


RESEARCH ARTICLE

Strength through adversity: Moderate lifetime stress exposure is associated with psychological resilience in breast cancer survivors

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Abstract

Stress research typically emphasizes the toxic effects of stress, but recent evidence has suggested that stress exposure, in moderation, can facilitate resilience. To test whether moderate stress exposure promotes psychological resilience to cancer, we examined the relationship between lifetime stress exposure prior to cancer diagnosis and postdiagnosis psychological functioning among 122 breast cancer survivors. Lifetime acute and chronic stress was assessed using an interview-based measure, and psychological functioning was assessed using measures of cancer-related intrusive thoughts and positive and negative affect. Results indicated that acute stress exposure was associated with cancer-related intrusive thoughts in a quadratic fashion ($p = .016$), such that participants with moderate acute stress reported fewer intrusive thoughts compared to those with low or high acute stress. Similarly, a quadratic relationship emerged between acute stress exposure and positive affect ($p = .009$), such that individuals with moderate acute stress reported the highest levels of positive affect. In contrast, acute and chronic stress were related to negative affect in a positive, linear fashion ($ps < .05$). In conclusion, moderate stress exposure was associated with indicators of psychological resilience among breast cancer survivors, supporting stress exposure as a key factor influencing adjustment to breast cancer and providing evidence for stress-induced resilience in a novel population.

KEYWORDS

breast cancer, health, quadratic, resilience, stress

1 | INTRODUCTION

For most women, receiving a breast cancer diagnosis and undergoing cancer treatment is profoundly stressful. Despite medical advances, breast cancer remains a life-threatening illness that leaves many women uncertain about their future. Breast cancer is typically accompanied by treatments such as surgery, chemotherapy, and radiation, as well as the adverse side effects of those treatments, including chronic fatigue, pain, nausea, hair loss, body image issues, and cognitive impairment (Ganz, Schag, Polinsky, Heinrich, & Flack, 1987; Tchen et al., 2003; Waring, 2000). Additionally, breast cancer and its treatment can lead to unwanted changes in social roles and relationships, such as the inability to work or fulfill normative family duties, and changes in sexual functioning (Ganz, Rowland, Desmond, Meyerowitz, & Wyatt, 1998; Meyerowitz, Sparks, & Spears, 1979; Waring, 2000). Finally, due to the costs of medical care combined

with the disruption in ability to work, breast cancer can also lead to financial strain for many women and their families (Jagsi et al., 2014; Meyerowitz et al., 1979; Waring, 2000).

Given the stressors associated with breast cancer diagnosis and treatment, it is perhaps surprising that a significant percentage of women do not become distressed after being diagnosed with breast cancer, or if they do become distressed, they recover quickly (Donovan, Gonzalez, Small, Andrykowski, & Jacobsen, 2014; Dunn et al., 2011; Henselmans et al., 2010; Stanton et al., 2015). For example, a study of 171 breast cancer patients conducted by Henselmans et al. (2010) found that nearly 70% of women either experienced no distress at all or experienced initial distress that resolved within 2 months following treatment completion (Henselmans et al., 2010). These and similar findings highlight the high prevalence of resilience among women with breast cancer (e.g., Donovan et al., 2014; Dunn et al., 2011; Stanton et al., 2015). Yet factors that contribute to

resilience in this context have not been fully identified. What might prepare some women to face and bounce back from the threat of breast cancer more effectively than others?

Although stress research has typically focused on the negative effects of stress exposure, several theories have suggested that exposure to moderate stress may actually contribute to the development of psychological resilience. For example, Dienstbier's model of psychophysiological toughness posits that stress exposure can have a "toughening" effect that improves coping with future stressors, when that exposure is limited and followed by a recovery period (Dienstbier, 1989, 1992). Theories predicting similar effects include stress inoculation (Meichenbaum & Novaco, 1985), immunization (e.g., Başoğlu et al., 1997), and steeling (e.g., Rutter, 2006). The common idea among these theories is that practice dealing with challenging yet manageable stressors can provide an individual with opportunities to develop personal resources (e.g., adaptive coping strategies and a sense of mastery) that can then improve the person's ability to cope with subsequent stressors. This toughening effect is theorized to be the result of exposure to moderate, surmountable stressors. It is posited that stressors that are too severe overwhelm an individual, interrupting toughening processes, but experiencing no or minimal stress does not provide opportunity for personal growth (Dienstbier, 1989; Dienstbier, 1992).

