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Problem-solving style and adaptation in breast cancer survivors: a prospective analysis

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Abstract
Introduction Emotional care of the breast cancer patient is not well understood; this lack of understanding results in both a high cost to the patient, as well as the health care system. This study examined the role of problem-solving style as a predictor of emotional distress, adjustment to breast cancer, and physical function immediately post-surgery and 12 months later.
Methods The sample consisted of 121 women diagnosed with breast cancer and undergoing surgery as a primary treatment. The survivors completed a measure of problem-solving style and three outcome measures immediately post-surgery, as well as at 1 year later. There was a 95.6% retention rate at 1 year.
Results Multiple hierarchical regressions revealed, after controlling for patient demographics and stage of cancer, that problem-solving style (particularly personal control) was associated with emotional distress, adjustment to chronic illness, and physical function immediately following surgical intervention. In addition, a more positive problem-solving style was associated with less emotional distress, but not a better adaptation to a chronic illness or physical functioning 12 months later; the Personal Control again was the best single predictor of the emotional distress, adding 10% of the variance in predicting this outcome.
Conclusions The utility of post-surgery assessment may help identify those in need for problem-solving training to improve these outcomes at 1 year. Future studies need to determine the impact of interventions tailored to levels of problem-solving styles in cancer survivors over time.
Implications for Cancer Survivors Understanding the role of problem solving style in breast cancer survivors deserves attention as it is associated with emotional distress immediately and one year after medical intervention. Problem-solving style should be evaluated early, and interventions established for those most at risk for emotional distress.

Keywords Breast cancer survivors · Problem-solving style · Psychological distress · Adaptation to illness · Function · Prospective

Introduction

Emotional care of the cancer patient is not well understood and is often neglected in the formal cancer care system. Moreover, there is a high cost due to patients and the health care system due to this neglect [6]. Higher levels of distress are often associated with more provider time and a greater number of phone calls, and tend to frustrate health providers. These patients also more often visit emergency rooms, or make telephone calls to oncologists' offices to address symptoms that can be exacerbated by heightened levels of distress [7]. This distress is often not addressed and can therefore be a significant source of clinical and financial burden [6]; we must "work more aggressively at

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maximizing the long-term health and well-being of (cancer) survivors" ([19], p.1).

Not surprisingly, even among survivors with similar medical and surgical interventions, stage of cancer, and demographic variables, approximately 30–50% of those living post primary treatment continue to experience prolonged distress [6]. It remains unclear as to why some cancer survivors experience better emotional adjustment than others, and what are some of the specific factors that can account for these differences. Although relatively little research has focused on predicting long-term psychological outcomes [9], to date medical-surgical variables seem to play a very small role (e.g., [20, 25]). In contrast, a number of risk and resilience factors have been identified that influence adjustment among cancer survivors, such as social support (e.g., [5, 28]), coping (e.g., [8]), optimism (e.g., [14, 38]), and self-schemas [40]. Identifying factors that are associated with long-term emotional distress (and coping) could help us develop evidence-based interventions for those survivors with high levels of distress.

In the last 25 years there has been growing evidence that applied problem solving plays a key adaptive role in both health and mental health across the age span with a variety of life challenges (e.g., [11, 13, 18, 24, 34]). For example, early research in applied problem solving focused on discreet thought processes, such as causal thinking; research found that inhibited children [35], impulsive adolescents [37], and adult psychiatric patients [31] engaged in less consequential thinking than their normal counterparts. Later, researchers focused on social problem solving abilities (i.e., problem orientation and self-reported problem solving skills), and found that caregivers with a negative problem orientation were more at risk to develop psychological and health problems over the course of a year [13].

Similarly, in the past 25 years a number of studies implicated applied problem solving in cancer progression, death, psychosocial distress, and quality of life (see [4, 17]). For example, one study found that lower levels of psychological distress were related to problem-solving strategies, namely lower levels of cognitive and behavioral escape-avoidance and higher levels of social distancing among patients with advanced cancer [42]. Similarly, Nezu et al. [29] found that social problem-solving ability was predictive of psychological distress with a group of patients diagnosed with various types of cancer. Consequently, a number of researchers began to evaluate a wide range of problem-solving based interventions (including within psychotherapy) with cancer patients, suggesting varying degrees of utility to promote physical and psychosocial adjustment (e.g., [1, 12, 15, 16, 26, 30, 36, 39]).

