
Does Self-Affirmation, Cognitive Processing, or Discovery of Meaning Explain Cancer-Related Health Benefits of Expressive Writing?

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Although expressive writing has positive effects on health, little is known about the underlying psychological mechanisms for these effects. The present study assessed self-affirmation, cognitive processing, and discovery of meaning as potential mediators of the effects of expressive writing on physical health in early-stage breast cancer survivors. A content analysis of the essays showed that self-affirmation writing was associated with fewer physical symptoms at a 3-month follow-up assessment, with self-affirmation writing fully mediating the effects of the emotional expression and benefit-finding writing conditions on reduced physical symptoms. Cognitive processing and discovery of meaning writing were not associated with any physical health outcomes. Consistent with evidence showing that self-affirmation plays an important role in buffering stress, the present study provides the first evidence for self-affirmation as a viable mechanism underlying the health benefits of expressive writing.

Keywords: *self-affirmation; cancer; cognitive processing; discovery of meaning; expressive writing*

Writing about major life events and traumatic experiences can have significant benefits for mental and

physical health. Throughout the past two decades, a large literature has shown that expressive writing improves physical health in a variety of populations (for a review, see Frisina, Borod, & Lepore, 2004; Smyth, 1998). For example, recent studies have shown that expressive writing reduces pain and fatigue and improves well-being in women with fibromyalgia (Broderick, Junghaenel, & Schwartz, 2005), reduces viral load in HIV-infected adults (Petrie, Fontanilla, Thomas, Booth, & Pennebaker, 2004), produces lower evaluations of pain intensity in chronic pain patients (Norman, Lumley, Dooley, & Diamond,

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2004), improves health in breast cancer patients (Stanton et al., 2002), and enhances mental and physical health in healthy college students (e.g., Epstein, Sloan, & Marx, 2005; King & Miner, 2000). Although reviews have indicated the efficacy of expressive writing for a broad range of health outcomes (Smyth, 1998), little is known about the psychological and biological mechanisms underlying these effects (Stone, Smyth, Kaell, & Hurewitz, 2000).

The present study is part of an effort to understand the physiological and psychological mechanisms of expressive writing. In a recent expressive writing trial, 63 Stage I and II breast cancer survivors were randomly assigned to write four essays throughout a 3-week period about either their deepest thoughts and feelings regarding their experience with breast cancer, perceived benefits from the experience, or facts about their breast cancer treatment (Stanton et al., 2002). Participants reported on their mood before and after each writing session, and measures of general life satisfaction, mood throughout the past week, and health status were taken at baseline, 1-month follow-up, and 3-month follow-up. The emotionally expressive writing and benefit-finding writing interventions produced fewer physical symptoms and cancer-related doctor visits among the women at 3-month follow-up, compared to the fact-writing control condition. In an examination of physiological mediators of these effects, greater heart rate habituation during the writing sessions (i.e., the difference between peak 1-min heart rate during writing and heart rate during the last min of writing) mediated the effects of writing on physical symptoms at 3-month follow-up (Low, Stanton, & Danoff-Burg, 2006).

Although theorists have considered potential psychological mediators of expressive writing (e.g., Pennebaker, Mayne, & Francis, 1997), few studies have included assessments or manipulations designed to test for potential psychological mechanisms. However, independent literatures in social and clinical psychology suggest that several self-processes may serve as expressive writing mechanisms in improving health outcomes. Specifically, findings from these literatures suggest that self-affirmation, cognitive processing, and discovery of meaning may buffer stress and improve health and adjustment (Bower, Kemeny, Taylor, & Fahey, 1998, 2003; Creswell et al., 2005; Keough, 1998). The present investigation tested these three self-processes as potential mechanisms for the effects of expressive writing on health. Specifically, we content analyzed the essays in the expressive writing trial and assessed the mediating role of self-affirmation, cognitive processing, and discovery of meaning on health improvements at 3-month follow-up.

Self-Resources and Self-Affirmation

Theories suggest that the self can serve as an important stress-buffering and health protective resource (Hobfoll, 1989; Ryff & Singer, 1998; Sherman & Cohen, 2006; Taylor, 1983). Hobfoll (1989) suggested that people who have greater self-resources (e.g., social status, personal characteristics) recover more quickly from negative events and experience greater well-being. Similarly, Taylor and Brown (1988) suggested that self-enhancing views buffer the deleterious effects of threatening events and positively affect mental and physical health (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). Consistent with these theoretical accounts of the self, research has shown that self-processes can act as stress-buffering and health protective resources in a variety of experimental contexts. Recent laboratory studies have shown that participants with positive self-views (e.g., high self-esteem, high self-enhancement) have lower distress and biological responses to stress (cortisol, cardiovascular responses; Bonnano, Rennie, & Dekel, 2005; Seery, Blascovich, Weisbuch, & Vick, 2004; Taylor, Lerner, Sherman, Sage, & McDowell, 2003a) and greater mental health (Taylor, Lerner, Sherman, Sage, & McDowell, 2003b). Similarly, studies have shown that people with more complex and differentiated self-concepts (Linville, 1987) and greater self-confidence (Holahan & Moos, 1990) have greater resilience under stress and better mental and physical health.

We recently demonstrated that the protective capacities of the self can be recruited with a self-affirmation activity to buffer physiological stress responses (Creswell et al., 2005). Self-affirmation theory posits that the overall goal of the self-system is to protect one's image of self-integrity when threatened and that one way to do this is through the affirmation of valued sources of self-worth (Steele, 1988). By fulfilling the need to protect self-integrity in the face of threat, self-affirmation can enable people to deal with threats and stressful life events in a less defensive and more adaptive manner (Sherman & Cohen, 2006). To assess the stress-buffering effects of self-affirmation, we randomly assigned participants to complete a brief self-affirmation activity about an important personal value (e.g., religion, politics) or an unimportant value and then had them participate in a laboratory stress challenge task. Participants who had affirmed an important personal value had reduced cortisol responses to the challenge task. Because biological stress reactivity has been shown to be associated with longer term health problems (S. Cohen et al., 2002), one important implication is that self-affirmation activities have the potential to buffer the stress of traumatic life events and positively affect functional health status.

