



Understanding the roles of patient symptoms and subjective appraisals in well-being among breast cancer patients

Adrian N. S. Badana¹ · Victoria R. Marino¹ · Maureen E. Templeman¹ · Susan C. McMillan² · Cindy S. Tofthagen³ · Brent J. Small¹ · William E. Haley¹

Received: 5 July 2018 / Accepted: 18 February 2019 / Published online: 8 March 2019
© Springer-Verlag GmbH Germany, part of Springer Nature 2019

Abstract

Purpose To examine the roles of both patient symptoms, and subjective appraisals of stress (self-efficacy, symptom barriers, symptom distress), in understanding well-being (anxiety, depression, cancer-specific quality of life, mental health quality of life, and physical health quality of life) in breast cancer patients.

Methods We examined data from 104 female breast cancer patients. Using a stress process model, we hypothesized that while high levels of patient symptoms would be associated with poorer patient well-being, these effects would be mediated by subjective appraisals, including patient self-efficacy, perceived symptom barriers, and symptom distress.

Results As expected, higher levels of patient symptoms were associated with poorer well-being on all five indicators. Subjective appraisals of stress added significantly to predictors of well-being, and were mediators of this relationship across all five outcomes.

Conclusions While patient symptoms are important predictors of patient well-being, subjective appraisals of the stressfulness of symptoms, and of patients' self-efficacy in managing symptoms, are also key factors. The findings suggest the utility of a stress process model in understanding well-being in breast cancer patients, and point to the potential value of targeting patient appraisals as well as symptoms to improve psychological well-being and quality of life.

Keywords Breast cancer · Cancer symptoms · Oncology · Psychological distress · Stress appraisal · Well-being

Introduction

Breast cancer is the most common cancer experienced by women in the USA, with more than 250,000 new cases reported per year [1]. In spite of the improvements in breast cancer survival rates, many patients continue to experience both physical and emotional symptoms during and following their cancer treatment. The most common distressing symptoms reported by breast cancer patients undergoing treatment

are insomnia, fatigue, and nausea [2, 3]. Other symptoms that have been found to be significant stressors include musculoskeletal pain, impaired limb movement, cognitive disturbances, changed sexuality, and swelling of arms or legs [4]. Symptoms have been found to be significant stressors for women with breast cancer [5], and are important factors affecting patient outcomes including quality of life, anxiety, and depression [6, 7]. Experiencing multiple cancer symptoms may contribute to greater psychological distress in women with breast cancer, such as higher levels of depression and anxiety [8–10]. While improving symptoms is a high priority in clinical settings, well-being is affected by multiple factors beyond symptom occurrence. Cancer symptoms may not fully explain distress in persons with cancer due to individual differences in patients' perceptions of symptoms [11].

According to stress process theories, an individual's subjective appraisal (i.e., perception) of objective stressors (e.g., symptoms) affects the level of impact stressors have on that person's well-being [12]. Patients can vary greatly in the ways that they interpret or subjectively appraise symptoms.

✉ Adrian N. S. Badana
abadana@mail.usf.edu

¹ School of Aging Studies, University of South Florida, 13301 Bruce B. Downs Blvd, 4202 E. Fowler Ave., MHC 1300, Tampa, FL 33612, USA

² College of Nursing, University of South Florida, 12901 Bruce B. Downs Blvd., MDC Box 22, Tampa, FL 33612, USA

³ Department of Nursing, Mayo Clinic, 4500 San Pablo Rd, Jacksonville, FL 32224, USA

Differences in perceptions of cancer symptoms can range from positive appraisals (feeling that symptoms are manageable and that they are able to function well in spite of them), to negative appraisals (feeling frightened, overwhelmed, or even helpless in reaction to symptoms). These subjective appraisals of stress can function as important mediators of the relationship between stressors and patient outcomes [11].

Symptom distress is a form of appraisal that is the degree of discomfort, suffering, or physical or mental anguish that a patient reports as a result of their experience of these symptoms that they perceive [13]. Symptom distress has been found to be more closely related to patient outcomes than just the magnitude of symptoms alone [9]. How an individual appraises his or her cancer symptoms may be altered by other factors, such as anxiety, support, and even time [3]; therefore, symptom distress is an inter-individualistic aspect of cancer treatment that can be attributed to patient perception.

Another form of appraisal, self-efficacy, is a resource that allows patients to appraise symptoms more benignly as they cope with cancer-related stress [14]. Self-efficacy has been shown to reduce perceived stress and thereby improve patient quality of life [5, 15, 16]. Self-efficacy for coping with cancer symptoms also has been found to predict symptom resolution [5, 16, 17], and serve as a mediator between stress and quality of life [18]. Furthermore, self-efficacy is related to symptom distress [19], number of symptoms reported [20], symptom intensity [21], anxiety and depression [14], and quality of life [7, 14].