However, the major question of what constitutes effective problem solving with cancer is still largely unexplained [27]. In general, there has not been a consensus of the most important components of applied problem solving over time among cancer researchers. In addition, there remains a need to better understand how breast cancer survivors in particular cope with this disease over time. Thus, at present it is unclear as to which problem-solving strategies are most predictive of less distress, and in which breast cancer patients. This has hampered successful program development to promote successful problem solving as well as emotional adjustment after primary medical treatment. Moreover, there is a need for more rigorous, prospective studies examining the role of applied problem solving in the psychological and physical adjustment of cancer survivors over time.

An important individual difference that influences problem-solving behaviors is a person's problem-solving style or appraisal [24]. Problem-solving style refers to a person's self-appraisal of their problem-solving abilities and attitudes (i.e., their self-evaluated capacity to resolve problems). The potential power of one's problem solving style is nicely reflected in Mahatma Gandhi's observation, "If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning." Research from over 130 studies have found that how people evaluate their problem-solving style has been related to a wide range of psychological adjustment and physical health indices, to the approach they use in coping with stressful problems, a robust moderator of the stress-psychological adjustment relationship, and to the resolution of educational and vocational issues (see [24]). The present study was conducted to examine the prospective role of problem-solving styles in predicting both breast cancer survivors' immediate emotional adjustment and physical health post-surgery, as well as 1 year later. Specifically, it was predicted that problem-solving style assessed shortly after breast cancer treatment intervention (at post-surgery) would be associated with emotional distress, adjustment to a new chronic illness (cancer), and physical function, all assessed immediately post-surgery. In addition, we predicted that that problem-solving style post-surgery would prospectively predict breast cancer survivors' emotional distress, adjustment to cancer, and physical function 1 year following treatment. Finally, we were interested in examining which factor(s) of the PSI would account for the most variance in predicting these three outcomes.

Methods

Participants

A total of 137 Midwestern women diagnosed with breast cancer began participation in the study. Participants were

scheduled to be followed over 12 months [3]; at 1 year, attrition was 4.4%, all due to death, resulting in a total of 131 survivors. No losses at this 12-month time were due to withdrawal or relocation. Another 10 participants had incomplete data on treatment and stage of disease, and were omitted from the study, leaving data from 121 participants for analysis. All of the breast cancer patients met the following three eligibility criteria: (a) over the age of 18 (mean age=59.7 years); (b) diagnosed with and treated for breast cancer; and (c) no prior history of lymphedema or breast cancer. The average educational level of this group was 13.6 years. Treatment characteristics available on the 121 participants revealed all but two had surgery applied as appropriate, either mastectomy or lumpectomy with sentinel lymph node biopsy (N=92) or axillary dissection (N=63); and as an adjuvant intervention, chemotherapy (N=30), radiation (n=31), or both (N=44). These treatment characteristics illustrate the diverse yet representative treatment in the sample.

Measures

Problem Solving Inventory, Form B (PSI; [21]) is a 35-item measure with a six-point Likert scale that assesses an individual's perceptions of his or her problem-solving styles, rather than actual problem-solving skills. Higher scores indicate an individual's assessment of oneself as a relatively ineffective problem solver. The PSI has a total score derived from three scales [24]. The three subscales are: (a) Problem-Solving Confidence (PSC, 11 items); (b) Approach-Avoidance Style (AAS, 16 items); and (c) Personal Control (PC, 5 items). The PSC refers to an individual's belief and trust in one's own problem-solving ability. The AAS is defined as a general tendency to approach or avoid a wide range of problem-solving activities. The PC refers to individual's belief that one is in control of his or her own behaviors and emotions while solving problems [22]. Previous studies demonstrated that the PSI has acceptable internal consistency estimates and good stability estimates of .80 over a 2-week period. Items of the total PSI and three subscales in this study had adequate internal consistency during both administrations: .92/.89 for the PSI total, as well as .85/.81, .88/.85, and .71/.64 for the PSC, AAS, and PC, at post-op and 12 months respectively. In addition, the construct, convergent, and discriminant validity of the PSI was well established based on over 120 studies (see [24]).