A growing body of evidence supports the idea of stress toughening. In an early qualitative study of 845 community-dwelling older men coping with a variety of life stressors, for example, 81.9% of men reported drawing strength from previous adverse experiences to help them deal with their current problem (Aldwin, Sutton, & Lachman, 1996). More recently, a quantitative study by Mortimer and Staff (2004) showed that, among young adults facing work stress, those with previous experience handling such stress during adolescence were resilient to the heightened depressed mood and reduced self-efficacy and self-esteem reported by those with little prior work stress. Similarly, in a diverse community sample of early adolescents, Shapero et al. (2015) found that adolescents who reported greater exposure to moderate (nonextreme) stressors in childhood had a blunted depressive response to recent life stressors compared to adolescents with lower moderate stress exposure. Further, a study of newlywed couples found that couples that experienced moderate stress during the early months of marriage exhibited better adjustment to later marital stress (i.e., the transition to parenthood) than did those without early marital stress experiences (Neff & Broady, 2011).

Importantly, a recent study by Seery, Holman, and Silver (2010) was among the first to test the effects of lifetime stress exposure (rather than exposure to a particular type of stress during a circumscribed time) on resilience in adults. In a national sample ($N = 2,398$), the researchers found a U-shaped quadratic relationship between the number of major life stressors individuals experienced (assessed using a self-report life events checklist) and mental health outcomes. Specifically, adults who reported low-to-moderate levels of lifetime stress exposure had better mental health (i.e., less global distress, functional impairment, posttraumatic stress symptoms, and more life satisfaction) than those with either no or high levels of lifetime stress. This was true both at baseline and at following subsequent life stressors. Additionally, in a subset of this sample with chronic back

pain ($N = 396$), the researchers showed that individuals reporting moderate lifetime stress exposure had less functional impairment and healthcare utilization than those reporting either no adversity or high adversity (Seery et al., 2010). Two further studies from the same research group found a similar curvilinear relationship between lifetime stress exposure and resilience when using controlled laboratory stressors (Seery, Leo, Lupien, Kondrak, & Almonte, 2013).

These studies provide compelling preliminary evidence that limited stress exposure may help to buffer an individual against the negative psychological effects of subsequent stressors. However, it remains unknown whether moderate prior stress exposure is associated with resilience to the cancer experience. Given that positive psychological adjustment to cancer has important implications for quality of life and can even influence medical adherence (Bender et al., 2014; Stanton et al., 2015), understanding the factors that contribute to resilience is of great importance. Additionally, in prior work, life stress has typically been measured using a life event checklist (e.g., Seery et al., 2010, 2013). Checklist-based measures of stress allow investigators to quickly quantify a person's exposure to a wide variety of stressors; however, such measures typically do not assess stressor duration and thus do not enable researchers to examine the effects of acute versus chronic stressors (Lepore, 1997).

The ability to assess stressor duration is critical, as theory and empirical evidence suggest that acute and chronic stressors may have unique patterns of influence (Slavich, 2016). In his toughening theory, for example, Dienstbier posited that stressors can only lead to toughening when the stress is limited and followed by a period of recovery (Dienstbier, 1989; Dienstbier, 1992), suggesting that this effect may only apply to acute stressors. Consistent with this formulation, in a community survey of more than 1,700 men and women, McGonagle and Kessler (1990) found that chronic stressors were stronger predictors of depressive symptoms than acute stressors (cf., Hammen, Kim, Eberhart, & Brennan, 2009; see also Monroe, Slavich, Torres, & Gotlib, 2007; Muscatell, Slavich, Monroe, & Gotlib, 2009). Cohen et al. (1998) also found that chronic, but not acute, stressors were associated with a substantial increased susceptibility to the common cold. Thus, it is plausible that the ongoing nature of chronic stressors may exert more uniformly negative influence on health, whereas the time-limited nature of acute life events could have more beneficial or toughening effects. Potential mechanisms of these differential effects could involve feelings of helplessness and self-efficacy: if a stressor has been ongoing for a long time, as in the case of chronic stress, attempts to resolve the stressor have likely failed, potentially leading to increased feelings of helplessness; in contrast, acute stressors, which are resolved more readily, could lead to increased feelings of self-efficacy (McGonagle & Kessler, 1990). However, studies examining the toughening effects of moderate stress exposure have not yet distinguished between acute and chronic stress exposure.

