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Benefit Finding in Women with Breast Cancer: Assessment and Relations with Cortisol

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UNIVERSITY OF MIAMI

BENEFIT FINDING IN WOMEN WITH BREAST CANCER:
ASSESSMENT AND RELATIONS WITH CORTISOL

By

Lisa M. Gudenkauf

A THESIS

Submitted to the Faculty
University of Miami
in partial fulfillment of the requirements for
the degree of Master of Science

Coral Gables, Florida

August 2013

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ASSESSMENT AND RELATIONS WITH CORTISOL

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Despite the stress associated with the diagnosis of breast cancer, many women are able to find benefits in the experience. Recent work has characterized benefit finding (BF) as a multidimensional construct with perceived benefits found in a variety of distinct domains, including family relations and world view, among others (Weaver, Llabre, Lechner, Penedo, & Antoni, 2008). However, factor analysis results from the Benefit Finding Scale (BFS; Antoni et al., 2001; Tomich & Helgeson, 2004) have been mixed, demonstrating the need for further examination of the question. Increased BF after psychological intervention has predicted improvements in physical health-related measures in breast cancer patients, including improved profiles of the stress hormone cortisol. An interesting question is whether women's ability to find benefit (independent of an intervention) in early stages of breast cancer treatment predicts lower levels of stress as measured by cortisol.

An exploratory factor analysis of the BFS was conducted on a sample of 419 women with early-stage breast cancer who were 2-10 weeks post-surgery. A subset of 179 women from this larger sample also provided serum and salivary cortisol samples. This subset was utilized to assess the cross-sectional relationship between BF and cortisol, controlling for relevant sociodemographic and medical variables. A single-

factor model of BF best represented perceived benefits in post-surgical breast cancer patients. Higher levels of BF were reported in younger and premenopausal women, Hispanic women, and those who had undergone a mastectomy rather than a lumpectomy. Higher evening cortisol levels were found in women with less education. Finally, BF was found to be unrelated to cortisol except in pre-menopausal women and those with lower income. In these subgroups, higher BF predicted lower cortisol awakening response. Findings suggest that time of assessment may influence the factor structure of BF such that the BFS generates a unitary measure of BF in the weeks after surgery. Furthermore, relations between BF and cortisol indicators during this period seem to be most evident in specific subgroups of women. This work may be relevant in planning future biobehavioral studies of BF-related processes in women with breast cancer.

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Chapter 1: Introduction

Breast cancer is the second most common cancer among women in the United States and the second leading cause of cancer death (American Cancer Society, 2012). For women who are diagnosed with breast cancer, the experience is often viewed as a crisis (Spencer et al., 1999), especially in the year following surgery. Women describe stress associated with treatment effects and financial burden as well as fears of recurrence and death (Spencer et al., 1999). However, even while dealing with these concerns, many women also report an ability to find benefit in the experience of breast cancer. Reported benefits include improved relations with family and friends, reprioritization, and greater acceptance in life (Antoni et al., 2001). One study found the prevalence of benefit finding in breast cancer patients to be as high as 83% (Sears, Stanton, & Danoff-Burg, 2003), highlighting the importance of investigating positive psychological adaptation to breast cancer (Stanton, Revenson & Tennen, 2007).

Background and Theory of Benefit Finding

In research that has emerged on positive adaptation during recent decades, benefit finding (BF) has been defined as the ability to perceive positive life changes from a life crisis (Lechner, Park, Stanton, & Antoni, 2009). BF has been reported in numerous populations outside of breast cancer, from other medical populations to caregivers to survivors of wars and natural disasters (Helgeson, Reynolds, & Tomich, 2006). Studies of BF in these other populations have strengthened the argument for the importance of BF and have informed BF research in breast cancer (Park, 2009).

Theories of BF development have focused on an individual's search for meaning after a traumatic event (Park & Folkman, 1997; Taylor, 1983). According to Taylor's

(1983) theory of cognitive adaptation, the search for meaning is characterized by two components: an individual's efforts to understand why a trauma occurred and how it has impacted his or her life. The desire to understand why a trauma occurred leads to causal attributions about the event, while the exploration of trauma impact often leads to the reappraisal of one's life. BF is posited as an outcome of the latter reappraisal process (Tomich & Helgeson, 2004). Taylor (1983) interviewed 78 women with breast cancer, and more than half of the women reported that their cancer diagnosis prompted them to reappraise their lives in a positive way. The experience of breast cancer had reportedly brought about a new attitude toward life, increased self-knowledge, and led to reprioritization. For these women, the cancer threat was perceived as a "catalytic agent for restructuring their lives along more meaningful lines with an overall beneficial effect" (Taylor, 1983, p. 1163). Although Taylor (1983) acknowledged that not all women find benefit, she found that those women who did derive positive meaning from their experience exhibited significantly better psychological adjustment. Thus, BF is theorized as a product of meaning-making during cognitive adaptation to a trauma with the potential for positive outcomes (Taylor, 1983).

Currently, BF is assessed using self-report questionnaires of growth (Tennen & Affleck, 2009). The Benefit Finding Scale (BFS) was adapted from Behr's Positive Contributions Scale for parents of children with disabilities (Behr, Murphy & Summers, 1992) and was specifically developed for and validated in samples of women with breast cancer (Antoni et al., 2001; Tomich & Helgeson, 2004). Items from the BFS begin with "Having had breast cancer has..." and conclude with potential benefits found in the experience, such as increased acceptance, personal growth, and changed world-view.

Although critics have raised concerns regarding the ability of the BFS to capture actual, veridical growth (Tennen & Affleck, 2009), BF proponents emphasize the importance of *perceived* growth. Evidence from a broad range of research areas suggests that perception of an experience may be a better predictor of later behavior than actual experience (Tennen & Affleck, 2009). In one study (Kahneman, Frederickson, Schreiber, & Redelmeier, 1993), perceived discomfort in two ice immersion tasks was a better predictor of willingness to repeat one of the tasks than were objective measures of discomfort and task duration. In another study, retrospective report of perceived enjoyment on a vacation was a better predictor of willingness to repeat the vacation than were either predicted experience or real-time experience measured by online report during the vacation (Wirtz, Kruger, Scollon, & Diener, 2003).

Perception is also important in medical illnesses, such as breast cancer, because perceived illness experiences can predict adjustment to illness. Indeed, an entire literature exists exploring the prominent role of perception in medical illness (Petrie & Corter, 2009). Although less than half of women are able to accurately report their breast cancer stage (Vothang, Lechner, Tocco, & Glück, 2006), their perceived disease severity is a strong indicator of later adjustment (Stanton, Bower, & Low, 2006), demonstrating the importance of perception in the breast cancer experience. Similarly, perceptions of benefit have been linked to better adjustment in breast cancer patients (Lechner & Weaver, 2009). This finding has led to interest in identifying processes that are associated with BF in breast cancer patients.

Perceived benefit in the aftermath of breast cancer diagnosis has been associated with greater optimism (Carver & Antoni, 2004; Sears et al., 2003) and positive affect

(Bower, Epel, & Moskowitz, 2009). BF is also associated with increased emotional processing (Antoni et al., 2001), positive reappraisal (Helgeson et al., 2006), and more approach-oriented active coping techniques (Sears et al., 2003), which may indicate better adjustment to crisis. While relations between BF and negative outcomes have been somewhat mixed (Tomich & Helgeson), BF in the year following surgery for breast cancer has been shown to predict less negative psychological outcomes, such as depression and negative affect, up to 4 to 7 years later (Carver & Antoni, 2004). BF in early-stage breast cancer has also predicted long-term increase in positive psychological outcomes, including positive affect (Bower et al., 2005b; Carver & Antoni, 2004) and quality of life (Carver & Antoni, 2004; Schwarzer, Luszczynska, Boehmer, Taubert, & Knoll, 2006). Clearly, the measurement of perceived positive life changes (Tennen & Affleck, 2009) with instruments such as the BFS can provide valuable information related to adaptation in breast cancer.

Benefit Finding Factor Structure

Descriptive reports of BF include experienced benefits in a variety of life domains (Tedeschi & Calhoun, 2004). Attempts to capture and characterize these domains led to the development of a number of assessment measures in recent decades, including the Stress-Related Growth Scale (SRGS; Park, Cohen, & Murch, 1996) and the Perceived Benefit Scale (PBS; McMillen & Fisher, 1998) in addition to the BFS (Antoni et al., 2001; Tomich & Helgeson, 2004). Each of these scales attempts to capture changed perception as well as potential behavioral and lifestyle changes and incorporates a different number of benefit finding domains, from three (SRGS; Park et al., 1996) to eight domains (PBS; McMillen & Fisher, 1998). Not only have factor structures differed

among these scales, but differences have also been found with repeated factor analyses of the same scale.

