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Cancer-Related Intrusive Thoughts Predict Behavioral Symptoms Following Breast Cancer Treatment

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Objective: Behavioral symptoms are common in breast cancer survivors, including disturbances in energy, sleep, and mood, though few risk factors for these negative outcomes have been identified. Our study examined intrusive thoughts as a predictor of lingering symptoms in breast cancer survivors in the year following treatment. ***Method:*** Data come from the Moving Beyond Cancer psychoeducational intervention trial, aimed at easing the transition from patient to survivor. Women ($n = 558$) completed psychosocial questionnaires within 4 weeks posttreatment and again 2, 6, and 12 months later. We examined intrusive thoughts about cancer at the baseline assessment as a predictor of fatigue, sleep problems, pain, breast cancer-specific symptoms, depressive symptoms, negative affect, and quality of life using growth curve modeling, controlling for study condition and other covariates. ***Results:*** Intrusive thoughts were associated with higher levels of all symptoms at baseline and at the 12-month assessment. Intrusive thoughts also influenced the trajectory of pain, depressive symptoms, negative affect, and physical functioning over time; women with higher intrusions at baseline started worse and improved over time, whereas those with lower intrusions remained at a constant, lower level over time. Intrusions were not associated with the trajectory of fatigue, sleep, breast cancer-specific symptoms, or mental functioning; women with higher intrusions at baseline started worse and remained worse over time. ***Conclusion:*** Intrusive thoughts are associated with enduring elevations in behavioral symptoms and impaired quality of life in the year after breast cancer treatment and may be a risk factor for poor outcomes.

Keywords: intrusive thoughts, symptoms, quality of life, breast cancer, survivorship

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Over 2.5 million women in the United States are breast cancer survivors (Centers for Disease Control, 2007). Most women transition from cancer diagnosis and treatment into survivorship without lasting psychological or physical repercussions (Ganz et al., 1996; Lindley, Vasa, Sawyer, & Winer, 1998). A subset of women, however, do not return to their pretreatment levels of functioning and quality of life (Donovan, Small, Andrykowski, Munster, & Jacobsen, 2007; Henselmans et al., 2010). Many of these women are plagued by long-term side effects of the cancer experience, including depressive symptoms, fatigue, sleep disturbance, and pain (Bower, 2008). We use the term behavioral symptoms broadly to encompass both psychological and physical symptoms. Behavioral symptoms may persist for months or years after treatment completion and have a negative impact on social relationships, work life, and overall quality of life (de Boer, Taskila, Ojajarvi, Van Dijk, & Verbeek, 2009; Ganz et al., 1993). Identifying risk factors for poor long-term adjustment will help identify vulnerable women and facilitate the development of targeted interventions.

One potentially important risk factor for persistent symptoms in survivorship is intrusive thoughts. Intrusive thoughts are unwanted and recurrent thoughts about a stressful experience. Intrusive thoughts are common at the time of cancer diagnosis and during treatment, though typically subside after treatment completion (Andrykowski, Cordova, McGrath, Sloan, & Kenady, 2000; Epping-Jordan et al., 1999; Matsuoka et al., 2002). Cancer survivors that experience intrusive thoughts report recurrent images of cancer treatment or fears of recurrence (Smith, Redd, Peyser, & Vogl, 1999).

From a theoretical perspective, intrusive thoughts are an integral part of cognitively processing a stressful experience (Horowitz, 1986). According to cognitive processing models of adjustment, a stressful event is distressing because it challenges preexisting views of the self and the world (Horowitz, 1986; Janoff-Bulman, 1989). Recovering from such an event requires incorporating the experience either by changing one's view of the world or by changing one's view of the event to fit within existing mental models. This process is thought to involve alternating cycles of

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intrusions and avoidance, which gradually subside as the event is incorporated. In the early stages of a stressor, intrusive thoughts may be adaptive to the extent that they bring aspects of the stressor to consciousness, facilitating processing, emotional expression, and eventual integration of the experience (Lepore, Silver, Wortman, & Wayment, 1996; Tait & Silver, 1989). However, if intrusive thoughts linger well after the stressor is completed, they may be an indicator of incomplete processing and a risk factor for poor adjustment.

Several longitudinal studies of cancer patients have found that experiencing intrusive thoughts predicts worse psychological adjustment over time. In a sample of 53 patients undergoing experimental treatment for metastatic renal cell carcinoma or melanoma, increased intrusive thoughts on the day of final treatment predicted heightened distress and worse mental health 1 month later (Devine, Parker, Fouladi, & Cohen, 2003). A larger study of over 500 individuals with newly diagnosed colorectal, gastric, breast, and prostate cancer found that intrusive thoughts at diagnosis predicted increased anxiety and depression 6 months later (Nordin, Berglund, Glimelius, & Sjödén, 2001). Parallel findings were reported by this research group in a sample of 159 newly diagnosed gastrointestinal cancer patients (Nordin & Glimelius, 1999).