Cancer patients' well-being may also be affected by their perceived barriers to symptom management [22]. Patients who perceive more barriers to symptom

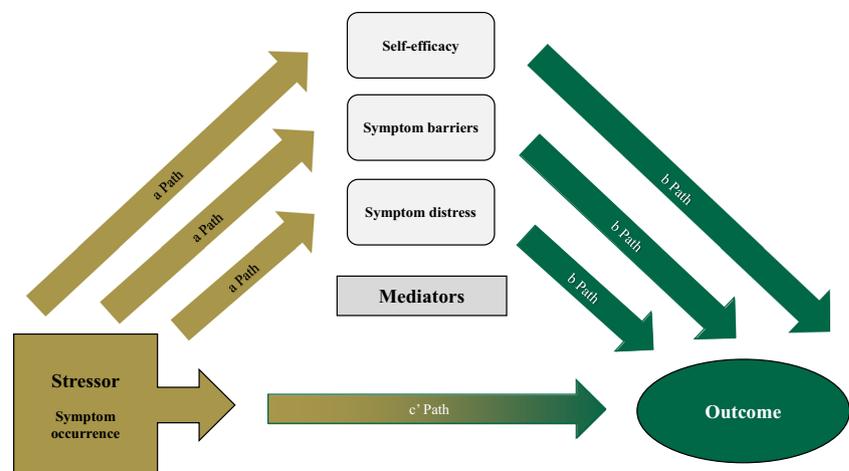
management are less likely to experience improved outcomes [10, 23]. Understanding how both patients' symptoms and appraisals affect well-being may be important and relevant in cancer care. Moreover, understanding and intervening with patients' perceptions and appraisals may be an essential avenue for intervention beyond symptom management. Previous research has mostly studied a single form of appraisal; therefore, including the three different aforementioned forms of appraisal will provide more insight into the relationship between cancer patients' perceptions of cancer symptoms and outcomes of health and well-being.

Conceptual framework

To better understand how breast cancer patients' perceptions of cancer symptoms are related to psychological distress, a stress process model was used as the basis for this cross-sectional, descriptive study (Fig. 1). Utilizing a stress process model as a theoretical framework that has been used successfully in previous research on cancer and well-being [24, 25] allowed us to examine and test the relationships between cancer symptoms and well-being and psychological distress while accounting for patients' perceptions. That is, individual differences in patients' perceived self-efficacy, symptom distress, and perceived symptom barriers may mediate the relationship between cancer symptoms and patient well-being.

Our project had the following aims: *Aim 1*. To examine whether breast cancer patients' well-being was associated with their physical symptoms (viewed as a stressor in the stress process model). Based on the previous literature, we predicted that higher levels of physical symptoms would be

Fig. 1 Multiple mediation stress process scheme



associated with poorer well-being across the diverse measures. *Aim 2.* To examine whether patients' appraisals of the stressfulness of their symptoms, their self-efficacy, and their perceived barriers to cancer treatment were associated with their well-being. We predicted that higher appraisals of stressfulness and barriers, and lower appraisals of self-efficacy, would be associated with poorer well-being. *Aim 3.* To evaluate whether patient appraisals of stressfulness of symptoms, self-efficacy, and symptom barriers mediated the relationships between the stressor (patient symptoms) and outcomes (patient well-being). We predicted that these variables would mediate this relationship, but we also explored which appraisals would be most important in this relationship.

Methods

Participants

Our sample was obtained from a larger study of cancer patients recruited for a randomized trial of an intervention to enhance caregiver coping and well-being at a large, comprehensive cancer center in the Southeastern United States. The study was approved by the Institutional Review Board at the University of South Florida [Pro00013488]. For the larger study, 3369 cancer patients were approached; 1759 refused participation, and 1076 were excluded due to not meeting inclusion criteria, therefore leaving 534 cancer patients for the study. Patients provided written informed consent before participating in the study. Inclusion criteria for the study included having scores of at least four or more (on a scale of 0 (least) to 10 (most) on measures of cancer symptom intensity, distress, and interference) on at least two of a list of 22 cancer symptoms. Participants also had to be at the beginning of their cancer treatment, read/understand English, have an Eastern Cooperative Oncology Group score of 3 or less (indicating sufficient functional status), and have a Short Portable Mental Status score of 8 or more. Exclusion criteria for the study included: non-melanoma skin cancer diagnosis, being within 6 weeks after surgery, unavailability during the study period, placement in hospice, or having a life expectancy of 3 months or less. Because we wanted to utilize a more homogeneous sample in the current study, we included only female participants diagnosed with breast cancer. While focusing on patients with breast cancer did diminish the sample size, using a more homogenous group of patients in these analyses helped us to avoid problems with the heterogeneity of symptoms across different types of cancer. We compared the analytic sample of breast cancer patients to patients in the larger study sample with other cancer types to determine if they differ on demographic measures. Results of the comparative analyses showed that the breast cancer sample was generally consistent with the larger sample of participants. There were 108 total