1.1 | The present study

To address these important issues, we tested linear and curvilinear associations between lifetime stress exposure and psychological well-being in a sample of breast cancer survivors. On the basis of prior research demonstrating the toughening effects of moderate stress

exposure (Seery et al., 2010, 2013), we hypothesized that lifetime acute stress exposure would be related to psychological well-being in quadratic fashion, such that women reporting a moderate level of acute stress exposure would exhibit better psychological functioning (i.e., less frequent cancer-related intrusive thoughts, higher positive affect, and lower negative affect) in the wake of cancer diagnosis, compared to individuals with low or high acute stress. In contrast, we hypothesized that lifetime chronic stress exposure would have more consistently adverse effects and thus exhibit a linear relationship with psychological functioning, such that greater chronic stress would predict poorer psychological adjustment (i.e., more frequent cancer-related intrusive thoughts, lower positive, and higher negative affect). We used an in-depth, comprehensive interview-based approach to assess lifetime acute and chronic stress exposure (see Section 2.3). In regards to outcome measures, cancer-related intrusive thoughts were examined as a measure of psychological functioning directly related to the cancer experience, as these thoughts are fixated directly on cancer and its stressful characteristics. Involuntary intrusive thoughts about cancer are commonly reported among patients following cancer diagnosis, and these intrusions can persist in some patients months or even years after diagnosis and treatment (Epping-Jordan et al., 1999), with detrimental effects on behavioral symptoms (Dupont, Bower, Stanton, & Ganz, 2014), quality of life (Lewis et al., 2001), and adherence to long-term treatments (Hershman, 2016). The other outcome measures of positive and negative affect were intended to capture the more general affective experience of our participants.

2 | METHOD

2.1 | Study design

Data were collected as part of a larger study on stress, inflammation, and tumor characteristics in breast cancer survivors. Data collection occurred in two waves: (a) December 2011–September 2012, and (b) July 2014–November 2014. All participants provided informed consent. Study procedures were approved by the University of California, Los Angeles (UCLA) Institutional Review Board and complied with the Declaration of Helsinki.

2.2 | Participants

Potential participants were primarily identified using the UCLA Tumor Registry, which is part of the California Cancer Registry System. Eligibility criteria included diagnosis with early-stage breast cancer (stages I–III) within the past 6 years, resection of primary tumor at UCLA, and English proficiency. Exclusion criteria for this study were breast cancer recurrence after the target diagnosis or presence of metastatic disease. One thousand forty-four women were identified and sent mailings inviting them to participate in the study; 227 women contacted our research team to express interest in participating, plus an additional 14 women who were referred to us by their oncologist. Of these 241 women expressing interest, 225 women were then successfully contacted and screened over the phone for eligibility. One hundred eighty-five women were deemed eligible for the study;

women were most commonly excluded due to either having an additional cancer diagnosis or metastatic disease.

After eligibility had been established, participants completed a lifetime stress exposure interview, which was administered over the phone by graduate student interviewers. The stress interview took approximately 45 min in this sample. Participants were subsequently asked to complete a set of self-report questionnaires to assess aspects of psychological functioning. One hundred seventy women completed the stress interview and/or some portion of the questionnaire. Complete data for the measures of interest in this study—specifically, the stress interviews and questionnaire measures of affect and cancer-related intrusions—were available for 122 women. Importantly, women who provided complete data and were thus included in the present study ($n = 122$) did not significantly differ in terms of key demographic and medical characteristics, including age, time since diagnosis, or cancer stage, compared with women who did not provide complete data ($n = 48$; $ps > .27$).

2.3 | Measures

2.3.1 | Lifetime stress exposure

Lifetime stress exposure was assessed with the Stress and Adversity Inventory (STRAIN; Bower, Crosswell, & Slavich, 2014; Slavich & Toussaint, 2014; Toussaint, Shields, Dorn, & Slavich, 2016), a structured, online lifetime stress assessment system that systematically queries an individual's lifetime exposure to 96 different types of acute and chronic stressors that may affect health. The STRAIN is based on gold-standard, interview-based methods for assessing life stress, including the Life Events and Difficulties Schedule (Brown & Harris, 1978), and covers the same life domains assessed in these methods, including housing, education, work, treatment or health, marital or partner, reproduction, financial, legal or crime, other relationships (e.g., confidants and other friendships), accidents, deaths, and possessions. The predictive validity of the STRAIN has been demonstrated in the context of predicting mental and physical health (Toussaint et al., 2016) and cancer-related fatigue (Bower et al., 2014). Additionally, there is a substantial literature demonstrating the reliability and validity of the core questions and interview methods from which the STRAIN was developed (for reviews, see Dohrenwend, 2006; Hammen, 2005; Monroe, 2008; Monroe, Slavich, & Georgiades, 2014). The present study used the STRAIN to systematically assess participants' exposure to both acute and chronic life stressors, occurring from birth to the date of breast cancer diagnosis.