Based on this research, the present study tested self-affirmation as a mechanism for the benefits of expressive writing. To assess the role of self-affirmation on health, we defined self-affirmation as a positive reflection on a valued self-domain and conducted a content analysis for self-affirmation writing in the expressive writing essays. Consistent with the self-affirmation literature, self-affirmation was defined broadly to capture all statements that reflected thoughts about the self-domains that were valued by each participant (Linville, 1987; Sherman & Cohen, 2006). Although no published studies have previously tested the effects of self-affirmation writing on health (but see Keough, 1998), one study with healthy college undergraduates suggested that daily self-affirmations enhance psychological well-being (Lange, Richard, Gest, de Vries, & Lodder, 1998). Specifically, Lange et al. (1998) randomly assigned participants to a positive self-instruction condition where they wrote a short essay about their positive characteristics and then read it aloud to themselves twice daily for 3 weeks. Daily positive self-reflectors had reduced feelings of inadequacy and greater self-esteem and self-confidence compared to controls at posttest, suggesting that daily self-affirmations may improve psychological functioning. Given the evidence that the protective qualities of the self can be recruited with self-affirmations to reduce physiological indicators of stress and enhance well-being, we hypothesized that self-affirmation writing would mediate the salutary effects of expressive writing on reported physical health at 3-month follow-up.

Cognitive Processing and Discovery of Meaning

A second theoretical perspective posits that self-processes relating to self-change play a critical role in coping, adjustment, and health status (Janoff-Bulman, 1992; Taylor, 1983). This theoretical work suggests that traumatic or stressful life events can threaten one's basic worldview, generating a period of dramatic self-change and readjustment. Cognitive processing and discovery of meaning have been identified as two basic psychological self-change processes associated with greater adjustment and improved physical health. Cognitive processing has been defined as the process of actively thinking about the thoughts and feelings associated with a threatening or stressful event and has been identified as an important component and mechanism in the effects of expressive writing (Pennebaker et al., 1997; cf. O'Leirigh et al., 2003). For example, content analyses of expressive writing studies with healthy adults have shown that the use of cognitive processing words is associated with improvements in health and performance. Using the Linguistic Inquiry Word Count (LIWC) computer program (Francis & Pennebaker,

1993), content analyses showed that use of causal or insight-oriented words was associated with decreases in physical symptoms and doctor visits, improvements in college students' grades, and improvements in employment status among unemployed workers (Pennebaker et al., 1997). Similarly, a more recent study with college undergraduates showed that cognitive processing words mediated the effects of writing on improvements in positive growth (Ullrich & Lutgendorf, 2002).

Investigators have posited that cognitive processing may mediate the effects of expressive writing on health; however, the cognitive changes that occur as a result of this processing may be more important for physical health than cognitive processing alone. After all, cognitive processing alone may indicate ruminative processes, whereas cognitive processing and a corresponding discovery of meaning may indicate a successful reconciliation of the traumatic event. Consistent with this notion, several studies suggest that cognitive processing must be linked to discovery of meaning to improve health. In a series of studies, Bower and colleagues assessed the role of cognitive processing and discovery of meaning on health outcomes in several populations. They conceptualized discovery of meaning as an enhanced appreciation for life and recognition of its fragility as the result of a traumatic or stressful life event (Bower et al., 2003). In an initial study, a content analysis of interviews conducted with bereaved HIV-seropositive men assessed the role of cognitive processing and discovery of meaning on CD4 T-cell declines and AIDS-related mortality at follow-up (Bower et al., 1998). Men who engaged in cognitive processing were more likely to discover meaning from the loss of a close partner or friend. Furthermore, discovery of meaning was shown to buffer declines in CD4 T-cells and AIDS-related mortality (Bower et al., 1998).

Studies with other bereaved and stressed populations have shown similar effects. Women who discovered meaning through the loss of a close relative to breast cancer had elevated natural killer cell cytotoxic activity (Bower et al., 2003), and discovery of meaning after breast cancer diagnosis was associated with elevated levels of positive emotions in breast cancer survivors (Bower et al., 2005). Finally, a study by Mann (2001) assessed the effects of writing about a positive future in HIV-seropositive women. Content analyses of the essays showed that although cognitive processing and discovery of meaning were not independently associated with medication adherence, the combination of cognitive processing and finding meaning predicted improvements in medication adherence at posttest (Westling & Mann, 2005). The present study tested cognitive processing, discovery of meaning, and a combination of the two as mechanisms for the health benefits of expressive writing in early-stage breast cancer patients. Specifically, we hypothesized that cognitive

processing and the combined measure of cognitive processing and discovery of meaning would mediate effects of expressive writing on health.

Study Overview

The present investigation examined how writing about emotions or benefits produces self-affirmation, cognitive processing, and discovery of meaning and how these processes affect health status in a sample of breast cancer patients. Specifically, the essays from Stanton et al. (2002) were coded for statements reflecting the potential mediators: self-affirmation, cognitive processing, discovery of meaning, and the combined category of cognitive processing and discovery of meaning, and each was then tested as a possible mediator of the relationship between expressive writing and health at 3-month follow-up.

METHOD

Participants

Sixty-three early-stage (Stage I and II) female breast cancer patients who were within 20 weeks after completing cancer treatment (e.g., chemotherapy, surgery, radiotherapy) participated in the study, with \$100 compensation. Participants ranged in age from 21 to 76 years old ($M = 49.5$) and identified themselves as Caucasian (93%), African American (5%), and Asian American (2%). Participants were excluded from the study if they had a diagnosis of recurrent or metastatic disease or were unable to write in English. Three participants dropped out of the study due to a cancer recurrence ($n = 2$) or lack of interest ($n = 1$).