breast cancer patients. One male patient and three patients with missing data on study measures were excluded, leaving 104 patients who were included in the present analyses.

Measures

Participants reported information on age, sex, ethnicity/race, and education at the baseline interview. Other measures represent components of the stress process model: stressors, mediators (stress appraisal measures), and outcomes.

Stressor

Symptom occurrence was assessed using the Cancer Symptom Scale (CSS), which lists 33 common cancer symptoms (e.g., pain, vomiting, and hair loss) [26]. Participants reported whether a symptom occurred in the past week (yes/no). A summed variable was computed for the total number of symptoms the participant experienced in the past week.

Mediators: appraisals of stress

Self-efficacy was assessed using the Cancer Behavior Inventory Brief version (CBI-B), which is a 12-item instrument with summed rating scales ranging from 1 (not at all confident) to 9 (completely confident) [27]. The instrument is designed to assess whether a participant believes that he or she can successfully enact behaviors designed to result in a desired outcome, such as improved symptom management. Higher scores indicate greater cancer-related self-efficacy. Validity of the measure is shown by positive correlations with measures of quality of life and optimism, and negative correlations with depression and sickness impact. Reliability for the measure in the current sample was $\alpha = 0.91$. Barriers to symptom management were measured using the Symptoms Barriers Questionnaire, a 9-item scale designed to assess barriers to management of symptoms other than pain [28]. Participants were presented with statements representing reasons why people do not like to talk about symptom occurrence and treatment, such as: "It does not do any good to talk about symptoms," "Medicine cannot relieve cancer symptoms," or "Good patients avoid talking about symptoms." Participants were asked to indicate how accurate each of the statements were for them on a scale ranging from 0 (strongly disagree) to 5 (strongly agree). Higher scores indicated that participants perceived greater barriers to symptom relief. Reliability for the questionnaire in the current sample was $\alpha = 0.77$.

Global symptom distress was assessed using the CSS [26]. Participants were asked about how distressing they found the symptoms that they reported on the CSS, using a scale of 0 (least) to 10 (most). Symptom distress scores were totaled for all symptoms to create a total score. Participants who reported more symptoms and higher item distress scores have higher

Global Distress Scores. Previous research supports the validity of this measure of appraisal of symptom distress [26]. As predicted, the correlation between the CSS and quality of life was significant but moderate ($r = 0.50$; $p < .001$) indicating that they measure two related but distinctly different concepts. The alpha for the Global Symptom Distress was very strong ($r = .76$).

Outcomes

State anxiety was assessed using the State-Trait Anxiety Inventory (STAI, 20-item) on a 4-point summated rating scale (1 to 4). State scale scores can range from 20 (no anxiety) to 80 (highest anxiety) [29]. Several studies have utilized the STAI among individuals with cancer and have found significant correlations between anxiety and various cancer-related symptoms [30, 31]. Reliability for the measure in the current sample was $\alpha = 0.92$. A score of 39 or higher indicates high levels of anxiety [32]. The Centers for Epidemiological Studies—Depression Scale (CES-D) is widely used to measure depressive symptoms and detect individuals at risk for depression. It has been translated into multiple languages for use in diverse populations, has impressive reliability, validity, sensitivity, and specificity. It has also been established as a reliable measure of depressive symptoms in breast cancer patients [33, 34]. This measurement is ideal for measuring depression in individuals with cancer since it does not include physical symptoms (i.e., fatigue, change in appetite, or weight) that are commonly seen in non-depressed individuals with cancer. Thus, this scale helps to avoid over-diagnosis of depressive symptoms in this population. The 10-item, dichotomous (yes or no) version of the CES-D was used for this study. Reliability for the measure in the current sample was $\alpha = 0.68$. A score of 4 or higher indicates significant depressive symptoms [35]. Quality of life was assessed using the multidimensional quality of life—cancer (MQOL-C), a 33-item measure that assesses four dimensions of quality of life [7, 36]. Items are scaled 0 to 10 with total scale scores that range from 0 (lowest) to 330 (highest quality). Validity was supported by significant correlations with measures of depression and social and physical functioning. Reliability for the measure in the current sample was $\alpha = 0.91$.