The SRGS (Park et al., 1996) represents one scale with a history of different factor structures (Park, 2004). Schaeffer and Moos (1992) conducted a review of the literature on life crises and personal growth and theorized three main categories of benefit finding, including (1) improved social relations, (2) enhanced personal resources, such as self-esteem, and (3) more adaptive coping skills, such as problem-solving. Based on these theoretical categories, Park et al. (1996) developed the 50-item SRGS expecting a three-factor structure. Contrary to expectations, however, factor analysis indicated a unitary SRGS when tested in an undergraduate student sample who had experienced a stressful event in the previous year (Park et al., 1996). Later, Armeli, Gunthert, and Cohen (2001) used an abbreviated SRGS with undergraduate students and alumni and found a seven-factor structure. A third factor analysis was conducted by Roesch, Rowley, and Vaughn (2004) with the original 50-item SRGS in a large, multiethnic undergraduate sample and revealed a three-factor structure.

The BFS (Antoni et al., 2001; Tomich & Helgeson, 2004) has a similar history of conflicting factor analysis results. In samples of post-surgical women with early-stage breast cancer, the 17-item BFS (Antoni et al., 2001) was found to be unidimensional (Antoni et al., 2001; Urcuyo, Boyers, Carver, & Antoni, 2005). With cancer caregivers, however, the 17-item BFS had six factors: acceptance, family, empathy, appreciation, positive self-view, and reprioritization (Kim, Schulz, & Carver, 2007). An 18-item version of the BFS (Tomich & Helgeson, 2002) was used with five-year survivors of non-metastatic breast cancer and resulted in two factors: personal growth and acceptance.

Soon after, the same group utilized a 20-item BFS (Tomich & Helgeson, 2004) in non-metastatic breast cancer patients within ten months of diagnosis and found the BFS to be unitary.

Most recently, a 29-item version of the BFS was used in a sample of prostate and breast cancer survivors following adjuvant treatment (Weaver et al., 2008). Six factors were identified, which differed slightly from those identified in the prior study of cancer caregivers (Kim et al., 2007). The six factors included acceptance, family growth, personal growth, social relations, world view, and health behaviors (Weaver et al., 2008). Multiple group comparisons demonstrated that the same multidimensional structure applied to men with prostate cancer and women with breast cancer (Weaver et al., 2008). The authors concluded that “the total composite score approach to this measure should be replaced by factors scores” (Weaver et al., 2008, p. 779) and recommended that BF be studied as a multidimensional construct in breast cancer research (Lechner & Weaver, 2009).

The Weaver et al. (2008) findings excite interest in studying BF dimensions and their relations to psychosocial and physiological outcomes. However, caution is warranted in adopting the six-factor BFS to all future breast cancer research. The history of mixed findings with the BFS factor structure (Antoni et al., 2001; Kim et al., 2007; Tomich & Helgeson, 2002; Tomich & Helgeson, 2004; Urcuyo et al., 2005; Weaver et al., 2008), suggests that BF dimensions may depend on the type of BF scale used as well as the specific stressor under study (Park, 2004). As Park (2004) points out, different BF measures, including the BFS (Antoni et al., 2001; Tomich & Helgeson, 2004) and the SRGS (Park et al., 1996) have produced different factor structures. Different BF studies

have also utilized samples with different types of traumatic stressors, ranging from breast cancer (Antoni et al., 2001; Urcuyo et al., 2005; Tomich & Helgeson, 2002; Tomich & Helgeson, 2004) to breast and prostate cancer (Weaver et al., 2008) to cancer caregiving (Kim et al., 2007), which may have contributed to differences in BF factor structures. The timing of BF assessment has also differed across studies, with BF assessed in the weeks following surgery up to 5 years post-diagnosis, which may also have contributed to differences in factor structure found across BF studies. Mixed results from these different factor analyses suggest the BFS factor structure may be more sample-specific than acknowledged by Weaver et al. (2008). The six-factor structure of the BFS (Weaver et al., 2008) may, therefore, have limited generalizability to other samples, and it may not be appropriate to broadly apply this factor structure to all future breast cancer research. Rather, an exploratory factor analysis (EFA) appears to be a necessary first step to any study investigating BF in a given breast cancer sample.

Sociodemographic and Medical Covariates in Benefit Finding

In order to further investigate outcomes of BF, it is important to consider sociodemographic and medical variables that may contribute to BF. Sociodemographic variables have been inconsistently related to BF in medical populations. Education, marital status, income, and employment status have been largely unrelated to BF (Lechner & Weaver, 2009). The evidence is more mixed for the influence of age and ethnicity. While some studies of BF in medical illness have found higher BF in younger persons and minority groups, other studies have found no association (Lechner & Weaver, 2009). The relationship between BF and treatment-related variables in medical illness has also been inconsistent. Stage of disease and perceived threat have been

associated with BF in some studies while other studies have found no relationship (Lechner & Weaver, 2009). Cross-sectional studies examining time since surgery report mixed findings on the relationship with BF (Lechner & Weaver, 2009). However, findings from two longitudinal studies suggest that BF is positively associated with time since surgery or diagnosis (Manne et al., 2004; Sears et al., 2003). Manne et al.'s (2004) study of post-surgical breast cancer survivors and their caregivers found that BF progressively increased over 18 months (Manne et al., 2004). Sears et al. (2003) recruited stage I and II breast cancer patients an average of 28 weeks post-diagnosis and found that longer time since diagnosis at study entry predicted greater BF (Sears et al., 2003). BF has also been associated with type of treatment, such that breast cancer patients 1-5 years post-diagnosis who underwent chemotherapy reported greater BF than those who did not (Bower et al., 2005b), which may be related to higher levels of experienced distress in these women (Tomich & Helgeson, 2004). In contrast, BF in breast cancer was reported to be unrelated to treatment status or type of surgery in other work (Lechner & Weaver, 2009).

Weaver et al. (2008) suggest that mixed findings with sociodemographic and treatment-related variables could be attributed to differences in measurement of BF and the use of a total BFS score rather than BF subscales. In their study, minority status and receipt of chemotherapy predicted higher total BF while age, socioeconomic status, and marital status were unrelated to total BF (Weaver et al., 2008). When BF subscales were examined, however, differential relationships emerged between predictors and different dimensions of BF (Weaver et al., 2008). For example, marital status was unrelated to overall BF but was significantly correlated with family relations and world view

domains; married women reported higher levels of benefit in relations with family and view of the world (Weaver et al., 2008). According to Weaver et al. (2008), the ability to discover domain-specific differences in BF undetected by a total BFS score underscores the importance of treating BF as a multidimensional construct. If BF subscales are identified in a given sample, findings from the Weaver et al. (2008) study may provide a foundation for the inclusion of covariates in outcomes studies utilizing BF subscales.

Benefit Finding and Physical Health

While BF has commonly been associated with psychological adjustment (Lechner & Weaver, 2009), less work has examined the relationship between BF and physical functioning (Bower et al., 2009). Perceptions of benefit have been associated with disease-specific objective health outcomes (Algoe & Stanton, 2009), including decreased cardiac morbidity 8 years after a heart attack (Affleck, Tennen, Croog, & Levine, 1987) and increased activity in those with rheumatoid arthritis who had high pain (Tennen, Affleck, Urrows, Higgins, & Mendola, 1992). Self-reported subjective health measures in breast cancer indicate that those participants for whom BF was induced through expressive writing (Stanton et al., 2002) reported significantly fewer somatic symptoms than those who wrote about the facts of their breast cancer experience (Low, Stanton, & Danoff-Burg, 2006; Stanton et al., 2002). Fewer studies have investigated associations between BF and objective measures of functional status in medical populations (Bower et al., 2009; Helgeson et al., 2006), but results have consistently demonstrated health benefits of BF (Algoe & Stanton, 2009). BF has predicted lower reinfarction incidence 8 years after a heart attack (Affleck et al., 1987), and intervention-induced BF predicted

fewer medical visits for breast cancer-related morbidities both 1 month and 3 months after intervention (Stanton et al., 2002).

