



Meaning in life mediates the relationship between social and physical functioning and distress in cancer survivors

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Objectives. Impairments in physical and social functioning are often associated with distress for the cancer survivor. Impaired functioning may also lead individuals to question previously held beliefs about meaning in life. Meaning in life was hypothesized to mediate the relationship between functioning and distress.

Design and methods. Two studies were conducted. In the cross-sectional study (I), cancer survivors ($N = 420$) were accrued via the Internet and completed measures of social and physical functioning, meaning and distress. In the longitudinal study (II), breast cancer survivors ($N = 167$) completed measures of functioning at 18 months, meaning at 24 months and distress at 30 months post-diagnosis.

Results. In Study I, meaning in life was a significant, partial mediator for both of the effects of physical and social functioning impairments on heightened distress. In Study II, significant indirect effects of functioning impairments on distress through meaning were replicated even when functioning and distress were measured 1 year apart. The relationship of social functioning and distress was fully mediated by meaning in life, whereas the relationship of physical functioning and distress was partially mediated by meaning.

Conclusions. The negative social and physical sequelae of cancer are associated with heightened distress, and this association appears to be accounted for, in part, by patients' loss of meaning in their lives.

Meaning in life can be broadly defined as a positively valenced framework of beliefs about the coherence of the world and one's own life. Meaning in life can bring a sense of wonder and joy in living (Schwartzberg & Janoff-Bulman, 1991), while meaninglessness is thought to underlie psychological disorders (e.g. Yalom, 1980). To date, there has

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been little research examining the role of meaning in adjustment to cancer, and thus we attempt to do so here.

We examine meaning in life in the context of the negative sequelae of diagnosis, namely impaired social and physical functioning. Reporting disruptions in these areas with consequent distress is common. What is more recent is the examination of positive responses – such as positive reappraisal, benefit finding and post-traumatic growth – and the direct or indirect role they may play in improving outcomes or lowering distress (e.g. Park & Folkman, 1997; Tomich & Helgeson, 2002). In this context, meaning in life is an important construct. On the few occasions it has been examined, research suggests that a cancer diagnosis can evoke a search for meaning as patients recover (Schroevers, Ranchor, & Sanderman, 2004). Cross-sectional data show that survivors reporting greater meaning also report better adjustment (Lewis, 1989; Vickberg, Bovbjerg, DuHamel, Currie, & Redd, 2000), although the temporal pattern to the latter relationship is unknown. Thus, our goal was to study how meaning might mediate the relationship between patients' social functioning or physical functioning and distress, as pictorially represented in Figure 1. We provide a brief overview of the meaning construct and discuss pathways in the mediation model leading to increased distress.

Path a: Impaired physical and/or social functioning leads to distress

Life is different following cancer. Disruptions in functional status, health (e.g. increased symptoms/signs, morbidities of treatments) and related effects (e.g. pain, fatigue) may be the most obvious (Cimprich, Ronis, & Martinez-Ramos, 2002; Collins, Taylor, & Skokan, 1990; Holzner *et al.*, 2001). Such physical functioning outcomes may persist following treatment or emerge late. All of these outcomes have been associated with increased distress in cancer survivors (Gotay & Muraoka, 1998). In fact, Hopwood and Stephens (1995) reported that impaired physical functioning was the single greatest risk factor for depression among lung cancer patients. Conversely, interventions that reduce symptoms and/or improve physical functioning, such as regular physical exercise, have been found to lower distress (e.g. Galvao & Newton, 2005).

Social changes following cancer are also potentially disrupting. Difficulty meeting social obligations, decreased social activity and disrupted ties to friends, family or the community can occur (Bloom, Fobair, Spiegel, Cox, Varghese, & Hoppe, 1991; Michael, Berkman, Colditz, Holmes, & Kawachi, 2002; Williamson, 2000). Ganz, Coscarelli, Fred, Kahn, Polinsky, and Petersen (1996), for example, found that 69% of breast cancer survivors reported only limited engagement in social recreational activities 3 years post-diagnosis, while Michael and colleagues found that 23% of breast cancer survivors reported smaller social networks 4 years after diagnosis. Moreover, disruptions in one's

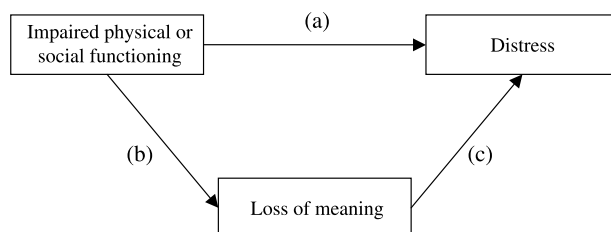


Figure 1. Hypothesized relationship of the loss of meaning as a mediator between physical or social functioning deficits and heightened emotional distress.

network, support or social activity are associated with increased distress in cancer patients (Allen, 1994; Cordova, Cunningham, Carlson, & Andrykowski, 2001; Thoits, 1983). Conversely, the presence of social interaction, particularly emotional encouragement and understanding during times of stress, is important for better adjustment (e.g. Bloom & Kessler, 1994; Dunkel-Schetter, 1984; Hoskins *et al.*, 1996).