We used the Medical Outcomes Survey (MOS) SF-36, which includes 36 items to assess mental and physical well-being [37, 38]. The mental well-being items ($\alpha = 0.91$) and physical well-being items ($\alpha = 0.81$) both had high internal consistency in this sample.

Statistical analyses

We used SPSS, version 24 (SPSS Inc., Chicago, IL), for statistical analyses. We first conducted correlation analyses to examine any significant associations between stressors,

appraisal variables, and outcomes. Using a stress process model as a guiding framework, we used Hayes PROCESS macros [39] to examine the direct effect of stressor variables on each of the five outcomes, as well as the extent to which the influences were mediated through the appraisal variables. Figure 1 shows the stress process mediation scheme that guided the mediation analyses. Significance for all analyses was established at the $\alpha = 0.05$ level, and the mediation analyses used 10,000 bootstrapped estimates, as recommended by Hayes [39].

Results

The overall sample was predominantly Caucasian, non-Hispanic, and on average received more than secondary education. The majority of the sample reported undergoing chemotherapy treatment (73.1%) and 45 participants (43.3%) reported at least one metastatic site. Participants reported more than 40% of the listed cancer symptoms and generally reported high self-efficacy, low symptom barriers, and moderate symptom distress. Using the cut points noted above, 32 patients (31%) had CES-D scores suggestive of significant depressive symptoms, and 30 (29%) had elevated State Anxiety scores. Table 1 displays the descriptive statistics of the sample.

Correlation analyses

Pearson's and Spearman's correlations were conducted to examine significant associations between demographic, stressor, stress appraisal, and well-being measures. None of the demographic variables were significantly correlated with either the stress appraisal variables or the outcome variables ($p < .05$). Table 2 shows the correlations between all variables in this study.

Mediation analyses

Multiple mediation analyses were conducted to examine significant mediation pathways of the three stress appraisal variables (i.e., self-efficacy, symptom barriers, symptom distress) separately for each of the five outcomes (anxiety, depression, quality of life, and both mental and physical health). Figure 1 displays the multiple mediation stress process scheme used for this study. Table 3 displays the estimates and statistical significance of the indirect and direct paths for each of the five outcomes. As a guide to this table, the “a” paths represent the effect of the stressor (e.g., symptom occurrence) on the mediators (e.g., appraisals of stress) and the “b” paths represent the effect of the mediators on the five outcomes. Direct effects, shown in the c' path (Fig. 1), denote a direct association from the stressor to the outcome variable that is independent of the mediating variable. Across all models, symptom occurrence

Table 1 Demographics, stressors, appraisals, and well-being in breast cancer patients

Variable	Participants (<i>n</i> = 104)	
	<i>M</i> (<i>n</i>)	SD (%)
Demographics		
Age (years)	56.04	10.70
Ethnicity/race (Caucasian)	(85)	(81.70)
Education (years)	14.22	2.58
Treatment		
Radiation	(6)	(5.8)
Chemotherapy	(76)	(73.1)
Both	(11)	(10.6)
Other	(11)	(10.6)
Metastatic site (yes)	(45)	(43.3)
Time since diagnosis (years)	3.38	2.33
Stressors		
Symptom occurrence using CSS	14.73	6.11
Appraisals		
Symptom barriers using SBQ	1.29	0.65
Symptom distress using CSS	5.24	1.73
Self-efficacy using CBI-B	7.30	1.23
Well-being		
Anxiety using STAI	33.38	10.88
Depression using CES-D-10	2.65	2.00
Quality of life using MQOL-Cancer	6.52	1.21
Mental health using SF-36	46.25	7.87
Physical health using SF-36	36.27	9.89

CSS Cancer Symptom Scale, SBQ Symptoms Barriers Questionnaire, CBI-B Cancer Behavior Inventory, STAI State-Trait Anxiety Inventory, CES-D-10 Center for Epidemiological Studies Depression Scale short form, MQOL-Cancer multidimensional quality of life cancer, SF-36 Short Form Health Survey

was significantly associated with each of the three appraisal variables. Specifically, higher symptom occurrence was associated with lower self-efficacy, higher symptom barriers, and higher symptom distress. The results of the mediating relationships for each of the five outcome measures are shown below.