Interestingly, improved physiological outcomes have also been predicted by BF. Improvements in immune functioning were predicted by BF in two HIV-positive samples (Bower, Kemeny, Taylor, & Fahey, 1998; Milam, 2006). In a sample of 40 HIV-positive gay and bisexual men, discovering meaning in HIV predicted slower rate of CD4+ T-cell decline and lower AIDS-related mortality (Bower et al., 1998). Moderated effects of BF were found in another sample of 412 HIV-positive men and women (Milam, 2006) such that BF predicted lower viral load in those low in pessimism as well as higher CD4+ cell counts in those low in optimism. BF also related to higher CD4+ cell counts in Hispanics in this study (Milam, 2006). BF has additionally been associated with improvements in cortisol profiles. In a sample of maternal caregivers of chronically ill children, positive affect moderated the effect of BF on cortisol. Specifically, in women who reported greatest positive affect, personal strength, spiritual growth, and life appreciation were found to predict steeper salivary cortisol slope (Moskowitz & Epel, 2006), a marker of healthy neuroendocrine function. Some work has suggested that BF changes during psychological intervention may show parallel changes in neuroendocrine and immune indicators. For instance, BF increases after intervention predicted psychological intervention-related improvements in lymphocyte proliferation (McGregor et al., 2004) and reduced serum cortisol levels (Cruess et al., 2000) in early-stage breast cancer patients. Based on the present evidence, BF appears to have a health advantage in medical populations (Algoe & Stanton, 2009). However, the small number of studies investigating this topic reveals that there is still much to be learned about the relationship

between BF and objective measures of health and physiological indicators in breast cancer.

Physiological Stress Response

Changes in physiological indicators reflecting hypothalamic-pituitary-adrenal (HPA) axis activity accompanying the development of BF may be especially important in breast cancer. Women with breast cancer show consistently high cortisol levels and flatter circadian profiles of cortisol relative to healthy controls (McEwen, 2007).

Cortisol is a steroid hormone released by the HPA axis in response to psychosocial stressors (Kirschbaum & Hellhammer, 1994; Sephton & Spiegel, 2003). The HPA axis involves a cascade of events whereby corticotropin-releasing hormone is first released from the hypothalamus helping induce the subsequent release of adrenocorticotropic hormone from the anterior pituitary, which in turn stimulates the release of glucocorticoids (GCs), such as cortisol, from the adrenal cortex (McEwen, 2007).

Cortisol release follows a diurnal cycle, with cortisol levels normally peaking around 8 am, after wakening, and decreasing gradually throughout the day (Kirschbaum & Hellhammer, 1989; Sephton, Sapolsky, Kraemer, & Spiegel, 2000).

In psychological research, cortisol levels have commonly been measured in blood serum (Crues et al., 2000; Touitou, Bogdan, Levi, Benavides, & Auzéby, 1996; van der Pompe, Duivenvoorden, Antoni, Visser, & Heijnen, 1997). Serum cortisol could also be used to measure pattern of response over time, but this invasive technique is not ideal for repeated sampling in clinical or research settings. Moreover, serum cortisol values reflect both the bound and unbound (biologically active) fractions. More recently, unbound, biologically active cortisol has been measured through salivary samples (Bower et al.,

2005a; Carlson, Speca, Faris, & Patel, 2007; Lang, Berbaum, & Lutgendorf, 2009), and salivary cortisol has been shown to reliably reflect serum cortisol concentrations across a 24-hour time period (Dorn, Lucke, Loucks, & Berga, 2007). Thus, salivary cortisol can be used as a non-invasive measure of both the magnitude of stress response and pattern of response over time (Fekedulegn et al., 2007). Salivary cortisol measurement has the added benefit of being a simple and portable technique, allowing participants to collect their own samples while going about their normal daily routine.

A broad range of cortisol indices have been used to assess HPA dysregulation (Vedhara, Tuinstra, Miles, Sanderman, & Ranchor, 2006). Cortisol measures in psychoncology research have included mean levels of cortisol within and across collection timepoints (Abercrombie et al., 2004; Weinrib et al., 2010) and evening cortisol level alone (Crues et al., 2000). Cortisol slope from morning peak levels to nighttime lows has also been used (Abercrombie et al., 2004; Sephton et al., 2000; Vedhara et al., 2006), with flatter diurnal slopes indicating greater dysregulation of the normal variability in cortisol levels across the day (Sephton et al., 2000). The proportion of evening cortisol levels to morning cortisol levels has also been used as a marker of cortisol variability throughout the day (Weinrib et al., 2010). Finally, the morning cortisol awakening response (CAR) capturing increase in cortisol just after wakening (Kirschbaum & Hellhammer, 1989) and area under the curve (AUC) of repeated wakening measures (Vedhara et al., 2006) have both been used as indicators of HPA responsiveness. Notably, CAR has been identified as the cortisol index with perhaps the greatest variability of all cortisol measurements in the day (Fekedulegn et al., 2007), making it an ideal measure for testing individual differences. Cortisol levels increase by 50-75%

within the first 30 minutes after wakening (Pruessner et al., 1997), so one option for capturing CAR is to simply subtract awakening cortisol levels from 30-minute post-awakening, or peak, values (Kunz-Ebrecht, Kirschbaum, Marmont, & Steptoe, 2004). This option makes CAR an appealing alternative to AUC when only two morning cortisol samples are available.

Of the cortisol indices used in psycho-oncology research, increased BF has been directly associated with reduced evening cortisol levels in a post-surgical breast cancer sample (Cruess et al., 2000). Interestingly, reduced evening cortisol level may be largely responsible for steeper cortisol slopes, which are indicative of healthier diurnal cortisol regulation and even better survival outcomes (Sephton et al., 2000). Thus, evening cortisol level appears to be an important cortisol index for BF research with physiological correlates. Other cortisol indices have been less directly related to BF. Previous work has identified reduced cortisol variability (Weinrib et al., 2010) and increased CAR (Chida & Steptoe, 2009; Kunz-Ebrecht et al., 2004) under conditions of stress. Since positive psychological measures, such as BF, are postulated to exhibit associations opposite to those of stress measures (Chida & Steptoe, 2009), then it could be predicted that BF would be associated with increased cortisol variability and reduced CAR. Some meta-analysis evidence has arisen in support of this hypothesis. CAR has been inversely associated with positive affect (Chida & Steptoe, 2009), and another meta-analysis suggests that positive affect is one of the most consistent and strongest correlates of BF (Helgeson et al., 2006), providing some weak support for an indirect relationship between BF and reduced CAR. In order to move beyond these indirect relationships with BF, an

important next step would be to investigate direct associations between cortisol variability and CAR and BF.

Biobehavioral Model of Stress in Breast Cancer

The body's stress response is helpful for handling short-term emergencies (McEwen, 1998), and glucocorticoids play an important role in physiological functioning. Indeed, cortisol regulates cardiovascular, metabolic, immunologic and homeostatic functions, and we cannot live without it (McEwen, 2007). However, long-term activation of the stress response and chronically high levels of GCs can contribute to tumor progression (Lutgendorf, Sood, & Antoni, 2010). Evidence shows that situations with low predictability, low controllability, and novelty, such as a first diagnosis of breast cancer, are particularly likely to stimulate the HPA axis with a subsequent rise in cortisol levels (Kirschbaum & Hellhammer, 1994). High GC concentrations have immunosuppressive effects (Kiecolt-Glaser et al., 1984), weakening the body's ability to deal with cancer burden. GCs can hinder chemotherapy treatment by triggering apoptosis in lymphocytes while activating survival genes in cancer cells (Antoni et al., 2006b) and may work in cooperation with catecholamines to contribute to cancer growth (Antoni et al., 2006b). Beyond disease progression, dysregulated cortisol has also been shown to impact recurrence and survival. In a sample of 227 women with non-metastatic breast cancer who were followed up to a median of 11 years, women who developed disease recurrence exhibited consistently higher salivary cortisol levels in the 17 months prior to detection of disease recurrence than disease-free individuals (Thornton, Andersen, & Carson, 2008). In metastatic breast cancer patients, Sephton et al. (2000) found that

flatter diurnal cortisol rhythms at study entry approximately 2 years post-diagnosis predicted lower survival rates up to 7 years later.