2.3.2 | Acute versus chronic stress

The STRAIN distinguishes between acute life events and chronic difficulties. Acute life events are defined as discrete, time-limited events, such as the loss of an important job, a serious accident, being the victim of a crime, a relationship breakup, or the death of a loved one. In contrast, chronic difficulties are defined as stressors that are present for at least 4 weeks, such as ongoing job strain, caretaking burden, financial difficulties, relationship strife, or housing problems. Although acute events can lead to chronic difficulties (e.g., a job loss, which produces chronic financial strain; Gottlieb, 1997), in the STRAIN, the acute and chronic aspects of a single stressful experience are treated as

separate stressors, because acute life events do not always initiate a chronic stress experience. The benefit of this approach is that it allows for examination of the potentially unique effects of the acute and chronic aspects of a single stressful experience (e.g., to compare the relative impact of losing a job with the chronic financial duress that may follow). Stress researchers have long called for the disaggregated assessment of acute and chronic stressors, in part because persistent, chronic stressors are thought to have a greater psychological impact and to cause more biological “wear and tear” than acute, time-limited stressors (Lepore, 1997; McEwen & Stellar, 1993).

2.3.3 | Cancer-related intrusions

Cancer-related intrusive thoughts were assessed with the Impact of Events Scale (Horowitz, Wilner, & Alvarez, 1979), a valid and reliable measure of subjective distress related to a specific event. We administered the 7-item intrusions subscale, which specifically taps into intrusive thoughts, nightmares, intrusive feelings, and imagery. Participants were asked to rate how often they had experienced each of the items over the past week with regard to their breast cancer, using a 4-point scale (0 = not at all, 1 = rarely, 3 = sometimes, and 5 = often). Example items include, “I thought about it when I didn’t mean to,” “Pictures of it popped into my mind,” and “Any reminder brought back feelings about it.” Scores range from 0 to 35, and higher scores indicate more frequent cancer-related intrusions.

2.3.4 | Positive and negative affect

Positive and negative affect were assessed with the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988). The Positive and Negative Affect Schedule is a valid and reliable measure, consisting of two separate 10-item subscales assessing positive and negative mood. Participants were asked to read each item and indicate to what extent they generally experienced each emotion, using a 5-point scale (1 = not at all and 5 = extremely). Example positive affect items include, “strong,” “proud,” and “content,”; example negative affect items include, “upset,” “nervous,” and “hostile.” Scores range from 10 to 50 for each subscale, with higher scores indicating more positive affect (for the positive subscale) or more negative affect (for the negative subscale).

2.3.5 | Demographic and clinical characteristics

Information on age, ethnicity, marital/relationship status, and educational background was obtained using a self-report questionnaire. Date of breast cancer diagnosis and information on cancer stage was collected from medical charts.

2.4 | Statistical analyses

Hierarchical multiple regression analyses were conducted to test linear and curvilinear relationships between lifetime stress exposure and the psychological outcome measures. Two primary indices of lifetime stress exposure were created as predictor variables: (a) an acute stress count index, calculated as the number of acute stressors endorsed by the participant as having occurred at any time in her life prior to cancer diagnosis, and (b) a chronic stress count index, calculated as the number of chronic stressors endorsed by the participant as having occurred

at any time in her life prior to cancer diagnosis. Outcome measures were treated as continuous variables and included (a) cancer-related intrusions, (b) positive affect, and (c) negative affect.

Covariates included in the models were participant’s age (at the date of STRAIN administration) and the amount of time elapsed since cancer diagnosis, calculated as the number of years between the date of cancer diagnosis and date of STRAIN administration. Age was included in the analyses as older women may have experienced more life stressors by virtue of their age alone, and because prior evidence also suggests that older women tend to report lower levels of distress (Avis et al., 2013). Time since diagnosis was included because distress has been shown to be highest immediately following cancer diagnosis for most women (Avis et al., 2013).