These reports provide initial evidence that intrusive thoughts may be a risk factor for poor psychological adjustment in mixed samples of cancer patients. Breast cancer survivors may be at particular risk, as intrusive thoughts are elevated in women with breast cancer relative to other patient groups (Nordin et al., 2001). Indeed, cross-sectional reports with breast cancer survivors have shown positive correlations between cancer-related intrusive thoughts and poor psychological adjustment both immediately after treatment completion (Anagnostopoulos, Slater, & Fitzsimmons, 2010) and several years after primary treatment (Cordova et al., 1995; Lewis et al., 2001; Matsuoka et al., 2002; Vickberg, Bovbjerg, DuHamel, Currie, & Redd, 2000). However, there are no longitudinal studies that have examined whether intrusions predict symptom trajectories over time in women with breast cancer. This question is particularly relevant for women with early stage disease, who face a long period of survivorship with annual oncology visits that provide reminders of the cancer experience.

Intrusive thoughts may also be relevant for other behavioral outcomes in breast cancer survivors, particularly physical symptoms. Disturbances in energy, sleep, and pain are common in breast cancer survivors, as are problems with cognitive function, weight gain, and menopausal symptoms (Bower, 2008; Stanton, Bernaards, & Ganz, 2005). Fatigue is perhaps the most common and distressing side effect of breast cancer treatment, with approximately one third of breast cancer survivors reporting significant levels of fatigue up to 10 years postdiagnosis (Bower et al., 2000; Lindley et al., 1998). Poor sleep quality is also common; up to 65% of breast cancer survivors report sleep problems immediately after cancer treatment and up to 42% experience persistent insomnia (Bower et al., 2011; Savard, Ivers, Villa, Caplette-Gingras, & Morin, 2011). Pain is a commonly reported and burdensome symptom. In a sample of 253 breast cancer survivors who were, on average, 9.4 years postdiagnosis, 46% reported at least some pain in the past week (Jensen et al., 2010). Despite the high prevalence of physical symptoms, few risk factors for these symptoms have been identified. Intrusive thoughts may be particularly relevant for physical symptoms, as these disruptive thoughts may disturb sleep or heighten sensitivity to physical sensations.

The goal of the current study was to examine whether intrusive thoughts at the end of active treatment predicted behavioral symptoms over the following year in a large sample of breast cancer survivors. The year after treatment, or the "reentry period," is a critical and yet understudied part of the survivorship trajectory (Stanton, 2012). As individuals transition from patient to survivor, they lose the security of frequent monitoring by medical staff, confront fears of recurrence, and report a decrease in emotional support (Allen, Savadatti, & Levy, 2009). Identifying risk factors that are measurable during the reentry period is key for determining who is at risk for poor long-term outcomes.

We hypothesized that intrusive thoughts at the end of treatment would predict worse psychological adjustment, increased physical symptoms, and decreased quality of life over the following year. We tested these hypotheses in a sample of nonmetastatic breast cancer patients who participated in the Moving Beyond Cancer (MBC) psychoeducational intervention trial (Ganz et al., 2004; Ganz, Kwan, Stanton, Bower, & Belin, 2011; Low, Stanton, Thompson, Kwan, & Ganz, 2006; Sears et al., 2003; Stanton, Ganz, et al., 2005). The MBC study was a multisite, randomized controlled trial that sought to help women make the transition from medical treatment into survivorship. Results showed that relative to receiving a standard National Cancer Institute (NCI) print material control, watching a preparatory videotape increased vitality 6 months later, particularly for women who felt unprepared for the reentry phase. Brief psychoeducational counseling was also beneficial, producing lower cancer-related distress (cancer-related intrusive thoughts, hyperarousal, and avoidance) at follow-up, but only for those who initially felt more prepared for the reentry phase (Stanton, Ganz, et al., 2005). For the current study, we looked across intervention groups at the role of intrusive thoughts measured at baseline in predicting recovery trajectories at 2, 6, and 12 months posttreatment using growth curve modeling.

Method

Procedure

With institutional review board approval, participants were recruited in surgical and medical oncology clinic sites in Los Angeles, California, Washington, D.C., and Kansas City/Lawrence, Kansas. Recruitment took place between July of 1999 and June of 2002. Clinicians referred 2,242 women to study coordinators. Of the 1,314 eligible women, 558 agreed to participate in the study. Comparisons of women who did versus did not agree to enroll in the study were conducted. Women over 65 years of age, non-White, unmarried, or less educated were less likely to enroll. Participants did not differ from nonparticipants on cancer history, cancer treatment plan, previous research participation, employment status, or initial self-reported physical functioning and mental health status (Sears et al., 2003).