Putting meaning in the picture: A definition

According to theorists, human beings have a 'will to meaning' (Frankl, 1963), a fundamental need to seek meaning and fulfilment in life (Baumeister, 1991; Klinger, 1998; Maddi, 1967; Reker & Wong, 1988; Yalom, 1980). Meaning has been equated with purpose in life (Crumbaugh & Maholick, 1964), life satisfaction and positively valued life goals (Battista & Almond, 1973), a combination of life experiences, contributions to the world, the attitude with which one faces suffering (Frankl, 1963; Yalom, 1980) and, simply, the sum of one's life experiences (Thompson & Janigian, 1988).

Considering these diverse views, meaning can be conceptualized as having four dimensions (Jim *et al.*, 2005). One includes feelings of inner peace and harmony and positive emotions connoting a sense of tranquility, serenity and comfort. A second dimension consists of feelings and thoughts of satisfaction with one's life, now and in the future, and the meaning assigned to one's own life. This is perspective towards future goals and direction in life. It also indicates personal growth, such as learning about oneself and becoming a better person. Third, meaning can include the benefits one may derive from spirituality. This dimension of meaning can be independent of religious faith or practices, such as church attendance. Finally, the absence or loss of meaning represents a fourth dimension and is reflected in negative emotions, confusion and a loss of life's value. For those without meaning, life is a negative experience. Individuals experience confusion about themselves and life in general.

These beliefs, thoughts and feelings about meaning can be differentiated from *sources of meaning*. Activities and experiences can give rise to meaning (i.e. they are meaningful), but they do not constitute meaning, *per se*. For example, one's capacities (e.g. intellectual, creative), personal relationships or service to others have been cited as common sources of meaning (Debats, 2000; O'Connor & Chamberlain, 2000; Reker, 2000).

Path b: Physical and social functioning impairments may bring meaning losses

A threatening aspect of cancer is the expectation or fear of long-term, negative consequences of the illness. Experiencing, or even perceiving, physical impairment or social disruption may challenge one's beliefs about order, coherence and purpose. Indeed, patients who have required physical assistance with daily living have reported lower purpose in life (Taylor, 1993). As a result, survivors may report less meaning in life.

Also, impaired physical and social functioning may prevent survivors from engaging in activities that previously provided sources of meaning. One's career, maintaining commitments of service to others or other personally enriching activities may become limited or necessarily abandoned (Debats, 2000; O'Connor & Chamberlain, 2000; Reker, 2000; Settersten, 2002). Kenyon (2000) has noted that such interaction with the world provides a foundation for meaning. Lower levels of social activity have been associated with decreased life satisfaction and fulfilment among cancer patients (Bloom & Spiegel,

1984). Conversely, social interaction is associated with greater meaning; quality family relationships are associated with increased purpose in life and religious and existential well-being (Schnoll, Harlow, & Brower, 2000).

Path c: With less meaning in life, distress is heightened

Meaning in life is itself an important life outcome, but meaning is also important by virtue of its association with other important psychological variables. Variation in meaning probably relates to differential levels of psychological distress (Beck, Rush, Shaw, & Emery, 1979; Brewin & Power, 1997). It has been suggested that meaning, or more precisely the *lack* of meaning, is a central component of psychopathology (Beck *et al.*, 1979; Frankl, 1963; Maddi, 1967). Zika and Chamberlain (1992) showed significant relationships between meaning and subsequently lower levels of distress and higher levels of well-being. Further, they suggested 'people who lack meaning are likely to show detrimental effects in all aspects of their psychological functioning' (Zika & Chamberlain, 1992). Thus, reduced meaning in life may be an important factor for later distress. Particularly for those undergoing difficult circumstances, meaning may be facilitative of positive coping and emotional stamina, but for those with less meaning, stress, negative affect, aimlessness and hopelessness may prevail.

Research aims and designs

Two studies were conducted to test meaning in life as a mediator of distress for cancer survivors. Figure 1 provides the general conceptual model for both. The methodology of Study I is suited to exploratory efforts and hypothesis generation, using a cross-sectional design for an efficient, initial test. Data were collected via the Internet from a heterogeneous sample - survivors previously diagnosed with prostate, breast, gynaecologic, lung, colo-rectal or haematological malignancies. Together, these diagnoses comprise more than half of all new cancer cases (Jemal *et al.*, 2005). Participants were also diverse in time since diagnosis and whether their disease had progressed to recurrence. Next, a more rigorous test of the mediation model is provided with Study II. A longitudinal design, using extensive psychosocial data from a homogeneous sample of cancer patients, is coupled with covariance structure modelling (CSM). Breast cancer patients were assessed on three occasions, long after treatments had ended (18, 24 and 30 months post-diagnosis). Multiple measures of social functioning and physical health status as well as distress were employed to create latent variables for the analyses. Together, the studies offer a broad examination of the beneficial role meaning in life may hold for cancer survivors.

STUDY I: CANCER SURVIVORS REPRESENTING HETEROGENEOUS SITES OF DISEASE

Method

Participants

Self-identified cancer survivors who were currently 20 years of age or older were eligible. Descriptive information for the sample ($N = 420$) is provided in Table 1. Briefly,

the sample was predominantly female (79%), Caucasian (93%), middle-aged (51 years), married (66%) and college educated (86%). More than seven different sites of disease were represented, and it had been an average of 5 years since patients had been diagnosed. The majority (80%) reported being currently disease free (i.e. 20% had recurred).