We used hierarchical multiple regression to test both linear and quadratic relationships between stress exposure and psychological outcomes. Quadratic trends were tested using a squared form of the predictor variable (e.g., acute stress count²). Blocks of variables were entered in the following sequence: (a) control variables (age and time since diagnosis), (b) the linear predictor term (e.g., acute stress count), and (c) the quadratic form of the predictor (e.g., acute stress count²). This strategy allowed us to examine the variance specifically attributable to the covariates and each form of the predictor. Analyses were performed using Stata Version 13.1 (StataCorp, College Station, TX, USA).

3 | RESULTS

3.1 | Sample characteristics

Demographic characteristics of the sample are presented in Table 1. Participants were primarily White, married or living as married, and college graduates, with a mean age of 59. All women were a minimum of 6 months postdiagnosis at the time of STRAIN administration, and the average time since diagnosis was 2.2 years. Thus, all participants were

TABLE 1 Demographic characteristics of the sample

Characteristic	M (SD)	Range	N = 122	%
Age	58.9 (11.6)	31.8–86		
Years since diagnosis	2.2 (1.3)	.61–5.7		
Ethnicity				
White			96	79
African American			4	3
Asian			12	10
Other			10	8
Marital status				
Married/living as married			78	64
Divorced/separated			15	12
Widowed			12	10
Single (never married)			17	14
Education status				
At most high school degree			27	22
College graduate			54	44
Postgraduate degree			41	34

beyond the initial stage of cancer diagnosis and treatment onset, and most had completed their primary treatments (i.e., surgery, radiation, and/or chemotherapy).

Table 2 provides descriptive statistics for the predictor and outcome variables, as well as their correlations. Participants reported between three and 56 acute events over the life course ($M = 15.9$, $SD = 8.6$); the most commonly reported acute events were having experienced the death of a close other (e.g., parent, spouse, and best friend) and divorce or breakup of a serious relationship. Participants reported between one and 35 chronic difficulties over the life course ($M = 11.4$, $SD = 6.4$); the most commonly reported chronic difficulties were serious illness of a close other and having held a job in which the demands were overwhelming. Cancer-related intrusions scores ranged from 0 to 31 ($M = 8.4$, $SD = 7.2$). Positive affect scores ranged from 14 to 50 ($M = 34.9$, $SD = 7.5$), and negative affect scores ranged from 10 to 36 ($M = 18.0$, $SD = 6.4$).

3.2 | Lifetime stress exposure and psychological outcomes

Hierarchical multiple regression analyses were run to test linear and curvilinear trends between acute and chronic stress count variables and the three psychological outcomes. Age and time since diagnosis were included as covariates in all models. Due to evidence of mild heteroskedasticity, robust standard errors were used. Results of key analyses are presented in Tables 3 and 4.

3.2.1 | Cancer-related intrusions

There was no significant linear association between acute stress count and cancer-related intrusions ($p > .3$; Table 3). However, results revealed a significant quadratic relationship between acute stress count and cancer-related intrusions ($b = .01$, $t(116) = 2.45$, $p = .016$, $R^2 = .12$, 95% CI [.002, .019]), such that individuals who experienced a moderate number of acute stressors reported less frequent cancer-related intrusive thoughts, compared with those with a low or high acute stress count (Figure 1; Table 3). There was no significant quadratic or linear association between chronic stress count and cancer-related intrusions ($ps > .2$; Table 4).

3.2.2 | Positive affect

There was no significant linear association between acute stress count and positive affect ($p > .7$; Table 3). However, there was a significant quadratic relationship between acute stress count and positive affect

($b = -.01$, $t(117) = -2.65$, $p = .009$, $R^2 = .06$, 95% CI [-.016, -.002]), such that individuals with a moderate number of lifetime acute stressors reported more positive affect, relative to those with a low or high acute stress count (Figure 2; Table 3). There was no significant quadratic or linear association between chronic stress count and positive affect ($ps > .5$; Table 4).

3.2.3 | Negative affect

There was a significant linear relationship between acute stress count and negative affect ($b = .19$, $t(118) = 2.03$, $p = .044$, $R^2 = .12$, 95% CI [.005, .37]), such that individuals who experienced a greater number of acute stressors reported higher levels of negative affect (Figure 3; Table 3). Similarly, there was a significant linear relationship between chronic stress count and negative affect ($b = .29$, $t(118) = 2.54$, $p = .012$, $R^2 = .14$, 95% CI [.06, .51]), such that individuals who experienced a greater number of chronic stressors reported more negative affect (Table 4). There was no significant quadratic relationship between acute stress count and negative affect ($p > .7$; Table 3), or chronic stress count and negative affect ($p > .7$; Table 4).