Participants provided written informed consent and completed baseline questionnaires within 4 weeks after completion of active treatment (surgery, radiation, and/or chemotherapy). Women were then randomly assigned to receive one of three types of information regarding the entry into survivorship: NCI standard print material; print material and peer-modeling videotape; or print

material, videotape, two sessions with a cancer educator, and an informational workbook. Women were then followed for 1 year and completed questionnaires at 2 months (n = 463), 6 months (n = 433), and 12 months (n = 400) after randomization. Measures relevant to the current analyses are described next.

Measures

Demographic and medical variables. Demographic variables included age, ethnicity, marital status, family yearly income, and employment status. Women also reported on the date of breast cancer diagnosis, surgery type (lumpectomy, mastectomy, or mastectomy with reconstruction), and type of adjuvant therapy (chemotherapy, radiation, hormone therapy).

Intrusive thoughts. The Revised Impact of Event Scale (IES-R; Weiss, 1997) is a reliable and valid 22-item scale that assesses intrusive thoughts about breast cancer, efforts to suppress such thoughts, and hyperarousal in the past week. On a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*), respondents indicate how much they have been distressed or bothered by each symptom. Subscales were scored by summing the individual item ratings. We focused on the eight-item intrusive thoughts subscale (e.g., "pictures about it popped into my mind") with α = .85 in our sample. Higher scores on this scale indicate higher levels of distress from or frequency of intrusive thoughts. We also computed the eight-item avoidance subscale (e.g., "I tried not to think about it,"), with an α = .81, and the six-item hyperarousal subscale (e.g., "I felt watchful and on guard"), with an α = .75. Higher scores on these scales indicate more frequent attempts to avoid cancer-related thoughts and a heightened sense of arousal.

Psychological adjustment. Depressive symptoms were assessed with the Center for Epidemiologic Studies–Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item scale assessing frequency of depressive symptoms over the past week. This scale was developed for use in the general population and has been found to be valid and reliable in samples of breast cancer survivors (Hann, Winter, & Jacobsen, 1999). Participants rate each symptom with response options ranging from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). Responses are summed to create an overall score reflecting depressive symptoms, with higher scores indicating higher levels and scores above 16 suggesting clinically significant depressive symptoms. In cancer populations αs of >0.85 have been reported (Hann et al., 1999), which is slightly higher than our current study, α = .70.

The Positive and Negative Affect Scale (PANAS) is a 20-item questionnaire containing a 10-item negative affect subscale (Watson, Clark, & Tellegen, 1988). The subscale has high reliability and construct validity (Crawford & Henry, 2004), with α = .87 in our sample. The negative affect subscale contains 10 emotion adjectives: distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, and afraid. Participants rated how much they felt each emotion during the past four weeks on a response scale of 1 (*very slightly or not at all*) to 5 (*extremely*). Higher scores indicate higher levels of negative affect.

Physical symptoms. Fatigue was assessed with the 14-item Fatigue Symptom Inventory (Hann et al., 1998). This scale was developed for use in cancer patients and has strong psychometric properties (Donovan & Jacobsen, 2010). We focused on fatigue severity, which is an average of three items: most fatigue in the last week, least fatigue in the last week, and average fatigue in the last week. Participants rated each item on an 11-point scale ranging from 0 (*not at all fatigued*) to 10 (*as fatigued as I could be*). For this study, α = .83 for fatigue severity. Higher scores indicate higher fatigue severity.

Sleep quality was assessed with a two-item sleep adequacy subscale from the Medical Outcomes Study (MOS) sleep scale (Ware & Sherbourne, 1992). This scale was found to have acceptable reliability and validity in a chronically ill sample (Wells et al., 2009). Participants rated how often, in the past month, they got enough sleep to feel rested in the morning and got the amount of sleep needed. The response scale for each item ranged from 1 (*all of the time*) to 6 (*none of the time*). Scores were transformed into a 0-to-100 scale. Consistent with other MOS scales, higher scores indicate better sleep quality. Interitem correlation was r = .85.

Bodily pain was assessed with the two-item Medical Outcomes Study SF-36 Bodily Pain Scale (Ware & Sherbourne, 1992). The first item assessed the amount of bodily pain or discomfort in the past 4 weeks on a scale ranging from 1 (*none*) to 6 (*very severe*). The second item assessed the extent to which pain interfered with normal activities in the past 4 weeks on a scale of 1 (*not at all*) to 5 (*extremely*). Scores were transformed into a 0-to-100 scale. Higher scores indicate better functioning and thus lower pain. Interitem correlation was r = .72.

