

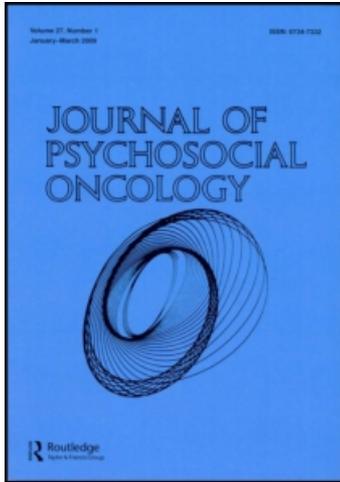
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Dispositional Cancer Worry: Convergent, Divergent, and Predictive Validity of Existing Scales

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Past research has suggested that dispositional cancer worry may be a key predictor of health behavior. The current study examined seven measures of dispositional cancer worry to see if they were significantly related (convergent validity), significantly different from similar but distinct traits (divergent validity), and capable of predicting cancer-relevant outcomes (predictive validity). Four hundred and eighty nine undergraduate students completed a survey measuring dispositional worry, dispositional cancer worry, and perceived cancer risk. Factor analysis identified four underlying dimensions that explained 67.3% of the variance in dispositional cancer worry: severity (42.8%), frequency (12.3%), psychological reactance (6.9%), and worry impact (5.3%). Four existing measures of dispositional cancer worry were found to represent each of these dimensions. In general, dispositional cancer worry measures were highly correlated with one another and only moderately correlated with measures of dispositional worry, supporting strong convergent and divergent validity. Hierarchical regression analyses revealed that dispositional cancer worry measures predicted significant variance in cancer-relevant outcomes above and beyond dispositional worry. The results of the

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current study support the notion that dispositional cancer worry and dispositional worry are distinct constructs. Furthermore, two dimensions of dispositional cancer worry (severity and frequency) seemed to have the strongest convergent, divergent, and predictive validity.

KEYWORDS *cancer, worry, dispositional, scale validation, oncology*

Worry is a cognitive activity wherein an individual experiences a series of negative thoughts about an uncertain issue (Borkovec, Robinson, Pruzinsky, & Dupree, 1983). Situational or state-based worry is often triggered by an event and is sometimes followed by attempts at problem solving, for example, worrying about an approaching tax deadline could facilitate thinking about how an individual might reorganize his or her life to complete the necessary tax documents. However, worry can also be a long-term or routine activity directed at ambiguous or extremely distant events. When persons think in this way they are said to be prone to dispositional or trait-based worry. Dispositional worry is unfocused, vague, and sometimes indicative of poor problem solving (Borkovec et al., 1983; Pruzinsky & Borkovec, 1990; Tallis, Eysenck, & Mathews, 1991). Conceptually, a person could engage in dispositional worry about life in general or about a specific event or issue (e.g., dispositional cancer worry).

Newly diagnosed cancer patients likely experience significant worry (i.e., state-based cancer worry), but even individuals who do not have cancer in their lives can dwell on the disease (i.e., trait-based cancer worry). The former has the potential to influence decision making about the stimulus (Lehto & Cimprich, 2009), but the latter is of interest to researchers because past studies have suggested that this type of thinking may be related to behaviors across the cancer continuum (Andersen, Drescher, Zheng, Bowen, & Wilson, 2007; Han, Moser, & Klein, 2006; Hay, McCaul, & Magnan, 2006; Henderson et al., 2008; Jensen, in press; Kinsinger, McGregor, & Bowen, 2009; Korfage et al., 2009; Mellon et al., 2009). For example, site-specific dispositional cancer worry has been related to obtaining genetic testing (Lerman et al., 1997), getting a mastectomy to prevent cancer (Stefanek, Enger, Benkendorf, Flamm-Honig, & Lerman, 1999), and engaging in cancer screening (Schwartz et al., 1995).

One limitation of existing work on dispositional cancer worry is that researchers have utilized an array of measures (modified or developed for individual studies) that have never been subjected to validity assessments (DeVellis, 2003; McQueen, Vernon, Meissner, & Rakowski, 2008) or that are designed to measure worry about a specific type of cancer (Champion &

Skinner, 2004; Consedine, Magai, Krivoshekova, Ryzewicz, & Neugut, 2009; Dijkstra & Brosschot, 2003; Lerman et al., 1991; McCaul & Goetz, n.d.; Weiss & Marmar, 1997). An exception to the rule is the Cancer Worry Chart (Gramling, Anthony, Frierson, & Bowen, 2007), which was designed to measure dispositional cancer worry in general and found to be highly correlated ($r = .66$) with a modified version of the Lerman Breast Cancer Worry scale (Lerman et al., 1991). Limitations of this study are that the Cancer Worry Chart is a single-item measure, that it was only compared to one measure of cancer worry, and that relationships between potentially related constructs (e.g., dispositional worry) were not examined.