Table 1. Means and standard deviations or percentages for socio-demographic and cancer history characteristics of Study I (Heterogeneous sites of disease) and Study II (Breast) participants

Characteristic	Heterogeneous (N = 420) Mean (SD)/%	Breast (N = 167) Mean (SD)/%
Age, years	50.53 (10.68)	51.30 (10.56)
Gender, % female*	79	100
Race, % caucasian	93	92
Marital status, % married	66	68
Years of education, %*		
12 or less	14	26
13 to 16	55	45
17 or more	30	29
US region, % Midwest*	24	100
Cancer site, %*		
Breast	33	100
Colorectal	12	0
Prostate	6	0
Gynaecologic	25	0
Other	24	0
Recurrence, % yes*	20	0
Years since diagnosis*	4.86 (4.97)	1.89 (0.42)

* $p < .05$.

Procedures

A study website featured the 'Meaning in Life Survey'. The site was described in local newspapers and television with later coverage in national media. Descriptions of the study were also posted on websites and Internet discussion groups for cancer patients. The site provided investigator contact information and informed consent documents. Following consent, participants completed the survey. All responses were anonymous and sent encrypted to a secure server/database.

As limitations exist in Internet data collection, we attempted to identify invalid responses/responders. To check for multiple submissions, data were examined for similarity of socio-demographic and disease profiles, and none was found. To identify random responding, item pairs were compared. For example, one pair included the items 'Indicate how much your health limits walking one block' and 'Indicate how much your health limits walking more than a mile'. If a responder indicated impairment in walking one block but no impairment when walking one mile, he or she could possibly be responding randomly. Five such pairs of items were examined. An *a priori* criterion of conflicting responses to three or more item pairs was established to discard a participant's data. No one met this criterion.

Measures

Physical and social functioning predictors. The Medical Outcomes Study-Short Form is a 36-item questionnaire with extensive reliability, validity and normative data, and it is used to assess health-related psychological and physical functioning (SF-36; Ware, Kosinski, & Keller, 1994; Ware & Sherbourne, 1992; Ware, Snow, & Kosinski, 2000). The SF-36 has eight subscales: vitality, social functioning, mental health, role functioning related to emotional health, role functioning related to physical health, physical functioning, bodily pain and general health. Patients rate their functioning during the previous month, with higher scores indicating better functioning. Each score is standardized with a mean of 50 and a standard deviation of 10. The physical functioning (PF) and social functioning (SF) subscales were used for the analyses. Cronbach's alphas were .92 and .79, respectively, for the PF and SF scales. Sample mean and standard deviation scores for these measures and those described below are provided in Table 2.

Table 2. Means and standard deviations for measures of physical and social functioning, meaning in life, and distress for Study I (Heterogeneous sites of disease) and Study II (Breast) participants

Variable/Scale	Heterogeneous (N = 420) Mean (SD)	Breast (N = 167) Mean (SD)
Physical functioning		
SF-36, physical functioning subscale*	75.88 (24.48)	81.11 (21.30)
Karnofsky Performance Status	NA	89.10 (6.76)
SWOG	NA	0.25 (0.12)
SF-36, physical component summary*	44.24 (11.59)	47.23 (10.23)
Social functioning		
Social functioning subscale*	76.18 (25.50)	85.33 (19.87)
Perceived Support Scale-family	NA	16.97 (4.08)
Perceived Support Scale-friends	NA	17.12 (3.21)
Social Network Index	NA	5.87 (2.85)
Katz Social Adjustment Scale	NA	3.41 (0.88)
Meaning in life		
Harmony and peace*	4.24 (1.17)	4.48 (1.10)
Life perspective, purpose and goals*	3.97 (1.15)	4.17 (0.93)
Benefits of spirituality*	4.15 (1.66)	4.81 (1.16)
Confusion and lessened meaning	1.93 (0.89)	1.85 (0.77)
Total meaning*	10.43 (3.86)	11.61 (2.87)
Distress		
SF-36, mental component summary*	47.79 (11.42)	49.99 (10.49)
POMS-SF, total mood disturbance*	17.31 (26.80)	15.61 (23.96)
POMS, total mood disturbance	NA	23.87 (34.71)
Impact of Events Scale	NA	12.53 (12.87)

* $p < .05$.

Note. SWOG = Southwest Oncology Group's rating of cancer treatment toxicities and current symptoms, POMS-SF = Profile of Mood States-short form and NA = not administered.

Meaning in life mediator. The Meaning in Life Scale (MiLS; Jim *et al.*, 2006) is a 21-item, multifaceted measure of meaning. Factor analysis reveals that it is comprised of four dimensions: harmony and peace (four items; e.g. 'I feel peaceful', 'I can reach into myself for comfort'), life perspective, purpose and goals (seven items; e.g. 'I feel more fulfilled and satisfied with life', 'I am settled about the future'), benefits of spirituality

(three items: e.g. 'I find comfort in my faith and spiritual beliefs', 'I have strength in my spiritual beliefs') and confusion and lessened meaning (seven items; e.g. 'I get confused when I try to understand life', 'Life has less meaning'), with a common second-order factor, meaning in life. Scale scores range from 1 to 6. The total meaning score is computed as the sum of scale scores for positive meaning minus the scale score for confusion and lessened meaning and ranges from -3 to 17. Higher scores indicate greater positive meaning, except for the confusion and lessened meaning scale, for which higher scores indicate less meaning. Two-week test-retest reliability is .79 for the total score. Coefficient alpha reliability was .93 in the sample.