Procedure

Participants were recruited from four medical clinics for a study on "learning more about how women adjust to having breast cancer." All participants wrote four essays about their breast cancer experiences during a 3-week period. Participants were randomly assigned to one of three conditions and instructed to write about their (a) deepest thoughts and feelings regarding their experience with breast cancer (Emotional Expression), (b) positive thoughts and feelings regarding their experience with breast cancer (Benefit-Finding), or (c) facts regarding their cancer and its treatment (Fact-writing Control). For each writing session, participants were instructed to write continuously for 20 min. All procedures were IRB-approved. For a detailed description of the study, see Stanton et al. (2002).

Heart rate was assessed continuously during the four writing sessions. Immediately before and after writing each essay, participants completed a measure of state distress using the state form of the Profile of Mood States (McNair, Lorr, & Droppelman, 1971). A state distress index was created by averaging the Anger, Depression, Tension, Fatigue, and Confusion subscales ($\alpha = .80-.88$). For the present study, analyses with the state distress measure focused on examining the associations between the potential mediators and distress levels immediately after writing.

Dependent Measures

At 1 and 3 months after completing the last writing assignment, participants completed questionnaires assessing their physical symptoms, cancer-related doctor visits, general life satisfaction (as measured by the Satisfaction With Life Scale [SWLS]; Diener, Emmons, Larsen, & Griffin, 1985), and mood throughout the past week (as measured by the Profile of Mood States [POMS]; McNair et al., 1971). The SWLS is a five-item scale consisting of statements regarding satisfaction with one's life rated on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*; sample $\alpha = .82$), whereas the POMS is a 65-item scale consisting of affect adjectives rated on a six-point scale (0 = *not at all* to 5 = *extremely*). A negative mood measure was created by summing items on the highly correlated POMS anger, depression, tension, fatigue, and confusion subscales (sample $\alpha = .85$), whereas positive mood was measured by the POMS vigor subscale (sample $\alpha = .92$). Participants returned the follow-up measures by mail.

Physical symptoms were assessed at baseline and follow-up with a nine-item measure assessing participants' experiences of nine different physical symptoms (e.g., coughing/sore throat) in the past 30 days (Pennebaker, 1982). In assessing cancer-related doctor visits, participants were given a form after their last writing session to keep a record of all of their medical visits throughout the following 3 months. This measure assessed the number of medical appointments for cancer-related morbidities, not including regularly scheduled cancer-related or non-cancer-related medical visits. A subset of these self-reported medical visit forms were confirmed with medical records, showing high accuracy (92%) of reporting.

Essay Coding

The 240 essays (60 participants \times 4 essays) were content analyzed by trained coders who were blind to the study hypotheses and the participants' writing condition. Two groups of three judges coded the essays, with three judges coding for self-affirmation and three judges

coding for cognitive processing and discovery of meaning. This strategy was used to reduce coding burden and to avoid contamination among coding categories. All judges for each coding category were trained as one group with a detailed coding manual to standardize training. The coding manual provided operational definitions and examples for each coding category and detailed instructions on how to code each essay. The judges were trained to code the essays for examples of self-affirmation or cognitive processing and discovery of meaning, with a sentence being the smallest unit of text that could be coded to a category. Judges coded statements as "text units," which was defined as a single sentence or multiple consecutive sentences describing a potential self-mediator. For example, the following two sentences were coded as one self-affirmation text unit: "Actually, I'm pretty tough, and it's going to take a little bit more than a bit of breast cancer to get me down. I'm a fighter." For the present study, frequency counts of coded text units were used in the final data analyses.¹ All coding was conducted using a computer content analysis software program (N6, QSR International), which was used as a tool for combining and quantifying the coding across judges.

Consistent with some common content analysis coding approaches (Smith, 2000; Suedfeld, Tetlock, & Streufert, 1992), each category was not considered to be independent of the others. Thus, some statements were coded in multiple categories if they were consistent with the category definitions. A strength of this approach is that the coding categories are allowed to share statements, permitting a more accurate measure of each coding category (constraining each coding category to be mutually exclusive increases coding errors where constructs are overlapping). A limitation of this approach is that overlapping coding violates the statistical assumption of independence of observations and can become problematic when multiple coded variables are entered into a single statistical model. Thus, in assessing the role of each mediator on the association between expressive writing and health at follow-up, each potential mediator was assessed alone. For a review of different approaches to coding text data, see Smith (2000).

Judges were trained in how to code the essays (using sample essays from three participants in the same dataset)² and then coded the essays independently of one another. In assessing interrater reliabilities among the three judges, 3% of agreement statistics were calculated between pairs of coders for each coding category. A high percentage of agreement was found for self-affirmation (90-92% agreement), cognitive processing (90-93% agreement), and discovery of meaning (94-95% agreement), suggesting that coding was highly reliable between judges. As an additional method to ensure

reliability of coding, a command was used in the text analysis software program that selected text units for which at least two of the three judges coded the individual text unit to the same coding category. The output of this function was used for the final data analyses, ensuring that the final text data used in the data analyses was agreed on by at least two of the three judges.

Coding the Potential Mediators

Formal operational definitions and text examples of each potential mediator are provided in Table 1. The present study used previous coding approaches for content analyzing the breast cancer participants' essays (Bower et al., 1998). Unlike content analysis approaches for coding cognitive processing and discovery of meaning (Bower et al., 1998), no procedures were available for coding naturalistic occurrences of self-affirmation. The psychology literature has tested the effects of self-affirmation using only experimental methods, manipulating affirmations in laboratory settings. Building on this literature (Sherman & Cohen, 2006) and on self-affirmation theory (Steele, 1988), the present study defined self-affirmation as "a positive reflection on a valued self-domain." The definition was intentionally broad to capture all statements that reflected thoughts about the self-domains that were valued by each participant (Linville, 1987). For example, statements affirming valued personal relationships, the global self-concept, spirituality, concern for others, career/education, property, hobbies, being affirmed by others, and personal health were coded as self-affirmation. A distinction also is made in the self-affirmation literature between affirmations that are in the same domain as the threat versus a different domain not related to the threat (Blanton, Cooper, Skurnik, & Aronson, 1997). The present conceptualization was inclusive of both of these categories, necessitated by the fact that people were writing about the threatened self-domain (i.e., cancer).