Importantly, increases in BF can predict reductions in cortisol levels in breast cancer patients (Cruess et al., 2000). One hypothesis for BF's role in cortisol alterations, proposed by Epel, McEwen, and Ickovics (1998), suggests that an individual's specific appraisal of a stressor impacts his or her stress response profile. Women high in BF report an increased acceptance in life, including adjustment to unchangeable circumstances and an ability to take things as they come (Antoni et al., 2001). Women also report personal growth through increased patience, greater ability to deal with stress, and ability to cope with future life challenges (Weaver et al., 2008). These enhanced stress-management skills point to a woman's increased ability to perceive life stressors as challenges (i.e., opportunities for gain or growth) rather than threats (i.e., signals of potential loss or harm; Epel et al., 1998). Whereas threat appraisal is associated with activation of the body's stress response (Bower et al., 2009; McGregor et al., 2004), challenge appraisal is theorized to result in lower physiological arousal (Bower & Segerstrom, 2004; McGregor et al., 2004). Thus, by engaging in challenge rather than threat appraisals, women high in BF may demonstrate an enhanced ability to buffer the negative physiological impacts of breast cancer stress (McGregor et al., 2004). More work is needed to determine whether women's ability to find benefit during the early phases of breast cancer diagnosis and treatment independent of psychological intervention is associated with women's post-surgical physiological functioning as indicated by cortisol regulation.

Current Study Aims and Hypotheses

The current study is a cross-sectional analysis of a total sample of 424 women with stages 0 – III breast cancer who were assessed on psychological and physiological measures within 2-10 weeks after surgery. The present study specifically examined measures of BF and cortisol and addressed two aims. The first aim was to determine whether BF during the acute phase of breast cancer treatment was unidimensional or multidimensional and identify the important domains of BF in this population. The second aim was to investigate whether women's ability to find benefit before psychological intervention predicted healthier cortisol profiles at baseline.

Aim 1: Exploratory factor analysis of benefit finding. Recent research has suggested that BF in breast cancer is best construed as a multidimensional construct (Weaver et al., 2008), but factor analysis findings have been mixed (Antoni et al., 2001; Kim et al., 2007; Tomich & Helgeson, 2002; Tomich & Helgeson, 2004; Urcuyo, et al., 2005; Weaver et al., 2008) and appear sample-specific (Park, 2004). An exploratory factor analysis (EFA) was performed in order to determine whether BF in women who are still in the acute phase of breast cancer treatment is unidimensional or multidimensional. Based on the findings of a recent factor analysis (Weaver et al., 2008), a multidimensional model of BF was hypothesized to best characterize the current sample of post-surgical breast cancer patients, as well.

Aim 2: Association between benefit finding and cortisol post-surgery. The effects of women's ability to independently find benefit in their circumstances were explored by correlating BF levels with objective stress indices at the time of entry into the current study. Specifically, women's ability to find benefit in this early stage of

survivorship was examined to determine whether BF predicts lower levels of stress as measured by cortisol profiles. As BF has previously been shown to predict lower levels of evening serum cortisol (Cruess et al., 2000), it was hypothesized that high levels of BF in the current sample would predict low levels of early evening serum and salivary cortisol. The relationship between BF and cortisol variability and CAR was also investigated. Previous work has identified reduced cortisol variability (Weinrib et al., 2010) and increased cortisol awakening response (CAR; Chida & Steptoe, 2009; Kunz-Ebrecht et al., 2004) under conditions of stress as well as associations between positive psychological traits and low CAR (Chida & Steptoe, 2009). Thus, higher BF at study entry was hypothesized to relate to greater cortisol variability and lower CAR from wakening to 30 minutes post-awakening. For these analyses, the factor structure of BF was taken into consideration to determine whether BF scale associations with cortisol indices were appropriate during this period.

Chapter 2: Method

Participants

Women age 18 or older with stage 0 – III breast cancer were recruited within 10 weeks of surgery from community clinics in the Miami area between 1998 and 2012. Potential participants were excluded if they had a history of prior cancer or neo-adjuvant treatment, severe psychiatric illness, acute or chronic co-morbid medical conditions, or were not fluent in English. These exclusion criteria were established to ensure participants' ability to participate in later intervention trials and to form a more homogenous sample. Demographic data was collected via self-report at baseline, and medical data was collected via both self-report and medical chart review.

Aim 1: Exploratory factor analysis of benefit finding. The EFA combined two samples of women recruited for psychological intervention trials at the University of Miami. The first sample included 240 women who were recruited between 1998 and 2005 for a 10-week group psychological intervention (Antoni et al., 2006a), and the second sample included 184 women who were recruited between 2006 and 2012 for a 5-week group psychological intervention. In both samples, women with stage 0 – III breast cancer were recruited from clinics in the Miami area within approximately one to two months post-surgery. Exclusion criteria were similar for recruitment of both samples, and women in both samples were initially assessed prior to adjuvant treatment. Although the interventions differed for the two samples, the EFA utilized only baseline BF values in both samples and was, therefore, unaffected by the difference in interventions. Five women with missing data on more than five (or greater than 30%) of the 17 BFS items

were excluded from the analyses. Thus, the combined sample for the EFA included a total of 419 women recruited between 1998 and 2012.

Aim 2: Association between benefit finding and cortisol post-surgery.

Because salivary cortisol was not measured in the first sample of 240 women recruited between 1998 and 2005, the second aim included only the 184 women in the second sample of early-stage breast cancer patients recruited between 2006 and 2012. This second sample provided the necessary BF and serum and salivary cortisol data for investigating associations between BF and cortisol. Five women with missing data on more than five (or greater than 30%) of the 17 BFS items were excluded from the analyses. Thus, Sample 2 included a total of 179 women recruited between 2006 and 2012.

Procedures

Women who met criteria provided informed consent and were assessed within 2-10 weeks after surgery. The baseline assessment involved a psychological questionnaire packet (with the BFS included), a peripheral venous blood sample, and collection of salivary cortisol at 8 time-points over 2 consecutive days. In order to map the daily cortisol rhythm (Kirschbaum & Hellhammer, 1989), participants were asked to collect salivary cortisol samples four times over the course of the day (upon wakening, 30 minutes after wakening, 4 pm, and 9 pm) using Salivette® tubes. This collection schedule was repeated over two consecutive days so that an average value from each timepoint could later be calculated for increased measurement reliability (Weinrib et al., 2010). Research associates provided verbal instructions on saliva collection at the time of consent. In addition, participants were provided with a saliva collection instruction

sheet (see appendix), a step-by-step instructional DVD, and a timer to serve as a reminder of collection times. Participants were instructed to refrain from alcohol use for at least 12 hours prior to sample collection, refrain from vigorous exercise the day of collection, and avoid consuming a large meal or brushing teeth within one hour of saliva collection.

After collection, the cotton swab was placed in a double-layer plastic test tube and stored in the participant's freezer to preserve the integrity of the saliva sample until all eight samples were collected and the tubes could be returned to the laboratory for assaying.

Measures

Benefit Finding Scale (BFS). Benefit finding was assessed using the 17-item Benefit Finding Scale (BFS; Antoni et al., 2001; Tomich & Helgeson, 2004). The BFS was adapted from Behr's Positive Contributions Scale for parents of children with disabilities (Behr et al., 1992) and was specifically developed for and validated in samples of women with breast cancer (Antoni et al., 2001; Tomich & Helgeson, 2004). The original 17-item version of the BFS scale was found to have an internal consistency of 0.95 (Antoni et al., 2006a). Items from the BFS begin with the statement "Having had breast cancer has..." and conclude with potential benefits found in the experience, such as improved family and social relations, increased acceptance, personal growth, and changed world-view. Response options range from *Not at all* (1) to *Extremely* (5). In order to encourage women to respond to all items, women were also provided the option of responding *Does not apply to me* (9). However, all items on the BFS can be considered broadly applicable to any woman. Thus, it was predetermined that items reported as *not applicable* would be recoded to *not at all*. For example, for item 1,

“Having had breast cancer has led me to be more accepting of things,” an endorsement of (9) *not applicable* would be recoded by the investigator to (1) *not at all*.

Serum cortisol. Blood samples were collected at the same time (4:00 – 6:30 pm) for all participants to control for diurnal rhythms in cortisol. A licensed phlebotomist used red-topped vacutainer tubes to collect peripheral venous blood because these tubes contain no anticoagulants and permit the separation of serum using a centrifuge. Kits from Diagnostic Systems Laboratories (Webster, Texas) were used for competitive enzyme-linked immunosorbent assays measuring cortisol levels in the serum.

Salivary cortisol. In the laboratory, saliva samples were processed, vortexed, centrifuged for 10 minutes at 1500 RPM, and then frozen at -20°C. Once a batch of samples was collected, samples were thawed for competitive immunoassay. The high sensitivity salivary cortisol ELISA kit from Immuno-Biological Laboratories, Inc. (USA) was used because it was specifically designed for the measurement of salivary cortisol levels with an AM range of 1.2 to 14.7 ng/ml for healthy adults and an analytical sensitivity of 0.012 ng/ml (data from manufacturer). The complete set of samples for each individual participant was assayed on the same plate.