4 | DISCUSSION

The present study was designed to investigate the relationship between acute and chronic stress exposure over the lifetime and postdiagnosis psychological well-being among breast cancer survivors. As hypothesized, results revealed quadratic relationships between lifetime acute stressor exposure and psychological outcomes, such that individuals who had experienced moderate acute stress exhibited fewer cancer-related intrusive thoughts and higher levels of positive affect, compared to individuals with low or high acute stress exposure. These findings are consistent with prior studies showing that moderate life stress exposure is associated with well-being and resilience to subsequent stressors (Neff & Broady, 2011; Seery et al., 2010, 2013; Shapero et al., 2015), but they are the first to demonstrate such associations in cancer survivors.

How might moderate levels of stress exposure contribute to psychological resilience following cancer? One possibility is that exposure to manageable levels of stress catalyzes the development of personal, psychological, and social resources that can be harnessed to cope with future stressors (Meichenbaum & Novaco, 1985; Updegraff & Taylor, 2000), including the stressors associated with breast cancer diagnosis and treatment. Women with moderate stress exposure prior to breast

TABLE 2 Descriptive statistics and correlations of predictor and outcome variables

Variable	M	SD	1	2	3	4	5	6	7
1. Age	58.9	11.6	—						
2. Years since diagnosis	2.2	1.3	.12	—					
3. Cancer-related intrusions	8.4	7.2	-.21*	-.19*	—				
4. Positive affect	34.9	7.5	.12	.12	-.23*	—			
5. Negative affect	18.0	6.4	-.12	-.23*	.38*	-.29*	—		
6. Acute stress count	15.9	8.6	.16	-.13	-.1	.03	.25*	—	
7. Chronic stress count	11.4	6.4	-.12	.009	.11	-.06	.29*	.68*	—

* $p < .05$.

TABLE 3 Results of three hierarchical multiple regression models predicting (a) cancer-related intrusive thoughts, (b) positive affect, and (c) negative affect from acute stress count (linear and quadratic terms)

Outcome	Variable	β	t	R ²	Df	F	ΔR^2
Cancer-related intrusive thoughts	Step 1			.07	2, 118	6.08**	--
	Age	-.12	-2.31*				
	Time since diagnosis	-.96	-2.34*				
	Step 2			.08	3, 117	4.41**	.008
	Acute stress count (linear term)	-.08	-.87				
	Step 3			.12	4, 116	5.60***	.043*
Positive affect	Step 1			.03	2, 119	1.67	--
	Age	.07	1.03				
	Time since diagnosis	.62	1.31				
	Step 2			.03	3, 118	1.12	.001
	Acute stress count (linear term)	.02	.29				
	Step 3			.06	4, 117	3.90**	.03**
Negative affect	Step 1			.06	2, 119	3.71*	--
	Age	-.05	-.98				
	Time since diagnosis	-1.1	-2.39*				
	Step 2			.12	3, 118	3.63*	.06*
	Acute stress count (linear term)	.19	2.03**				
	Step 3			.12	4, 117	2.79*	.002
	Acute stress count ² (quad. term)	.002	.35				

* $p < .05$.** $p < .01$.*** $p < .001$.

cancer diagnosis may be better equipped to cope with the threats associated with breast cancer and thus demonstrate fewer intrusive thoughts and higher positive affect in the wake of cancer.

Unlike acute stress exposure, chronic stress exposure was not related to intrusive thoughts or positive affect in a quadratic fashion, suggesting that the potential toughening effects of stress exposure may be unique to acute stress. This is consistent with prior work showing that acute and chronic stress can have unique effects (McGonagle & Kessler, 1990), and with theory suggesting that stress exposure only leads to resilience when the exposure is time-limited (Dienstbier, 1989; Dienstbier, 1992).