Additionally, no study to date has verified whether cancer worry (dispositional or otherwise) is empirically distinct from worry in general. That is, it is currently unclear whether measures of cancer worry contribute significant variance above and beyond that which could be predicted by standard measures of worry (e.g., the Penn State Worry Questionnaire; Meyer, Miller, Metzger, & Borkovec, 1990). Demonstrating that the two constructs do diverge is essential before continuing forward.

DeVellis (2003) proposed that new and existing scales should be subjected to three types of validity tests: convergent, divergent, and predictive. Using his criteria as well as building on recent attempts to develop and validate measures of state-based cancer worry (Hirari et al., 2008), the current study examines seven modified or existing measures of dispositional cancer worry to see if they are significantly related (convergent validity), significantly different from similar but distinct traits (divergent validity), and capable of predicting cancer-relevant outcomes (predictive validity).

METHOD

Participants

Undergraduate students ($N = 489$) voluntarily participated in a survey for extra credit. More females (59.9%) participated than males (40.1%). The mean age of participants was 19.4 years ($SD = 1.5$). The racial background of participants was 80.2% White, 11.2% Asian, 5.1% Hispanic, 4.3% Black or African American, and 2.5% describing themselves as "other."

Procedure

Participants were students enrolled in communication courses at a large university in the midwestern United States. Communication courses fulfill general educational requirements, so the students in the current study represent

a wide range of majors. At their discretion, course instructors presented students with the opportunity to earn extra credit (equal to 3% of their final grade) by participating in department research studies. Interested students visited the research participation Website and signed up to participate. Participants who were ready to complete the study had the option to connect to the study Website and complete the survey. Those visiting the Website read a consent form, agreed to participate in the study, and then completed a series of demographic questions, worry measures, and open-ended items.

Dispositional Worry Measures

Penn State Worry. The Penn State Worry Questionnaire (henceforth, "Penn St. Worry") is a 16-item scale that measures dispositional worry (Meyer et al., 1990). Respondents answer each question using 5-point scales ranging from *not at all typical of me* to *very typical of me*. Sample items include, "If I do not have enough time to do something, I do not worry about it," "My worries overwhelm me," and "I do not tend to worry about things." The Penn St. Worry has proved to be a reliable measurement instrument (Cronbach's $\alpha = .93$) and has demonstrated good test-retest reliability ($r = .92$; Meyer et al., 1990).

Worry Domains. The Worry Domains Questionnaire (henceforth, "Worry Domains") is a 25-item scale that measures general worry within five specific areas of life: relationships, self-confidence, the future, work incompetence, and finances (Tallis, Davey, & Bond, 1994; Tallis, Eysenck, & Mathews, 1992). Respondents answer each question using 5-point scales ranging from *not at all* to *extremely*. Sample items include, "I worry that my money will run out," "I worry that I cannot be assertive or express my opinions," and "I worry that my future job prospects are not good." The Worry Domains has proved to be a reliable measurement instrument (Cronbach's $\alpha = .85-.88$; Joormann & Stober, 1997; Stober, 1998; Stober & Joormann, 2001) and has demonstrated good test-retest reliability ($r = .79$; Tallis et al., 1994).

Worry Severity. The Brief Measure of Worry Severity (henceforth, "Worry Severity") is an 8-item scale measuring how severely worry affects one's life (Gladstone et al., 2005). Respondents answer each question using 4-point scales, ranging from *not true at all* to *definitely true*. Sample items include, "When I worry, it interferes with my day-to-day functioning (e.g., stops me from getting work done, or organizing my day)," "When I think I should be finished worrying about something, I find myself worry about the same thing over and over," and "My worrying leads me to feel down and depressed." The Worry Severity has demonstrated strong reliability in the past (Cronbach's $\alpha = .86-.91$).

Dispositional Cancer Worry

McCaul Brief Worry Scale. The McCaul Brief Worry Scale (henceforth, “McCaul”), is a 3-item scale originally designed to measure the frequency and intensity of worry about colon cancer (McCaul & Goetz, n.d.). For the current study, the McCaul scale was modified to refer to cancer in general. The first item, “During the past week, how often have you worried about getting cancer sometime in your lifetime?” is answered using a 4-point scale that ranges from *never* to *all of the time*. The final two questions, “How bothered are you by thinking about getting cancer?” and “How worried are you about getting cancer?” are answered using a 5-point scale ranging from *not at all* to *extremely*. No reliability statistics are available for this scale as it has not been formally tested.