The current study utilized evening salivary cortisol levels collected at 4 pm and 9 pm, as well as measures of salivary cortisol variability and salivary CAR. The evening salivary cortisol levels were log-transformed in order to normalize their distributions (Weinrib et al., 2010). Salivary cortisol variability was defined according to Weinrib et al. (2010) as $\ln(9 \text{ pm cortisol level} / \text{awakening cortisol level})$. Salivary CAR was defined according to Kunz-Ebrecht et al. (2004) as 30-minute post-awakening cortisol level minus awakening cortisol level.

Putative covariates. Demographic variables were collected via self-report questionnaire. Women reported their age at the time of assessment, their race/ethnicity (African-American, Black/Caribbean, non-Hispanic White, Cuban-American, Puerto Rican, Venezuelan, Colombian, Argentine, Hispanic/other, mixed ethnicity, or other), marital status (married or otherwise “partnered,” separated, divorced, widowed, or single and never married), annual household income, highest education level attained (e.g., completing college is equivalent to 16 years of education), and menopausal status (premenopausal, perimenopausal, and postmenopausal). For the purposes of these analyses, ethnicity was re-categorized into Black (African-American and Black/Caribbean), non-Hispanic White, Hispanic (Cuban-American, Puerto Rican, Venezuelan, Colombian, Argentine, and Hispanic/other), and other (mixed ethnicity and other). Marital status was re-categorized into “partner status” with partnered (married or otherwise partnered) and non-partnered (separated, divorced, widowed, or single and never married) categories. Menopausal status was categorized as a bimodal variable with premenopausal = 0 and perimenopausal or postmenopausal = 1.

Treatment variables were collected via self-report and medical chart review at the women’s surgical oncologist offices in the Miami area. Disease stage was categorized as Stage 0, I, II, and III. Type of surgery was categorized as a bimodal variable with mastectomy = 0 and lumpectomy = 1. Finally, time since surgery was calculated as the number of days from date of surgery to date of baseline assessment.

Analytic Approach

Aim 1: Exploratory factor analysis of benefit finding. The EFA of BF was conducted using Mplus-Version 7 (Muthén & Muthén, 2012) with full information

maximum likelihood (FIML). FIML has the advantage of using all available data for each individual in the sample and can estimate parameters despite missing data (Enders, 2006). Oblique rotation for correlated factors was selected, including the default Geomin criterion, which provides an interpretable pattern matrix while allowing for complex factors (Sass & Schmitt, 2010). In order to maximize power and enhance generalizability, the sample for the EFA included the combined sample of 419 women recruited between 1998 and 2012.

Aim 2: Association between benefit finding and cortisol post-surgery. The association between post-surgical levels of BF and cortisol was examined using multiple regression analysis in Mplus-Version 7 (Muthén & Muthén, 2012) with FIML. A regression was carried out for the composite 17-item BFS mean score with evening serum and salivary cortisol levels. Regressions of salivary cortisol variability and salivary CAR on the BF17 mean score were also conducted. A significant beta weight ($p < 0.05$) indicated an association between women's ability to find benefit in their circumstances during the period after biopsy through surgery and levels of stress as measured by cortisol profiles.

Putative covariates. For Aim 2, all regressions were first run without control variables. Theory and previous empirical evidence have highlighted important relations between sociodemographic and medical variables with both BF (Lechner & Weaver, 2009) and cortisol (Cruess et al., 2000). Based on this evidence, the following demographic and treatment variables were selected for investigation: age, ethnicity, partner status, income, education level, menopausal status, disease stage, type of surgery, and time since surgery. Bivariate correlations were conducted for BF and cortisol indices

with these demographic and treatment variables. Those demographic and treatment variables that were found to significantly correlate with either BF or cortisol indices in bivariate correlations were selected for inclusion as covariates in subsequent multiple regression analyses.

Chapter 3: Results

Sample Description

A summary of sample sociodemographic and medical characteristics for Sample 1 (Antoni et al., 2006a), Sample 2, and the combined sample is provided in Table 1. Sample 1 and Sample 2 were comparable (p 's > 0.05) in terms of average time between surgery and assessment, type of surgical procedure, average level of education, and partner status. However, the two samples differed significantly in terms of age, stage of disease, income, race/ethnicity, and menopausal status. On average, Sample 2 was significantly older ($p < 0.001$) with a greater proportion of women with perimenopausal or postmenopausal status ($p = 0.01$). The average annual household income was also greater for Sample 2 ($p < 0.01$). Finally, the racial/ethnic composition of the samples differed significantly ($p < 0.001$), with Sample 2 including a more equal representation of non-Hispanic White females and Hispanic females than Sample 1. Thus, utilizing both Sample 1 and Sample 2 in a combined sample not only increased the power for the EFA of Aim 1 but also enhanced the diversity of the sample and increases generalizability of the findings.

Aim 1: Exploratory Factor Analysis of Benefit Finding

Exploratory factor analysis of the 17-item BFS extracted three factors with eigenvalues greater than one according to the Kaiser criterion (DeCoster, 1998). However, these three factors were highly correlated (factors 1 and 2, $r = .61$, $p < 0.001$; factors 1 and 3, $r = .65$, $p < 0.001$; factors 2 and 3, $r = .69$, $p < 0.001$). Further, examination of the scree plot (Figure 1) showed a sharp break between the first factor (eigenvalue = 8.76) and the second (eigenvalue = 1.22) and third (eigenvalue = 1.03)

factors, with no subsequent break observed after the third factor. All items loaded on a single factor with a minimum geomin rotated value of 0.49 up to a maximum of 0.82 (Table 2), exceeding the minimum 0.45 cut-off for primary loadings specified by Comrey and Lee (1992). Given these considerations, the factor structure of the 17-item BFS was concluded to be unitary. Cronbach's alpha for the 17-item BFS in the combined sample was 0.94. The item means and standard deviations are shown in Table 3.

Aim 2: Association Between Benefit Finding and Cortisol Post-surgery

Benefit finding. Based on the Aim 1 EFA finding that the 17-item BFS is best represented by a single factor, a 17-item mean score (BF17 mean) was calculated for each of the 179 women in Sample 2. Cronbach's alpha for the 17-item BFS in this second sample was 0.95.

Associations among cortisol indices. In order to determine which salivary cortisol evening value most closely matched the evening serum cortisol value (collected between 4:00 and 6:30 pm), correlations were conducted between serum cortisol and salivary cortisol values collected at 4 pm, salivary cortisol values collected at 9 pm, and salivary cortisol values averaged between 4 and 9 pm. Salivary cortisol collected at 4 pm on the second day of collection was the only salivary cortisol value that correlated with evening serum cortisol ($r = 0.16, p < 0.05$). The 4 pm salivary collection was the closest in time to the serum cortisol collection time (4:00 – 6:30 pm), and it is reasonable to suppose that women were more reliable in collecting saliva on the second day, after one day of practice. Based on the relationship with serum cortisol, salivary cortisol sampled at 4 pm on collection day 2 was selected as the evening salivary cortisol index for further analysis. Notably, cortisol variability was negatively associated with evening salivary

cortisol ($r = -.33, p < 0.001$). No other significant correlations among cortisol indices were found.

Bivariate correlations with covariates. After the BF17 mean score was calculated and the evening salivary cortisol index was selected, correlations among all study variables, including BF, cortisol indices (evening serum cortisol, evening salivary cortisol, salivary cortisol variability, and salivary CAR), and the hypothesized covariates were then conducted. Pearson correlation values for bivariate associations between study variables are reported in Table 4.

Relationships between BF and sociodemographic and medical variables were first examined. BF was negatively correlated with age ($p < 0.01$). BF was also associated with menopausal status ($p = 0.01$) and surgical procedure ($p = 0.01$). Premenopausal women ($M = 3.40, SD = 0.95$) reported significantly more benefit than perimenopausal and postmenopausal women ($M = 2.97, SD = 1.05$). Women who underwent a mastectomy ($M = 3.31, SD = 0.98$) reported significantly more benefit than women who underwent a lumpectomy ($M = 2.91, SD = 1.07$). Finally, BF was associated with racial/ethnic status ($p = 0.02$). Post-hoc comparisons revealed that Hispanic women ($M = 3.40, SD = 0.96$) reported significantly more benefit than non-Hispanic White women ($M = 2.73, SD = 1.03, p < 0.001$), but were not different from women self-identified as Black ($M = 3.41, SD = 1.09, p = 0.08$) or Other racial/ethnic status ($M = 3.48, SD = 0.75, p = 0.20$). Results of post-hoc group differences in BF are depicted in Figure 2. BF was not associated with income, education, partner status, stage, or time since surgery (all p 's > 0.05).