- For *anxiety*, two of the mediated paths were statistically significant. Higher anxiety was related to lower self-efficacy and higher symptom distress. A comparison of the magnitude of these indirect effect indicated that self-efficacy was the stronger mediated relationship ($\beta = 0.239$, $SE = 0.100$, $CI [0.072, 0.470]$). There was no significant direct effect of symptom occurrence on anxiety independent of the mediated relationships.
- For *depression*, neither the direct effect of symptom occurrence nor the indirect effects through the mediators were statistically significant.

- All three of the mediated relationships were statistically significant for *quality of life*. Better quality of life was associated with higher self-efficacy and lower symptom barriers and symptom distress. A comparison of the magnitude of the mediated effects indicated that self-efficacy was a stronger mediator of the effect of symptom occurrence on quality of life ($\beta = -0.022$, $SE = 0.010$, $CI [-0.045, -0.006]$) as compared to symptom barriers. Independent of the mediated relationships, higher symptom occurrence scores were related to lower quality of life.
- Two of the mediated relationships were statically significant for *mental health*. Lower self-efficacy and higher symptom distress were associated with worse mental health, with self-efficacy exhibiting the strongest relationship ($\beta = -0.133$, $SE = 0.068$, $CI [-0.301, -0.026]$). There was a significant direct effect of symptom occurrence on mental health.
- Only one mediated path was statistically significant for *physical health*. In this case, higher symptom distress was associated with poorer physical health. Independent of the mediated relationships, the direct effect of symptom occurrence on physical health remained statistically significant.

Discussion

Our sample focused on patients receiving treatment for breast cancer, and the recruitment-targeted patients who had at least moderate numbers of cancer symptoms. The sample also showed significant levels of psychological distress, with 32 patients (31%) reporting CES-D scores suggestive of significant depressive symptoms, and 30 (29%) reporting elevated State Anxiety scores. Such patients are greatly in need of treatment to reduce symptoms and the psychological sequelae of these symptoms. While much of cancer care focuses on improving patient symptoms, our results demonstrate that symptom distress, barriers, and self-efficacy all mediate the relationship between symptom occurrence and well-being. These findings are consistent with the stress process model and our hypotheses. The pattern of mediation varied somewhat across the five dependent variables measuring well-being, but self-efficacy and symptom distress were most commonly significant as mediators. Patients with higher self-efficacy may be better able to process symptom-related information and find appropriate ways to manage symptoms, therefore improving their well-being and quality of life [17]. Patients with higher self-efficacy may also be better able to process symptom-related information and accurately associate symptoms with their cause, thereby

Table 2 Correlations between demographics, primary stressors, mediators, and outcomes

Measure	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Age	–	.255**	–.158	–.078	.009	.148	.051	–.116	–.030	.162	.047	–.024
2. Education		–	.048	.171	–.013	–.096	.010	.026	–.094	.019	–.037	–.024
3. Ethnicity			–	–.056	.133	–.034	.145	–.088	–.063	–.025	.035	.033
4. Symptom occurrence				–	.214*	–.373**	.322**	.385**	.334**	–.514**	–.448**	–.349**
5. Symptom barriers					–	–.433	.200*	.409**	.319**	–.462**	–.368**	–.202*
6. Self-efficacy						–	–.268**	–.662**	–.405**	.646**	.546**	.262**
7. Symptom distress							–	.405**	.395**	–.494**	–.392**	–.457**
8. Anxiety								–	.478**	–.667**	–.643**	–.304**
9. Depression									–	–.640**	–.652**	–.413**
10. Overall QOL										–	.654**	.696**
11. SF-12 mental											–	.192
12. SF-12 physical												–

$n = 104$; Patient symptoms a count of dichotomous (yes or no), ethnicity recoded as white or other, education in years, age in years; symptom distress score is average distress rating per symptom endorsed

QOL quality of life, SF short form

* $p < .05$; ** $p < .01$ correlation between mental and physical well-being trending at $p = .051$

reducing anxiety related to the symptoms [17]. Patients may vary considerably in how distressing they find their symptoms based on a variety of factors, including the subjective meanings they assign to symptom occurrence.

Appraisals of symptom barriers were much less consistent in their relationship to well-being than appraisals of symptom distress and self-efficacy. Symptom barrier appraisals did mediate the relationship between symptom occurrence and specific components of mental health. The instrument used to assess symptom barriers in the current study assessed patient perceptions of barriers to symptom management such as fatalistic attitudes, fears of distracting the team from its mission to treat the cancer, fears of addiction, and other side effects [28].

Our analyses did not find evidence that self-efficacy, symptom distress, or barriers mediated the relationship between symptom occurrence and depression. Depression has been identified as the most common psychological symptom in breast cancer [40]. The mean scores for depression did not meet the cutoff of 4 or higher on the 10-item version that indicates significant depressive symptomatology [35]. Perhaps, the low depression scores in this sample affected our depression-related results.