Brief Worry Scale. The Brief Worry Scale about Smoking (henceforth, “BWS”) is a 4-item scale measuring worry about physical health as a consequence of smoking (Dijkstra & Brosschot, 2003). Respondents answer each question using 7-point scales ranging from *not at all* to *very much*. For the current study, the BWS was modified to refer to cancer in general. Sample items from the modified scale include “I am afraid of the physical consequences of getting cancer,” “I worry about my health because of my chances of getting cancer,” and “I feel anxiety when I think of the possible consequences of getting cancer.” This BWS has demonstrated strong reliability in the past (Cronbach’s $\alpha = .95$).

Worry Scale. The Worry Scale is a 2-item scale measuring worry about colon cancer (McCaul & Goetz, n.d.). In the current study, the Worry Scale was modified to refer to cancer in general. For the first question, “How much does thinking about cancer *worry* you?” respondents answer by marking a point on a continuum from *no worry* to *moderate worry* to *extreme worry*. For the second question, “How *bothered* are you by thinking about cancer?” respondents answer by marking a point on a continuum from *not at all* to *moderately* to *extremely* (McCaul & Goetz, n.d.). No reliability statistics are available for this scale as it has not been formally tested.

Worry Chart. The Worry Chart is a single-item measure, “How much have you been bothered by thoughts or worry about your chances of getting breast cancer,” evaluated using a 5-point scale (*not at all*, *slightly*, *moderately*, *quite a bit*, *extremely*). The Worry Chart also include three faces (smiling, normal, frowning) to help people visualize the response options (Gramling et al., 2007).

Revised Impact of Events Scale. The Revised Impact of Events Scale includes a subscale measuring intrusive thoughts (henceforth, “RIES–Intrusive”). The subscale was modified for the current study to refer to cancer worry in general. Participants received the following instructions, “Please indicate how frequently the following thoughts and feelings about cancer happened for you during the past seven days.” Participants

responded via seven items evaluated using a 4-point scale: *not at all*, *rarely*, *sometimes*, *often* (Horowitz, Wilner, & Alvez, 1979). Sample items include, "I had dreams about cancer," "Pictures about cancer popped into my mind," and "Other things kept making me think about cancer." The RIES–Intrusive has demonstrated excellent internal consistency (Cronbach's $\alpha = .86$) and good test–retest reliability ($r = .87$; Sundin & Horowitz, 2002).

Champion Breast Cancer Fear Scale. The Champion Breast Cancer Fear Scale (henceforth, "Champion"), is an 8-item scale that measures physical arousal and fear in an effort to assess worry (Champion & Skinner, 2004). Respondents answer each of the questions using a 5-point scale ranging from *strongly agree* to *strongly disagree*. For the current study, the Champion scale was modified to refer to cancer in general. Sample items include, "The thought of cancer scares me," "When I think about cancer, I get upset," "When I think about cancer, I get jittery," and "When I think about cancer, I get depressed." The Champion scale has demonstrated strong reliability in the past (Cronbach's $\alpha = .91$).

Lerman Breast Cancer Worry Scale. The Lerman Breast Cancer Worry Scale (henceforth, "Lerman"), is a 3-item scale that measures frequency of breast cancer worry and the impact of worrying on mood and ability to perform daily activities (Lerman et al., 1991). For the current study, Lerman was modified from breast cancer to cancer in general. The first question, "How worried are you about getting cancer someday?" was measured on a 5-point scale with responses ranging from *not at all* to *almost all the time*. Impact of worrying was assessed with two items, "How much does your worry affect your mood?" and "How much does your worry affect your ability to perform your daily activities?" Responses to the impact questions were measured using a 4-point scale that ranged from *not at all* to *a lot*. The Lerman scale has demonstrated strong internal consistency (Cronbach's $\alpha = .86$; Brain et al., 2002).

Outcome Measures

Cancer Worry. In addition to the scales, participants responded to an open-ended question: "We've asked you to respond to several questions about worry and cancer. Could you tell us, in your own words, what you think about cancer? Do you worry about it? If not, why? If so, when and how often?" Three graduate students coded the responses as either "participant generally worries about cancer" or "participant does not generally worry about cancer." Each response was coded by two of the three coders, and Cohen's kappa was calculated to estimate intercoder reliability (kappa = .85).

