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REGULAR ARTICLE

Chronic Stress in Vocational and Intimate Partner Domains as Predictors of Depressive Symptoms After Breast Cancer Diagnosis

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Abstract

Background After cancer diagnosis, depressive symptoms are elevated on average and decline over time, but substantial variability is apparent. Few studies have examined to what extent chronic stress in distinct life domains affects depressive symptoms.

Purpose Chronic stress in vocational and intimate partner life domains, and their interaction, were tested as predictors of depressive symptoms after breast cancer diagnosis.

Methods Women (N = 460) completed validated interviews regarding chronic stress in specific life domains shortly after diagnosis and a measure of depressive symptoms every 6 weeks for 6 months.

Results In latent growth curve modeling analyses, greater chronic stress in work (b = 2.90; p < .001) and intimate partner domains (b = 1.38, p = .02) was associated with higher depressive symptoms at study entry (intercept), and greater work stress predicted faster recovery from depressive symptoms over time (b = –0.10; p = .01). The two domains of chronic stress also interacted significantly on depressive symptoms at study entry (b = –1.54; p < .02) and over time (b = 0.14; p < .001). Greater work stress was associated with higher depressive symptoms at study entry regardless of intimate partner stress, but greater intimate partner stress was associated with higher depressive symptoms when work stress was low. The decline over 6 months in initially elevated depressive symptoms predicted by high work stress was significantly steeper when intimate partner stress was low.

Conclusions Targeting interventions to recently diagnosed breast cancer patients living with chronically stressful vocational and intimate partner life circumstances could be worthwhile.

Keywords Breast cancer • Depressive symptoms • Stress • Intimate partner • Marriage • Employment

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Introduction

Breast cancer is the most common cancer among women in the Western hemisphere, affecting one in eight women [1]. Evidence consistently points to a heightened risk for psychological and physical morbidity in women with breast cancer, including elevated depressive symptoms, during the diagnosis and treatment phase [2–10]. With the disease affecting women from all walks of life, women enter breast cancer treatment with varying chronic psychosocial stressors affecting their daily lives. These stressors may render women more susceptible to (or protected from) psychological morbidity. An extensive body of research points to clear links between psychosocial stress and worse physical and mental health [11–14], both in general and in the context of cancer [15–17]. For example, in a longitudinal study of women recently diagnosed

with breast cancer, contextual life stress reported as occurring the year prior to diagnosis predicted poorer psychological and physical quality of life during and after treatment completion [18]. Understanding the psychological consequences of distinct types of stressors, separately and in combination, is important for identifying women most at risk for negative psychological outcomes during and after breast cancer treatment. Accordingly, the primary goal of this study was to examine the distinct predictive power of chronic stress in two central life domains of vocation and intimate partner on depressive symptoms over and above the contributions of demographic and medical factors and stress in other life domains.

It is well established that episodic stress, defined as stressors with a specific onset and offset [19], can provoke depressive episodes, but their psychological effects tend to wane over weeks or months [20]. Chronic stress, typically defined as enduring for a minimum of 3–6 months, is more pernicious [21–23]. Specific domains of chronic stressors are likely to be important in the cancer context. When identifying the person most central to their life throughout the experience of breast cancer, most women identify their spouse or intimate partner [24]. This finding is in alignment with a model proposed by Cantor [25] that, in healthy populations, when stressful episodes occur, married people commonly turn first to their spouses for support and thereafter their children, other family members, friends, and neighbors. The model suggests that the unique closeness of the intimate partner connection, or the lack of that relationship, is of major importance in a crisis [26]. In the midst of the breast cancer experience, which also affects partners [27–29], the intimate relationship also can be stressful. Intimate partner stress is related not only to depression, but also to anxiety [30] and low quality of life [31] in women with breast cancer.

The vocational context represents another central life domain also likely to contribute to cancer-related adjustment. Women typically devote a substantial proportion of their lives to their vocations. Research shows a clear relationship between work-related factors, such as overload, control, demand, and the quality of the associated social environment, as well as the absence of a productive vocation, with physical and psychological well-being [32]. Research illuminating how interactions at work can influence what happens at home and vice versa can be found in the work–family spillover literature, showing how stressors in central life domains can affect each other and important outcomes such as marital behavior and satisfaction, recovery from work, and diurnal cortisol [33, 34]. The medical and psychological effects of cancer and its treatment may contribute to various impairments that diminish functioning, with negative implications for obtaining and keeping employment [35]. Additional work-related factors can be affected, including work ability, productivity, sustainability, and number of working hours [36, 37].

