Support Care Cancer (2017) 25:1401–1407
DOI 10.1007/s00520-016-3533-3

ORIGINAL ARTICLE

Fear of recurrence or progression as a link between somatic symptoms and perceived stress among cancer survivors

Daniel L. Hall[1,2] · **Inga T. Lennes**[3] · **William F. Pirl**[4] · **Emily R. Friedman**[3,5] · **Elyse R. Park**[1,3,5]

Received: 15 July 2016 / Accepted: 5 December 2016 / Published online: 13 December 2016

Abstract
Purpose Many cancer survivors report experiencing somatic symptoms as well as elevated stress. Theoretical models have suggested that physical symptoms generate subjective stress via fears of recurrence or progression. To date, this indirect effect has not been established empirically. This study aimed to provide preliminary evidence as to whether fear of recurrence or progression is an intermediary between somatic symptom severity and perceived stress among heterogeneous cancer survivors.
Methods Adult cancer survivors (N = 67; median 2.4 years since diagnosis; 34% male) presenting at a hospital survivorship clinic completed measures assessing somatic symptom severity (Patient Health Questionnaire-15 (PHQ-15)), perceived stress (four-item Perceived Stress Scale (PSS-4)), and fear of recurrence or progression (Assessment of Survivor Concerns (ASC)). Interrelatedness among variables was assessed using Pearson correlations. Indirect effects were modeled using 5000-iteration bootstrapping.
Results Survivors endorsed a range of somatic symptom severity (29% minimal, 39% low, 18% medium, and 14% high). Somatic symptoms, perceived stress, and fear of recurrence or progression were all significantly positively correlated (rs 0.29 to 0.47). Controlling for time since diagnosis, there was a significant indirect effect of somatic symptom severity on stress via fear of recurrence or progression [B = 0.06, SE = 0.04 (95% CI 0.01–0.16)]. The model accounted for more than one third of the variance in perceived stress [R^2 = 0.35, $F(3,54)$ = 9.59, $p < 0.001$].
Conclusions Survivors with greater somatic symptoms tended to report higher levels of stress, due in part to elevated fears of recurrence or progression. Our findings support concerns about recurrence or progression as a mechanism underlying stress states in cancer survivors. Efforts to assist survivors with stress management should teach strategies for managing cancer-related uncertainties stemming from somatic symptoms.

Keywords Cancer · Oncology · Survivorship · Fear of recurrence · Stress · Symptoms

✉ Daniel L. Hall
dhall7@mgh.harvard.edu

Inga T. Lennes
ilennes@partners.org

William F. Pirl
wfp14@med.miami.edu

Emily R. Friedman
erfriedman@mgh.harvard.edu

Elyse R. Park
epark@mgh.harvard.edu

[1] Harvard Medical School/Massachusetts General Hospital, Boston, MA, USA

[2] Harvard Medical School/Beth Israel Deaconess Medical Center, Boston, MA, USA

[3] Massachusetts General Hospital Cancer Center, Boston, MA, USA

[4] Sylvester Comprehensive Cancer Center, Miller School of Medicine, University of Miami, Miami, FL, USA

[5] Mongan Institute for Health Policy, Massachusetts General Hospital, Boston, MA, USA

Introduction

Cancer survivorship has increased steadily over the last 50 years, with 19 million survivors projected to be living in the USA by 2024. Regardless of cancer type, survivors often

experience persistent physical health concerns, including fatigue [1, 2] and pain [3]. Collectively, physical sequelae of cancer and/or its treatment constitute a psychosocial burden on survivors that can significantly impair survivors' mental health [4, 5].

According to biopsychosocial models of distress in cancer, somatic symptoms can influence psychosocial stress by way of patients' cognitive appraisals of stimuli related to cancer diagnosis, treatment, and survivorship [6, 7]. These cognitions include interpretations, judgments, and beliefs regarding cancer-related events or cues [8]. Chief among these is fear of recurrence or progression [9], with moderate to high levels present in 30–70% of cancer survivors [10, 11]. Fear of recurrence or progression can be triggered by cancer-related stimuli throughout survivorship, such as follow-up appointments [12, 13]. Survivors' worries about disease recurrence or progression may continue for years after treatment ends [12, 14, 15] and can persist at levels equal to that experienced at the time of diagnosis [16].