Brief Symptom Inventory (BSI; [10]) is a 53-item self-report psychological symptom inventory. Each symptom (i.e., item) is rated according to the amount of distress experienced. The BSI is scored on nine primary dimensions (e.g., somatization, interpersonal sensitivity) or in one of three global indices of adjustment (e.g., Global Severity Index, GSI). The present study used the GSI, which is considered to be the best single predictor of the respondent's level of distress [10]. Higher scores indicate more distress. Derogatis [10] reported excellent convergent and construct validity, as well as test-retest reliability. The alpha coefficients of the GSI for the two administrations in this study were .93/.96 at post-op and 12 months, respectively.

Psychological Adjustment to Illness Scale-Self-Report (PAIS-SR) The 46-item PAIS-SR [10] is used to assess a patient's psychological and social adjustment to the experience of chronic, potentially life-threatening illness. Although the measure includes seven domains (e.g., health care orientation, vocational environment), only the total scale score was used in this study. Higher scores indicated higher levels of overall psychological distress related to their illness. Extensive reliability testing has been done with various patient groups, including cancer patients, revealing good internal consistency [10]. The alpha coefficients of the PAIS-SR (total score) for the samples used in this study were .92/.94 at post-op and 12 months, respectively.

Functional Living Index-Cancer (FLI-C) The FLI-C [32] is a fourth-generation questionnaire composed of 22 items to assess the domains of physical function, psychological state, and family situational interaction; only the physical function subscale was used in this study (FLI-C: Function). Higher scores indicate better functioning. The FLI-C has well-established test-retest reliability and internal consistency, as well as content, construct, and concurrent validity. The alpha coefficients of the FLI-C: Function for the samples used in this study were .85/.88 at post-op and 12 months, respectively.

Procedures

Recruitment and Retention of Participants Patients meeting the inclusion criteria were referred by surgical and medical oncologists in the Midwest. The breast cancer survivors were informed of the study through flyers, as well as invited personally to participate by telephone, or at the time of clinic visits. Written consent was obtained from those willing to participate. Approximately 83% of the possible pool of breast cancer patients agreed to participate in the study. HIPPA standards prohibit us from examining files of patients who refuse to participate in research to determine if there were any differences between those who agreed to participate versus those who did not participate. However, our participants do match the hospital's annual report data in terms of demographic variables such as age, ethnicity, etc., as well as stage of disease. We have no reason to think

these two groups differed from each other. At 1 year, the project had a retention rate of 95.6%; attribution was only due to death. Specifically, the measuring procedure was noninvasive [2]; there were no toxic side effects to participation; the scheduled data collection points were coordinated with the patients' routine follow-up visits; and participants earned $25 per administration for their participation, with a final bonus of $25 for completion of all data collection points.

Background data on age, diagnosis, treatment (including node status), and co-morbidity (such as diabetes) were collected and verified through an interview using a researcher-developed instrument with structured and open-ended questions, and through an examination of patients' treatment records by an oncology nurse clinician upon completion of study. Data on psychosocial variables were collected by a mail-back survey, beginning immediately post-surgery and again 12 months after surgery. Together, these instruments required 60 to 90 min for completion.

Results

Changes over time: univariate analyses

Table 1 presents the means and standard deviations on all variables in the study for the data collected immediately post-surgery and 12 months post surgery. The PSI scores suggest that as a group, participants rated their problem-solving style as comparable to healthy adults (see [21]). The GSI indicated that participants experienced a low level of emotional distress. The PAIS-SR revealed participants were experiencing a low level of distress in adjusting to cancer. The FLI-C: Function also indicated that as a group they were experiencing a moderate level of physical functioning. Wilcoxon Signed Rank Tests were conducted on the difference between the variables immediately post surgery and 12 months later. Although no differences were found on the PSI total and the GSI, significant differences were found on the Personal Control factor of the PSI, as well as the PAIS-SR and FLI-C: Function (see Table 1); twelve months post surgery, the participants indicated better emotional control, less distress in adjusting to a chronic illness, and better physical function.