Although evidence indicates that contextual life stress affects psychological adjustment to breast cancer, little is known about the relative contributions of distinct domains of chronic stressors [38, 39]. Although research separately documents the importance of stressors related to work and the primary intimate relationship during cancer diagnosis and treatment, relatively little work has compared the independent, relative contributions of work and intimate partner domains of chronic stress. Furthermore, although the spillover literature suggests that work and intimate partner domains overlap and affect each other, no research has assessed how chronic stress in vocational and intimate partner domains may combine or interact to predict depressive symptoms following a cancer diagnosis, as was this study's major goal.

We hypothesized that (i) both work stress and intimate partner stress would independently predict greater depressive symptoms shortly after breast cancer diagnosis and across the subsequent several months and (ii) work stress and intimate partner stress would interact to affect depressive symptoms, such that their combined effect would amplify depressive symptoms. Chronic stress in other life domains of personal health, finances, children, family, friends, and health of family was included in the predictive model to determine whether work stress and intimate partner stress, as well as stress in other central life domains, accounted for unique variance in the outcome over and above demographic and medical factors.

Method

Participants

Participants were 460 women diagnosed with invasive breast cancer (stages I–IV) within 4 months prior to study entry. Recruitment took place at three oncology clinics in the greater Los Angeles area and in Tucson, Arizona (University of Arizona Cancer Center). The present study reports on the first five assessment points (study entry through 6 months) from a larger longitudinal study [40–44]. Participants were on average 56 years (±13 years) of age and recruited on average 2.1 months after diagnosis. The majority of the sample (68%) was non-Latina White, and 19% were Latina. Sixty-seven percent were partnered (married or cohabiting). Approximately half were employed at diagnosis (n = 236, 52%), 30% were retired, and 18% were unemployed. Of those who were employed, the majority (77%) worked at least 30 hr per week. Most women had early-stage breast cancer and underwent surgery, chemotherapy, and endocrine therapy during the study (for detailed sample characteristics, see [41]).

Procedures

At each recruitment site, consecutive (within scheduling constraints) newly diagnosed or newly recurrent breast cancer patients received a description of the study at their clinic appointment from research staff. Inclusion criteria were a new or an initially recurrent diagnosis of invasive breast cancer, diagnosed within the prior 4 months, and ability to complete assessments in English. Any oncologic treatment was allowed (i.e., surgery, chemotherapy, radiotherapy, endocrine therapy), as was any additional medication. Exclusion criteria included current or past bipolar disorder, schizophrenia, schizoaffective disorder, younger than 21 years, or a cognitive disorder (e.g., dementia). Eligible participants were scheduled for an in-person study entry assessment and follow-up telephone assessments every 6 weeks for 6 months. Study procedures were approved by the University of California, Los Angeles, and the University of Arizona institutional review boards. Procedures are detailed in [41].

Study entry assessment

The study entry session was completed in a private room at the treating oncology center or at women's homes and conducted by trained post-baccalaureate-level research staff. After giving informed consent, participants completed several measures, including the University of California, Los Angeles (UCLA) Life Stress Interview (LSI) and questions on demographics and medical information. Self-reported measures were completed in interview format or independently on the computer with the interviewer present.

Six-week assessments

Every 6 weeks for 6 months after study entry (i.e., 6–10 months after diagnosis), women completed a 30-min assessment by telephone of physical and psychological health. Assessments included a measure of depressive symptoms (Center for Epidemiologic Studies–Depression Scale, CES-D; see below).

Of the 460 women who completed the study entry assessment, 428 (93%) completed the Week 6 assessment, 420 (91%) completed the Week 12 assessment, and 411 (89%) completed the Weeks 18 and 24 assessments. Approximately 61% of women completed the CES-D at every assessment. If a participant missed an assessment, she was able to rejoin the study at a later point. Complete enrollment and attrition data can be found in [40, 41].

Measures

Sociodemographic and medical variables

Demographic information (i.e., age, marital status, educational level, employment, ethnicity, household income, recruitment site, subjective social status obtained by the socioeconomic status ladder [45]) was assessed at study entry. Medical information (i.e., number of weeks since diagnosis, surgery, chemotherapy, radiotherapy, endocrine therapy, new vs. recurrent diagnosis, physical comorbidities, current psychological treatment) was obtained through self-report at each assessment point. Cancer stage was obtained via medical chart review and, when not available, filled in by self-report.