Perceived Risk of Developing Cancer. Perceived risk was measured using a modified version of the Disease Specific Perceived Risk (DSPR) Scale

(DiLorenzo et al., 2006). The DSPR was modified to measure perceived lifetime risk of developing breast cancer, lung cancer, colon cancer, and melanoma.

RESULTS

Scale Reliabilities

Initially, scale reliabilities were calculated and examined for measures utilized in the current study. All three dispositional worry measures were found to be reliable: Penn St. Worry (Cronbach's $\alpha = .90$, $M = 3.48$, $SD = .99$), Worry Domains (Cronbach's $\alpha = .93$, $M = 2.31$, $SD = .74$), and Worry Severity (Cronbach's $\alpha = .90$, $M = 2.03$, $SD = .71$). Four of the dispositional cancer worry measures were reliable as conceived: BWS (Cronbach's $\alpha = .89$, $M = 3.25$, $SD = 1.63$), Worry Scale (Cronbach's $\alpha = .78$, $M = 2.09$, $SD = 1.00$), RIES–Intrusive (Cronbach's $\alpha = .90$, $M = 1.30$, $SD = .50$), and Champion (Cronbach's $\alpha = .92$, $M = 2.39$, $SD = .95$). The Lerman scale had low initial reliability (Cronbach's $\alpha = .57$); however, item analysis revealed reliability for the scale would increase to .83 if one of the questions were dropped (item #26 in Table 1). This was to be expected, as the Lerman scale has had similar reliability issues in the past (Lerman et al., 1991). In line with past work, the problematic item was removed and transformed into a single-item scale (henceforth, “Lerman–Intensity”) and the remaining items were relabeled “Lerman–Worry Impacts” (Cronbach's $\alpha = .83$, $M = 1.89$, $SD = .86$). The McCaul scale had acceptable reliability (Cronbach's $\alpha = .78$), but item analysis revealed that dropping one item (item #1 on Table 1) would increase stability. Thus, the problematic item was removed and transformed into a single-item scale (henceforth, “McCaul–Frequency”) and the remaining items were relabeled “McCaul–Severity” (Cronbach's $\alpha = .82$, $M = 2.28$, $SD = .96$). The Worry Chart was initially a single-item measure, so no reliability data could be calculated.

Factor Analysis

Principal axis factor analysis was utilized to examine the underlying structure of the 28 items from the seven dispositional cancer worry scales. If dispositional cancer worry is a uni-dimensional construct, then factor analysis should reveal a single underlying factor (DeVellis, 2003). Counter to this idea, four initial factors were identified with eigenvalues >1 , explaining 42.8%, 12.3%, 6.9%, and 5.3%, respectively, of the variance. An examination of the scree plot supported a four-factor solution (see the appendix). To aid in interpretation of the four factors, varimax rotation was utilized (see Table 1). The first factor (I) appears to represent cancer worry severity. Four

TABLE 1 Principal Component Factor Analysis of Dispositional Cancer Worry Items

	Factors				M	SD
	I	II	III	IV		
McCaul-Frequency (4 pt. scale)						
1. During the past week, how often have you worried about getting cancer sometime in your lifetime?	.540	.487			1.55	.71
McCaul-Severity (5 pt. scales)						
2. How bothered are you by thinking about getting cancer?	.690				2.30	1.04
3. How worried are you about getting cancer?	.771				2.27	1.04
BWS (7 pt scales)						
4. I am afraid of the physical consequences of getting cancer.	.756				3.95	1.97
5. I worry about my health because of my chances of getting cancer.	.802				3.33	1.96
6. I feel anxiety when I think of the possible consequences of getting cancer.	.755				3.17	1.88
7. I brood about the physical consequences of getting cancer.	.638				2.59	1.72
Worry Scale (5 pt. scales)						
8. How much does thinking about cancer worry you?	.682				2.10	1.11
9. How bothered are you by thinking about cancer?	.599				2.10	1.10
Worry Chart (5 pt. scale)						
10. How much have you been bothered by thoughts or worry about your chance of getting cancer?	.651				1.99	0.98
RIES-Intrusive (4 pt. scales)						
11. I thought about cancer when I didn't mean to.		.755			1.45	.73
12. I had trouble falling asleep or staying asleep, because of pictures or thoughts about cancer that came to mind.		.794			1.16	.51
13. I had waves of strong feelings about cancer.		.848			1.27	.60
14. I had dreams about cancer.		.775			1.14	.45
15. Pictures about cancer popped into my mind.		.825			1.27	.61
16. Other things kept making me think about cancer.		.766			1.42	.74
17. Any reminder brought back feelings about cancer.		.706			1.40	.71