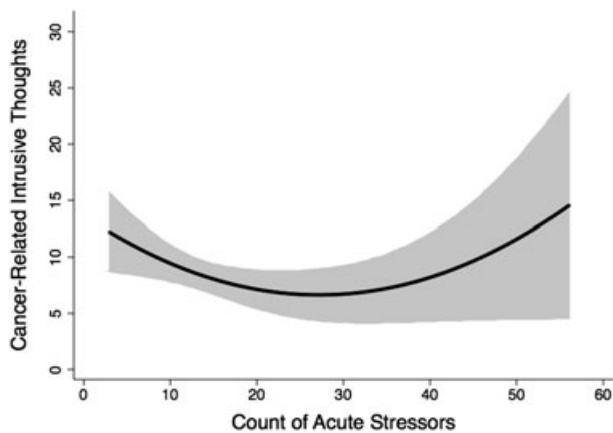
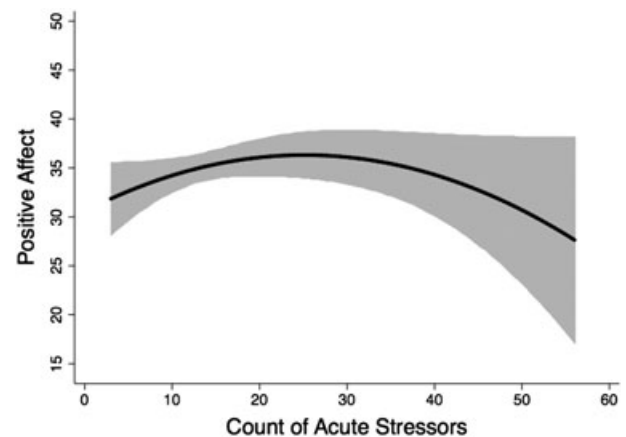
In contrast to the quadratic trends found for cancer-related intrusions and positive affect, both acute and chronic stress were related to negative affect in a positive, linear fashion, with more stress associated with more negative affect. Considered together, then, individuals who experienced the potentially toughening effects of moderate prior life stress exhibited fewer intrusive thoughts and more positive affect, but elevated levels of negative affect. Although elevations in negative affect may initially seem to speak against the resilience-building effects of moderate stress, prior work has suggested that it is not an absence of negative emotions that characterizes resilience but rather the capacity to experience positive emotions in the midst of negative emotions. For example, in a series of studies on stress resilience, Tugade and Fredrickson (2004) found that although even highly resilient individuals experienced negative emotions in the face of a stressor, what distinguished these high-resilient individuals from their low-resilient

peers was their unique ability to experience positive emotions even amidst negative emotions. Similarly, in their dynamic model of affect theory, Davis, Zautra, and Smith (2004) conceptualize resilience as an ability to sustain affective complexity (i.e., processing both the negative and positive aspects of a given situation, rather than focusing solely on the negative aspects) during times of stress. Thus, the present finding that individuals with moderate prior life stress exposure exhibit elevations in both positive and negative affect speaks to the capacity of these individuals to maintain affective complexity in the aftermath of breast cancer and therefore supports the idea that moderate stress exposure does indeed contribute to psychological resilience.

The present study has several limitations. First, due to the correlational nature of the data, it is not possible to conclude that lifetime stress exposure caused differences in intrusive thoughts or affect. It may be that those with more frequent intrusive thoughts, for example, tended to retrospectively report more lifetime stress. However, it is unclear then why those with the least frequent intrusive thoughts would have reported moderate (rather than low) acute stressors. Second, we did not assess contextual features of past stressors, such as whether the outcome of a past stressor was favorable or not, which could affect an individual's response to future stressors. For example, if a past stressor was difficult but ultimately ended favorably for the participant (e.g., a participant was laid off, but later found a better job), this could lead to a more favorable response to a subsequent stressor. Given the already considerable time burden associated with assessing lifetime stress exposure, we did not assess contextual factors

TABLE 4 Results of three hierarchical multiple regression models predicting (a) cancer-related intrusive thoughts, (b) positive affect, and (c) negative affect from chronic stress count (linear and quadratic terms)

Outcome	Variable	β	t	R ²	Df	F	ΔR^2
Cancer-related intrusive thoughts	Step 1			.07	2, 118	6.08**	--
	Age	-.12	-2.31*				
	Time since diagnosis	-.96	-2.34*				
	Step 2			.08	3, 117	4.40**	.008
	Chronic stress count (linear term)	.10	1.10				
	Step 3			.08	4, 116	3.39*	.004
Positive affect	Step 1			.03	2, 119	1.67	--
	Age	.07	1.03				
	Time since diagnosis	.62	1.31				
	Step 2			.03	3, 118	1.22	.002
	Chronic stress count (linear term)	-.05	-.68				
	Step 3			.03	4, 117	1.19	.001
Negative affect	Step 1			.06	2, 119	3.71*	--
	Age	-.05	-.98				
	Time since diagnosis	-1.11	-2.39*				
	Step 2			.14	3, 118	5.66**	.08*
	Chronic stress count (linear term)	.29	2.54*				
	Step 3			.15	4, 117	5.44***	.002
Chronic stress count ² (quad. term)		-.004	-.32				