It has been suggested that fear of recurrence or progression acts as an intermediary between somatic symptoms and poor psychological outcomes. Theoretical models, including uncertainty in illness theory and the cognitive-behavioral model of health anxiety, emphasize the centrality of fear of recurrence or progression as a mechanism underlying stress states among cancer survivors [17–21]. Fardell and colleagues' [21] recent review highlights an overall paucity of studies examining indirect pathways in these models; most quantitative support comes from bivariate correlations that are added to models in a piecemeal fashion. For instance, evidence suggests that survivors' fear of recurrence or progression can be triggered by physiological symptoms [12, 22] on one hand and are associated with poorer psychological adjustment [23] on the other. However, to date, the indirect effect of somatic symptoms on perceived stress levels via fear of recurrence or progression has not been examined empirically.

The present study thus aimed to specifically address this gap; we hypothesized that within a sample of heterogeneous cancer survivors, (1) the severity of somatic symptoms would be positively associated with stress, and (2) these associations would be driven by an indirect effect via fear of recurrence or progression.

Methods

Sample

As described previously [24], this sample was comprised of patients receiving care at the cancer survivorship clinic at the Massachusetts General Hospital (MGH) Cancer Center (N = 67). The current study utilized an abbreviated version of a survey meant to guide patients' clinical encounters, completed prior to their first appointment with a survivorship clinician. The Institutional Review Board of the MGH/Partners Human Research Committee approved this research.

Measures

Sociodemographic and medical characteristics Participants reported their age, gender, race, education level, partner status, and insurance status. Time since diagnosis and cancer type data were collected from participants' electronic health record.

Somatic symptom severity Items assessing somatic symptoms were obtained from the Patient Health Questionnaire-15 (PHQ-15) [25]. The PHQ-15 is a psychology measure which assesses the severity of medically under-explained physical symptoms. Although its items have been used in studies of cancer patients [26], it was originally developed to measure somatization and somatoform disorders. Participants rated the degree to which they were bothered by 15 physical health concerns over the past month on a three-point Likert scale ranging from 0 ("not bothered at all") to 2 ("bothered a lot"). Total scores range from 0 to 30 and are interpreted as minimal (0 to 4), low (5 to 9), medium (10 to 14), or high (15 to 30) [25]. In the present study, the PHQ-15 had acceptable internal consistency (α = 0.76).

Fear of recurrence or progression Fear of recurrence or progression was measured using the Assessment of Survivor Concerns (ASC) [27]. The ASC asked participants to rate the frequency of worries over the past 2 weeks related to "future diagnostic tests," "another type of cancer," "my cancer coming back," "dying," and "my health." Response options were on a four-point Likert scale ranging from 1 ("not at all") to 4 ("very much"). Cronbach's alpha in the current sample was excellent (α = 0.92).

Perceived stress Perceived stress was measured using the four-item Perceived Stress Scale (PSS-4) [28]. Items asked survivors to recall how frequently they have experienced psychosocial difficulty over the past month. Responses were presented on a five-point Likert scale ranging from 0 ("never") to 4 ("very often"). Cronbach's alpha in this sample was good (α = 0.82).

Data analyses

Participants entered data directly into a secure online database using Research Electronic Data Capture (REDCap) software. All data were analyzed using SPSS version 20.0. Data were examined for normality of distributions. Descriptive statistics assessed patients' sociodemographic and cancer characteristics, somatic symptoms, perceived stress, and fear of recurrence or progression. Interrelatedness among main study

variables was calculated using Pearson correlations. For correlational analyses, p values at the two-sided alpha level of <0.05 were considered statistically significant.

Indirect effects were modeled using the Preacher and Hayes [29] method with 5000-iteration bootstrapping [30]. A regression model was constructed with somatic symptom severity as the independent variable. Fear of recurrence or progression was entered as the mediating variable, and the dependent variable was perceived stress. Time since diagnosis was used as a covariate. The model was run twice, once with covariates and once without. After running the models for a 5000-iteration bootstrapping, a 95% confidence interval for each indirect effect was produced for interpretation. For each model, if the confidence interval for the indirect effect did not contain zero, the effect is significantly different from zero, implying partial mediation. The magnitudes of these effects are presented as unstandardized regression coefficients.