Breast cancer-specific physical symptoms were assessed using the 45-item Breast Cancer Prevention Trial (BCPT) Symptom Checklist (Ganz, Day, Ware, Redmond, & Fisher, 1995; Stanton, Bernaards, et al., 2005). This scale assesses symptoms that are common among breast cancer survivors, such as hot flashes and cognitive problems. Patients were asked to endorse whether they had experienced each symptom during the past 4 weeks. Positively endorsed symptoms were summed to create a total score, with higher scores indicating more symptoms.

Quality of life. The physical and mental component scores from the Medical Outcomes Study SF-36 were used as summary measures of physical and mental health-related quality of life (Ware & Sherbourne, 1992). The physical component summary score (PCS) assesses physical functioning, role limitations due to physical problems, bodily pain, and general health perceptions. The mental component summary score (MCS) assesses anxiety, depression, loss of behavioral or emotional control, and psychological well-being. Each subscale score is transformed to a 0-to-100 scale. Higher scores indicate better physical or mental health quality of life. In our study, α = .88 for standardized PCS and α = .88 for standardized MCS.

Statistical Analyses

Multilevel modeling techniques were used to model behavioral symptom change over time and examine intrusive thoughts at baseline as a predictor. We chose multilevel modeling because of the hierarchical nature of the data, with individual self-reports of adjustment nested within four time points. An advantage of multilevel modeling is that it allows for missing data in repeated measures; thus, all participants who completed a baseline assessment were included in analyses regardless of the number of follow-up assessments completed.

We conducted separate growth curve analyses for each outcome variable: depressive symptoms, negative affect, fatigue, sleep qual-

ity, pain, sum of breast cancer-specific symptoms, and overall mental and physical functioning. Predictor variables included in the models were intrusive thoughts at baseline (log transformed), time, and the interaction of intrusions and time in order to assess rate of change. Given that these data were from a larger intervention trial, we included treatment arm (control/video/video and counseling) as a control variable. Results from the original study found that perceived preparedness for reentry after cancer treatment moderated effects of the intervention on outcomes, so we also controlled for perceived preparedness and the interaction of perceived preparedness and treatment arm.

We evaluated a number of demographic and treatment-related variables for potential inclusion in the models. Variables that were either correlated at $p < .05$ with any of the dependent variables or expected to be related to the dependent variables on the basis of empirical evidence were included as covariates. Control variables significantly related to the dependent variables and included in the final models were: age, marital status, annual income, employment status, chemotherapy (yes/no), and radiotherapy (yes/no). Current tamoxifen use was also included as a covariate on the basis of prior evidence (Ganz et al., 2002).

Age was centered on the sample mean (57 years old). Preparedness was also centered on its mean. The covariance structure was unstructured. Our model specification is as follows:

$$Y_{it} = \beta_0 + \beta_1 \text{time} + \beta_2 \text{intrusions} + \beta_3 \text{time} * \text{intrusions} + \Delta + \mu_i + \varepsilon_{it}$$

t = time

i = individuals

Δ = all relevant covariates.

$\mu_i \sim N(0, T^2)$

$\varepsilon_{i\,t} \sim N(0, \sigma^2)$

Results

Sample Characteristics

A total of 558 women completed questionnaires within 4 weeks posttreatment (baseline assessment). Complete demographic information for the sample is presented in Table 1. Participants were, on average, 57 years old, and the majority were White, in a committed relationship, and employed at least part time. Half of the women had received chemotherapy, 68.1% had undergone radiation, and 54.5% were taking tamoxifen at baseline. On average, women were diagnosed with breast cancer 6.4 months before the baseline assessment.

We examined the relationships between intrusive thoughts and demographic and treatment characteristics. Younger women had more intrusive thoughts, $r = -.275$, $p < .001$, as did women who received chemotherapy versus those who did not, $t(556) = 2.92$, $p = .004$. Women who received a mastectomy with reconstruction (vs. a lumpectomy or mastectomy without reconstruction) had significantly more intrusive thoughts, $F(2, 546) = 5.74$, $p = .003$.

Description of Behavioral Symptoms

We began by conducting descriptive analyses to characterize symptom levels. Scores on intrusive thoughts and all outcome variables are presented in Table 2. Our sample is similar to previous breast cancer survivor samples, with slightly higher fatigue and lower depressive symptoms (Donovan et al., 2007; Ganz, Rowland, Desmond, Meyerowitz, & Wyatt, 1998; Otte, Carpenter, Russell, Bigatti, & Champion, 2010). All symptoms improved moderately during the first year of survivorship, except for sleep quality and pain, which remained constant.