It is important to note that the present definition and approach to measuring self-affirmation is consistent with experimental self-affirmation manipulations (e.g., Sherman, Nelson, & Steele, 2000) in which participants are asked to rank-order up to 10 self-domains (e.g., relationships, religion, money) and then are asked to think about the importance and provide examples from one self-domain. Self-affirmation was constrained in the present study so that only positive reflections on current self-domains were considered for selection as self-affirmation. Statements about the past self (e.g., "Before my operation I was an excellent golfer") or future self (e.g., "Someday I hope to join a church") did not qualify as self-affirmation because these statements reflected processing about a past self or optimistic thinking about a future self.

TABLE 1: Definitions and Examples of Coded Potential Mediating Variables**Self-Affirmation: A Positive Reflection on a Valued Self-Domain**

1. "We have been married over 31 years and we are very lucky because we still love each other." (Relationships)
2. "I have always had a good positive attitude about all things and that has really helped me during this time." (Global self-concept)
3. "I did pray more than I ever have. I have always found that to be most of my strength." (Religion and spirituality)

Cognitive Processing: The Process of Actively Thinking About the Positive Aspects of One's Cancer Experience

1. "I feel I can look forward to a long life because I was so fortunate to have detected this so early."
2. "I have Stage II breast cancer with a large tumor that was completely removed. I had both breasts removed, although a very positive result was that I did not have any lymph node involvement, which was such a good thing."

Discovery of Meaning: A Major Shift in Values, Priorities, or Perspectives in Response to Getting Cancer

1. "All my senses seem more acute and I tend to focus on them more than I did before cancer." (Mindfulness)
2. "Subsequently, I have new goals, like college graduations, weddings, and grandchildren." (Life goals)
3. "This experience brings home my own mortality and leads me to feel I should be taking much better care of myself in other respects." (Life is fragile and precious)

NOTE: Subcategories of each process variable are italicized.

Cognitive processing and discovery of meaning were assessed according to procedures developed by Bower et al. (1998), based on theoretical accounts of cognitive processing (Greenberg, 1995) and discovery of meaning (Tedeschi & Calhoun, 1995). Cognitive processing was defined as "the process of actively thinking about the positive aspects of one's cancer experience." Of importance, judges were trained to code statements about cognitive processing about their breast cancer experience and not statements about thoughts and feelings unrelated to breast cancer. To compare cognitive processing and self-affirmation, we elected to focus our cognitive processing definition on cognitive processing about the positive aspects of cancer.³ Discovery of meaning also was based on Bower et al.'s (1998) criteria and was defined as "a major shift in values, priorities, or perspectives in response to getting cancer." Statements reflecting positive feelings of growth, mindfulness, life being seen as fragile and precious, and new or enhanced spirituality, life goals, self-awareness, and life enjoyment were coded as discovery of meaning (Bower et al., 1998). Statements were considered for the discovery of meaning category if they described processes of positive self-change (e.g., new or enhanced self-domains).

RESULTS

Preliminary Analyses

Preliminary analyses revealed no significant experimental condition differences at baseline for stage of breast cancer ($p = .70$), time since diagnosis ($p = .65$), or physical symptoms ($p = .15$), suggesting that random-

ization was effective in equalizing the health status of the groups at baseline.

Table 2 shows the percentages of statements coded for each of the subcategories of self-affirmation, and Table 3 shows the percentages for discovery of meaning. To create composite measures for each potential mediator, the total number of coded text segments was summed separately for self-affirmation, cognitive processing, and discovery of meaning across each participant's four essays. (For the self-affirmation and discovery of meaning categories, all coded text segments were first summed across the subcategories.) The three writing conditions yielded writing in each potential self-mediator category across the four essays: self-affirmation statements ($M = 8.98$, $SD = 8.53$), cognitive processing statements ($M = 5.32$, $SD = 5.50$), and discovery of meaning statements ($M = 5.50$, $SD = 11.56$). To assess the combined effects of cognitive processing and discovery of meaning on health, a pooled measure for cognitive processing and discovery of meaning was created by combining the composite measures of these two categories. The combined cognitive processing and discovery of meaning measure produced the highest frequency of coded statements across the potential self-mediator categories ($M = 10.82$, $SD = 13.01$). We also examined the consistency of writing across the four essay writing samples in the coded potential mediator categories. Intraclass correlations showed that there was a high degree of consistency in writing frequency across the essay writing periods (i.e., essays 1-4) for each coded potential mediator (self-affirmation $r_1 = .89$; cognitive processing $r_1 = .74$; discovery of meaning $r_1 = .89$; combined cognitive processing and discovery of meaning $r_1 = .87$).