Results

Demographic and medical characteristics of participants are presented in Table 1. Participants were primarily non-Hispanic white (92%) and female (62%). The sample was comprised of survivors of various cancers, chiefly those of the breast (32%), gastrointestinal sites (18%), and lymphoma/myeloma (18%). Survivors were on average 4.57 years since diagnosis (SD = 5.45 years, range = 0.18 to 30.87 years). The median time since diagnosis was 2.43 years.

Table 2 summarizes the main study variables. Survivors reported a wide range of somatic symptom severity. On average, participants reported low symptom severity (M = 7.95, SD = 4.75, observed range 1–20). For descriptive purposes, scores were also calculated within established severity ranges. Approximately one third (29%) of participants had minimal levels. The modal response endorsed low levels, with 39% of participants' scores falling within 5 to 9. The remaining one third of participants endorsed either medium (18%) or high (14%) levels of somatic symptom severity.

With regard to psychological concerns, survivors on average endorsed moderate levels of both fear of recurrence or progression (M = 2.60, SD = 0.95, observed range 0–4) and perceived stress (M = 6.72, SD = 3.66, observed range 0–14). As hypothesized, somatic symptom severity was positively correlated with greater perceived stress (r = 0.47, p < 0.001). Additionally, fear of recurrence or progression was independently positively associated with both somatic symptom severity (r = 0.29, p = 0.02) and levels of perceived stress (r = 0.38, p = 0.002).

Next, a model was tested to examine fear of recurrence or progression as an intermediary between physical symptoms and perceived stress (see Fig. 1). Consistent with our hypothesis, the indirect effect of somatic symptom severity on perceived stress via fear of recurrence or progression was

Table 1 Demographic and medical characteristics (N = 67)

	M (SD)/n (%)
Age (years)	51.8 (12.2)
Gender (men)	23 (34.3%)
Race (non-Hispanic white)	61 (91.0%)
Education (completed college)	50 (74.6%)
Relationship status (partnered)	44 (65.7%)
Insurance type	
Private	57 (85.1%)
Other	9 (13.4%)
Time since diagnosis (years)	4.21 (5.56)
Cancer type	
Breast	21 (31.3%)
Gastrointestinal	12 (17.9%)
Genitourinary	3 (4.5%)
Gynecologic	2 (3.0%)
Head/neck	6 (9.0%)
Lung	1 (1.5%)
Lymphoma/myeloma	12 (17.9%)
Melanoma	6 (9.0%)
Sarcoma	4 (6.0%)
Thyroid	2 (3.0%)
Cancer stage[a]	
I	15 (22.4%)
II	21 (31.3%)
III	13 (19.4%)
IV	16 (23.9%)
Treatment type	
Surgery	55 (83.3%)
Chemotherapy	58 (87.9%)
Radiation	44 (65.7%)

M mean, *SD* standard deviation

[a] Two participants' primary cancer site data not discernible from available records

Table 2 Descriptive statistics of key study variables

Variable	Mean	SD	Pearson correlations		
			A	B	C
A Somatic symptom severity	7.95	4.75	1	0.29*	0.47***
B Fear of recurrence or progression	2.60	0.95		1	0.38**
C Perceived stress	6.72	3.66			1

SD standard deviation

*$p \le 0.05$, **$p \le 0.01$, ***$p \le 0.001$

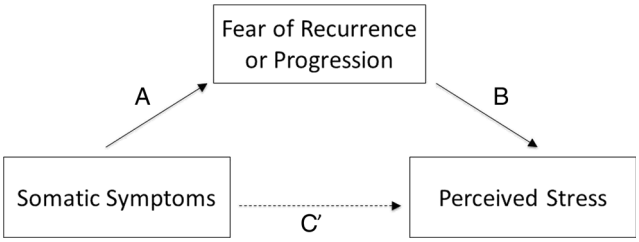

Fig. 1 Conceptual model of fear of recurrence or progression as an intermediary between somatic symptoms and perceived stress among cancer survivors

statistically significant controlling for time since diagnosis [$B = 0.06$, SE = 0.04 (95% CI 0.01–0.16)]. Overall, the indirect effect model accounted for more than one third of the variance in perceived stress scores [$R^2 = 0.35$, $F(3,54) = 9.59$, $p < 0.001$].

Time since diagnosis had a negative, borderline-significant relation with perceived stress [$B = -0.14$, SE = 0.07, $p = 0.06$]. To ensure that its inclusion in the model did not lead to spurious effects [31], the model was rerun without covariates, and results were not affected.