Distress outcome. The 37-item Profile of Mood States-Short Form (POMS-SF; DiLorenzo, Bovbjerg, Montgomery, Valdimarsdottir, & Jacobsen, 1999; Shacham, 1983) assesses negative mood. A total mood disturbance score is the sum of five scales (tension, depression, anger, fatigue and confusion) minus the score of a vigour scale. The total mood disturbance score can range from -24 to 124 with higher scores indicating greater mood disturbance. Cronbach's alpha was .93 for the total mood disturbance score; alphas for the scales ranged from .85 to .95.

Analytic strategy

For each type of functioning (physical and social), three hierarchical multiple regression (HMR) analyses were required for establishing mediation, as has been described (Baron & Kenny, 1986; MacKinnon & Dwyer, 1993). The first regression tested functioning (either physical or social) as a predictor of distress. The second tested functioning as a predictor of meaning in life. The third regression tested meaning in life as a predictor of distress after controlling for functioning. Significant results for all three tests suggest mediation (Baron & Kenny, 1986). A related requirement is that the indirect effect of functioning on distress through meaning be significant (MacKinnon & Dwyer, 1993). The Sobel test statistic (Sobel, 1982) was used to test the indirect effects based on the unstandardized beta weights and their associated standard errors from the HMR analyses (Preacher & Leonardelli, 2001). Finally, full mediation is in evidence if the variance explained by functioning is no longer significant after accounting for the effect of meaning in life. Alternatively, if the variance explained by functioning is reduced but still significant when accounting for the effect of meaning, partial mediation is implied.

Results

To summarize, findings from the three HMR analyses supported the interpretation of meaning in life as a partial mediator for the effect of physical functioning on distress. Physical functioning alone accounted for 12% of the variance in distress ($\beta = 0.34$, $p < .001$). Physical functioning also accounted for significant variance in meaning in life (2%, $\beta = 0.14$, $p = .003$). Controlling for physical functioning, meaning in life accounted for 39% of variance in distress ($\beta = -0.63$, $p < .001$), and the variance in distress explained by physical functioning was reduced to 6%, although still significant ($\beta = -0.25$, $p < .001$). As hypothesized, the indirect effect of physical functioning on distress through meaning in life was significant (Sobel test statistic $z = -2.57$, $p = .01$). These results indicate that the association between physical functioning and distress was partially mediated by meaning in life.

The HMR results for the social functioning revealed a similar pattern of predicted effects. Social functioning alone accounted for 40% of the variance in distress

($\beta = -0.63$, $p < .001$) and 16% of variance in meaning in life ($\beta = -0.40$, $p < .001$). Controlling for social functioning, meaning in life accounted for 21% of variance in distress ($\beta = -0.50$, $p < .001$), and the variance in distress explained by social functioning was reduced to 16%, although still significant ($\beta = -0.43$, $p < .001$). As hypothesized, the indirect effect from social functioning to distress through meaning in life was significant ($z = -7.70$, $p < .001$). Thus, the association between social functioning and distress was also partially mediated by meaning in life.

It is noted that, after the direct tests of mediation using Sobel statistics, both HMRs were repeated controlling for any patient characteristics that were correlated ($p < .05$) with distress. Gender, type of cancer and recurrence status were not associated with distress, but the variables of age, marital status and time since diagnosis were. HMRs were repeated with the inclusion of the latter variables. An identical pattern of significant direct and indirect effects was found (data not shown), suggesting that age, marital status or time since diagnosis were not influential in relationship with meaning or distress.

STUDY II: BREAST CANCER SURVIVORS

Method

Participant eligibility, accrual and procedures

Women diagnosed with regional breast cancer, surgically treated and awaiting adjuvant therapy, were eligible to participate in a larger study. Exclusion criteria included having received a prior cancer diagnosis, refusal of cancer treatment, age ≤ 20 or > 85 years, residence > 90 miles from the research site, diagnoses of mental retardation, severe or untreated psychopathology (e.g. schizophrenia), neurological disorders, dementia or immunologic conditions/diseases. Patients were consecutive cases at a university-affiliated National Cancer Institute, designated Comprehensive Cancer Center or self- and physician-referred cases from the community accrued to a randomized clinical trial testing the efficacy of a psychological intervention. A total of 227 participants were enrolled in the clinical trial.

Complete descriptions of patient eligibility and statistical analyses of the accrual, stratification and randomization procedures have been previously reported (Andersen *et al.*, 2004). To summarize, there were no significant differences ($ps > .10$) between participants vs. non-participants on socio-demographics, disease and prognostic characteristics, and cancer treatments received/planned. Similarly, study arms (intervention vs. assessment only) did not differ on socio-demographics ($ps > .27$; age, race, education, income, marital status), disease and prognostic characteristics ($ps > .35$; stage, number of nodes, tumour size, oestrogen receptor status, menopausal status) and extent of surgery or treatments planned ($ps > .23$; radiation, hormonal therapy and chemotherapy, including each chemotherapy drug administered and drug dosage). The intervention was conducted in small patient groups with one session per week for 4 months and then one session per month for 8 months for a total of 12 months. Sessions included strategies to reduce stress, improve mood, alter health behaviours and maintain adherence to cancer treatment and care. While the intervention was effective for several biobehavioural outcomes (Andersen *et al.*, 2004; Andersen *et al.*, in press), it produced no change in patients' reports of meaning ($p = .62$) and no efforts had been made to directly do so. After 12 months of

participation, patients were followed and reassessed every 6 months for 5 years; patients were paid \$25 for each assessment. The reassessments include psychological, behavioural and biomedical measures but the meaning measure is not among them; meaning was assessed only at 24 months. The present meaning study is based on physical and social functioning data collection at 18 months, meaning at 24 months and distress at 30 months.