The UCLA LSI

The UCLA LSI [46–50] provides a detailed, semistructured format for objective assessment of ongoing chronic stress in several central life domains: personal and family health, financial, vocational, and interpersonal (i.e., intimate partner, children, family, friends). The reliable and valid LSI includes assessment of circumstances associated with the presence or absence of normatively central life domains, such as the stress from having an intimate partner or being single but desiring an intimate partner, and the stress from having chronic work overload or being unemployed [46–48]. Interviewers were thoroughly trained by the scale's developer (CH), including supervision of audiotaped administration and scoring of the interviews. At study entry, respondents replied to prompts that assessed levels of chronic stress and functioning over the past 6 months in each life domain (episodic or acute stressors were assessed, but not included in this report [43]). Separate scores were assigned for each life domain. Interviewer ratings of chronic strains have demonstrated excellent inter-judge reliability (0.72–0.99) [49, 50]. Scores are assigned in each domain for all women to provide a comprehensive profile of chronic strains and to enable modeling of data from the entire sample. All domains are assessed on equivalent scales ranging from excellent functioning/conditions to very poor functioning/conditions. At study entry, chronic stress was assessed with separate questions for the 6 months prior to breast cancer diagnosis (prediagnosis) and from diagnosis to study entry (post-diagnosis; $M = 2.13$ months after diagnosis). Because the ratings for pre- and post-diagnosis chronic stress were highly correlated (range $r = 0.88$–0.92, $p \leq .001$), scores were averaged. All LSI stress domains were approximately normally distributed.

Work stress

After obtaining a basic description of employment over the past 6 months, including whether the participant was working for pay, not for pay, or on medical leave, interviewers asked: "What were the working conditions like in the past six months?" and/or "What was not being employed like in the past six months?" Probes for employed participants included assessment of safety, work environment, workload, adequacy of rewards (e.g., pay, appreciation,

possible advancement), relationships with supervisor and coworkers, and how women managed work and home demands. Circumstances of unemployment/retirement were queried similarly. Chronic stress was rated on a five-point scale, with lower scores indicating no or low chronic stress. For employed women, scores ranged from *exceptionally good conditions* (1) to *chronic job instability* (5). For unemployed women, scores ranged from *no need for job or has job options if needed* (1) to *job desired and needed but poor skills and prospects of work* (5). As such, an advantage of this approach is that chronic work stress scores can be assigned regardless of employment status.

Intimate partner relationship stress

Stress in the intimate partner domain was assessed with general questions (e.g., "What was the relationship like in the past six month period?" and "How often did you and [name of partner] argue or fight?") and probes for stress duration, relationship stability, conflict, closeness, trust, and confiding. Separate scales were used for women who were currently partnered, women who were not, and women who were dating. Chronic strain was rated on a five-point scale, with lower scores indicating no or low chronic strain. For partnered women, scores ranged from *exceptional relationship, close, confiding, very trusting, with competent conflict resolution* (1) to *abusive relationship (physically or emotionally), negative conditions, lack of communication and/or a one-sided relationship* (5). For unpartnered women, scores ranged from *completely satisfied without partner* (1) to *extremely unhappy and lonely without a partner* (5). For women who were dating, scores ranged from *frequent dating, perceiving partner as excellent potential for future relationship* (1) to *extremely adverse experiences through mistreatment* (5).

Other chronic stress domains

Other chronic stress domains assessed were friendship network, family relationships, and children, rated on five-point scales from *exceptionally high quality relationships* (1) to *very poor quality relationships* (5); finances, rated on a five-point scale from *more than enough money, lives comfortably* (1) to *hardship/poverty* (5); health of self and health of close family, rated on five-point scales from *exceptionally good health* (1) to *severe or life-threatening condition* (5). Queried and scored similarly, these domains mirrored the structure and the rating system of stress in the vocational and intimate partner domains.

CES-D scale

At all assessments, participants completed the 20-item CES-D scale [51]. Participants rated how often they had experienced depressive symptoms (e.g., "I felt like everything I did was an effort") over the past week, from 0 (*rarely or none of the time*) to 3 (*most or almost all of the time*). Scores can range from 0 to 60. Shown to have strong psychometric properties, the CES-D is a widely used continuous measure of depressive symptoms in the breast cancer population and the community [52]. Internal consistency was high in this study ($\alpha = 0.91–0.93$).

Data Analysis

To assess univariate associations between chronic stress domains and depressive symptoms at each assessment, Pearson's correlation coefficients were calculated. Next, to determine whether work stress, intimate partner stress, and their interaction predicted change in depressive symptoms over time, multilevel structural equation modeling (MSEM [53]) was used. MSEM specifically accounts for the nested, hierarchical data structure that results when repeated measures are taken over time. In other words, MSEM estimates both inter-individual variability (i.e., between-person) and intra-individual variability (i.e., within-person) [54]. To model change in depressive symptoms, weeks since study entry was entered as a within-person (uncentered; Level-1) variable. To calculate the interaction term, work stress and intimate partner stress were mean-centered and their product was taken. Work stress, intimate partner stress, and the Work Stress × Intimate Partner Stress interaction term were entered as between-person or time-invariant (grand mean-centered; Level-2) variables. MSEM calculates the mean intercept (study entry) and mean slope (rate of change over time). Models were estimated using full information maximum likelihood (FIML) [55, 56], which is robust to missing data. Throughout, a $p < .05$ of two-tailed significance tests was considered statistically significant. All analyses were performed using Statistical Packages for the Social Sciences version 22 (SPSS) [57] and Mplus version 7.4 [58].