TABLE 2: Percentage of Statements Coded to Self-Affirmation Subcategories

<i>Self-Affirmation</i>
Valued relationships (70%)
Religion, spirituality, faith (12%)
Global self-concept (8%)
Concern for others (4%)
Hobbies (2%)
Health (2%)
Being affirmed by others (1%)
Career/education (1%)
Property (.5%)

TABLE 3: Percentage of Statements Coded to Discovery of Meaning Subcategories

<i>Discovery of Meaning</i>
New/enhanced life goals (19%)
Greater mindfulness/awareness of the present moment (17%)
New/enhanced spirituality/faith (17%)
Feelings of growth (14%)
Life seen as fragile/precious (8%)
Other positive meaning categories (8%)
Greater enjoyment of life (7%)
New/enhanced self-awareness (6%)
Fewer fears or worries (3%)

To compare the degree of relatedness among the potential mediator categories, the number of sentences double-coded by the judges was assessed in the composite measures of self-affirmation, discovery of meaning, and cognitive processing (as shown in Table 4). The potential mediators shared a small degree of overlap. Specifically, 13% of the coded sentences in self-affirmation and discovery of meaning were overlapping, 10% in self-affirmation and cognitive processing were overlapping, and 2% in cognitive processing and discovery of meaning were overlapping. Coding to all three categories represented < 1% of the total coded sentences. To assess the associations between our current coding categories and the commonly used LIWC computer program (Francis & Pennebaker, 1993), we assessed associations between the potential mediators and the LIWC word count results for positive emotion (e.g., “happy”), negative emotion (e.g., “scared”), and insight-related (e.g., “because”) words (as shown in Table 4; see also Low et al., 2006). We found positive associations among all three of the potential mediators and the LIWC-derived positive emotion words.

The potential mediator scores were square-root transformed to normalize the data, consistent with recommendations for normalizing frequency data distributions (Howell, 2001). Two dummy codes were used for the two experimental conditions, with the control condition

designated as the reference group. Predictor variables were centered prior to conducting multiple regression analyses (J. Cohen, Cohen, West, & Aiken, 2003). To control for the potential confounding effects of essay length on the frequencies of each potential mediator, essay length was entered as a control variable in all analyses that included self-affirmation, cognitive processing, or discovery of meaning. The inclusion of essay length as a control variable did not substantially influence the significance or direction of effects in any of the reported results.

Analytic Plan

The focus of the present study was to assess whether self-affirmation, cognitive processing, discovery of meaning, or a combined measure of cognitive processing and discovery of meaning accounted for the relationship between emotional expression and benefit-finding writing on health at 3-month follow-up. Accordingly, a series of multiple regression equations were conducted using an analytic approach specified by Baron and Kenny (1986). This approach specifies that four steps must be met to show mediation: (a) A significant relationship between the predictor (writing condition) and the outcome variable (health status at follow-up), (b) a significant relationship between the predictor and a proposed mediating variable (e.g., self-affirmation), (c) a significant relationship between the proposed mediating variable and outcome must be found when the proposed mediating variable and predictor variable are entered simultaneously in predicting the outcome variable, and (d) to establish full mediation, the relationship between the predictor and outcome variable must become zero in the Step 3 equation. Finally, if the four steps provide evidence for mediation, the significance of the mediating variable effect is computed using a test assessing the joint significance of the two mediating variable effects (Distribution of ab/s) (MacKinnon, Lockwood, & Hoffman, 1998). Recent reviews suggest that this approach provides a greater balance between Type I error rates and statistical power, compared to other common mediation approaches (e.g., Sobel, 1982; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

Step 1: Effects of Writing Condition on Physical Health

Step 1 assessed the effects of the emotional expression and benefit-finding writing relative to the fact writing control condition on physical health at 3-month follow-up. Consistent with univariate ANOVAs presented in Stanton et al. (2002), standardized, multiple-regression analyses confirmed that compared to fact-writing

TABLE 4: Associations Among the Potential Mediators and the Linguistic Inquiry and Word Count (LIWC) Program Results

	<i>Self-Affirmation</i>	<i>Discovery of Meaning</i>	<i>Cognitive Processing</i>	<i>LIWC Positive</i>	<i>LIWC Negative Emotion Words</i>	<i>LIWC Insight Words Emotions Words</i>
Self-affirmation	—					
Discovery of meaning	13%	—				
Cognitive processing	10%	2%	—			
LIWC positive emotion words	.70***	.44***	.56***	—		
LIWC negative emotion words	-.10	-.13	-.12	.05	—	
LIWC insight words	.20	.13	.07	.28**	.49***	—

NOTE: Associations among the potential mediators (self-affirmation, discovery of meaning, and cognitive processing) are represented in the percentage of statements that were coded to both categories. All other values represent correlation coefficients.

** $p < .05$. *** $p < .01$.

TABLE 5: Frequency of Coded Writing Statements for Each Writing Condition

	<i>Emotional Expression</i>	<i>Benefit Finding</i>	<i>Fact Writing</i>
Self-affirmation			
<i>M</i>	5.48	18.61	1.83
<i>SD</i>	3.91	6.03	2.81
Cognitive Processing (CP)			
<i>M</i>	4.00	8.95	2.61
<i>SD</i>	4.23	6.41	3.07
Discovery of Meaning (DM)			
<i>M</i>	1.10	14.29	.39
<i>SD</i>	1.37	16.31	1.24
Combined CP and DM			
<i>M</i>	5.10	23.24	3.00
<i>SD</i>	4.17	14.77	3.79

NOTE: Means and standard deviations are of untransformed frequency data.

controls, emotional expression ($\beta = -.37$), $t(54) = -2.99$, $p = .004$, and benefit-finding ($\beta = -.23$), $t(54) = -1.92$, $p = .060$, predicted fewer physical symptoms at 3-month follow-up, after controlling for physical symptoms at baseline. Similarly, compared to fact-writing controls, emotional expression ($\beta = -.48$), $t(57) = -3.36$, $p = .001$, and benefit-finding ($\beta = -.35$), $t(57) = -2.46$, $p = .017$, predicted fewer cancer-related doctor visits during the 3 months following the writing intervention.