Accrual for the meaning study began 2 years after the start of the clinical trial. Patients were eligible to participate if they had (1) completed all cancer therapies (all treatments had actually ended by 12 months), (2) been followed for at least 30 months and (3) remained disease free. Of the 227 women enrolled in the clinical trial, by the accrual date for the meaning study 26 (11%) women had recurred or died, 29 (13%) women were no longer participating and 5 (2%) women missed their 24-month assessment but remained in the trial, resulting in a sample of 167 participants. Analyses compared the participants of the meaning study ($N = 167$) to the remainder ($N = 60$) with respect to baseline (initial assessment) characteristics using chi-squared or ANOVA as appropriate. The groups did not significantly differ in age, study arm (intervention vs. assessment), employment, family income, spousal status, menopausal status, disease characteristics (stage, hormone receptor status, number of nodes) or cancer treatment received (surgery type, radiation or hormonal or chemotherapy) ($ps > .06$). Only in education did the groups differ ($p = .003$). Both had spent some time at college, but the meaning study group had roughly 1 year more ($Ms = 15.07$ vs. 13.85 years).

Participants

Description of the sample appears in Table 1. Briefly, the sample was predominantly Caucasian (92%), middle-aged (51 years), married (68%) and college educated (74%). The characteristics of this group are similar to those for breast cancer patients in the Cancer Incidence Surveillance System (Community Health Assessments, 2002) and SEER (Surveillance, Epidemiology and End Results program, 2000) databases. Regarding disease and prognostic characteristics, the majority had been diagnosed with Stage II (90%) rather than Stage III (10%) disease and were oestrogen receptor positive (65%). All had been surgically treated with breast conserving therapy (44%) or modified radical mastectomy (56%). Regarding adjuvant treatments, 57% had received radiation therapy, 85% received chemotherapy and 79% were currently on hormonal therapy (e.g. tamoxifen). At the time of the 18-month assessment, all had completed any radio- or chemotherapy at least 6 months previously and were disease free.

Measures

The longitudinal design provides data for physical and social functioning predictors assessed at 18 months, meaning in life mediator assessed at 24 months and emotional distress outcome assessed at 30 months. Reliability estimates are from the present sample with test-retest intervals being 6 months. Table 2 displays the sample mean and standard deviation values for all measures.

Physical functioning predictor. Three measures were used for the latent variable. Measures (1) and (2) were completed by a research nurse during a clinical interview with the patient and in conjunction with medical chart review and physician consultation. (1) Functional status. The Karnofsky Performance Status (KPS; Karnofsky

& Burchenal, 1949) is a rating scale ranging from 100 (normal, no complaints, no evidence of disease) to 0 (dead) with 10-point intervals. It assesses disruption in daily activities and functioning due to symptoms/signs of illness or treatment. Inter-rater reliability ranges from .70 to .97 (Mor, Laliberte, Morris, & Wiemann, 1984; Yates, Chalmer, & McKegney, 1980). (2) Symptoms, signs, illnesses, and toxicities. Health status was evaluated using a measure developed for cancer treatment clinical trials by the Southwest Oncology Group (SWOG; Moinpour *et al.*, 1989). The survey includes 22 body categories (e.g. gastrointestinal, cardiac) and within each several symptom/sign (e.g. nausea, blood pressure) items are listed. Items are rated on a five-point toxicity grading scale (0 = none to 4 = life-threatening). Items were averaged for a total score, with higher scores indicating a greater number and/or severity of signs and symptoms. Internal consistency was .84. (3) Disruption due to physical health. The Medical Outcomes Study-Short Form (SF-36; Ware & Sherbourne, 1992) is described above. Mental and physical health component scores are computed by differentially weighting the subscales. The physical component summary (PCS) is computed with higher weights for the following subscales: physical functioning, role functioning related to physical health, bodily pain and general health. Test-retest was .63 and internal consistency was .93.

Social functioning predictor. Four measures were used for the latent variable and include the dimensions of perceived support, structural support and engagement in social activities. (1-2) Social support. The Perceived Support Scale for Family (PSS-Fa) and Friends (PSS-Fr) assesses the need for and perception of receiving support from friends and family members (Procidano & Heller, 1983). Total scores can range from 0 to 20 for both scales, with a higher score indicating greater perceived social support. Test-retest was .77 and .76 and alpha reliability was .66 and .65, respectively. (3) Social integration. The Social Network Index (SNI; Berkman, 1978) is a 10-item measure that assesses social integration by documenting the number of people with whom an individual has contact on a regular basis, as well as the number of important social roles he or she fulfils (e.g. parent, spouse, neighbour). The SNI can range from 1 to 12, with a higher score indicating greater social integration. Test-retest was .80. (4) Family, social, and leisure activities. A modified version of the Katz Social Adjustment Scales (KSAS; Katz & Lyerly, 1963) indexed social activities involving children, household, relatives and leisure. Rather than a three-point scale, behavioural frequency ratings (0 = 'did not occur' to 9 = 'occurred more than 4 times a day') for the 15 items were used and averaged; scores ranged from 0 to 9. Internal consistency was .59.