Three nested models were tested. First, an unconditional model was fitted to determine the overall depressive symptom trajectory. Second, a set of sociodemographic and medical covariates known to be theoretically and empirically related to the outcome, depressive symptoms [40], was selected, and the relationship between each covariate and depressive symptoms over time was examined. These were entered as between-person or time-invariant (Level-2) variables to predict change in depressive symptoms over time. Continuous variables tested were age, number of days since breast cancer diagnosis, number of physical comorbidities, income, perceived social status, and breast cancer stage. Categorical variables were ethnicity, education, employment status,

marital status, recruitment site, and whether it was a first breast cancer diagnosis. Variables that were significantly related to depressive symptoms were retained as covariates ($p < .05$).

Third, to test the primary hypothesis, work stress, intimate partner stress, and their interaction were entered into the model with the retained covariates. The time-invariant covariates entered into the final (third) model were age, marital status, employment status, perceived social status, cancer stage, and recruitment site. To examine unique contributions of work stress and intimate partner stress, additional variables from the UCLA LSI domains were included in the model as distinct domains of stress: personal health, finances, children, family, friends, and health of family. The time-varying covariates entered into the final model were surgery, chemotherapy, radiotherapy, endocrine therapy, and psychological treatment. Significant interactions were probed by estimating simple slopes of work stress (predictor) at the mean and ±1 SD of intimate partner stress (moderator). Estimated simple slopes were graphed at each time point as were the trajectories of distinct combinations of work and intimate partner stress levels across time. The primary predictors had little missingness: 8% for work stress and intimate partner stress at study entry.

Results

Descriptive Statistics

Descriptive statistics and correlations for chronic stress variables and depressive symptoms (CES-D) are shown in Table 1. Study entry work stress and intimate partner stress were positively correlated ($r = 0.30$, $p < .01$). Study entry work stress was significantly correlated with depressive symptoms at all time points ($r = 0.22$–0.35, $p < .01$), as was intimate partner stress ($r = 0.23$–0.36, $p < .01$).

Unconditional Model

At study entry, CES-D scores for depressive symptoms were on average 12.82. Over the 24 weeks of follow-up, depressive symptoms were estimated to decrease on average 0.25 units per week.

Tests of Covariates

When theoretically and empirically relevant covariates were entered into the model, there were no significant effects of ethnicity, education, number of physical comorbidities, annual household income, time since diagnosis, or whether it was a first breast cancer diagnosis (all *p*s > .05) on depressive symptoms, either at study

Table 1 Correlations between LSI chronic stress variables and CES-D at all assessment points ($N = 460$)

Variable	*M* (*SD*)	2 ($n = 340$)†	3 ($n = 404$)†	4 ($n = 437$)†	5 ($n = 439$)†	6 ($n = 434$)†	7 ($n = 438$)†	8 ($n = 436$)†	9 ($n = 453$)†	10 ($n = 395$)†	11 ($n = 388$)†	12 ($n = 384$)†	13 ($n = 384$)†
1. Stress own health	1.88 (0.65)	.05	.13*	.16**	.15**	.11*	.20**	.21**	.17**	.12*	.15**	.09	.12*
2. Stress own children	2.16 (0.65)	–	.20**	.14**	.17**	.28**	.25**	.09	.24**	.24**	.21**	.23**	.22**
3. Stress family	2.60 (0.77)		–	.10*	.19**	.10*	.15**	.14**	.17**	.12*	.25**	.16**	.23**
4. Stress finances	2.26 (0.77)			–	.16**	.07	.23**	.45**	.26**	.24**	.19**	.20**	.28**
5. Stress friends	1.95 (0.75)				–	.10*	.30**	.22**	.18**	.16**	.13*	.08	.20**
6. Stress health family (not self)	2.53 (0.72)					–	.19**	.09	.17**	.19**	.15**	.19**	.17**
7. Stress intimate partner	2.04 (0.82)						–	.30**	.36**	.23**	.34**	.27**	.32**
8. Stress work	2.30 (0.72)							–	.35**	.32**	.28**	.22**	.28**
9. CES-D total Wk 0	12.82 (10.64)								–	.64**	.57**	.53**	.51**
10. CES-D total Wk 6	12.35 (10.73)									–	.56**	.49**	.50**
11. CES-D total Wk 12	11.65 (10.94)										–	.60**	.54**
12. CES-D total Wk 18	9.97 (9.44)											–	.62**
13. CES-D total Wk 24	10.10 (10.16)												–

Stress domains measured at study entry. *SD* standard deviation; *CES-D* Center for Epidemiologic Studies Depression Scale; *LSI* Life Stress Interview; *Stress* the type of chronic stress domain measured with the UCLA Life Stress Interview.

*$p < 05$, **$p < .01$, ***$p < .001$, †*n* pairwise present data.

entry or over time. Accordingly, these variables were not included in the final model.