Follow-up analyses were conducted to investigate potential associations between racial/ethnic status and SES in order to better understand the relationship between racial/ethnic status and BF. Race/ethnicity was not associated with income ($p = 0.68$) or education ($p = 0.64$). To rule out potential suppressor effects, BF was regressed on race/ethnicity, controlling for both income and education. The relationship between racial/ethnic status and BF was lost when controlling for both income and education ($\beta = 0.13, p = 0.12$).

Cortisol indices were largely unrelated to the hypothesized covariates (p 's > 0.05) with the exception of evening salivary cortisol. Evening salivary cortisol level was negatively associated with education ($p = 0.02$). Evening cortisol levels were unrelated to age, race/ethnicity, partner status, income, stage, type of surgical procedure, time since surgery, and menopausal status (p 's > 0.05). Cortisol variability and CAR were not significantly related to any sociodemographic or medical variables (all p 's > 0.05).

Linear regressions of cortisol indices on benefit finding. Each of the four cortisol indices (evening serum cortisol, evening salivary cortisol, cortisol variability, and CAR) were independently regressed on BF17 mean score. BF did not significantly predict any of the four cortisol indices (all p 's > 0.1).

Multiple regressions including covariates. Multiple regressions including sociodemographic and medical covariates were then conducted to determine whether non-significant linear regressions were caused by a potential specification error (Kline, 2011). Covariates that had significantly related to either BF or cortisol indices were included as covariates, specifically age, race/ethnicity, education, surgical procedure, and menopausal status. To ensure that true predictive relationships between BF and cortisol

indices were not being masked by potential suppressor variables, sociodemographic and medical variables were independently included as control variables in separate regression analyses. BF17mean did not predict any of the four cortisol indices, even when controlling for possible suppressor variables (all p 's > 0.05).

Exploratory Moderator Analyses

In the absence of direct associations between BF and physiological markers, previous work has shown moderation effects on this relationship (Milam, 2006; Moskowitz & Epel, 2006). BF has predicted lower viral load in HIV+ patients who were low in pessimism as well as higher CD4+ cell counts in those low in optimism (Milam, 2006). In a sample of maternal caregivers, positive psychological states moderated the effect of BF on cortisol such that women who reported greatest positive affect, personal strength, spiritual growth, and life appreciation had steeper salivary cortisol slopes (Moskowitz & Epel, 2006), a marker of healthy neuroendocrine function. These findings suggest a potential association between BF and indicators of physiological health in specific subgroups based on psychological factors. The current study sought to expand upon these moderation findings and determine whether sociodemographic and medical variables moderate the relationship between BF and the cortisol indices of interest. In order to examine potential moderation of continuous variables, including age, income, education, and time since surgery, each predicted moderator was centered and independently multiplied by the centered BF17 predictor, producing four respective interaction terms. Potential categorical moderators, including race/ethnicity, stage, procedure, partner status, and menopausal status, were dummy coded. These dummy coded variables were then multiplied by the centered BF17 predictor to produce

interaction terms. Next, individual hierarchical regressions were carried out for each potential moderator to test effects on the relationship between BF and each of the four cortisol indices (evening serum cortisol, evening salivary cortisol, cortisol variability, and CAR). Significant results of the hierarchical moderator regression analyses of BF and cortisol are represented in Table 5.

The interaction between income and BF explained a significant proportion of the total variance in CAR ($p = 0.01$). Thus, income was a significant moderator of the relationship between BF and CAR. In order to conduct post-hoc analyses comparing groups of income levels, income was re-centered at one standard deviation above the sample mean income level and one standard deviation below the sample mean income level. Post-hoc analyses revealed no relationship between BF and CAR for individuals in the high income group ($p = 0.34$). However, there was a significant relationship between BF and CAR for individuals in the low income group ($p < 0.01$). Table 6 reports means, standard deviations, and inter-correlations between BF and CAR by level of income. Figure 3 depicts the interaction between income and BF in predicting CAR.

The interaction between menopausal status and BF explained a significant proportion of the total variance in CAR ($p = 0.02$). Thus, menopausal status was a significant moderator of the relationship between BF and CAR. Post-hoc analyses were conducted to compare premenopausal and peri/postmenopausal groups, with premenopausal individuals coded as 0 and perimenopausal and postmenopausal individuals coded as 1. Post-hoc analyses revealed no significant relationship between BF and CAR for peri/postmenopausal individuals ($p = 0.91$). However, there was a significant relationship between BF and CAR for premenopausal individuals ($p = 0.01$).

Means, standard deviations, and inter-correlations between study variables by menopausal status group can be found in Table 7. Figure 4 depicts the interaction between menopausal status and BF in predicting CAR. Age, education, time since surgery, partner status, race/ethnicity, stage, and type of surgical procedure were not found to moderate the relationship between BF and cortisol indices.

Chapter 4: Discussion

The current study aimed to determine the factor structure of the 17-item BFS (Antoni et al., 2001; Tomich & Helgeson, 2004) in a sample of post-surgical breast cancer patients and to examine the relationship between women's ability to find benefit early in the cancer experience and their cortisol levels. Results indicate that BF in this sample is unidimensional and best represented by a composite 17-item score rather than distinct subscales. This finding is consistent with previous single-factor BFS results in post-surgical breast cancer samples (Antoni et al., 2001; Tomich & Helgeson, 2004; Urcuyo et al., 2005) but disparate from multidimensional BF factor results in two-year (Weaver et al., 2008) and five-year breast cancer survivors (Tomich & Helgeson, 2002). These differences may be less attributable to large-scale differences in type of BF scale used (i.e., BFS vs. SRGS vs. PBS) or the type of traumatic stressor experienced by the sample (Park, 2004) since all the aforementioned studies utilized the BFS (Antoni et al., 2001; Tomich & Helgeson, 2004) in breast cancer samples. Rather, the clearest pattern in these differences may be the time frame in which BF is assessed. Studies assessing women within months of diagnosis and surgery appear to consistently find that BF is a unitary construct (Antoni et al., 2001; Tomich & Helgeson, 2004; Urcuyo et al., 2005) while those assessing women who are more than two to five years beyond diagnosis find BF to be multidimensional (Tomich & Helgeson, 2002; Weaver et al., 2008). The current study lends further support to this pattern. Thus, not only do longitudinal studies demonstrate increased levels of BF in breast cancer samples over time (Manne et al., 2004; Sears et al., 2003), but factor analyses suggest that women also report more differentiated BF with greater time since surgery.

These findings support the idea that increased time since diagnosis provides more time to process and work through the experience (Manne et al., 2004; Sears et al., 2003). Although growth can happen early in the survivorship trajectory (Manne et al., 2004), Taylor's (1983) theory of cognitive adaptation suggests that more time provides women with greater opportunity to explore trauma impact and subsequently reappraise and restructure their lives in a positive way. Soon after diagnosis and surgery, distressed breast cancer patients may perceive benefits more generally, experiencing similar benefits across a broad range of areas (Antoni et al., 2001). As time passes, women may be better able to explore the differential impact breast cancer has had on distinct life domains, such as their ability to be more accepting, family growth, personal growth, social relations, world view, and health behaviors (Weaver et al., 2008). BF later in the survivorship trajectory may represent a more fine-tuned approach to perceiving benefits, and studies of these specific domains provide an interesting look at domain-specific differences in BF predictors and outcomes (Weaver et al., 2008). However, subscale analysis with the BFS does not appear to appropriately capture BF in post-surgical breast cancer patients. Results of the current study point to the importance of utilizing a composite 17-item BFS score in the current post-surgical breast cancer sample and, on a broader level, the importance of conducting a factor analysis before adopting subscales from other BF studies (i.e., Weaver et al., 2008).

The possibility that BF factor structure changes over the survivorship trajectory raises several questions and holds interesting implications for longitudinal research and intervention effects on BF. Should BF be treated differently across different measurements periods, and how should intervention effects on BF be assessed if the

factor structure of BF changes over time? How long does it take women to begin to differentiate between BF domains, and at what point is BF better characterized as multidimensional? An important direction for future research could be an observational examination of repeated BF measures over time in a large breast cancer sample.