Meaning in life mediator. See description in Study I above. Internal consistency was .90 for the sample.

Distress outcome. Three measures were used for the latent variable. (1) Mental health. The mental component summary (MCS) of the SF-36 (see description above, Study I) has higher weights for the following scales: mental health, role functioning related to emotional health, social functioning and vitality. (We note that the social functioning subscale was removed from the calculation of MCS outcome as other measures of social functioning comprised the social functioning predictor.) Test-retest reliability was .50 and coefficient alpha was .88. (2) Negative mood. The 65-item Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) was used. The total mood disturbance score is the sum of the tension, depression, anger, fatigue and confusion scales minus the vigour scale. Test-retest was .62 and internal consistency was .93. (3) Anxiety. The Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979) examines anxious cognitions involving re-experiencing and denial of thoughts and avoidant

behaviours related to anxiety reactions and traumatic stress. Similar to previous studies of cancer stress (Butler, Koopman, Classen, & Spiegel, 1999; Cordova, Andrykowski, Kenady, McGrath, Sloan, & Redd, 1995), items were slightly reworded to ensure respondents focused upon cancer-related thoughts and behaviours. Total scores can range from 0 to 65 with higher scores reflecting greater disruption. Coefficient alpha reliability for the total score was .90 and test-retest was .68.

Analytic strategy

Covariance structure modelling was used to examine relationships between physical and social functioning, meaning in life and psychological distress. Latent variables in the model served as predictors, outcome or mediator of indirect relationships between predictors and outcome. An important feature of the analysis is the ability to test multiple pathways to multiple variables simultaneously. The hypothesized model was tested using LISREL (Joreskog & Sorbom, 2001). In specifying the model, physical functioning and social functioning at Time 1 (18 months) were specified as exogenous latent variables (variables not receiving causal input from other variables). Physical functioning was measured by three indicators: KPS, SWOG and PCS. Social functioning was measured by four indicators: PSS-Fa, PSS-Fr, SNI and KSAS. The outcome variable, distress at time 3 (30 months), was specified as an endogenous latent variable measured by three indicators: MCS, POMS and IES. Meaning in life was specified as an endogenous latent variable measured at Time 2 (24 months) by its four scales from the measure of the same name: harmony and peace, satisfaction with life and future, benefits of spirituality, and loss of meaning and confusion. Meaning in life was positioned as a mediator between physical and social functioning as predictors and distress as an outcome. Direct paths from physical and social functioning to distress were included consistent with a partial mediation model. Patient characteristics (sociodemographic, disease and treatment variables) were selected for inclusion in the model as controls if they were significantly correlated ($p < .05$) with *any* of the indicators for the outcome variable, distress (i.e. MCS, POMS and IES). This resulted in the inclusion of age and racial group membership in the model.

Model estimation was carried out using the raw data as input, in which only 3.9% of values overall were missing. In order to utilize data from patients with incomplete data, the covariance matrix was estimated using the EM algorithm procedure to obtain starting values for full information maximum likelihood (FIML) estimation of model parameters. To provide a metric for the latent constructs and to identify the measurement model, one indicator loading for each latent variable was set to 1.0 in the unstandardized solution. Direct and indirect (mediated by meaning in life) effects were estimated, along with their standard errors. The Sobel test (Sobel, 1982) was used to test the significance of each indirect effect ($p < .05$). The ability of the model to explain the covariances between variables was evaluated using the root mean square error of approximation (RMSEA; Browne & Cudeck, 1992), which considers both fit and parsimony.

Finally, we note two aspects of the data analyses reported below. First, descriptive analyses were conducted to determine whether significant changes in the patients' physical functioning occurred during the study interval. We conducted one-way (time: 18 and 30 months) repeated measures analyses of variance (ANOVAs) for the three measures of physical functioning. For both the SWOG and the KPS the time effect was not significant ($p = .881$ and $.136$, respectively). For example, the average SWOG scores

were 0.250 ($SD = 0.118$) at 18 months and 0.252 ($SD = 0.110$) at 30 months. While the SF-36 was significant ($p = .031$), the magnitude of change (improvement) was quite small ($M_s = 47.0$ vs. 48.3) and is unlikely to be of clinical significance. Taken together, the data do not indicate substantial (or any) changes in physical functioning during the study interval. Second, the analyses are conducted with study arms collapsed. Analyses were, however, also conducted with study arm specified as a control variable. When done so, the parameter coefficient of the path from study arm to distress was $-.02$ ($t = -0.35$, $p = .73$), indicating no statistical relationship between study arm and patients' reports of distress at 30 months. Also, the magnitude and direction of all direct and indirect effects and the model fit were equivalent to those reported below.