Symptom distress was the only significant mediator between symptom occurrence and physical health-related quality of life. This finding is consistent with previous research that has found that patients who perceive their physical symptoms to be distressing are likely to perceive that the symptoms are adversely effecting both their

physical and emotional well-being, as well as their overall quality of life [26].

This study had important limitations to be noted. First, the analyses are cross-sectional in nature, so they do not show potential change over time and cannot demonstrate causal relationships. Longitudinal data analysis should be used in future research to explain changes in symptoms, stress appraisal, and well-being in individuals with breast cancer across different time points. Second, our sample may not be fully representative of breast cancer patients for several reasons. The sample was drawn from a single site that is a designated National Cancer Institute cancer center; some patients refused to participate, and participants were required to have at least moderate symptomatology. We did not have information comparing individuals who were in the sample versus those who either declined participation or who were ineligible. It is possible that those who enrolled are not representative with respect to demographic, socioeconomic, or symptoms experienced, which could have influenced our findings.

Clinical implications

Our findings suggest that interventions aimed at improving outcomes related to well-being in breast cancer should also address not only efforts to reduce symptoms (which can be challenging), but also how patients subjectively appraise the stress of cancer and their symptoms. In particular, self-efficacy and perceptions of the subjective stressfulness of symptoms appear important. Incorporating assessment of these appraisals, and appropriate interventions to modify them, may

Table 3 Mediation results

Variables	a Path β (SE)	b Path β (SE)	Indirect effect β (SE)	Direct effect (c' Path) β (SE)
Anxiety				
Symptom occurrence → self-efficacy → anxiety	−0.071 (0.019)*	−4.00 (0.781)*	0.284 (0.094)*	−
Symptom occurrence → symptom barriers → anxiety	0.023 (0.010)*	1.94 (1.40)	0.045 (0.040)	−
Symptom occurrence → symptom distress → anxiety	0.068 (0.027)*	1.49 (0.482)*	0.101 (0.064)*	−
Symptom occurrence → anxiety	−	−	−	0.237 (0.140)
Depression				
Symptom occurrence → self-efficacy → depression	−0.071 (0.019)*	−0.144 (0.249)	0.010 (0.023)	−
Symptom occurrence → symptom barriers → depression	0.023 (0.010)*	0.645 (0.501)	0.015 (0.020)	−
Symptom occurrence → symptom distress → depression	0.068 (0.027)*	0.167 (0.166)	0.011 (0.017)	−
Symptom occurrence → depression	−	−	−	0.085 (0.049)
Quality of life				
Symptom occurrence → self-efficacy → quality of life	−0.071 (0.019)*	0.397 (0.078)*	−0.028 (0.009)*	−
Symptom occurrence → symptom barriers → quality of life	0.023 (0.010)*	−0.246 (0.139)	−0.006 (0.004)*	−
Symptom occurrence → symptom distress → quality of life	0.068 (0.027)*	−0.214 (0.048)*	−0.015 (0.007)*	−
Symptom occurrence → quality of life	−	−	−	−0.047 (0.014)*
Mental health				
Symptom occurrence → self-efficacy → mental health	−0.071 (0.019)*	2.31 (0.587)*	−0.164 (0.060)*	−
Symptom occurrence → symptom barriers → mental health	0.023 (0.010)*	−1.33 (1.05)	−0.031 (0.029)	−
Symptom occurrence → symptom distress → mental health	0.068 (0.027)*	−1.02 (0.362)*	−0.069 (0.044)*	−
Symptom occurrence → mental health	−	−	−	−0.301 (.105)*
Physical health				
Symptom occurrence → self-efficacy → physical health	−0.071 (0.019)*	0.317 (0.849)	−0.023 (0.062)	−
Symptom occurrence → symptom barriers → physical health	0.023 (0.010)*	−0.296 (1.52)	−0.007 (0.037)	−
Symptom occurrence → symptom distress → physical health	0.068 (0.027)*	−2.14 (0.524)*	−0.145 (0.086)*	−
Symptom occurrence → physical health	−	−	−	−0.358 (0.153)*

* $p < .05$

represent important opportunities for clinical intervention that may yield improvements in distress and quality of life. Previous studies have successfully emphasized appraisal as a focus of interventions for cancer patients, family caregivers, and couples [41–43].