(Continued on next page)

TABLE 1 Principal Component Factor Analysis of Dispositional Cancer Worry Items (*Continued*)

	Factors				M	SD
	I	II	III	IV		
Champion (5 pt. scales)						
18. The thought of cancer scares me.	.677				3.56	1.29
19. When I think about cancer, I feel nervous.	.556		.609		2.73	1.26
20. When I think about cancer, I get upset.	.444		.678		2.51	1.26
21. When I think about cancer, I get depressed.			.700		2.14	1.14
22. When I think about cancer, I get jittery.			.824		1.88	1.03
23. When I think about cancer, my heart beats faster.			.812		1.84	1.02
24. When I think about cancer, I feel uneasy.	.418		.754		2.32	1.22
25. When I think about cancer, I feel anxious.			.764		2.09	1.13
Lerman-Severity (4 pt. scale)						
26. How worried are you about getting cancer someday?	.754				2.11	.90
Lerman-Worry Impact (4 pt. scale)						
27. How much does your worry affect your mood?				.889	2.05	.95
28. How much does your worry affect your ability to perform your daily activities?				.899	1.75	.90
% of variance explained	42.87	12.33	6.97	5.38		
Eigenvalue	12.00	3.45	1.95	1.50		

Note: BWS = Brief Worry Scale about Smoking; RIES = Revised Impact of Events Scale. Principal components factor analysis using varimax rotation with Kaiser normalization.

items (#1, 19, 20, and 24) load on multiple factors, suggesting that those questions should be dropped. The second factor (II) consists of the entire RIES–Intrusive subscale and the problematic McCaul item (#1). One interpretation of the RIES–Intrusive is that it is a measure of cancer worry frequency. This interpretation is consistent with the logic of the scale because respondents indicate the frequency of intrusive or avoidant thoughts (about cancer, in this case). As validation of this interpretation, the problematic McCaul item that loads with the RIES asks “how often” people worry about getting cancer (i.e., frequency). Factor three (III) is the modified Champion scale. The Champion scale either represents a construct other than cancer worry or a component of cancer worry that could be described as arousal, fear, or psychological reactance. Finally, the fourth factor (IV) is the Lerman–Worry Impacts scale (#27 and 28) that assess how cancer worry affects an individual (i.e., mood, performance of daily activities). In summary, four scales seem to serve as representations of the four factors identified in the analysis: the BWS (I), the RIES–Intrusive (II), the Champion Fear Scale (III), and the Lerman–Worry Impact Scale (IV).

Convergent and Divergent Validity

Convergent validity is demonstrated when measures of the same construct are found to be significantly related to one another. Divergent validity is demonstrated when measures of one construct are found to differ from measures of another construct. To address both of these issues, correlations were examined among all of the dispositional worry and dispositional cancer worry measures (see Table 2).

Dispositional worry measures (e.g., Penn St. Worry, Worry Domains) were found to be highly correlated ($r = .49-.66$). Of the dispositional cancer worry measures, only the Lerman–Worry Impacts scale was highly correlated ($r = .46-.61$) with the dispositional worry measures. The remaining dispositional cancer worry measures were correlated with dispositional worry, but to a lesser degree ($r = .17-.35$). Finally, all of the dispositional cancer worry measures were highly correlated with one another, except for the McCaul Frequency Scale, the RIES–Intrusive subscale, and the Lerman–Worry Impacts scale. The McCaul–Frequency scale and the RIES–Intrusive subscale are measures of worry frequency, and as such they were highly correlated ($r = .54$). The McCaul–Frequency scale was highly correlated ($r = .41-.54$) with every other dispositional cancer worry measure except for the Champion scale ($r = .39$) and the Lerman–Worry Impacts scale ($r = .20$). This is consistent with the factor analysis as the McCaul–Frequency scale loaded on the first two factors (severity and frequency) but not the third and fourth. Apart from the McCaul–Frequency scale, the RIES–Intrusive subscale was moderately correlated with all of the other dispositional cancer worry measures

TABLE 2 Correlation Matrix for Measures of Dispositional Worry and Dispositional Cancer Worry