Table 1
Baseline Characteristics for the Sample (N = 558)

Variable	Total
Age, mean (range)	56.9 (27–87)
Months since diagnosis, *M* (*SD*)	6.4 (3.1)
Ethnicity, *N* (%)	
White	480 (86.2)
Hispanic	11 (2)
African American	37 (6.6)
Asian	20 (3.6)
Other	9 (1.6)
Marital status, *N* (%)	
In committed relationship	389 (69.7)
Single	169 (30.3)
Family yearly income, *N* (%)	
Under $30,000	62 (11.3)
$30,001–$60,000	139 (25.7)
$60,001–$100,000	167 (30.9)
Over $100,000	172 (31.9)
Employment status, *N* (%)	
Employed full time	238 (42.7)
Employed part time	76 (13.6)
Retired	127 (22.8)
On temporary medical leave	27 (4.8)
Other	90 (16.2)
Treatment arm, *N* (%)	
Control	187 (33.5)
Video	187 (33.5)
Video + counseling	184 (33)
Study site, *N* (%)	
Los Angeles	279 (50)
Washington, D.C.	160 (28.7)
Kansas	119 (21.3)
Treatment type, *N* (%)	
Chemotherapy received	279 (50)
Radiation received	380 (68.1)
Currently taking tamoxifen	304 (54.5)
Type of surgery	
Lumpectomy	367 (66.8)
Mastectomy	99 (18)
Mastectomy w/ reconstruction	83 (15.1)

Intrusive Thoughts as a Predictor of Symptoms Over Time

We hypothesized that intrusive thoughts would be associated with baseline scores (intercept) and with rate of change (slope) of behavioral symptoms over time. More specifically, we hypothesized that higher intrusions at baseline would be associated with more severe symptoms at baseline and with a slower rate of recovery. Our data partially support these hypotheses. All model results are presented in Table 3.

Consistent with hypotheses, all model intercepts were significant; women with higher intrusive thoughts at baseline had worse behavioral symptoms at baseline, controlling for intervention arm and relevant covariates. We next examined whether intrusive thoughts moderated the rate of change in symptoms over time.

Table 2
Means and Standard Deviations of Intrusive Thoughts and Behavioral Symptom Scores at Four Assessments

Variable	Baseline (n = 558) M (SD)	2 months (n = 463) M (SD)	6 months (n = 433) M (SD)	12 months (n = 400) M (SD)
Intrusive thoughts (IES-R)	4.59 (4.31)	4.41 (4.55)	3.78 (4.11)	3.42 (4.04)
Depressive symptoms (CESD)	10.5 (8.72)	10.29 (9.23)	9.0 (8.08)	8.87 (7.88)
Negative affect (PANAS-NA)	16.64 (6.12)	16.65 (6.21)	15.91 (5.52)	15.72 (5.56)
Fatigue severity (FSI)	3.66 (1.87)	3.7 (1.92)	3.49 (1.91)	3.38 (1.44)
Sleep adequacy (MOS)	57.85 (28.34)	59.37 (28.13)	62.37 (27.85)	60.34 (28.15)
Pain (SF-36 Pain index)	72.43 (21.79)	73.95 (21.95)	74.73 (22.05)	75.53 (22.44)
Number of breast cancer-specific symptoms (BCPT symptom checklist)	12.28 (5.85)	12.58 (6.09)	11.91 (6.32)	11.71 (6.21)
Mental health functioning (SF-36 MCS)	48.74 (9.67)	46.48 (10.01)	51.43 (9.78)	51.72 (9.5)
Physical functioning (SF-36 PCS)	45.06 (9.87)	46.48 (10.02)	47.63 (9.7)	47.82 (9.97)

Note. M = mean; SD = standard deviation.

There was a significant interaction between intrusive thoughts and time for depressive symptoms, negative affect, pain, and physical functioning. For these outcomes, those with higher intrusive thoughts started worse and improved over time, whereas those with lower intrusive thoughts remained at a constant, lower level over time. This pattern of results is illustrated in Figure 1 of the online supplemental materials. For graphing purposes, we separated individuals by level of intrusive thoughts at baseline (at the mean, 1 *SD* above the mean, and 1 *SD* below the mean). Although the differences are not dramatic, Figures 1A through 1D of the online supplemental materials show that, for these specific outcomes, the group lines are not parallel because the recovery patterns (steepness of slope) differs as a function of the level of intrusive thoughts. The results did not support our hypothesis that high intrusions would predict a slower rate of recovery. Instead, those with high intrusions had a faster rate of recovery for these outcomes. However, despite an accelerated rate of recovery for women with high intrusive thoughts, these women still had significantly higher levels of depressive symptoms, negative affect, and pain at the 12-month assessment than women with low intrusions, as indicated by post hoc tests of marginal means. The pattern for physical functioning was somewhat different in that, by the 12-month time point, there was no significant difference between the three groups (p = .295).