Conclusions

The findings from this study support the application of the stress process model to better understand the complex relationships between symptoms, appraisals, and well-being in persons with breast cancer. Since cancer and cancer-related symptoms have enormous potential to adversely affect physical and emotional well-being and quality of life, understanding mediators of those relationships is useful toward implementing effective interventions.

Funding information Research reported in this article was funded in part through a Patient-Centered Outcomes Research Institute (PCORI) Award (CE-12-11-4025). The statements in this article are solely the

responsibility of the authors and do not necessarily represent the views of the Patient-Centered Outcomes Research Institute (PCORI), its Board of Governors or Methodology Committee.

Compliance with ethical standards

The study was approved by the Institutional Review Board at the University of South Florida [Pro00013488].

Conflict of interest The authors declare that they have no conflict of interest.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

1. American Cancer Society, (2017) Cancer facts & figures, American Cancer Society, Atlanta
2. Boehmke MM (2004) Measurement of symptom distress in women with early-stage breast cancer. *Cancer Nurs* 27:144–152
3. Liao MN, Chen SC, Chen SC, Lin YC, Chen MF, Wang CH, Hsu YH, Hung HC, Jane SW (2015) Change and predictors of symptom

- distress in breast cancer patients following the first 4 months after diagnosis. *J Formos Med Assoc* 114:246–253
4. Rosedale M, Fu MR (2010) Confronting the unexpected: temporal, situational, and attributive dimensions of distressing symptom experience for breast cancer survivors. *Oncol Nurs Forum* 37:E28–E33
 5. Byrna EA, Given BA, Given CW, You M (2009) The effects of mastery on pain and fatigue resolution. *Oncol Nurs Forum* 36:544–552
 6. Chou FY, Dodd M, Abrams D, Padilla G (2007) Symptoms, self-care, and quality of life of Chinese American patients with cancer. *Oncol Nurs Forum* 34:1162–1167
 7. Pud D, Ben Ami S, Cooper BA, Aouizerat BE, Cohen D, Radiano R, Naveh P, Nikkhou-Abeles R, Hagbi V, Kachta O, Yaffe A, Miaskowski C (2008) The symptom experience of oncology outpatients has a different impact on quality-of-life outcomes. *J Pain Symptom Manag* 35:162–170
 8. Lengacher CA, Reich RR, Post-White J, Moscoso M, Shelton MM, Barta M, Le N, Budhrani P (2012) Mindfulness based stress reduction in post-treatment breast cancer patients: an examination of symptoms and symptom clusters. *J Behav Med* 35:86–94
 9. McMillan SC, Small BJ (2007) Using the COPE intervention for family caregivers to improve symptoms of hospice homecare patients: a clinical trial. *Oncol Nurs Forum* 34:313–321
 10. Yeom H, Heidrich SM (2009) Effect of perceived barriers to symptom management on quality of life in older breast cancer survivors. *Cancer Nurs* 32:309–316
 11. Scott SE, McGurk M, Grunfeld EA (2007) The process of symptom appraisal: cognitive and emotional responses to detecting potentially malignant oral symptoms. *J Psychosom Res* 62:621–630
 12. Lazarus RS, Folkman S (1987) Transactional theory and research on emotions and coping. *Eur J Personal* 1:141–169
 13. McCorkle R, Young K (1978) Development of a symptom distress scale. *Cancer Nurs* 1:373–378
 14. Mystakidou K, Parpa E, Tsilika E, Galanos A, Vlahos L (2008) General perceived self-efficacy: validation analysis in Greek cancer patients. *Support Care Cancer* 16:1317–1322
 15. Hoffman AJ, von Eye A, Gift AG, Given BA, Given CW, Rothert M (2009) Testing a theoretical model of perceived self-efficacy for cancer-related fatigue self-management and optimal physical functional status. *Nurs Res* 58:32–41
 16. Liang SY, Yates P, Edwards H, Tsay SL (2008) Factors influencing opioid-taking self-efficacy and analgesic adherence in Taiwanese outpatients with cancer. *Psychooncology* 17:1100–1107
 17. Shelby RA, Edmond SN, Wren AA, Keefe FJ, Peppercorn JM, Marcom PK, Blackwell KL, Kimmick GG (2014) Self-efficacy for coping with symptoms moderates the relationship between physical symptoms and well-being in breast cancer survivors taking adjuvant endocrine therapy. *Support Care Cancer* 22:2851–2859