	1	2	3	4	5	6	7	8	9	10	11
Worry											
1. Penn St. Worry											
2. Worry Domains	.49										
3. Worry severity	.66	.63									
Cancer Worry											
4. McCaul-Frequency	.19	.18	.27								
5. McCaul-Severity	.31	.23	.35	.41							
6. BWS	.31	.26	.34	.50	.74						
7. Worry Scale	.23	.17	.28	.45	.70	.67					
8. Worry Chart	.31	.26	.32	.50	.66	.61	.62				
9. RIES-Intrusive	.19	.21	.24	.54	.39	.35	.39	.47			
10. Champion	.28	.25	.35	.39	.66	.69	.66	.59	.41		
11. Lerman-Severity	.20	.25	.24	.44	.61	.60	.50	.58	.30	.49	
12. Lerman-Worry Impact	.46	.45	.61	.20	.26	.23	.18	.26	.21	.26	.10

Note: BWS = Brief Worry Scale about Smoking; RIES = Revised Impact of Events Scale.
 All coefficients are significantly different, $p < .05$.

($r = .30-.41$) except for the Worry Chart ($r = .47$) and the Lerman–Worry Impact scale ($r = .21$). The Lerman–Worry Impact scale had a weaker correlation with other dispositional cancer worry measures as well ($r = .18-.26$). It should be noted that the strongest observed correlations were between the McCaul–Severity scale, the BWS, and the Worry Scale ($r = .67-.74$).

Taken as a whole, the results suggest that all of the dispositional cancer worry measures except for the Lerman–Worry Impacts scale have strong divergent validity from dispositional worry. That is, there is good reason to believe that dispositional cancer worry is related to dispositional worry, but an empirically distinct construct. Convergent validity was demonstrated for all three measures of dispositional worry (Penn St. Worry, Worry Domains, and Worry Severity) as well as the dispositional cancer worry severity (McCaul–Severity, BWS, Worry Scale, Worry Chart, Lerman–Severity) and frequency measures (McCaul–Frequency, RIES–Intrusive). The Champion scale was highly correlated with the dispositional cancer worry severity measures, an observation that is consistent with the factor analysis (a separate factor, but one with several items that cross load). The Lerman–Worry Impacts scale was more correlated with the dispositional worry measures than the dispositional cancer worry measures. This suggests poor divergent and convergent validity for that measure.

Gender Differences

Risk for certain cancers varies by gender (e.g., breast cancer). Past research has suggested that cancer worry also varies by gender; cancer worry may be more frequent in women (McQueen et al., 2008; Zajac, Klein, & McCaul, 2006). To examine this idea, a series of *t* tests were carried out with gender as the predictor and all of the worry measures as the outcome variables of interest (see Table 3). Consistent with past work, women were more likely to worry. In fact, women were more likely to worry in general as well as to have higher cancer worry severity and frequency scores.

Predictive Validity

Predictive validity is obtained when a construct is capable of predicting relevant outcomes. In the case of dispositional cancer worry, two outcomes seem pertinent: (1) whether participants describe themselves as cancer worriers (in their open-ended response data) and (2) whether participants perceived themselves to be at risk of developing cancer. Moreover, dispositional cancer worry should be able to predict variance in these outcomes above and beyond standard measures of worry (e.g., Penn St. Worry) to establish the utility of a cancer-specific measure of worry.

TABLE 3 Gender Differences Across Dispositional Worry and Dispositional Cancer Worry

	Male	Female	<i>t</i>
Worry			
1. Penn St. Worry	3.11 (0.87)	3.74 (0.99)	-7.09***
2. Worry Domains	2.18 (0.05)	2.39 (0.04)	-3.06**
3. Worry Severity	1.83 (0.68)	2.17 (0.70)	-5.82***
Cancer Worry			
4. McCaul-Frequency	1.36 (0.58)	1.67 (0.76)	-4.95***
5. McCaul-Severity	1.92 (0.82)	2.52 (0.97)	-7.28***
6. BWS	2.64 (1.46)	3.66 (1.62)	-7.02***
7. Worry Scale	1.77 (0.86)	2.31 (1.03)	-6.27***
8. Worry Chart	1.66 (0.77)	2.21 (0.90)	-6.89***
9. RIES-Intrusive	1.21 (0.41)	1.36 (0.55)	-3.46**
10. Champion	2.00 (0.85)	2.65 (0.93)	-7.67***
11. Lerman-Severity	1.86 (0.85)	2.28 (0.90)	-5.06***
12. Lerman-Worry Impact	1.78 (0.81)	1.97 (0.88)	-2.44***

Note: BWS = Brief Worry Scale about Smoking; RIES = Revised Impact of Events Scale.

Means, standard deviations (in parentheses), and *t* tests testing whether dispositional worry and dispositional cancer worry scores differ by gender.