Zero-order correlations between the PSI and the criterion variables are presented in Table 2. The PSI Total was significantly correlated with the GSI immediately after surgery, as well as 12 months after surgery, but not the PAIS or the FLI-C: Function. In addition, the patterns of the correlations were similar across the PSI factor scores with the three outcome variables immediately after surgery, except the Personal Control factor was also correlated with all three outcome variables (GSI, PAIS, and FLI-C: Function). The zero-order correlations between the PSI and three PSI factors and the three outcome variables 12 months post surgery revealed that the PSI Total and all three factors were significantly correlated with the GSI, but not the PAIS or FLIC-Function. For both sets of correlations, Personal Control was most strongly correlated with the outcome variables. These results are partially consistent with the first and second hypothesis that the PSI would be significantly correlated with emotional distress, but was not significantly correlated with adjustment to chronic illness nor physical function immediately post-surgery, as well as 12 months later; moreover, the Personal Control factor had the highest correlations with the three outcomes immediately post surgery and, for the most part, 12 months later, as well.

Table 1 Problem-solving styles, emotional distress, adaptation to chronic illness, and physical function in breast cancer survivors' post primary treatment and one-year post treatment

Post treatment	12-Month post treatment								
Variable	N	Range	M	SD	N	Range	M	SD	Wilcoxon signed rank test
Problem solving inventory (total)	115	35–154	78.6	22.6	98	36–142	78.2	18.5	.07
Problem-solving confidence	116	11–52	22.6	7.5	98	11–42	23.1	6.9	.23
Approach-avoidance style	116	17–75	40.5	12.7	98	16–80	41.1	11.2	1.01
Personal control	116	5–28	15.4	5.2	98	5–30	14.1	4.5	−2.25*
Global severity index	113	0–2.5	0.4	0.4	97	0–2.6	0.4	0.5	−1.40
Psychological adjustment to illness scale-self-report	96	2–82.5	24.6	14.3	87	0–93	18.4	16.8	−4.38****
Functional living index-cancer: function	105	14–49	35.9	7.6	90	18–49	41.4	7.1	7.17****

*=$p<.05$

**=$p<.01$

***=$p<.001$

****=$p<.0001$

Table 2 Problem-solving styles, emotional distress, adaptation to chronic illness and physical function in breast cancer survivors' post primary treatment and 1 year post treatment and one-year post treatment

	Immediately post treatment			
	PSI	PSC	AAS	PC
Problem solving inventory (PSI)	-			
Problem-solving confidence (PSC)	.82****	-		
Approach-avoidance style (AAS)	.92****	.61****	-	
Personal control (PC)	.70****	.46****	.51****	-
Global severity index	.35****	.36****	.25**	.35***
Psychological adjustment to illness scale-self-report	.16	.11	.09	.27**
Functional living index-cancer: function	−.19	−.18	−.12	−.23*
Age	−.12	−.00	−.15	−.13
Education	−.19*	−.05	−.22*	−.15
	One-year post treatment			
Problem solving inventory	.61****	-		
Problem-solving confidence	.36***	.46****	-	
Approach-avoidance style	.58****	.34***	.62****	-
Personal control	.49****	.41****	.40****	.51****
Global severity index	.29**	.21*	.26**	.31**
Psychological adjustment to illness scale-self-report	.13	.02	.13	.19
Functional living index-cancer: function	.04	.06	.03	.01

*=p<.05

**=p<.01

***=p<.001

****=p<.0001

Hypothesis 1: Predicting outcomes immediately post treatment

The first hypothesis was tested using a series of standardized regression analyses. The first hypothesis predicted that after covariates were entered, the PSI total assessed immediately post treatment would be associated with the three criterion variables being emotional distress (GSI), adaptation to illness (PAIS-SR), and physical function (FLI-C: Function). The covariates were age, education, marital status, and cancer stage. A series of hierarchical regressions were conducted, first entering the covariates, followed by the PSI, on each criterion variable; these results are summarized in Table 3. After the variance associated with the demographic variables and cancer stage were removed, a more positive problem-solving style was associated with less emotional distress and better physical function immediately after treatment, but not better adaptation to a chronic illness. The PSI added between 6%–12% in predicting physical function and emotional distress, respectively.