 18. Kreitler S, Peleg D, Ehrenfeld M (2007) Stress, self-efficacy and quality of life in cancer patients. *Psychooncology* 16:329–341
 19. Curtis R, Groarke A, Sullivan F (2014) Stress and self-efficacy predict psychological adjustment at diagnosis of prostate cancer. *Sci Rep* 4:5569
 20. Motl RW, Snook EM, McAuley E, Gliottoni RC (2006) Symptoms, self-efficacy, and physical activity among individuals with multiple sclerosis. *Res Nurs Health* 29:597–606
 21. Kurtz ME, Kurtz JC, Given CW, Given BA (2008) Patient optimism and mastery-do they play a role in cancer patients' management of pain and fatigue? *J Pain Symptom Manag* 36:1–10
 22. Riley-Doucet C (2010) Beliefs about the controllability of pain: congruence between older adults with cancer and their family caregivers. *J Fam Nurs* 11:225–241
 23. Bagecivan G, Tosun N, Komurcu S, Akbayrak N, Ozet A (2009) Analysis of patient-related barriers in cancer pain management in Turkish patients. *J Pain Symptom Manag* 38:727–737
 24. Haley WE, LaMonde LA, Han B, Burton AM, Schonwetter R (2003) Predictors of depression and life satisfaction among spousal caregivers in hospice: application of a stress process model. *J Palliat Med* 6:215–224
 25. Bigatti SM, Stiener JL, Miller KD (2012) Cognitive appraisals, coping and depressive symptoms in breast cancer patients. *Stress & Health* 28:255–261
 26. McMillan S, Toftagen C, Choe R, Reingans J (2015) Assessing symptoms experienced by patients with cancer: occurrence, intensity, distress, interference and frequency. *J Hosp Palliat Nurs* 17:56–65
 27. Merluzzi TV, Nairn RC, Hegde K, Martinez Sanchez MA, Dunn L (2001) Self-efficacy for coping with cancer: revision of the Cancer Behavior Inventory (version 2.0). *Psychooncology* 10:206–217
 28. Wells N, Johnson RL, Wujcik D (1998) Development of a short version of the Barriers Questionnaire. *J Pain Symptom Manag* 15:294–297
 29. Spielberger CD, Gorsuch RL, Lushene R, Vagg PR, Jacobs GA (1983) Manual for the State-Trait Anxiety Inventory. Consulting Psychologists Press, Palo Alto, CA
 30. Challis GB, Stam HJ (1992) A longitudinal study of the development of anticipatory nausea and vomiting in cancer chemotherapy patients: the role of absorption and autonomic perception. *Health Psychol* 11:181–189
 31. Heim HM, Oei TPS (1993) Comparison of prostate cancer patients with and without pain. *Pain* 53:159–162
 32. Julian LJ (2011) Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). *Arthritis Care Res (Hoboken)* 63(Suppl 11):S467–S472
 33. Radloff LS (1977) The CES-D scale: a self report depression scale for research in the general population. *Appl Psychol Meas* 1:385–401
 34. Hann D, Winter K, Jacobsen P (1999) Measurement of depressive symptoms in cancer patients: evaluation of the center for epidemiological studies depression scale (CES-D). *J Psychosom Res* 46:437–443
 35. Cheng ST, Chan AC (2005) The Center for Epidemiologic Studies Depression Scale in older Chinese: thresholds for long and short forms. *Int J Geriatr Psychiatry* 20:465–470
 36. Rustøen T, Moum T, Padilla G, Paul S, Miaskowski C (2005) Predictors of quality of life in oncology outpatients with pain from bone metastasis. *J Pain Symptom Manag* 30:234–242
 37. Ware JE, Sherbourne CD (1992) The MOS 36-item Short-Form Health Survey (SF-36). *Med Care* 30:473–483
 38. Ware JE, Snow KK, Kosinski M, Gandek B (1993) SF-36 Health Survey manual and interpretation guide. The Health Institute, Boston: MA
 39. A.F. Hayes.(2012) PROCESS: a versatile computational tool for observed variable mediation, moderation, and conditional process modeling. The Ohio State University,
 40. Tojal C, Costa R (2015) Depressive symptoms and mental adjustment in women with breast cancer. *Psychooncology* 24:1060–1065
 41. McMillan S, Small BJ, Weitzner M, Schonwetter R, Tittle M, Moody L, Haley WE (2006) Impact of coping skills intervention with family caregivers of hospice patients with cancer. *Cancer* 105:214–222
 42. Baik OM, Adams KB (2011) Improving the well-being of couples facing cancer: a review of couples-based psychosocial interventions. *J Marital Fam Ther* 27:250–266
 43. Lee V, Cohen SR, Edgar L, Laizner AM, Gagnon AJ (2006) Meaning-making intervention during breast or colorectal cancer treatment improves self-esteem, optimism, and self-efficacy. *Soc Sci Med* 62:3133–3145