Discussion

This study sought to investigate whether fear of recurrence or progression is an intermediary between somatic symptoms and perceived stress among cancer survivors. As hypothesized, physical symptoms and psychosocial stress levels were highly related, and indeed, this association was partially explained by survivors' fear of recurrence or progression acting as an intermediary linking these phenomena. To the best of our knowledge, this is the first study to provide empirical evidence for this path and highlight the centrality of fear of recurrence or progression to the study of stress in cancer patients.

Despite on average being more than 4 years since diagnosis, 32% of participants in this study endorsed elevated somatic symptoms. This prevalence is consistent with literature describing the transition from early to long-term cancer survivorship, whereby health-related concerns decrease from occurring in the majority to a minority of survivors [5]. Consistent with previous findings, an exploratory examination of individual items on the PHQ-15 demonstrated that the most frequently endorsed physical concerns in our sample were fatigue (79%) and limb and joint pain (59%) [32, 33]. Furthermore, ratings of the 15 physical health concerns were for the most part positively correlated, suggesting that survivors tended to have co-occurring symptoms.

In the period beyond diagnosis and active treatment, cancer survivors are faced with not just somatic concerns but emotional challenges as well. Handling fear of cancer recurrence or progression is one of the most prominent [9] and common, with moderate to high levels present in 30–70% of cancer survivors [10, 11]. Concerns about additional cancer diagnoses, recurrence, progressions, or death are likely to persist throughout survivorship, as former patients will continue to encounter cancer-related triggers (e.g., follow-up appointments, public health campaigns, new diagnoses in family or friends) after treatment ends [12, 13, 34]. In line with these findings, survivors in the present study on average endorsed moderate to high levels of fear of recurrence or progression. Similarly, participants reported elevated levels of stress. The average PSS-4 score in our sample ($M = 6.72$) was 1.5 times higher than that observed in the general population ($M = 4.49$) [35]. Taken together, these results support literature implicating fear of recurrence or progression and stress as common and pressing concerns among cancer survivors.

As hypothesized, physical health concerns were positively correlated with stress ratings. These findings corroborate a vast and established literature linking physical and mental health symptoms among cancer survivors [5, 36, 37]. While these relationships may be bidirectional in nature [37], the "top-down" hypothesis that stress causes or worsens physical health in cancer is somewhat controversial, requires measurement of multiple biological intermediaries, and has produced inconsistent findings depending on the psychoneuroimmunological pathway examined [38]. Alternatively, the "bottom-up" hypothesis that somatic concerns cause or worsen psychological stress has face validity and consistent empirical support. Given the cross-sectional nature of the data collected, a statement of causality is beyond the scope of the present investigation and may be more appropriately interpreted within theoretical models of stress in cancer. More broadly, the strong positive correlation ($r = 0.47$) we observed supports literature linking these phenomena in general. Given the diagnostic heterogeneity in our sample, this association may generalize across a wide array of survivor subgroups.

This study is the first to test a pathway linking somatic symptoms to perceived stress by way of fear of recurrence or progression. Overall, the indirect effect model was statistically significant and explained 35% of the variability in perceived stress levels across survivors. In other words, these data suggest that one third of stress levels among cancer survivors is accounted for by somatic concerns and resulting fear of recurrence or progression. This indirect effect model lends empirical support to multiple theoretical models highlighting fear of recurrence or progression as a mechanism underlying stress in cancer survivors, including uncertainty in illness theory and the cognitive-behavioral model of health anxiety [17–21]. Of note, the

magnitudes of the observed relationships among these variables are nearly identical with previous literature examining intolerance of uncertainty, a variable related to cancer-related worries and fears [23]. The current study builds on Eisenberg et al.'s [23] findings, as survivors in the present study were heterogeneous with respect to gender and cancer site, suggesting that these associations are generalizable to a broader range of cancer survivors. Factors accounting for survivors' stress levels that were not evaluated in this study include unemployment/medical leave, restructured social support networks and new social support needs, and mental health concerns such as depression and anxiety [5].

The indirect effect model summary statistics were not affected by covarying time since diagnosis, underscoring the relevancy of fear of recurrence or progression in linking physical and subjective stress states for both early and long-term survivors. Adaptation to survivorship has been described to be a process [5], such that triggers of fears of recurrence or progression are likely to change throughout survivorship, [39] coinciding with and, as our findings suggest, potentially mediating evolving physical and mental health concerns.