Work Stress, Intimate Partner Stress, and the Work × Intimate Partner Stress Interaction

A final model was fitted which included work stress, intimate partner stress, the Work Stress × Intimate Partner Stress interaction term, and included relevant covariates as between-person or time-invariant (Level-2) variables. Model fit indices indicate acceptable model fit, $\chi^2(46) = 74.52$, $p = .04$, with Root Mean Square Error of Approximation (RMSEA) = 0.02, Comparative Fit Index (CFI) = 0.97, and Standardized Root Mean Square Residual (SRMR) = 0.02. Age, perceived social status, and cancer stage were not statistically significant with regard to the intercept or slope of depressive symptoms (Table 2). Patterns of results for depressive symptoms at study entry and change in depressive symptoms over time are described separately below.

Associations of Work Stress and Intimate Partner Stress With Depressive Symptoms at Study Entry (Intercept)

With respect to the covariates, being unmarried ($b = –2.47$, $p = .01$), living in California (vs. in Arizona) ($b = 1.90$, $p = .03$), and being employed (vs. retired) ($b = –2.81$, $p = .02$), or unemployed (vs. employed) ($b = 2.99$, $p = .01$) were associated with higher depressive symptoms at study entry (Table 2). Of the six chronic stress covariates, stress in domains of family members' health and children was related independently to study entry depressive symptoms (Table 2).

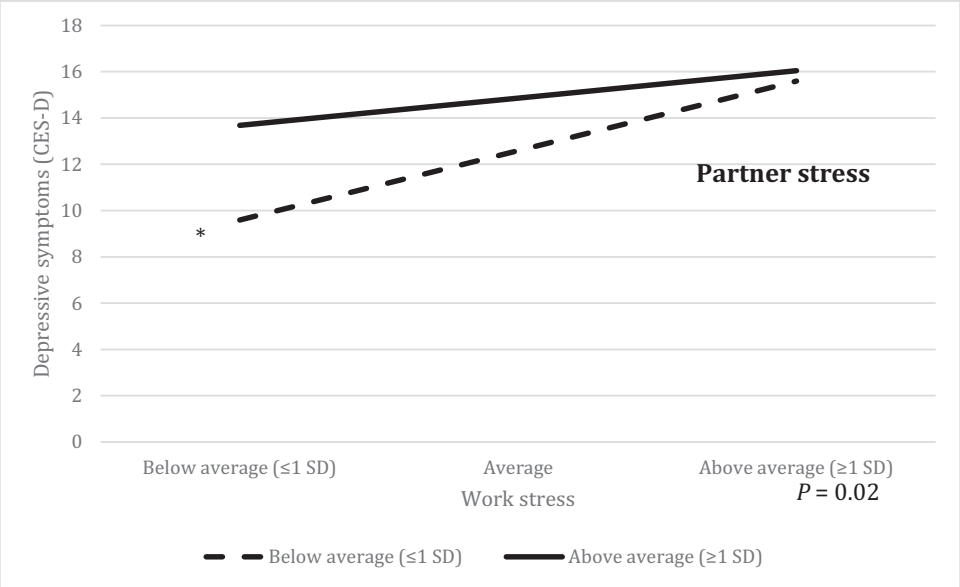
At study entry (Table 2), greater chronic stress in the work domain ($b = 2.90$, $p < .001$) and the intimate partner domain ($b = 1.38$, $p = .02$) was significantly and independently associated with greater depressive symptoms. These relationships were qualified by a significant Work × Intimate Partner Stress interaction ($b = –1.54$, $p = .02$) (Table 2). The interaction was probed by calculating simple slopes for the relationship of work stress with depressive symptoms at –1 SD (low), mean, and +1 SD (high) intimate partner stress. Figure 1 reveals that when chronic work stress was high at study entry, estimated initial CES-D scores approached 16, the clinically suggestive cutoff, regardless of the level of intimate partner stress. Women with low stress in the work domain but high intimate partner stress also had relatively high depressive symptoms at study entry, with estimated CES-D scores approaching 14. Work stress and depressive symptoms were significantly related when intimate partner stress was low, such that low chronic stress in both work and intimate partner domains at study entry was associated with lowest depressive symptoms, but estimated depressive symptoms were higher as work stress was higher.