Step 2: Effects of Writing Condition on the Potential Mediators

Step 2 compared the effects of emotional expression and benefit-finding to the fact control condition in eliciting writing about the potential mediators. The mean frequencies of coded writing statements for each writing condition are provided in Table 5. Multiple regression analyses showed that the emotional expression ($\beta = .40$), $t(56) = 4.76$, $p < .001$, and benefit-finding conditions ($\beta = 1.00$), $t(56) = 11.69$, $p < .001$, elicited significantly more self-affirmations than did the fact-writing control condition. Also, the benefit-finding condition elicited significantly more cognitive processing ($\beta = .60$),

$t(56) = 4.27$, $p < .001$, and discovery of meaning writing ($b = .61$), $t(56) = 4.49$, $p < .001$. However, the emotional expression condition did not elicit significant cognitive processing ($\beta = .12$), $t(56) = .89$, $p = .38$, or discovery of meaning ($\beta = .03$), $t(56) = .22$, $p = .83$. As expected given this pattern of results, using the combined measure of cognitive processing and discovery of meaning, only the benefit-finding condition elicited both cognitive processing and discovery of meaning statements ($\beta = .85$), $t(56) = 7.70$, $p < .001$, whereas the emotional expression condition did not ($\beta = .17$), $t(56) = 1.63$, $p = .11$. Thus, findings from Step 2 showed that both experimental writing conditions elicited self-affirmations, whereas only the benefit-finding condition elicited cognitive processing, discovery of meaning writing, and their combination.

Steps 3 and 4: Self-Affirmation as a Mediating Variable

Steps 3 and 4 assessed the relationships between the writing conditions and the potential mediators on physical symptoms and cancer-related doctor visits. Multiple regression equations tested each potential mediator on

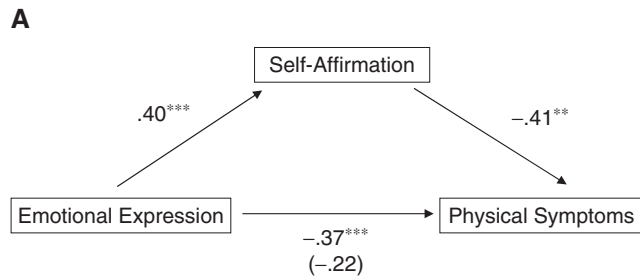


Figure 1a Self-affirmation mediation analysis of the association between emotional expression writing and physical symptoms at 3-month follow-up, controlling for baseline physical symptoms.

NOTE: Numbers represent standardized beta coefficients, with parentheses representing beta coefficients when writing condition and self-affirmation are entered simultaneously.

** $p < .05$. *** $p < .01$.

each health outcome separately, with writing condition and a potential mediator entered simultaneously as predictors. In each multiple regression equation, we tested for a significant association between the potential mediator and each health outcome (Step 3) and then, if needed, assessed whether there was a reduction in the strength of the association between the expressive writing conditions and each health outcome with the inclusion of the potential mediating variable (Step 4). Self-affirmation was tested first. Consistent with predictions, self-affirmation writing fully mediated the relationship of both experimental writing conditions on reductions in physical symptoms at 3-month follow-up. As shown in Figures 1a and 1b, after controlling for baseline levels of physical symptoms, self-affirmation was significantly negatively correlated with physical symptoms at 3-month follow-up ($\beta = -.41$), $t(52) = -2.08$, $p = .043$ (Step 3), whereas the associations for the emotional expression ($\beta = -.22$), $t(52) = -1.59$, $p = .12$ (Step 4), and the benefit-finding writing conditions ($\beta = .11$), $t(52) = .48$, $p = .63$ (Step 4), were no longer significant. The inclusion of self-affirmation as a simultaneous predictor variable produced substantial reductions in the strength of the association for both the emotional expression (β change = .16) and the benefit-finding writing conditions (β change = .34). A test assessing the joint significance of the two mediating variable effects was conducted (MacKinnon et al., 1998). Self-affirmation significantly mediated the path between emotional expression writing and physical symptoms ($Z' = -1.90$, $p < .01$) and between benefit-finding writing and physical symptoms ($Z' = -2.04$, $p < .01$).

Step 3 multiple regression analyses were conducted for each of the remaining potential mediators in predicting physical symptoms at 3-month follow-up. Cognitive processing ($\beta = .18$), $t(52) = 1.54$, $p = .13$, discovery of meaning ($\beta = -.11$), $t(52) = -.92$, $p = .36$, and the combined

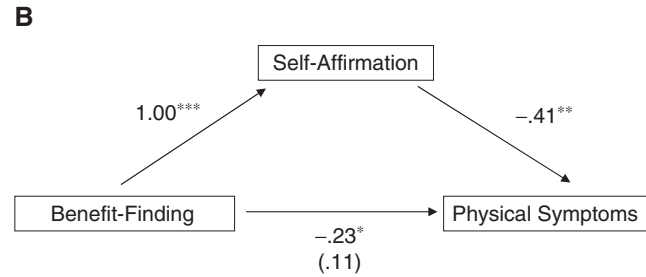


Figure 1b Self-affirmation mediation analysis of the association between benefit-finding writing and physical symptoms at 3-month follow-up, controlling for baseline physical symptoms.

NOTE: Numbers represent standardized beta coefficients, with parentheses representing beta coefficients when writing condition and self-affirmation are entered simultaneously.

* $p < .10$. ** $p < .05$. *** $p < .01$.

measure of cognitive processing and discovery of meaning ($\beta = .13$), $t(52) = .83$, $p = .41$, did not significantly predict physical symptoms at 3-month follow-up, and thus, no Step 4 mediation analyses were conducted. Step 3 multiple regression analyses assessed if the coded potential mediators were associated with cancer-related doctor visits during the 3 months postintervention. None of the potential mediators were associated with cancer-related doctor visits (self-affirmation: $\beta = -.06$), $t(55) = -.25$, $p = .80$ (cognitive processing: $\beta = -.01$), $t(55) = -.06$, $p = .95$ (discovery of meaning: $\beta = -.01$), $t(55) = -.07$, $p = .95$ (combined: $\beta = .02$), $t(55) = .11$, $p = .91$).