There is emerging support for the impact and sustainability of psychosocial interventions on fear of recurrence or progression among cancer survivors. Mishel et al. found that a brief, telephone-delivered uncertainty management intervention improved survivors' confidence in their ability to cope with fear of recurrence or progression 20 months post-intervention [40, 41]. More recently, trials have found preliminary support for the efficacy of a cognitive existential group intervention for survivors of breast or gynecological cancer [42], as well as a mindfulness-based stress reduction protocol adapted for breast cancer survivors [43–45], on reducing fear of recurrence or progression. Our findings suggest that these effects may be driven by either (a) improvements in symptoms that trigger fear of recurrence or progression or (b) survivors' interpretations of somatic symptoms. Indeed, a primary strategy of several interventions discussed here is teaching participants to decatastrophize their appraisals of cancer-related concerns. Future fear of recurrence or progression interventions could deliberately target the appraisals of somatic concerns, which may include psychoeducation, cognitive-behavioral techniques, and acceptance-based skills.

While fear of recurrence or progression was associated with higher perceived stress, a certain level of concern may in fact be adaptive. Vigilance to signs of a potential recurrence may motivate health-promoting behaviors. Fear of recurrence or progression may also prompt interpersonal connectedness, with survivors calling on social support from formal or informal caregivers [46]. Given this potential for positive outcomes, we identify a need for further research into interventions that help frame fear of recurrence or progression in such a way that promotes adaptive responses over heightened physiological and psychological stress.

This study had several strengths and limitations. Survivors in the present analyses were heterogeneous with respect to cancer site, stage, and treatment history, making our findings generalizable to a broad survivorship population despite a relatively small sample size. Participants also tended to be older, educated, non-Hispanic white women who were either married or partnered. Future studies examining fear of recurrence or progression would benefit from including a larger and more diverse sample with respect to age, race/ethnicity, and relationship status. Additionally, participants were seeking care at a survivorship clinic, so they might have had more physical and/or psychological symptoms than cancer survivors in general. Participants may have been taking hormonal therapies, which could have introduced variability in self-reported ratings of symptom severity. Future studies building on these findings could use measures that assess clusters of cancer-related physical symptoms (e.g., [47]) to ascertain the potency of specific physical triggers of fear of recurrence or progression. In the present study, we used a psychological measure of somatization (PHQ-15). We selected this measure specifically because it assesses a variety of somatic complaints, rather than those which respondents attribute to cancer and its sequelae. Still, the PHQ-15 neither captures information about symptom frequency nor cues respondents to rate symptoms they explicitly attribute to their prior cancer. Therefore, we were limited in our ability to parse out the influence of symptom frequency (vs. severity) and somatic symptom severity overall (vs. severity of symptoms perceived by survivors to be cancer-related). Future studies might benefit from measuring these qualities to better understand how they uniquely influence fear of recurrence or progression and, in turn, perceived stress. Finally, the use of cross-sectional data precludes our ability to draw causal conclusions; gathering longitudinal data is thus an important next step to delineate directionality and causality.

We conclude that for cancer survivors, fear of recurrence or progression plays a key role in the relationship between somatic symptoms on one hand and stress on the other. A sizeable proportion of stress among cancer survivors may be due to fear of recurrence or progression triggered by physical concerns; data here suggest that proportion is as high as 35%. Given the high prevalence of mental and physical health concerns among cancer survivors, interventions are needed to address fear of recurrence or progression as a key intermediary linking these phenomena.

Acknowledgements The authors wish to acknowledge the patients who participated in this study.

Compliance with ethical standards

Funding source This study was supported by internal funds from the Massachusetts General Hospital Cancer Center. DLH was supported by an Institutional National Research Service Award (T32AT000051) from the National Center for Complementary and Integrative Health at the National Institutes of Health. ERP was supported by a midcareer investigator award (NCI K24CA197382) from the National Cancer Institute.