Table 2 Longitudinal growth model of the association of stress with CES-D depressive symptoms score

Random effects (time-invariant covariates)	Intercept Est. (*SE*)	*p*	Linear trajectory Est. (*SE*)	*p*
Age	–0.07 (0.05)	.12	0.00 (0.00)	.23
Married (ref = no)	–2.47 (0.89)	.01	0.04 (0.04)	.36
Employment (ref = employed)				
Retired	–2.81 (1.21)	.02	0.12 (0.06)	.06
Unemployed	2.99 (1.10)	.01	0.04 (0.06)	.44
Perceived social status	–0.58 (0.31)	.06	0.01 (0.02)	.66
Cancer stage	0.80 (0.53)	.13	0.02 (0.03)	.49
Site (ref = Arizona)	1.90 (0.86)	.03	0.05 (0.04)	.26
Stress own health	0.73 (0.65)	.26	–0.03 (0.03)	.28
Stress own children	2.49 (0.76)	.00	–0.03 (0.04)	.37
Stress family	1.03 (0.57)	.07	0.04 (0.03)	.20
Stress own finances	–0.04 (0.65)	.95	0.05 (0.03)	.14
Stress friends	0.59 (0.59)	.31	–0.04 (0.03)	.21
Stress health family	1.47 (0.60)	.02	–0.02 (0.03)	.55
Stress intimate partner	1.38 (0.60)	.02	0.02 (0.03)	.61
Stress work	2.90 (0.68)	<.001	–0.10 (0.03)	.01
Interaction Work × Intimate Partner Stress	–1.54 (0.64)	.02	0.14 (0.03)	<.001

Potential covariates not included due to nonsignificant prediction: ethnicity, educational level, income, new versus recurrent diagnosis, and physical comorbidities.

Est regression coefficient; *SE* standard error; *CES-D* Center for Epidemiologic Studies Depression Scale; *Stress* the chronic stress domain measured with the UCLA Life Stress Interview.



* $p < 0.05$.

Fig. 1. Significant interaction of intimate partner stress and work stress on depressive symptoms at study entry (interactions were not significant at Weeks 6, 12, and 18). *$p < .05$.

Associations of Work Stress and Intimate Partner Stress With Depressive Symptoms Over Time (Slope)

With regard to prediction of change in depressive symptoms over time, none of the covariates, including the six covariate stress domains, significantly predicted the slope of depressive symptoms (Table 2), except that radiotherapy at 18 weeks was associated with a faster recovery (declining depressive symptoms) ($b = –2.73$, $p = .01$) and surgery at 24 weeks predicted a slower recovery ($b = 3.16$, $p = .01$) (see Supplementary Table).

Intimate partner stress at study entry was not associated significantly with change in depressive symptoms over 24 weeks ($b = 0.02$, $p = .61$), but chronic stress in the work domain predicted a significantly faster recovery in depressive symptoms over time ($b = –0.10$, $p = .01$; Table 2). Chronic stress in work and intimate partner domains interacted significantly ($b = 0.14$, $p < .001$). Figure 2 reveals that when work stress was high at study entry, higher partner stress predicted higher (a slower decline in) depressive symptoms at 24 weeks ($b = 1.81$, $p < .05$). When study entry work stress was low, regardless of initial partner stress, depressive symptoms were low over the following 24 weeks.

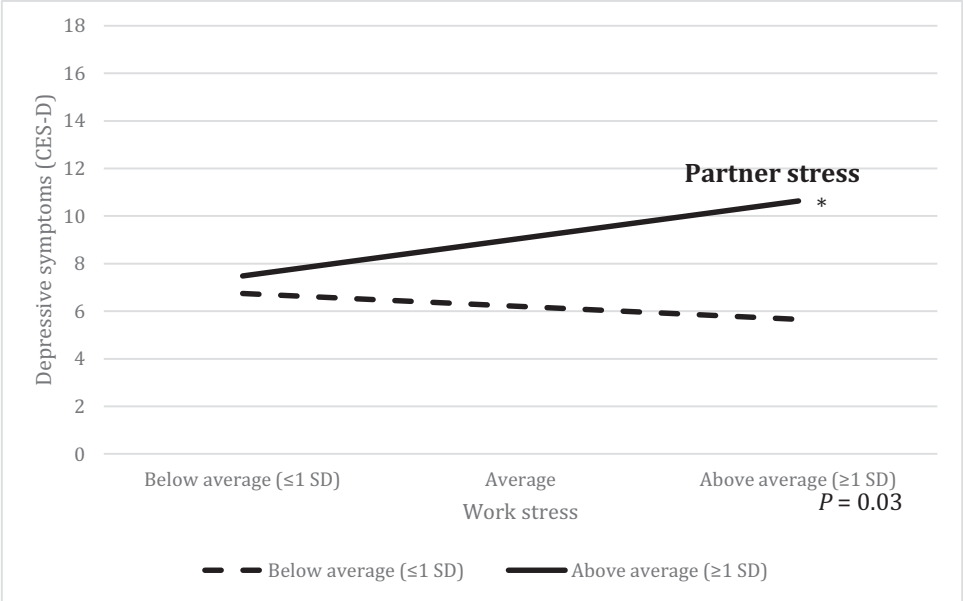
As displayed in Fig. 3, depressive symptom slopes associated with four combinations of chronic stress in work and intimate partner domains indicate that participants with high initial work stress and high intimate partner stress had relatively high estimated depressive symptoms over the 24 weeks, compared with the other three trajectories. Participants with relatively high chronic stress in the work domain but low intimate partner stress also were estimated to have high depressive symptoms initially, accompanied by the steepest recovery over 24 weeks. Having low stress in both domains was associated with relatively low and stable depressive symptoms across time (p's > 0.05).