Another set of standardized regression analyses was conducted to determine which PSI factors were accounting for the most variance in these regressions after first entering the covariates, as in the first set of regressions above. The results revealed that the Personal Control factor was significantly associated with all three outcomes (GSI, PAIS-SR, and FLI-C: Function) after the demographic variables, cancer stage, and treatment were removed. The Personal Control factor added between 4–13% of the variance in predicting the three outcomes. In addition, Problem-Solving Confidence added additional variance (4%) beyond the covariates and Personal Control in predicting the GSI. Thus, not only was a more positive problem-solving style associated with less emotional distress and better physical function immediately after treatment, but one of the PSI factors, Personal Control, was the best single predictor of all three criterion variables.

Hypothesis 2: Predicting outcomes 12 months post treatment

The second hypothesis was tested using a similar series of standardized regression analyses. It was predicted that the PSI total assessed immediately post-treatment would be

Table 3 Hierarchical regressions on emotional distress, adaptation to chronic illness and physical function (immediate post treatment)

	Emotional distress (GSI)					Adaptation to illness (PAIS-SR)					Physical function (FLI-C: function)				
Immediate Post Treatment	N	ΔR^2	β	*SE(β)*	95% CI	N	ΔR^2	β	*SE(β)*	95% CI	N	ΔR^2	β	*SE(β)*	95% CI
	108					94					101				
Covariates		.08					.13					.15			
PSI		.12	.36***	.10	.18–.55		.01	.10	.11	.12–.32		.06	−.20*	.10	−.40– .00
	108					94					101				
Covariates		.08					.13					.15			
Personal control		.13	.27****	.10	.06–.48		.05	.25*	.11	.04–.45		.06	−.25*	.10	−.43– .05
PSC		.04	.23*	.10	.02–.43										

PSI problem solving inventory, *PSC* problem-solving confidence

*=p<.05

**=p<.01

***=p<.001

****=p<.0001

associated with the three criterion variables, GSI, PAIS-SR, and FLI-C: Function 12 months post treatment. The covariates were age, education, marital status, cancer stage, and treatment (e.g., chemotherapy, radiation, and both chemotherapy and radiation). A series of hierarchical regressions were conducted, first entering the covariates, followed by the PSI, on each criterion variable; these results are summarized in Table 4. After the variance associated with the covariates were removed, the results indicated a more positive problem-solving style was associated with less emotional distress (adding 8% of the variance) 1 year after treatment, but was not associated with adaptation to a chronic illness nor physical functioning.

Another set of standardized regression analyses was conducted to determine which PSI factors were accounting for the most variance after first entering the covariates as in the first set of regressions above. The Personal Control factor was significantly associated with the GSI (adding 10% of the variance) after the covariates were removed, but not the PAIS-SR or FLI-C: Function. Thus, a stronger sense of Personal Control was associated with less emotional distress after 12 months (an additional 10% of the variance beyond all the covariates).

These results indicate that problem-solving appraisal and particularly emotional control was associated with extent of emotional adjustment immediately after the initial medical treatment and this relationship was relatively stable over a year.

Discussion

Our primary interest in this study was whether breast cancer survivors' approach to problem solving measured after

Table 4 Hierarchical regressions on emotional distress, adaptation to chronic illness and physical function (12 months post treatment)

	Emotional distress (GSI)					Adaptation to illness (PAIS-SR)					Physical function (FLI-C: function)				
12 Months post treatment	N	ΔR^2	β	*SE (β)*	95% CI	N	ΔR^2	β	*SE (β)*	95% CI	N	ΔR^2	β	*SE (β)*	95% CI
	93					84					88				
Covariates		.07					.11					.13			
Problem solving inventory		.08	.29**	.11	.07–.50		.01	.12	.12	−.12 –.35		.00	.05	.11	−.17–.27
	93					84					88				
Covariates		.07					.11					.08			
Personal control		.10	.33**	.11	.12–.54										