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

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Berger AM, Gerber LH, Mayer DK (2012) Cancer-related fatigue: implications for breast cancer survivors. Cancer 118(S8):2261–2269
2. Stasi R, Abriani L, Beccaglia P, Terzoli E, Amadori S (2003) Cancer-related fatigue: evolving concepts in evaluation and treatment. Cancer 98(9):1786–1801
3. Kehlet H, Jensen TS, Woolf CJ (2006) Persistent postsurgical pain: risk factors and prevention. Lancet 367(9522):1618–1625
4. Bloom JR, Stewart SL, Chang S, Banks PJ (2004) Then and now: quality of life of young breast cancer survivors. Psychooncology 13(3):147–160
5. Stanton AL, Rowland JH, Ganz PA (2015) Life after diagnosis and treatment of cancer in adulthood: contributions from psychosocial oncology research. Am Psychol 70(2):159–174
6. Osborn RL, Demoncada AC, Feuerstein M (2006) Psychosocial interventions for depression, anxiety, and quality of life in cancer survivors: meta-analyses. Int J Psychiatry Med 36(1):13–34
7. Traeger L, Greer JA, Fernandez-Robles C, Temel JS, Pirl WF (2012) Evidence-based treatment of anxiety in patients with cancer. J Clin Oncol 30(11):1197–1205
8. Simard S, Savard J, Ivers H (2010) Fear of cancer recurrence: specific profiles and nature of intrusive thoughts. J Cancer Surviv 4(4):361–371
9. Crist JV, Grunfeld EA (2013) Factors reported to influence fear of recurrence in cancer patients: a systematic review. Psychooncology 22(5):978–986
10. Savard J, Ivers H (2013) The evolution of fear of cancer recurrence during the cancer care trajectory and its relationship with cancer characteristics. J Psychosom Res 74(4):354–360
11. Thewes B et al (2012) Fear of cancer recurrence: a systematic literature review of self-report measures. Psycho-Oncology 21(6):571–587
12. Gil KM, Mishel M, Belyea M, Germino LS, Porter L, LaNey IC, Stewart J (2004) Triggers of uncertainty about recurrence and long-term treatment side effects in older African American and Caucasian breast cancer survivors. Oncol Nurs Forum 31(3):633–639
13. McGinty HL, Small BJ, Laronga C, Jacobsen PB (2016) Predictors and patterns of fear of cancer recurrence in breast cancer survivors. Health Psychol 35(1):1–9
14. Hilton BA (1988) The phenomenon of uncertainty in women with breast cancer. Issues Ment Health Nurs 9(3):217–238
15. Mckinley ED (2000) Under toad days: surviving the uncertainty of cancer recurrence. Ann Intern Med 133(6):479–480
16. Nelson JP (1996) Struggling to gain meaning: living with the uncertainty of breast cancer. ANS Adv Nurs Sci 18(3):59–76
17. Mishel MH (1990) Reconceptualization of the uncertainty in illness theory. Image J Nurs Sch 22(4):256–262
18. Salkovskis PM, Warwick HM (1986) Morbid preoccupations, health anxiety and reassurance: a cognitive-behavioural approach to hypochondriasis. Behav Res Ther 24(5):597–602
19. van de Wal MA, Gielissen MF, Servaes P, Knoop H, Speckens AE, Prins JB (2015) Study protocol of the SWORD-study: a randomized controlled trial comparing combined online and face-to-face cognitive behaviour therapy versus treatment as usual in managing fear of cancer recurrence. BMC Psychol 3(1):12
20. Warwick HM (1989) A cognitive-behavioural approach to hypochondriasis and health anxiety. J Psychosom Res 33(6):705–711
21. Fardell JE et al (2016) Fear of cancer recurrence: a theoretical review and novel cognitive processing formulation. J Cancer Surviv: 1–11
22. Dow KH (1995) A review of late effects of cancer in women. Semin Oncol Nurs 11(2):128–136
23. Eisenberg SA, Kurita K, Taylor-Ford M, Agus DB, Gross ME, Meyerowitz BE (2015) Intolerance of uncertainty, cognitive complaints, and cancer-related distress in prostate cancer survivors. Psychooncology 24(2):228–235
24. Sporn NJ, Smith KB, Pirl WF, Lennes IT, Hyland KA, Park ER (2015) Sexual health communication between cancer survivors and providers: how frequently does it occur and which providers are preferred? Psychooncology 24(9):1167–1173
25. Kroenke K, Spitzer RL, Williams JB (2002) The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. Psychosom Med 64(2):258–266
26. Kroenke K et al (2010) Somatic symptoms in patients with cancer experiencing pain or depression: prevalence, disability, and health care use. Arch Intern Med 170(18):1686–1694
27. Gotay CC, Pagano IS (2007) Assessment of Survivor Concerns (ASC): a newly proposed brief questionnaire. Health Qual Life Outcomes 5(1):15
28. Cohen S, Kamarck T, Mermelstein R (1983) A global measure of perceived stress. J Health Soc Behav 24(4):385–396
29. Preacher KJ, Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Methods 40(3):879–891
30. Hayes AF (2009) Beyond Baron and Kenny: statistical mediation analysis in the new millennium. Commun Monogr 76(4):408–420
31. Simmons JP, Nelson LD, Simonsohn U (2011) False-positive psychology undisclosed flexibility in data collection and analysis allows presenting anything as significant. Psychol Sci: 0956797611417632
32. Bennett MI, Rayment C, Hjermstaf M, Aass N, Caraceni A, Kaasa S (2012) Prevalence and aetiology of neuropathic pain in cancer patients: a systematic review. Pain 153(2):359–365
33. Hofman M, Ryan JL, Figueroa-Moseley CD, Jean-Pierre P, Morrow GR (2007) Cancer-related fatigue: the scale of the problem. Oncologist 12(S1):4–10
34. Koch L et al (2013) Fear of recurrence and disease progression in long-term (≥ 5 years) cancer survivors—a systematic review of quantitative studies. Psycho-Oncology 22(1):1–11

