effect in question, partialling out the effect of all other main effects and interactions.

Table 4
Adjusted Tukey *p*-values for interquartile differences in the cross-sectional association between social support and QOL subscales

Social support quartile comparison	General health	Emotional well-being	Energy/fatigue	Pain	Physical functioning	Limitations (emotional problems)	Limitations (physical problems)	Social functioning
1 st and 2 nd quartile	.64	<.0001	.13	.98	1.00	<.005	.99	<.01
2 nd and 3 rd quartile	.99	.82	.77	.96	.59	.40	.73	.34
3 rd and 4 th quartile	<.05	.66	.87	.67	.90	.13	.44	.42
1 st and 4 th quartile	<.001	.0001	.28	.67	.96	<.001	1.00	<.05

Table 5

Repeated measures MANCOVA results of the longitudinal effect of T2 worry and social support on QOL subscales at T3 and T4 (N=480)^a

	Wilk's λ	F	Multivariate p^b
General health			
Worry	0.97	6.71	<.005*
Social support	0.97	2.23	<.05*
Worry x social support	0.99	0.62	0.71
Emotional well-being			
Worry	0.96	9.65	<.0001
Social support	0.95	4.15	<.001*
Worry x social support	0.96	3.53	<.005 [†]
Energy/fatigue			
Worry	0.98	4.18	<.05
Social support	0.97	2.34	<.05
Worry x social support	0.99	1.01	0.41
Pain			
Worry	0.99	2.49	0.08
Social support	0.99	0.71	0.64
Worry x social support	0.99	0.74	0.61
Physical functioning			
Worry	1.00	0.39	0.67
Social support	0.99	0.4	0.88
Worry x social support	0.99	0.89	0.50
Limitations (emotional problems)			
Worry	0.98	5.77	<.01
Social support	0.97	2.7	<.05
Worry x social support	0.96	3.02	<.01
Limitations (physical problems)			
Worry	0.98	5.69	<.005
Social support	0.98	1.32	0.25
Worry x social support	0.98	1.7	0.12
Social functioning			
Worry	0.96	8.43	<.001 [†]
Social support	0.98	1.9	0.08
Worry x social support	0.99	0.69	0.65

^aAnalyses were adjusted for trait anxiety, depression history, age at diagnosis, race, education, cancer stage, type of surgical treatment, and type and receipt of adjuvant treatment.

^bA p -value of < .05 indicates a significant overall multivariate effect of the T2 predictor on the relevant QOL score over time. That is, T2 had a longitudinal relationship with a given QOL subscale at some point over the three measurement opportunities. Follow-up ANCOVAs identified the specific timepoints at which the relationship was significant.

Asterisks (*) indicate that the predictor was significantly associated with the outcome at the T3 interview.

A dagger ([†]) indicates significance at T4 but not T3.