Treatment Benefits of Writing About the Self

Next, we tested for reasons why writing about the self might positively influence health. In particular, we were interested in why self-affirmation mediated the effects of expressive writing on reduced physical symptoms. In previous work, it was shown that heart rate habituation (i.e., the difference between peak 1-min heart rate and heart rate during the last minute of writing) mediated the effects of expressive writing on physical symptoms at 3-month follow-up (Low et al., 2006). Of interest, after controlling for baseline heart rate, self-affirmation writing was not associated with heart rate habituation ($\beta = .11$), $t(51) = .79$, $p = .44$. Similarly, cognitive processing ($\beta = -.09$), $t(51) = -.62$, $p = .54$, discovery of meaning ($\beta = .04$), $t(51) = .29$, $p = .77$, and their combination ($\beta = -.03$), $t(51) = -.23$, $p = .82$, were not associated with heart rate habituation. Thus, self-affirmation, cognitive processing, and discovery of meaning did not exert their effects through heart rate habituation, suggesting that there may be an independent psychological pathway for the effects of self-affirmation writing.

Past research has shown that self-affirmation buffers stress (Creswell et al., 2005) and so we tested if self-affirmation reduced distress immediately after each writing session. After controlling for state distress before each writing session, self-affirmation ($\beta = -.09$), $t(56) = -2.69$, $p = .009$, and the combined measure of cognitive processing and discovery of meaning was associated with significantly less distress immediately after writing ($\beta = -.09$), $t(56) = -2.55$, $p = .01$. The individual measures of cognitive processing and discovery of meaning were not associated with lower state distress ($ps > .14$).

The Role of Baseline Individual Differences in Expressive Writing

Few studies have considered the role of individual differences in expressive writing and health (but see Cameron & Nicholls, 1998; Mann, 2001; Smyth, 1998). In the present study, general life satisfaction and mood (throughout the past week) were assessed at each of the three time points, providing an opportunity to consider if these measures were associated with, or moderated, the expressive writing findings.⁴ First, we considered a potential alternative explanation for the present findings, which would postulate that preexisting levels of positive or negative self-related feelings may account for the expressive writing effects. To test this alternative explanation, we conducted a univariate ANOVA assessing mean differences in general life satisfaction and mood across the three writing conditions. No significant differences emerged among the three writing conditions for general life satisfaction at baseline, $F(2, 54) = .38$, $p = .68$. Similarly, univariate ANOVAs showed that there were no significant differences in baseline levels of negative mood, $F(2, 56) = .39$, $p = .68$, or positive mood, $F(2, 56) = 1.19$, $p = .31$, among the three writing conditions, suggesting that it was not preexisting group differences in self-related feelings (e.g., life satisfaction, mood) that could have explained the present findings.

Although preexisting levels of self-related feelings at baseline did not explain the effects of expressive writing on health, it is also possible that they may predict the potential mediators or, alternatively, that they may moderate the effectiveness of expressive writing (i.e., having more preexisting positive self-related feelings may increase the likelihood of self-affirmation writing or increase the effectiveness of expressive writing). First, multiple regression analyses assessed if baseline life satisfaction or baseline mood predicted the potential mediators, controlling for essay length. Life satisfaction at baseline significantly predicted more self-affirmation writing ($\beta = .28$), $t(54) = 2.18$, $p = .03$, but did not predict any of the other potential mediators (all $ps > .12$).

Baseline positive mood and negative mood did not significantly predict any potential mediator (all $ps > .11$). Second, we considered if preexisting self-related feelings moderated the effectiveness of the experimental writing conditions on the potential mediators and health outcomes. Controlling for essay length, multiple regression analyses assessed if baseline life satisfaction (or mood), writing condition (dummy coded), and their interaction predicted each potential mediator or predicted health outcomes. No interaction was significant in predicting each potential mediator (all $ps > .23$) or the health outcomes (all $ps > .27$), suggesting that baseline levels of life satisfaction and mood did not moderate the effectiveness of expressive writing.

DISCUSSION

Reviews of the expressive writing literature indicate that the underlying mechanisms of expressive writing are still unknown (Stone et al., 2000). The present study reveals that self-affirmation may act as a psychological mechanism for the benefits of expressive writing on aspects of health in early-stage breast cancer survivors. Using a content analysis methodological approach, the present findings show that self-affirmation writing was related to fewer physical symptoms at 3-month follow-up. Moreover, self-affirmation writing fully mediated the relationships between emotional expression and benefit-finding writing on physical symptoms at 3-month follow-up. Although self-affirmation has not been assessed previously in expressive writing studies, the present findings are consistent with a growing literature showing that self-affirmations can buffer stress and improve well-being (Creswell et al., 2005; Lange et al., 1998) and expressive writing studies showing that writing about one's positive experiences or "a best possible future self" produce improvements in health and well-being (Burton & King, 2004; King, 2001). Of importance, the present study extends this work to early-stage breast cancer survivors, suggesting that self-affirmations, in the context of expressive writing, may have health-protective effects in at-risk populations.

In building on the experimental and theoretical evidence for self-affirmation (Sherman & Cohen, 2006), the present study is the first investigation to our knowledge to assess the naturalistic use of self-affirmations. Despite no explicit instructions for writing self-affirmations in the emotional expression and benefit-finding writing conditions, participants made a significant number of self-affirmations across multiple self-domains. Of interest, affirmation of valued relationships was the most common form of self-affirmation in writing about cancer. This

finding is consistent with theories about the self that propose that valued social relationships play a central role in one's self-concept (e.g., Ryff & Singer, 1998) and with evidence suggesting that enhancement of valued relationships (Taylor, 1983) and recognizing one's supportive social networks (e.g., Hawkley, Burleson, Berntson, & Cacioppo, 2003) are associated with improved mental and physical health.