Post hoc Analyses

A relevant question is whether stress in work or intimate partner domains interacts with other domains of chronic stress to predict depressive symptoms. Post hoc tests of interactions of work stress or intimate partner stress with stress in the other six life domains (personal health, finances, children, family, friends, health of family) on depressive symptoms were not statistically significant.

Discussion

Past research has assessed the separate contributions of work stress and intimate partner stress on depressive symptoms following breast cancer diagnosis [16, 35]; investigation of how chronic stress in vocational and intimate partner life domains independently and in interaction predicts depressive symptoms had not been conducted prior to the present study. On average, depressive symptoms decreased from shortly after breast cancer diagnosis to 6 months later. Largely consistent with the first hypothesis, the experience of chronic stress in each of the two domains an average of 2 months after



* $p < 0.05$.

Fig. 2. Significant interaction of intimate partner stress and work stress at study entry on depressive symptoms at Week 24. *$p < .05$.

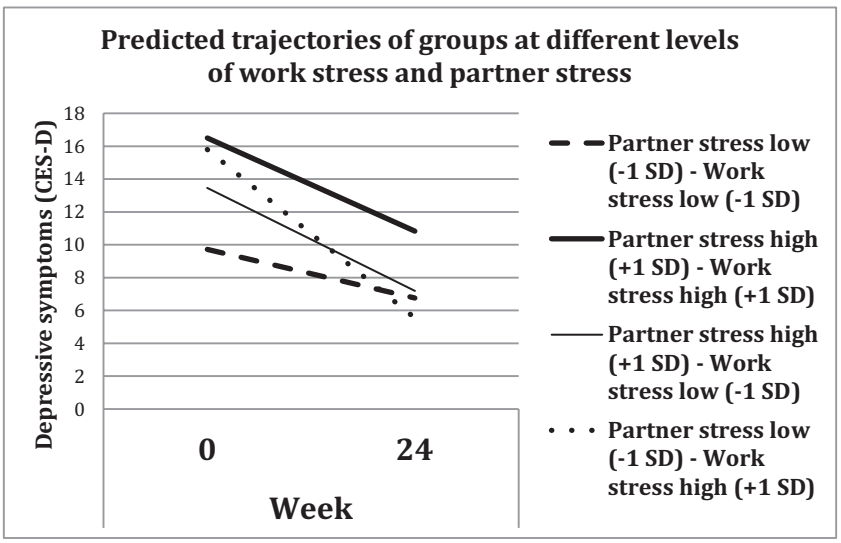


Fig. 3. Predicted depressive symptom trajectories at different levels of work stress and intimate partner stress.

diagnosis was related independently to higher depressive symptoms at that point, and stress in the work sphere (but not the intimate partner domain) predicted change in depressive symptoms over 6 months. These findings require interpretation in light of significant interactions between work and intimate partner stress, as hypothesized, on depressive symptoms at both study entry and over 6 months. As discussed in what follows, the nature of the interactions was not entirely consistent with hypothesis.

At study entry, the significant interaction denoted that consideration of the levels of stress in both domains is indeed important with regard to their relationships with depressive symptoms experienced shortly after breast cancer diagnosis (i.e., intercept). However, the shape of the interaction (Fig. 1) suggested that high chronic stress in the domain of work was related to depressive symptoms approaching the clinically suggestive CES-D cutoff, and this relationship did not depend on the levels of intimate partner stress. Higher chronic stress in the intimate partner domain emerged as important to depressive symptoms at lower levels of work-related stress, however, in that it amplified the work stress–depressive symptoms relationship at study entry.

The interaction between stress in vocational and intimate partner domains also was important in predicting change in depressive symptoms over 6 months (Figs. 2 and 3). Specifically, participants experiencing high initial work stress and low intimate partner stress were estimated to have the most rapid recovery in their initially elevated depressive symptoms. Relatively high intimate partner stress was important in that it appeared to slow the recovery in initially high depressive symptoms in the context of high work stress. Low chronic stress in both life domains predicted low initial depressive symptoms, which evidenced a modest decline.

It is important to note that these main effects and interactions of stress in vocational and intimate partner domains on depressive symptoms were significant over and above the contributions of demographic and medical factors, as well as chronic stress in other life domains. Furthermore, as is standard in the UCLA LSI, chronic stress in specific life domains was evaluated on a metric that combines experiences across the presence and absence of specific role occupancy (e.g., being employed or unemployed); it is notable that chronic stress in work and intimate relationship domains contributed to depressive symptoms independent of employment and relationship status.