Results

The LISREL test of the partial mediation model is presented graphically in Figure 2 and includes standardized estimates of parameters in the measurement and structural models. In preface, it is noted that all the hypothesized effects were significant and in the expected direction. The model exhibited reasonable fit to the data, as specified by Browne and Cudeck's (1992) guidelines, with a RMSEA of .087. In this model, the paths from physical and social functioning to meaning in life were significant (pathweights .25, .50; $t_s = 2.26, 2.33$; $p_s < .03$). In turn, the $-.65$ pathweight from meaning in life to distress was also significant ($t = -4.82$, $p < .0001$). As hypothesized, the indirect effects - from physical functioning and social functioning on distress through meaning in life - were both significant (Sobel test statistic $z_s = -2.15, -2.10$; $p_s < .04$), supporting the view that meaning in life mediates the effects of both types of functioning on distress. While the direct path from social functioning to distress was not significant (pathweight 0, $t = 0.02$, $p = .98$), the direct path from physical functioning to distress was (pathweight $-.25$, $t = -2.54$, $p = .01$). Thus, the effect of physical functioning on distress was partially mediated through meaning in life, but the effect of social functioning on distress was fully mediated through meaning in life. In addition, one's physical and social functioning levels were significantly correlated with each other ($r = .35$, $p = .048$).

Finally, the significant negative pathweight ($-.30$) from age to distress ($t = -4.34$, $p < .001$) indicates that independent of the level of functioning, breast cancer patients stricken with cancer at a younger age reported greater distress. The path from racial group membership to distress was not significant (pathweight .10, $t = 1.52$, $p = .13$). However, this was a weak test as the number of non-Caucasian participants was low (8%).

Discussion

It is commonly understood that poor functional status and symptomatology are distress producing (e.g. Given, Stommel, Given, & Osuch, 1993; Hays, Marshall, Wang, & Sherbourne, 1994), but the present data suggest a possible mechanism for the relationship between poor functioning and heightened distress. In Study II, the effect of social functioning impairments on distress was fully mediated by meaning in life, while the effect of physical impairments was partially mediated by meaning. Thus, for the association between physical impairments and distress, there is a possibility of other mediators, in addition to meaning in life. In contrast, the data suggest that the detrimental effects of patients' reduced social support, networks and activities on later distress may be explained almost entirely by the patients' reduced meaning in life. It

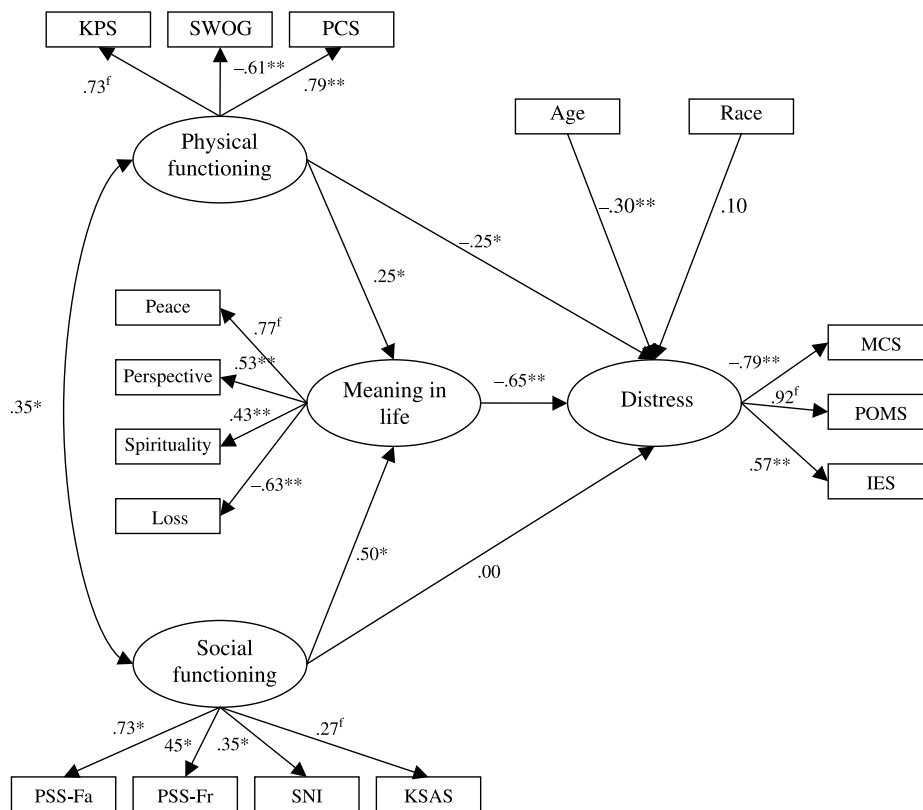


Figure 2. Standardized LISREL estimates of longitudinal relationships between physical and social functioning, meaning in life and distress ($N = 167$). Functioning, meaning and distress are latent constructs at 18, 24 and 30 months post-diagnosis, respectively. Superscript f indicates factor loadings set to 1.0 in the unstandardized solution; other factor loadings and pathweights are significant as notated (* $p < .05$; ** $p < .01$). Estimates for the direct paths from both physical and social functioning to distress inform the reader of whether full or partial mediation occurred. For simplicity, unique and residual variances are omitted. To summarize the findings, the effect of physical functioning on distress was partially mediated through meaning in life, but the effect of social functioning on distress was fully mediated through meaning in life.

Note. KPS = Karnofsky Performance Status, SWOG = Southwest Oncology Group's rating of cancer treatment toxicities and current symptoms, PCS = physical component summary of the SF-36, PSS-Fa and PSS-Fr = Perceived Support Scale for family and friends, SNI = Social Network Index, KSAS = family, social, and leisure activities rating from the Katz Social Adjustment Scale, MCS = mental component summary of the SF-36, POMS = Profile of Mood States and IES = Impact of Events Scale.

would not be unexpected to discover that women's levels of social functioning impairment are associated with their distress 1 year later, but that this association may be mainly attributable to women's meaning in life is novel.