†*p* < .10, **p* < .05, ***p* < .01, ****p* < .001.

Hierarchical regression analyses were carried out with gender entered in the first block, the three standard measures of worry (i.e., Penn St. Worry, Worry Domains, and Worry Severity) entered in the second block, and the four scales representing the four factors of dispositional cancer worry (BWS, RIES-Intrusive, Champion, and Lerman-Worry Impact) entered in the third block. The first dependant variable was whether participants had described themselves as worriers in their open-ended responses. For that outcome, the regression was significant at the first, second, and third blocks (reported at the third block), $R = .57$, $R^2 = .33$, $F(7, 406) = 28.3$, $p < .001$ (see Table 4). Dispositional cancer worry accounted for about 22% of the variance in participant's responses (above and beyond gender and dispositional worry). An examination of the coefficients reveals that cancer worry severity ($p < .001$), frequency ($p = .013$), and impact ($p = .048$) were all significant predictors in the second block. Interestingly, worry impact was negatively related to participant's self-labeling as worriers.

For perceived risk, participants were asked to assess the lifetime probability that they would develop particular cancers (breast, lung, colon, and melanoma). For perceived breast cancer risk, the regression was significant at the first, second, and third blocks (reported at the third), $R = .76$, $R^2 = .58$, $F(8, 413) = 71.26$, $p < .001$. Cancer worry accounted for about 7% of the variance in perceived breast cancer risk. An examination of the coefficients revealed that cancer worry severity ($p < .001$), frequency ($p = .026$), and impact ($p = .032$) were all significant predictors in the third block. Interestingly, worry impact was negatively related to perceived breast cancer risk. For perceived lung cancer risk, the regression equation was significant at

TABLE 4 Hierarchical Regression Predicting Perceived Cancer Risk from Dispositional Cancer Worry

	Open-ended Cancer Worry		Breast		Lung		Colon		Melanoma	
	<i>B</i> (<i>SE</i>)	<i>R</i> ²	<i>B</i> (<i>SE</i>)	<i>R</i> ²	<i>B</i> (<i>SE</i>)	<i>R</i> ²	<i>B</i> (<i>SE</i>)	<i>R</i> ²	<i>B</i> (<i>SE</i>)	<i>R</i> ²
Block 1		.09*		.49*		.00		.00		.08*
Gender	.11 (.04)*		3.13 (.18)*		-.01 (.20)		-.24 (.19)		1.12 (.25)*	
Block 2		.15*		.50*		.08*		.02*		.10*
Penn St. Worry	.05 (.02)		-.03 (.11)		-.19 (.12)		.09 (.12)		-.19 (.16)	
Worry Domains	-.02 (.03)		-.01 (.14)		.68 (.16)*		.20 (.15)		.30 (.20)	
Worry Severity	.06 (.04)		.38 (.19)*		-.17 (.21)		.01 (.20)		.32 (.27)	
Block 3		.33*		.58*		.13*		.04†		.17*
BWS	.10 (.01)*		.39 (.07)*		.29 (.08)*		.16 (.07)*		.47 (.10)*	
RIES (Intrusive)	.10 (.04)*		.39 (.17)*		.32 (.19)		.07 (.18)		.14 (.25)	
Champion	.03 (.03)		.00 (.12)		-.26 (.14)†		.00 (.13)		-.22 (.18)	
Lerman (Worry Impact)	-.05 (.02)*		-.26 (.12)*		.28 (.13)*		-.02 (.13)		-.18 (.17)	
<i>N</i>		426		422		416		418		419

Note: BWS = Brief Worry Scale about Smoking; RIES = Revised Impact of Events Scale.

Coefficients (*B*) and standard errors (*SE*) are for the final model in which all variables are entered. The *R*² column represents the amount of variance explained by all of the blocks included up to that point. Subtracting *R*² from the previous block will yield *R*² change (i.e., the amount of variance explained by that block alone). †*p* < .10, **p* < .05.

the second and third blocks (reported at the third), $R = .36$, $R^2 = .13$, $F(8, 407) = 7.71$, $p < .001$. Cancer worry accounted for about 5% of the variance in perceived lung cancer risk. An examination of the coefficients revealed that cancer worry severity ($p < .001$) and impact ($p = .039$) were positively related to perceived risk and psychological reactance was marginally negatively related to perceived risk ($p = .067$). For perceived colon cancer risk, the regression equation was significant at the second block and marginally significant at the third block (reported at the third), $R = .21$, $R^2 = .04$, $F(8, 409) = 2.48$, $p = .059$. Cancer worry accounted for about 2% of the variance in perceived colon cancer risk. An examination of the coefficients revealed that only cancer worry severity ($p = .026$) was a significant predictor of risk in the third block. For perceived melanoma risk, the regression equation was significant at the first, second, and third blocks (reported at the third), $R = .41$, $R^2 = .17$, $F(8, 410) = 10.46$, $p < .001$. Cancer worry accounted for about 7% of the variance in perceived melanoma cancer risk. An examination of the coefficients revealed that only cancer worry severity ($p < .001$) was a significant predictor of risk in the third block.