*=p<.05

**=p <.01

***=p<.001

****=p<.0001

primary treatment would predict the degree of emotional distress, adjustment to cancer, and overall physical function immediately after primary treatment, as well as a year later. The results of this study clearly indicate that breast cancer survivors' initial problem-solving style was significantly associated with emotional distress and overall physical function immediately following primary treatment, as well as emotional distress 1 year later, but not adjustment to cancer or physical function 12 months later. Moreover, the results suggest that the Personal Control factor of the PSI was the single best problem-solving dimension associated with the above study outcomes. When survivors indicated they felt a lack of emotional control, they reported feeling more emotionally overwhelmed, making snap judgments, and did not know what to do. They clearly felt a lack of control over their emotions and actions. That is, after entering the covariates, Personal Control accounted for an additional 4–13% of the variance in predicting emotional distress, adjustment to illness, and physical function immediately after primary treatment, and 10% in predicting emotional distress a year later. In short, the relatively trait-like disposition, problem-solving appraisal, and especially breast cancer survivors' sense of emotional control was not only concurrently predictive of immediate post-surgery emotional distress, adjustment to cancer, and physical function, but also prospectively predictive of emotional distress 1 year later. These findings are consistent with previous research that found the Personal Control factor was also predictive of a number of physical health complaints and behavioral symptoms (e.g., [41]).

In essence, the results of this study suggests that the problem-solving approach to challenges experienced by breast cancer survivors is related to adjustment 12 months following primary treatment (see also [9]). Moreover, the results suggest that a specific problem solving component related to emotional control was the best single predictor of adjustment. These results suggest it is not just the cancer diagnosis and treatment, and all that entails, but how the individual confronts this experience that is related to outcomes at 1 year. Given the 95% 12-month retention rate of the sample in this study, the external validity of these conclusions are greatly strengthened (cf. a 37% retention rate reported in [9]).

Given that problem-solving appraisal is learned, and, most importantly, enhanced after 5–8 problem-solving training sessions (e.g., [23, 24, 30]), it also suggests that survivors' self-appraisal of their problem-solving skills is amenable to change. Most importantly, when cancer survivors learn this approach, they also experience lower levels of emotional distress [30]. Moreover, the present findings suggest that at-risk breast cancer survivors who feel emotionally out of control as problem solvers might be excellent candidates for problem-solving training interventions to impact emotional distress and possible other outcomes post-treatment. Randomized control trials are needed to examine this hypothesis with long-term end points, at least 1 year and beyond, perhaps 2–5 years or longer. There are many promising possibilities for applied interventions to enhance problem-solving appraisal and ability to cope with stressful life events such as breast cancer, and thereby to enhance people's life satisfaction and well-being. Research is now needed to prospectively examine the utility of problem-solving training, with perhaps booster training over time, to augment their ability to cope with their symptoms and illness over many years post primary treatment.

Although the results of this study provide prospective information regarding problem-solving style and adaptation, there are limitations of the present findings. The prospective reports of this study are limited to 1 year post-surgery, and a relatively small sample given the number of covariates and predictors (N=8 or more). Larger samples are needed over a longer period of time to more fully understand the predictive role of problem-solving appraisal in breast cancer patients' adjustment related to being a breast cancer survivor over time. Problem-solving appraisal was not measured before the cancer diagnosis or treatment; it is unclear if the cancer diagnosis or treatment influenced the survivors' initial problem-solving appraisal measured right after treatment (although the survivors' problem-solving scores were stable over the 12 months); future studies need to measure problem solving before diagnoses or treatment, as well as follow the problem-solving scores over a longer period of time. In addition, the findings are restricted to one Midwestern sample, and additional research with other samples is needed to extend the external validity of the study. Most importantly, although the study clearly implicates the role of problem-solving appraisal (and particularly emotional control) in adjustment immediately post-surgery and 1 year later, additional research is now needed to rigorously test interventions that incorporate problem-solving training components on breast cancer survivors' emotional adjustment both immediately post-surgery and over time.

In sum, emotional care of the breast cancer patient is not well understood; this lack of understanding results in both a high cost to the patient as well as the health care system. This study using a prospective design with a specific Midwestern group of cancer survivors exposed to surgery as the primary medical treatment observed that after controlling for several covariates, problem-solving style, and particularly personal control, was associated with three potentially important measures of outcome, specifically emotional distress, adjustment to cancer, and physical function, immediately after primary treatment, and with emotional adjustment 12 months later. The results suggest that problem-solving training interventions may be useful to reduce levels of distress, and

enhance coping approaches, particularly for breast cancer survivors who report low levels of personal control and may be at risk for greater distress.

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