35. Cohen S (1988) Perceived stress in a probability sample of the United States
36. Cohen S, Herbert TB (1996) Health psychology: psychological factors and physical disease from the perspective of human psychoneuroimmunology. Annu Rev Psychol 47(1):113–142
37. Glaser R, Kiecolt-Glaser JK (2014) Handbook of human stress and immunity. Academic Press
38. Antoni MH et al (2006) The influence of bio-behavioural factors on tumour biology: pathways and mechanisms. Nat Rev Cancer 6(3): 240–248
39. Deimling GT, Bowman KF, Sterns S, Wagner LJ, Kahana B (2006) Cancer-related worries and psychological distress among older adult, long-term cancer survivors. Psychooncology 15(4):306–320
40. Gil KM, Mishel MH, Belyea M, Germino B, Porter LS, Clayton M (2006) Benefits of the uncertainty management intervention for African American and white older breast cancer survivors: 20-month outcomes. Int J Behav Med 13(4):286–294
41. Mishel MH et al (2005) Benefits from an uncertainty management intervention for African-American and Caucasian older long-term breast cancer survivors. Psycho-Oncology 14(11):962–978
42. Lebel S et al (2014) Addressing fear of cancer recurrence among women with cancer: a feasibility and preliminary outcome study. J Cancer Surviv 8(3):485–496
43. Lengacher CA, Johnson-Mallard V, Post-White J, Moscoso MS, Jacobsen PB, Klein TW, Widen RH, Fitzgerald SG, Shelton MM, Barta M, Goodman M, Cox CE, Kip KE (2009) Randomized controlled trial of mindfulness-based stress reduction (MBSR) for survivors of breast cancer. Psychooncology 18(12):1261–1272
44. Lengacher CA, Johnson-Mallard V, Barta M, Fitzgerald S, Moscoso MS, Post-White J, Jacobsen PB, Shelton MM, Le N, Budhrani P, Goodman M, Kip KE (2011) Feasibility of a mindfulness-based stress reduction program for early-stage breast cancer survivors. J Holist Nurs 29(2):107–117
45. Lengacher CA, Shelton MM, Reich RR, Barta MK, Johnson-Mallard V, Moscoso MS, Paterson C, Ramesar S, Budhrani P, Carranza I, Lucas J, Jacobsen PB, Goodman MJ, Kip KE (2014) Mindfulness based stress reduction (MBSR(BC)) in breast cancer: evaluating fear of recurrence (FOR) as a mediator of psychological and physical symptoms in a randomized control trail (RCT). J Behav Med 37(2):185–195
46. Kim Y, Carver CS, Spillers RL, Love-Ghaffari M, Kaw CK (2012) Dyadic effects of fear of recurrence on the quality of life of cancer survivors and their caregivers. Qual Life Res 21(3):517–525
47. Fan G (2007) Symptom clusters in cancer patients: a review of the literature. Curr Oncol 14(5):173–179