Observational studies could investigate not only differences in level of BF over time but also differences in BF factor structure over time through factor analyses with each measurement timepoint. Findings from such investigations could not only inform research on BF predictors and outcomes but could also indicate how best to assess intervention effects on BF over time in clinical trials. It would be important to examine invariant factor structures in both intervention groups and control groups. One other consideration is the impact of major treatment stages, from diagnosis through surgery, beginning and ending adjuvant treatment, and possibly recurrence, on the level and factor structure of BF over time. It would be interesting to attempt to clarify these crisis points throughout the survivorship trajectory and examine BF during these distinct periods.

Associations among Cortisol Indices

Serum cortisol and most of the salivary cortisol indicators were not associated in the current study, potentially due to limited reliability of salivary cortisol collection procedures, or because of the fact that serum contains bound and unbound cortisol, whereas saliva contains only unbound cortisol. Previous work utilizing a range of cortisol indices in breast cancer also found that cortisol indices were not uniformly associated with one another (Vedhara et al., 2006). Vedhara et al. (2006) interpreted this finding as a reflection of the distinct nature of each of the cortisol indices. Future work should clarify the relationship among cortisol indices and their underlying biological

mechanisms to help inform research on associations between cortisol and psychosocial measures.

In the present study, salivary cortisol collected at 4 pm on the second day of collection was the only salivary cortisol value that correlated with evening serum cortisol. This association was presumably found because of the close proximity in time of measurement and because women had practiced on the first day and were better able to capture a valid saliva sample on the second day. Comparisons between saliva samples across the days of collection should be conducted in future work to assess this possibility. Secondly, lower cortisol variability was associated with greater evening salivary cortisol levels. This negative association is important because it suggests that low cortisol variability, which has been shown to relate to poorer health outcomes in cancer patients (Sephton et al., 2000; Weinrib et al., 2010), may be attributable to high evening cortisol levels in conjunction with high morning cortisol levels, rather than low evening and low morning cortisol levels. This carries implications for future work with cortisol in breast cancer as it suggests that low cortisol variability may be driven by high evening cortisol levels.

Associations between Benefit Finding and Study Covariates

Sociodemographic variables and benefit finding. Results of bivariate correlations between BF and sociodemographic variables were all consistent with Helgeson et al.'s (2006) meta-analytic results and revealed that BF was associated with age and race/ethnicity but unrelated to education, income, and partner status. Younger women found significantly more benefit than did older women. A related finding was that premenopausal women reported greater BF than did perimenopausal and

postmenopausal women. Helgeson et al. (2006) suggest that the relationship between BF and younger age may be explained by greater reported stress in younger women as younger women are prematurely threatened by mortality (Bower et al., 2005b). For the most part, higher stress facilitates increased BF according to Taylor's (1983) cognitive adaptation theory, although too much stress may undermine BF by overwhelming coping resources (Lechner & Weaver, 2009). Younger women generally have fewer comorbidities and fewer trying life events against which to compare their breast cancer experience and are, therefore, more affected by their diagnosis (Bellizzi & Blank, 2006).

The present study found that Hispanic women reported significantly more BF than non-Hispanic White women. This finding partially supports conclusions from Helgeson et al. (2006) as well as Lechner and Weaver (2009) that minority groups report greater BF than non-Hispanic White individuals. Differences in BF between non-Hispanic White women and those women in the Black and Other racial/ethnic categories were not found in the current study, likely due to the low number of women in these minority groups, which limits power to find a significant effect. A number of possible explanations for greater BF in minority groups have been proposed. Differences may be attributable to differences in SES, health beliefs, social support, spirituality, or coping strategies (Lechner & Weaver, 2009). Indeed, greater use of religious coping strategies has been found to mediate the effect of minority status on BF (Urcuyo et al., 2005). Health beliefs, social support, spirituality, and coping were not assessed in the current study, but income and education were measured. No racial/ethnic differences in income or education were found. Follow-up analyses revealed that the effect of racial/ethnic status on BF was lost when controlling for both income and education, suggesting that

socioeconomic status (SES) may partially explain the effects. Future research could further explore this relationship with a more sensitive measure of SES (Cundiff, Smith, Uchino, & Berg, 2013) and should also examine the influence of health beliefs, social support, and spirituality on BF in minority groups. Most studies, including the current study, combine racial and ethnic status into a single variable (Lechner & Weaver, 2009). An important next step could be to distinguish between racial and ethnic status in order to determine their separate relationships with BF. Future work should also strive to include balanced groups with equal representation from each racial and ethnic category of interest. Exploration of individual differences within racial and ethnic groups would also be an area worthy of future study.

Medical variables and benefit finding. Results of bivariate correlations between BF and medical variables in the current study showed that BF was associated with type of surgical procedure but unrelated to disease stage and time since surgery. Women in the current study who underwent a mastectomy reported significantly more benefit than women who underwent a lumpectomy. While this finding contradicts previous results suggesting that BF is unrelated to primary surgical treatment (Bellizzi & Blank, 2006), it is consistent with the finding that greater objective severity of an event promotes greater BF (Helgeson et al., 2006). Women who underwent the objectively more severe surgical procedure may have been more challenged to cognitively adapt, providing greater opportunity for BF (Taylor, 1983).

In contrast to this theory, stage of disease was not related to BF in the current study. BF has been inconsistently related to stage in the literature (Lechner & Weaver, 2009), and previous work has attributed these inconsistent findings to a curvilinear

relationship between BF and stage (Lechner et al., 2003). With some exceptions, stage has most often related to BF in those studies including women with invasive breast cancer (Bellizzi & Blank, 2006; Lechner et al., 2003). Similar to the current study, Manne et al. (2004) utilized a sample of stage 0 to stage III breast cancer patients, with greatest representation from stage I and stage II disease, and found no relationship between disease stage and BF. The relationship between BF and stage may be more clear when the full range of disease severity is represented in the sample.

Interestingly, time since surgery was not significantly correlated with BF in the current study. Although longitudinal studies demonstrate a positive relationship between BF and time since surgery (Manne et al., 2004; Sears et al., 2003), cross-sectional studies investigating this relationship have met with mixed results (Lechner & Weaver, 2009). Cross-sectional studies, such as the present study, may involve a restrictive range of time since surgery, with too little variance to detect a significant difference. Indeed, the current sample of women were specifically recruited to fit within a small window of time soon after surgery (2 – 10 weeks) for reasons unrelated to the current study. Significant differences in levels of BF over time within this tight window of time so soon after surgery may be unlikely.

Associations between Cortisol and Study Covariates

Sociodemographic variables and cortisol. In terms of the relationship between cortisol and sociodemographic and medical variables, evening salivary cortisol level was negatively associated with education level, indicating that women with lower levels of education may exhibit more dysfunctional cortisol patterns (Sephton et al., 2000). This finding is consistent with work specifically investigating the relationship between SES

and stress hormones which found that lower education was associated with higher cortisol levels (Cohen, Doyle, & Baum, 2006), controlling for race, age, gender, and body mass. Associations between SES and cortisol have been somewhat inconsistent in the general literature likely due to differences in cortisol sampling and SES measures used (Dowd, Simanek, & Aiello, 2009). Consistency between the current study and that of Cohen et al. (2006a) may be due to similarities in measures used for education (i.e., highest level of education achieved) and salivary cortisol.

Dysregulation of cortisol rhythms in individuals of lower SES may be attributable to psychosocial and behavioral factors. Women of lower SES are likely to experience environments characterized by high levels of psychosocial disruption with continuous stress-eliciting threats (Cohen et al., 2006a). Chronic stressor exposure in lower SES individuals can result in HPA activation and heightened cortisol levels. Women with lower education may also be more likely to engage in night-time shift work, a specific behavioral pattern known to disrupt endocrine rhythms (Schernhammer et al., 2003). In their study, Cohen et al. (2006a) found that the relationship between SES and cortisol in individuals of lower SES was largely explained by greater smoking, less diverse social networks, and skipping breakfast. These results were also produced in a large cohort sample with higher mean SES, more similar to the current sample (Cohen et al., 2006b), suggesting that relative differences in SES and cortisol hold across a range of SES levels. The current study was limited in that the influence of health practices was not examined, but future work could expand on the work of Cohen and colleagues by examining both psychosocial and health practice differences among SES levels in breast cancer.