We did not find a significant interaction between intrusive thoughts and time for fatigue, sleep quality, breast cancer-specific symptoms, or mental health functioning. As shown by the parallel lines in Figures 1E through 1H of the online supplemental materials, women with higher levels of intrusive thoughts had higher levels of these symptoms at baseline and stayed worse over the following year compared with women with low levels of intrusive thoughts at baseline. Post hoc tests of marginal means confirmed that women with the highest level of intrusive thoughts at baseline reported significantly worse fatigue, sleep quality, mental health functioning, and increased number of symptoms 12 months later than women with low intrusive thoughts at baseline.[1]

Exploratory Analyses of Avoidance, Hyperarousal, and Behavioral Symptoms

Although the focus of this study was on intrusive thoughts, we conducted exploratory analyses to examine whether avoidance of thoughts about cancer and hyperarousal to cancer-related thoughts (as measured by the IES-R avoidance and hyperarousal subscales) predicted behavioral symptoms over time. When avoidance replaced intrusions as a predictor in the model, model intercepts were significant for depressive symptoms, negative affect, mental health functioning, and number of symptoms. This indicates that higher levels of avoidance at baseline were associated with worse psychological adjustment and increased number of breast cancer symptoms at baseline, controlling for intervention arm and relevant covariates. Avoidance was unrelated to fatigue, sleep, pain, and physical function scores at baseline.

We next examined whether avoidance moderated the rate of change in symptoms over time. There was a significant interaction between avoidance and time for depressive symptoms only. Women with higher avoidance reported higher depressive symptoms at baseline and improved over time at a faster rate than women with lower avoidance at baseline. Tests of marginal means showed that women with the highest level of avoidance (+1 *SD* above mean) at baseline reported significantly worse mental health functioning and increased number of breast cancer specific symptoms at the 12-month assessment compared with women with low avoidance; differences for other behavioral symptoms were not significant.

When hyperarousal replaced intrusive thoughts as a predictor in the model, all model intercepts were significant; women with higher hyperarousal at baseline had worse behavioral symptoms at baseline, controlling for intervention arm and relevant covariates. There was a significant interaction between hyperarousal and time for depressive symptoms, negative affect, mental health functioning, and pain. Similar to the pattern for intrusions, women with higher hyperarousal started worse and improved over time, whereas women with lower hyperarousal remained constant over time. Tests of marginal means showed that women with high hyperarousal (+1 *SD* above mean) at baseline reported higher levels of all symptoms except for pain and physical functioning at the 12-month assessment compared with women with low hyperarousal.

[1] Exploratory analyses examined whether behavioral symptoms at baseline predicted intrusive thoughts over time, as requested by one of the reviewers. There was a significant association between higher symptoms at baseline and higher intrusive thoughts over the following year.

Table 3
Coefficients of The Growth Curve Models of Behavioral Symptom Trajectories