An important question remains as to why self-affirmation may be a psychological mechanism for the cancer-related benefits of expressive writing. Of interest, we did not find self-affirmation to be associated with greater heart rate habituation during the writing sessions, a physiological mechanism reported in a previous study (Low et al., 2006). This suggests that self-affirmation writing may influence health through a separate psychological pathway. There are at least two potential explanations for the beneficial effects of self-affirmation writing on health. A first plausible mechanism is that self-affirmation writing may have increased self-esteem and self-efficacy for coping with cancer. Consistent with this explanation, one study showed that daily self-affirmations increased self-esteem in healthy undergraduates (Lange et al., 1998), and other studies have shown that expressive writing increases self-esteem (Donnelly & Murray, 1991; Esterling, Antoni, Fletcher, Margulies, & Schneiderman, 1994) and that these increases in self-esteem are associated with improved immune function (Esterling et al., 1994). Although we did not measure changes in self-esteem directly in the present study, we did test if self-affirmation writing predicted increases in general life satisfaction at 3-month follow-up, after controlling for essay length and baseline levels of life satisfaction. We did not find evidence for self-affirmation writing predicting increases in life satisfaction at 3-month follow-up ($\beta = .13$), $t(52) = 1.35$, $p = .18$, providing some evidence that the self-affirmation effects may not be explained by increases in levels of positive self-related feelings. More studies are needed, however, that more rigorously assess the role of self-esteem and coping in self-affirmation writing to examine this possible explanation.

A second plausible, and in our judgment more likely, explanation is that self-affirmations buffered the stress associated with writing about difficult cancer-related thoughts and feelings. Consistent with our previous finding showing that self-affirmation buffers biological stress responses to a laboratory challenge task (Creswell et al., 2005), the present study shows that self-affirmation writing was associated with lower state distress immediately after the writing sessions.⁵ This stress-buffering effect found for self-affirmation writing likely has important implications for the way in which participants engaged

in the expressive writing task in the present study. Specifically, as a stress buffer, self-affirmation writing may have reduced participants' defensiveness (Sherman & Cohen, 2002), enhanced efforts at maintaining involvement during writing, and facilitated efforts at working through difficult cancer-related thoughts and feelings.

Contrary to study predictions, we did not find evidence that cognitive processing, discovery of meaning, or their combination mediated the association between expressive writing and physical health. The null findings with cognitive processing are consistent with previous work using the LIWC content analysis software program (Francis & Pennebaker, 1993), that is, causal or insight-related words were not associated with physical health and did not mediate the association between expressive writing and health at 3-month follow-up, although they were associated with greater heart rate habituation in Low et al. (2006). However, we found some evidence for benefits associated with the combination of cognitive processing and discovery of meaning. Similar to the self-affirmation findings, the combination of cognitive processing and discovery of meaning writing predicted less distress immediately after writing, suggesting that the process of thinking about cancer and finding meaning in the experience may act as buffers against distress experienced while writing about cancer-related thoughts and feelings.

Study Limitations

There are several limitations to the present study. Most prominent among these is that rather than manipulating self-affirmation, cognitive processing, or discovery of meaning writing directly, we assessed the naturalistic occurrence of these statements in the context of an expressive writing trial. Although this limitation restricts our ability to make causal statements about improving health in breast cancer, benefits of this approach include the opportunity to compare the naturalistic uses of self-affirmation, cognitive processing, and discovery of meaning as coping strategies during breast cancer recovery and the opportunity to test for underlying psychological mechanisms in a widely used, expressive writing intervention.

A second potential limitation is that the present study did not define the potential mediators as mutually exclusive categories, making it difficult to interpret correlations among the mediators or assess their independent contributions as orthogonal constructs. However, this approach was necessary due to the fact that the essays revealed clear instances in which a single statement could be coded to more than one category

(e.g., the following statement was coded as both self-affirmation and discovery of meaning: "Being sick has also helped me to tune into others who are suffering, I care so much more about people who are suffering now.") This approach is unlikely to have influenced the results given the minimal overlap among the coding categories.

Conclusions

In closing, the present study provides evidence for self-affirmation as a viable psychological mechanism underlying the beneficial effects of expressive writing on health in early-stage breast cancer survivors. These findings connect three large literatures, providing important links among basic research on self-affirmation, intervention research using expressive writing, and health psychology perspectives on coping with chronic diseases. The present study employed a novel approach for assessing potential psychological mediators, pointing to the potential value of conducting content analyses of essays in future expressive writing studies. The present findings suggest that writing about valued aspects of the self reduces stress and promotes health and well-being, and it is hoped that these findings provide an impetus for considering the protective role of the self in future studies and interventions.

NOTES

1. The text analysis software program also permitted us to conduct analyses on the frequency of sentences coded to each category. The results were in the same direction as those reported using the text unit as the unit of analysis, but the effects were somewhat less robust. We believe that coding essays by text units provides a more precise measure of the potential mediators. Specifically, coding by text units captures qualitatively related expressions of meaning for each participant, whereas coding by individual sentences can artificially separate a single related thought or feeling into multiple components, resulting in an overestimate of the statement's significance.

2. We recognize that using essays from the same data set for training purposes violates the independence of coding for these essays and may overestimate the interrater reliability of the judges. However, it is likely that the small number of essays used for training (representing 5% of the total essays in the data set) had a minimal impact on the sample-wide independence of ratings.

3. We also coded for processing about the negative aspects of the cancer experience (coded as "Negative Cognitive Processing"). We then combined the positive and negative cognitive processing categories and assessed this "General Cognitive Processing" variable as a potential mediator. This variable was not significantly associated with any of the outcomes reported in the Results section (data not reported).

4. Previous studies have shown that life satisfaction is strongly and positively correlated with other measures of the self-concept (e.g., trait self-esteem, optimism; Diener & Diener, 1995; Lucas, Diener, & Suh, 1996).

5. It is not surprising, then, that self-affirmation was not associated with the physiological measure of heart rate habituation in the present data set, given that self-affirmation appears to be keeping stress responses at low levels (i.e., low stress reactivity), whereas heart rate habituation represents a measure of autonomic habituation to writing over time (tapping recovery from peak levels).

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