* $p < .05$.** $p < .01$.*** $p < .001$.**FIGURE 1** Significant quadratic relationship between the number of acute stressors an individual experienced over the life course, prior to cancer diagnosis, and the frequency of cancer-related intrusive thoughts following cancer diagnosis. Individuals with a moderate number of prior acute stressors reported less frequent cancer-related intrusive thoughts, compared to individuals with a low or high number of prior acute stressors**FIGURE 2** Significant quadratic relationship between the number of acute stressors an individual experienced over the life course, prior to cancer diagnosis, and the level of positive affect following cancer diagnosis. Individuals with a moderate number of prior acute stressors reported higher levels of positive affect, relative to individuals with a low or high number of prior acute stressors

in the current study, but this is an important question for future research. Third, there was considerable variability in how much time had passed since women had been diagnosed with cancer. Although we adjusted for this statistically, studies assessing individuals' psychological functioning in the immediate aftermath of cancer diagnosis will help to better characterize the role of prior life stress in the trajectory

of psychological adjustment to breast cancer. Additionally, we did not collect comprehensive data on the treatment status of women. Although most women (86%) were more than a year postdiagnosis and thus had likely completed primary adjuvant therapy (e.g., radiation and/or chemotherapy), differences in type of treatment received could influence psychological functioning; future work should account for such differences. Finally, we were unable to test mechanisms by which

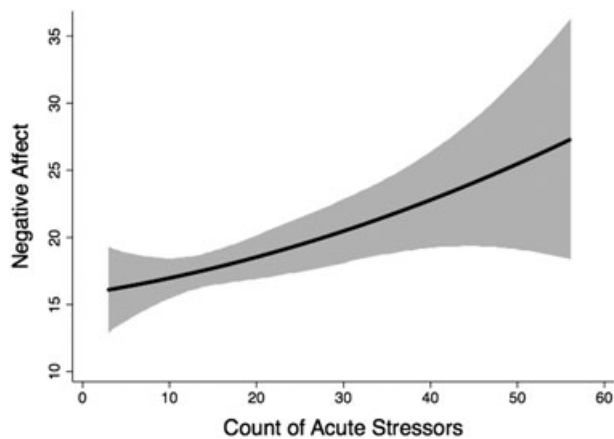


FIGURE 3 Significant linear relationship between the number of acute stressors an individual experienced over the life course, prior to cancer diagnosis, and the level of negative affect following cancer diagnosis. Increasing numbers of prior acute stressors were associated with increasing levels of negative affect

acute stress exposure may lead to psychological resilience. Theory suggests that moderate stress exposure increases an individual's sense of mastery and self-efficacy, leading to toughening effects (Dienstbier, 1989; Dienstbier, 1992), but additional research is needed to test these and other mechanisms in the context of cancer.

Despite these limitations, the present study offers several theoretical and clinical contributions. For example, although stress research has typically emphasized the negative effects of stress exposure, the present data add to a nascent literature suggesting that exposure to stressful events, in moderation, can benefit psychological health. These findings highlight the importance of testing curvilinear associations between stress and health in order to better capture the true complexity of their relationship. Moreover, this study is the first to test the potentially unique roles of acute and chronic stress exposure on resilience and suggests that only acute stress exposure may have toughening effects. The findings also highlight the role of prior stress exposure in psychological resilience to breast cancer. Positive adjustment to breast cancer has been linked to better quality of life and treatment adherence among women with breast cancer (Bender et al., 2014; Stanton et al., 2015). Thus, understanding the factors that promote resilience can begin to inform intervention efforts to increase positive psychological adjustment among breast cancer survivors, with potential implications for mental and physical health. Although interventions cannot retrospectively expose women to moderate stress, clinicians could remind women of how they have successfully coped with previous stressors, ask them to try to identify the specific tools and resources they used to cope with those stressors, and encourage them to harness these resources to help cope with the stress of breast cancer.

CONFLICT OF INTEREST

The authors have declared that they have no conflict of interest.

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