	Psychological adjustment		Physical symptoms				Quality of life	
	Depressive symptoms *Estimate* (*SE*)	Negative affect *Estimate* (*SE*)	Fatigue *Estimate* (*SE*)	Sleep *Estimate* (*SE*)	Pain *Estimate* (*SE*)	Specific symptoms *Estimate* (*SE*)	Mental health functioning *Estimate* (*SE*)	Physical functioning *Estimate* (*SE*)
Fixed Effects								
Predictors								
Intrusive thoughts	7.66*** (.83)	5.38*** (.56)	1.05*** (.2)	−13.67*** (2.98)	−12.88*** (2.42)	5.35*** (.67)	−7.95*** (.98)	−3.98*** (1.11)
Time	.04 (.08)	.04 (.05)	−.01 (.02)	−.13 (.23)	−.28 (.19)	−.07 (.04)	.1 (.09)	−.01 (.08)
Time × Intrusive thoughts	−.25** (.08)	−.19*** (.05)	−.0 (.02)	.33 (.24)	.55** (.2)	−.07 (.04)	.17 (.09)	.23** (.08)
Covariates								
Age	−0.11*** (.03)	−.13*** (.02)	−.01 (.01)	.59*** (.12)	−.11 (.09)	−.07** (.03)	.23*** (.04)	−.18*** (.05)
Married vs. Not married	−1.79** (.89)	−.28 (.46)	−.13 (.17)	3.58 (2.55)	1.82 (2.06)	−.55 (.58)	1.35 (.81)	1.35 (.97)
Income (reference group: <$30,000/year)								
$30–60k	1.95* (1.02)	1.23 (.7)	.29 (.26)	−5.72 (3.84)	−3.45 (3.09)	−.26 (.88)	−1.72 (1.22)	−.95 (1.45)
$60–100k	.87 (1.05)	1.17 (.71)	.14 (.27)	−5.61 (3.94)	−.75 (3.18)	−.55 (.9)	−.11 (1.25)	−.14 (1.5)
Over $100k	.32 (1.1)	.72 (.74)	−.06 (.28)	−7.24 (4.11)	−1.26 (3.31)	0 (.94)	.28 (1.3)	.28 (1.55)
Employed at least part−time	−.77 (.67)	−.94* (.45)	−.02 (.17)	−4.39 (2.51)	2.66 (2.02)	−.39 (.57)	.36 (.79)	2.12* (.95)
Chemotherapy	1.11 (.63)	1.0* (.43)	.17 (.16)	−5.2* (2.36)	−.4 (1.9)	−.38 (.54)	−2.51** (.75)	1.1 (.89)
Radiation	.53 (.62)	.12 (.42)	.01 (.16)	1.72 (2.31)	−1.09 (1.86)	−.61 (.53)	.08 (.75)	−1.18 (.87)
Currently taking tamoxifen	−.11 (.6)	.07 (.4)	−.33 (.15)	5.73* (2.22)	−1.62 (1.79)	−.53 (.51)	.49 (.7)	.12 (.84)
Treatment arm (reference group: Arm 1)								
Arm 2	.88 (.79)	.22 (.54)	0 (.2)	−1.06 (2.85)	−2.75* (2.32)	.65 (.64)	.03 (.94)	−1.63 (1.06)
Arm 3	1.23 (.79)	.43 (.54)	.2 (.2)	−4.08 (2.83)	−4.95* (2.31)	1.19 (.63)	−1.09 (.94)	−.8 (1.05)
Preparedness	−1.22** (.44)	−.46 (.3)	−.17 (.11)	−.62 (1.64)	1.11 (1.32)	−.62 (.37)	.79 (.52)	.63 (.62)
Treatment Arm × Preparedness (reference group: Arm 1)								
Arm 2	.36 (.57)	.11 (.39)	−.09 (.14)	1.43 (2.12)	−.38 (1.71)	−.06 (.49)	.15 (.67)	−.06 (.8)
Arm 3	.22 (.59)	−.21 (.4)	−.04 (.15)	1.6 (2.2)	.83 (1.77)	.1 (.5)	.24 (.7)	−.08 (.83)
Treatment Arm × Time								
Arm 2	.01 (.08)	.01 (.05)	−.01 (.02)	.49* (.24)	.04 (.2)	.02 (.04)	−.04 (.09)	.1 (.07)
Arm 3	.07 (.08)	.03 (.05)	.01 (.02)	−.11 (2.37)	.09 (.2)	0 (.04)	0 (.09)	−.01 (.08)
Random effects								
Intercept variance	23.86 (2.28)	10.98 (1.05)	1.68 (.15)	377.62 (31.74)	239.89 (20.75)	21.09 (1.66)	33.68 (3.21)	56.75 (4.54)
Slope variance	32.67 (1.35)	15.16 (.63)	1.58 (.07)	292.97 (12.08)	212.32 (8.77)	10.41 (.43)	46.02 (1.9)	31.6 (1.31)

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

Discussion

Findings from this study indicate that intrusive thoughts predict worse behavioral symptoms in the year after active breast cancer treatment. Breast cancer survivors who experienced higher levels of cancer-related intrusive thoughts in the weeks after completion of surgery, radiation, and/or chemotherapy were more likely to report higher levels of psychological distress, more severe physical symptoms, and worse quality of life over the following year.

These results are consistent with previous cross-sectional studies showing positive associations between intrusive thoughts and poor psychological adjustment in cancer populations (e.g., Greenberg et al., 1997; Vickberg et al., 2000; Epping-Jordan et al., 1999), and extend this area of research in several ways. First, our findings indicate that intrusive thoughts are associated with physical as well as psychological adjustment in the critical year after breast cancer treatment. Specifically, intrusive thoughts predicted elevations in fatigue, sleep disturbance, and pain, which are among the most common and distressing side effects of breast cancer treatment. Second, our results suggest that women who experience intrusive thoughts in the immediate aftermath of cancer treatment are at risk for persistent psychological and physical problems. Those who reported high intrusive thoughts continued to report elevated depressive symptoms, fatigue, sleep disturbance, and pain, and lower mental health functioning at 1-year posttreatment. Slow recovery of these symptoms in the initial year after treatment may portend persistent difficulties in the years to come (Bower et al., 2006).