The data suggest that survivors with poor functioning appear to be at a disadvantage in finding (or retaining) meaning. The health morbidities of cancer are, of course, common and distressing (Bowman, Deimling, Smerglia, Sage, & Kahana, 2003; Garman, Pieper, Seo, & Cohen, 2003), but we speculate that poorer physical health status can

bring meaning losses. Consistent data come from a cross sectional study reported by Edman, Larsen, Hägglund, and Gardulf (2001), who found stem cell transplant patients with poor physical functioning reporting a decreased sense of coherence in life. Poorer health status may also disrupt, impair or even bring an end to sources of meaning [e.g. loss of employment (Bradley, Neumark, Luo, Bednarek, & Schenk, 2005)], including ones that have social aspects (e.g. caring for one's children), and thereby, survivors experience a loss of meaning. The significant correlation between physical and social functioning found in Study II ($r = .35, p < .05$) suggests a reliable statistical relationship between physical functioning and social functioning. Finally, data from Study I suggest that the significant relationships between poor functioning, meaning losses and distress may not diminish over time if functioning remains impaired. Time since diagnosis was not influential in the Study I findings.

Considering the impact of social functioning disruption, cancer patients with the fewest social resources, lowest levels of support, and in general, the least engagement with the social world are among those with the most distress and adjustment difficulty (Helgeson & Cohen, 1996). Family ties, roles and social relationships are likely sources of meaning, but for some, they may provide the essence of life satisfaction, fulfilment and purpose. This may account for the noteworthy findings of Study II indicating that the relationship of social functioning and distress was fully mediated by meaning in life. The disrupted social factors, meaning losses and heightened distress linkage may be particularly strong for females. It has been suggested that the creation and maintenance of social networks may be used selectively by females, in contrast to males, in responding to stressors (Taylor *et al.*, 2000). If so, any direct or indirect disruption of social variables may produce a particularly heightened level of distress and, possibly, broader effects, including loss of meaning. Our data cannot address this interesting possibility as the Study I sample was predominantly female and the Study II sample was entirely so, and thus the gender specificity of these particular findings will need to be explored.

As the role of meaning in adjustment to cancer has received only recent study, the combination of studies presented here has advantages. The cross-sectional data of Study I provided an exploratory opportunity, and further, the heterogeneity of the sample provided a robust, initial test across cancer relevant dimensions (e.g. disease site, time since diagnosis, disease progression). By contrast, the Study II sample provided less participant generalizability but a longitudinal design with more measurement and data analytic rigour. Rather than individual measures, social and physical functioning and distress were represented as latent constructs, each indicated by multiple, validated indicators. Such construct estimates are unbiased by correlated measurement errors, facilitating a closer estimate of the 'true score' for each, and discussion of relationships among latent variables rather than correlations among measures. Modelling analyses relying upon the sequential assessment of functioning, meaning and distress imply causality (Baron & Kenny, 1986), but, of course, do not demonstrate it. The finding of meaning as a mediator between prior functioning and later distress lays a foundation for the next level of research designs. Our data relate to meaning losses and heightened distress, but it may be that establishing or re-establishing meaning may play a role in lowering distress. For an extension of these effects, a plausible step would be tests of interventions designed to reduce stress by impacting meaning directly (Breitbart, Gibson, Poppito, & Berg, 2004; Cole & Pargament, 1999).

Fewer quality of life studies have been conducted with survivors diagnosed with cancers other than breast, and the Internet accrual offered this advantage. The Internet may also provide the opportunity to sample individuals who otherwise might not

participate in research. Oftentimes, refusers to clinical trials come disproportionately from the ranks of more disabled and/or highly distressed patients (see Manne *et al.*, 2005, for a discussion). Such individuals may find Internet participation easier. Interestingly, comparison of the two study samples indicated significantly poorer physical and social functioning reported by the Internet sample than was reported by the breast cancer survivors ($ps < .05$) despite their similar mean ages.

While generalizability across levels of functioning is important, the findings are limited by other factors, such as low sampling from culturally diverse groups. Multicultural participant accrual is an important goal in quality of life research (Quintana, Troyano, & Taylor, 2001). The minority representation in the Study II sample was, unfortunately, similar to that found in many university-based studies with cancer patients, and the same was true with Internet accrual. Despite multiple efforts (e.g. announcements of the study on minority health websites), the Study I sample was also predominantly Caucasian (93%). As the cultural diversity of Internet users in the US has increased in recent years (US Department of Commerce, 2002), the Internet may eventually become a useful tool in this effort.

The negative physical and psychological sequelae of cancer diagnosis and treatment are well documented and far ranging. Fatigue, cognitive impairment, decreased sexual functioning and body image disturbances can occur (Hawighorst-Knapstein *et al.*, 2004; Rosenthal, 2001) along with many other psychological, behavioural, social and physical difficulties (Gotay & Muraoka, 1998). Yet, focus upon the risks for and occurrence of negative sequelae provides an incomplete understanding of the cancer experience. Negative sequelae may be lessened, in part, by the coexistence of positive responses, such as greater appreciation for life, satisfaction with one's life and future and the ability to make meaning of the cancer experience. Researchers are moving to greater integration. For the present, these findings suggest one specific mechanism - meaning - as potentially important in the adjustment process to the impaired physical and social functioning common among cancer survivors.

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