Combined, the results suggest that dispositional cancer worry is a unique construct capable of predicting variance in key outcomes above and beyond gender and dispositional worry. Cancer worry severity, as represented by the BWS, was the most consistent factor of the four. It significantly predicted all five outcomes examined in the current study (strong predictive validity).

DISCUSSION

Past research has suggested that dispositional worry might have two underlying factors: severity and frequency (Eysenck & Van Berkum, 1992). The current study is consistent with this idea, as severity and frequency accounted for considerable variance in dispositional cancer worry (55%) and demonstrated excellent convergent, divergent, and predictive validity. The results also suggest that researchers would be well served to use the four-item BWS and eight-item RIES–Intrusive to measure dispositional cancer worry severity and frequency. For researchers interested in using an equal number of items (i.e., a combined eight-item scale measuring both factors), the factor analytic data support a four-item version of the RIES–Intrusive scale (items #12, 13, 14, and 15 in Table 1) that could be combined with the BWS. For those with even less space, the Lerman–Severity, Worry Scale, and Worry Chart offer single-item measures of dispositional cancer worry severity.

Two other potential factors of dispositional cancer worry were identified in the current study: physiological reactance and worry impact. The former was entirely a byproduct of the modified Champion scale. The original scale was designed to measure fear (of breast cancer), a construct that may be

conceptually distinct from worry (Russell & Barrett, 1999). Items in the scale seem to target arousal of various sorts, and this distinguishes it from other measures of cancer worry and worry in general (McCaul & Goetz, n.d.). Thus, physiological reactance could be a factor of dispositional cancer worry or a related, but unique construct. Worry impact offers similar challenges, because the current analyses rely on a two-item measure (the Lerman–Worry Impact scale), and it is unclear whether this is truly a dimension of dispositional cancer worry or a unique construct. As currently operationalized, worry impact is not significantly divergent from dispositional worry nor is it convergent with other measures of dispositional cancer worry. Further explication of worry impact is in order.

Consistent with past research, gender was significantly related to cancer worry. Women reported more severe and more frequent cancer worry. Higher cancer worry scores could reflect the tendency for males to mask worry in line with gender norms (e.g., Nicholas, 2000). Consistent with this idea, past research on cancer perceptions and behaviors has found that gender differences may be highly contingent on question wording (e.g., Arnold & DeJong, 2005; Jensen & Moriarty, 2008). However, differences could also reflect underlying gender differences in information acquisition and utilization; for example, women seem to be more open-minded when evaluating health information in general (e.g., Gonzalez, Chapman, & Leventhal, 2002). Additional psychometric research exploring the origins of gender differences in the context of cancer worry would be beneficial, especially if question wording effects were investigated.

The current study had several limitations. Even though means and standard deviations for all scales were comparable to those observed with other samples, it is still the case that undergraduate students may not be representative of the population as a whole. Dispositional cancer worry measures were found to be divergent from dispositional worry measures, but future work should consider whether these scales are significantly different from other related constructs (e.g., sorrow, stress). Finally, continued validation of dispositional cancer worry needs to examine the stability of the construct over time. From an explication standpoint, it is unclear whether dispositional cancer worry should be temporally stable, but researchers will want to investigate this notion and to explore relationships between state- and trait-based measures of the construct.

People worry about many aspects of their lives. Past research has demonstrated that some people experience prolonged worry, a phenomena referred to as trait-based or dispositional worry (Borkovec et al., 1983). Reliable measures of dispositional worry have been around for some time, but researchers have been exploring the possibility that worrying about cancer, and not just worrying in general, could be meaningfully related to a number of health behaviors and outcomes (e.g., Hay et al., 2006). The current study found that several existing measures of dispositional cancer worry are

reliable, and capable of predicting unique variance in cancer-relevant perceptions. These validated scales provide researchers with proven measures and should help to launch new lines of research concerning dispositional cancer worry.

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APPENDIX

Scree Plot