Our results also map on to theoretical models of adjustment to stressful experiences that emphasize the importance of cognitive processing (Horowitz, 1986; Janoff-Bulman, 1989). According to Horowitz (1986), individuals who undergo a stressful or traumatic event experience alternating cycles of intrusive thoughts about the stressor and efforts to avoid thinking about it as they attempt to process and integrate the experience. Although intrusions are thought to be adaptive in the immediate aftermath of a stressor, our results suggest that persistent intrusions can become toxic and are associated with impairments in psychological and physical recovery.

Exploratory analyses examined whether attempts to avoid thinking about cancer, another component of the cognitive processing model, were also associated with behavioral symptoms in the year after cancer treatment. Results showed that avoidance was associated with worse psychological adjustment and elevated breast cancer-related symptoms at baseline. However, unlike intrusions, avoidance was not related to fatigue, sleep disturbance, pain, and physical function at baseline or to trajectories of physical symptoms over the following year. These results suggest that intrusions may have more potent effects on physical symptoms than avoidance.

There are several possible mechanisms through which intrusive thoughts may lead to increased physical symptoms. Constant reminders of the cancer experience may lead to catastrophizing, which can exacerbate symptoms (Jacobsen, Andrykowski, & Thors, 2004). In addition, recurrent, unwanted thoughts about cancer may lead to hypervigilance or hyperarousal to signs of cancer recurrence through heightened awareness of bodily sensations, resulting in overreporting of symptoms. Indeed, exploratory analyses suggested that women with higher levels of cancer-related hyperarousal experienced more psychological and physical symptoms at baseline and over time. Intrusive thoughts may also lead to increased activity in neuroendocrine and immunologic stress pathways (Lutgendorf et al., 2008; Andersen et al., 1998; Mundy-Bosse, Thornton, Yang, Andersen, & Carson, 2011), with potential effects on depressive symptoms, fatigue, and other sickness behaviors (Bower, 2008). Future research should explore psychological and biological mechanisms through which cognitive disruptions may increase the experience of physical symptoms.

There is initial evidence that psychological interventions that help women process their experience can decrease intrusive thoughts. In a randomized controlled study by Antoni et al. (2006), a 10-week cognitive behavior stress management intervention in 199 women newly treated for nonmetastatic breast cancer was effective in reducing intrusive thoughts postintervention; this effect persisted 9 months later. A supportive expressive group therapy intervention in metastatic breast cancer patients showed a decrease in total IES score over 12 months; however, the effect was primarily driven by a decrease in avoidance attempts, not a decrease in intrusions (Classen et al., 2001). Future interventions should explore whether decreases in intrusive thoughts lead to subsequent improvements in physical functioning and physical symptoms.

Strengths of the current study include the large sample size, the longitudinal, prospective study design, and sophisticated statistical techniques that enabled us to look at symptom trajectories over time. There are also several limitations. First, intrusive thoughts before treatment, which we did not measure, may predict symptoms during treatment, in turn leading to more intrusive thoughts and creating a cycle of cognitive and physical disruptions. Alternatively, symptoms experienced during treatment may have led to both increased intrusive thoughts and increased symptoms in the posttreatment period. In a sample of 151 women who had recently finished active treatment for breast cancer, Jim, Andrykowski, Munster, and Jacobsen (2007) found that physical symptoms during treatment predicted increased intrusive thoughts and general distress 4 months later. Exploratory analyses in our sample revealed similar results; behavioral symptoms at treatment completion predicted intrusive thoughts over time, suggesting a bidirectional relationship between intrusive thoughts and symptoms. Prospective studies that follow women from the time of diagnosis through the posttreatment period are needed to probe the temporal relationship between intrusive thoughts and symptom onset and persistence.

A second limitation is that our study design did not allow us to test potential moderators of intrusive thoughts such as the social environment. Previous studies have shown that social constraints and social support moderate the association between intrusions and adjustment in individuals with cancer, such that intrusive thoughts are associated with increased distress only those who are socially constrained (Devine et al., 2003; Lepore, 2001; Lepore & Helgeson, 1998; Lepore & Revenson, 2007). Future studies should include measures of the social environment to examine these moderating effects. Finally, our sample is representative of women with early-stage breast cancer in the regions from which participants were recruited, but results may not be generalizable to other groups of breast cancer survivors, including women with metastatic disease, or other cancer samples.

Breast cancer survivors who experience persistent cancer-related symptoms are stuck in a middle ground between sick and well. Identifying women who are at risk for difficulties in recovery, and why, is critical for implementing targeted interventions. Our study provides evidence that intrusive thoughts are one such

potential risk factor, and a potential target for screening and intervention efforts.

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