That high stress in the vocational domain was associated independently with greater initial depressive symptoms is consistent with the clear empirical association between work-related problems and psychological morbidity in cancer survivors [35]. In addition, a systematic review of 59 longitudinal studies in the general population yielded strong evidence that job strain (high psychological demands and low decision latitude), low decision latitude by itself, and bullying at work significantly predicted depressive symptoms over 1- to 5-year follow-up [59]. Certainly, unstable or underemployment might constrain finances available to secure adequate oncologic treatment or paid help with other role responsibilities. However, stress in the work domain was associated uniquely with initial depressive symptoms over and above chronic financial stress, signaling the power of the larger vocational context. Indeed, high chronic work stress that pre-exists and likely is exacerbated by breast cancer diagnosis and treatment, as was assessed in this study, appears particularly potent in that it was linked to depressive symptoms across levels of partner stress at study entry.

High chronic stress in the intimate partner domain also was important in its (1) association with initially high depressive symptoms (approaching or exceeding the clinical cutoff on CES-D) at low levels of work-related stress and (2) prediction, in combination with high work-related stress, of slower recovery from initially high depressive symptoms (relative to more rapid recovery in the context of high work stress and low intimate partner stress). These findings add to the literature demonstrating that intimate partner stress contributes to psychological morbidity in longitudinal studies [60, 61]. The fact that chronic stress regarding one's children and the health of close family members also was uniquely related to depressive symptoms at study entry also demonstrates the important roles of close interpersonal relationships during the weeks after cancer diagnosis [62].

The obtained pattern of significant interactions warrants interpretation. Perhaps the seemingly less central role of chronic intimate partner stress than vocational stress reflects previous findings that breast cancer and its treatment can contribute to aspects of the intimate partner relationship being placed temporarily "on hold" [63, 64]. Consequences of relationship stress might start to "catch up" with the disruptive influence of work stress over time, contributing to a slower resolution of depressive symptoms. In addition, practical aspects of work stress often need more attention soon after diagnosis when facing potential breast cancer-related disability [65], in contrast to the nature of intimate partner stress as an ongoing burden. As such, through its enduring presence, intimate partner stress may pervade a woman's life in a different way, may not be as easily altered, and may, in combination with work stress, place the woman at risk for more persistent depressive symptoms later in the breast cancer trajectory.

Findings from this study address a gap in the current literature regarding the optimal timing of intervention delivery [66, 67]. Acknowledging and helping women negotiate the influence of chronic vocational stress appear warranted soon after breast cancer diagnosis, and research is needed on effective approaches to reduce that source of stress. Also, because findings show that when study entry work stress was high, higher study entry intimate partner stress was associated with a slower depressive symptom recovery at 6 months, interventions targeting intimate partner stress may be helpful across breast cancer diagnosis and treatment.

The findings also have implications for theories of stress. Chronic stress in distinct domains may influence depressive symptoms differently. In contrast to the notion that "all stress is bad," stress specificity also was supported in Cohen's seminal study [68], which demonstrated that interpersonal and un/underemployment stressors were more potent predictors of getting a cold after viral exposure than were other stressor domains (also see [69]).

This study is, to our knowledge, the first to investigate the contribution of contextual life stress to depressive symptoms in women with breast cancer prospectively with a reliable and valid indicator of chronic stress burden in distinct central life domains [70]. Additional strengths are the study's relatively large sample and use of multilevel modeling and the FIML modeling of

missing data to examine theoretically and clinically relevant predictors of depressive symptoms through several months. Although the relationship of stress with depressive symptoms is likely bidirectional [71, 72], the longitudinal design increases confidence that chronic work stress and intimate partner stress are contributors to, rather than merely consequences of, depressive symptoms.

A limitation is that this study's sample was predominantly non-Latina White women, potentially limiting generalizability of findings; ethnicity (Latina vs. non-Latina White) was not significantly related to depressive symptoms, however. In addition, this relatively young sample of women with breast cancer [73] likely contained a larger proportion of women working outside the home compared with breast cancer population norms. Also, results are based on women's experience only from shortly after diagnosis (mean = 2.1 months) through the next 6 months, but this early phase of survivorship is one of the most stressful phases of the breast cancer experience [74].

In conclusion, findings suggest that considering the independent and combined influences of chronic stress in central life domains has important implications for understanding depressive symptoms in the several months following a breast cancer diagnosis. With these findings as a backdrop, interventions targeting newly diagnosed cancer patients who are living with marked chronic stress in vocational and interpersonal domains appear warranted to make efficient use of often limited psychosocial resources.

Supplementary Material

Supplementary material is available at *Annals of Behavioral Medicine* online.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Stinesen Kollberg, Wiley, Ross, Jorge, Weihs, and Stanton declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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