Medical variables and cortisol. The current study failed to show an association between cortisol indices and medical variables, including disease stage, type of surgery, and time since surgery. Given the evidence in support of a relationship between cortisol and treatment-related variables that impact physiology (Sephton & Spiegel, 2003), the null findings in the current study may be more attributable to limitations of measurement than to a true null relationship. Medical variables in the current study were collected via both self-report and medical chart reviews because medical chart information was not available for all participants. Women reported their disease stage and surgery type soon after initial surgery, and some women were unaware of their final staging or later went on to have a second surgery, so self-reported disease stage and surgery type measures may not have been accurate. Furthermore, the time since surgery measure was limited by the cross-sectional nature of the current study and the tight window during which women were recruited (2-10 weeks post-surgery) potentially resulting in too little variance for a significant relationship with cortisol to be detected. Future work should investigate the relationship between treatment variables and cortisol using only objective measures of treatment factors derived from medical charts.

Relations between Cortisol Indices and Benefit Finding

Results of the current study showed that women's ability to find benefit right after surgery for breast cancer did not significantly predict any of the four cortisol indices examined. Multiple regressions with sociodemographic and medical covariates indicate that the non-significant relationships between BF and cortisol indices were not attributable to the impact of suppressor variables. These findings are consistent with those of previous cross-sectional work reporting no relationship between BF and cortisol

(Moskowitz & Epel, 2006) but conflict with the longitudinal work of Cruess et al. (2000). Importantly, Cruess et al. (2000) investigated the relationship between change in BF and change in cortisol after psychological intervention, controlling for pretreatment levels of BF and cortisol. The initial, cross-sectional relationship between BF and cortisol prior to intervention was not reported. It could be that women's ability to find benefit prior to psychological intervention was unrelated to pre-intervention cortisol levels, as was found in the current study. If true, this may indicate that a shift in BF during psychological intervention is necessary to detect a relationship with cortisol. The intervention described by Cruess et al. (2000) began 8 weeks post-surgery and lasted for a period of 10 weeks, spanning the time during which most women began adjuvant treatment. Perhaps this period of higher stress prompted efforts at cognitive adaptation, which could be nurtured in the intervention group to promote an increase in BF and a corresponding decrease in stress hormone release. A relationship between BF and cortisol may be more evident during periods in which BF is activated and changing, such as during psychological intervention or during a crisis period when stress is greater (Taylor, 1983). A few months after surgery, BF may be more stable, so a cross-sectional look at BF at this point may not be synchronous with physiological measures that vary day-to-day and even within the day, such as cortisol. BF assessed months after surgery may truly be a reflection of an earlier cognitive process, resulting in a lack of correspondence with momentary cortisol measures. An interesting direction for future work would be to sample BF at initial diagnosis, recurrence diagnosis, or other identified crisis points, in order to determine whether active efforts at BF more closely corresponds to momentary cortisol measures.

BF is thought to lead to physical benefits across a range of medical illnesses (Bower et al., 2009), but the literature on physiological correlates of BF in breast cancer is relatively sparse. Numerous studies on positive affect, one of the strongest correlates of BF in the literature (Helgeson et al., 2006), have found an association with cortisol regulation (Pressman & Black, 2012). Fewer studies have directly linked BF with cortisol. This pattern of findings has led researchers to hypothesize that effects of BF on physiological variables, such as cortisol, could be attributable to BF's relationship with positive affect (Bower et al., 2009). In a study of maternal caregivers, positive affect was a moderator, not a mediator, of the effect of BF on cortisol (Moskowitz & Epel, 2006). BF predicted a more adaptive cortisol pattern only in women who reported greater positive affect. The current study did not examine positive affect as a variable of interest, but here a mediation effect is also unlikely given that BF was unrelated to cortisol. Future research could examine positive affect as a potential moderator of BF's effect on cortisol in breast cancer patients to determine whether a relationship between BF and cortisol may be evident in women with breast cancer who report greater positive affect. Proposed mediators of BF's effect on cortisol could also be examined, including appraisals, coping, relationships, and goals (Bower et al., 2009).

Moderators of the Association between Benefit Finding and Cortisol

Exploratory analyses suggest that income and menopausal status may independently moderate the relationship between BF and one cortisol indicator, salivary cortisol awakening response (CAR). Notably, CAR is championed as the cortisol index with perhaps the greatest potential for capturing individual differences (Fekedulegn et al., 2007), which could help explain why moderator relationships were found for BF and

CAR but no other cortisol indices. Exploratory results suggest that BF may predict lower CAR within specific subgroups, including women with lower income and pre-menopausal women. Since lower CAR is thought to be indicative of healthier cortisol regulation (Chida & Steptoe, 2009), women in these subgroups who report greater BF also appear to demonstrate better cortisol regulation. The current study is cross-sectional, so direction of causation cannot be resolutely determined. However, it could be reasoned that the cognitive process of perceiving benefits in the experience of breast cancer likely preceded the momentary assessment of cortisol. Based on this notion, it is possible that BF confers a health advantage for women with lower income and pre-menopausal women.

As previously described, women of lower SES may experience more chronic stressors and be a group more vulnerable to stress (Cohen et al., 2006a). Women of lower SES likely encounter more psychosocial disruption and stress-eliciting threats (Cohen et al., 2006a), providing greater opportunity to reappraise these threats as challenges (Epel et al., 1998). Women in this group who are able to perceive challenges may experience lower physiological arousal (Bower & Segerstrom, 2004; McGregor et al., 2004), buffering the negative physiological impacts of breast cancer-related stress (McGregor et al., 2004).

Similarly, pre-menopausal status may represent an increased vulnerability to stress in the context of breast cancer. Pre-menopausal women with breast cancer report more concerns related to deficits in emotional, social, and cognitive functioning relative to post-menopausal women in addition to increased frequency of menopausal side effects of treatment (Befort & Klemp, 2011). With a greater number of perceived threats, pre-

menopausal women experience greater opportunity for reappraising these threats as challenges, reducing stress response activation. Thus, pre-menopausal women who are able to perceive benefit and appraise threats as challenges may experience a protective effect of BF on cortisol regulation. However, the current post-hoc moderator results require replication with *a priori* hypotheses before definitive conclusions can be drawn.

Limitations

Beyond the aforementioned limitations, the current study was primarily limited by issues of measurement and generalizability. A number of limitations of the current BFS (Antoni et al., 2001; Tomich & Helgeson, 2004) have been identified (Tennen & Affleck, 2009). First of all, the BFS is a retrospective self-report. Critics have argued that recall of previous states is often biased (Wilson & Ross, 2001) with a tendency for respondents to over-estimate growth (Tennen & Affleck, 2009). Temporal comparison theory (Albert, 1977) suggests that remembering a more negative past self creates a sharper contrast with the present self and allows people to maintain positive self-regard. This retrospective bias would result in an inflated sense of growth. Additionally, the BFS reveals only the perceived presence of growth, not the mechanisms for its development (Tennen & Affleck, 2009), which limits our understanding of BF. Another potential difficulty of the BFS is interpretation of scores (Carver, Lechner, & Antoni, 2009) since higher BF may not always signify better adaptation. Curvilinear relationships have demonstrated advantages of both high and low levels of BF (Lechner et al., 2003; Lechner, Carver, Antoni, Weaver, & Phillips, 2006). These findings have been attributed to differential levels of distress (Carver et al., 2009). A certain sense of crisis must be experienced for BF to occur (Tedeschi & Calhoun, 2004), so women who experience

little distress from breast cancer (theoretically due to minimal discrepancy between appraised and global meaning; Park & Folkman, 1997) may not have high BF, yet seem to adapt well (Carver et al., 2009). Researchers who focus solely on increasing BF regardless of distress level may be missing important information and may not find linear associations with outcomes (Carver et al., 2009). The concern most often raised with the BFS is that the scale may not reflect actual growth (Tennen & Affleck, 2009). For now, it is perhaps best to interpret items on the BFS as *perceived* beneficial life changes (Tennen & Affleck, 2009). Evidence from various areas of research suggests that perception of an experience may be a better predictor of later behavior than actual experience (Tennen & Affleck, 2009), and perception of benefits in medical illness has been targeted as an important predictor of adaptation (Petrie & Corter, 2009). Thus, it could be argued that there is merit in measuring perceived benefits in the experience of breast cancer.

The current study was also limited by potential issues with the measurement of salivary cortisol. The common practice for salivary cortisol collection is to place the responsibility of sampling in the hands of the participants (Dowd et al., 2009). Women in the present study were instructed to collect saliva using cotton swabs upon wakening, 30 minutes post-wakening, at 4 pm, and at 9 pm over two consecutive days. It was presumed that women complied with these instructions, and cortisol indices were calculated based on instructed collection times. Future work should examine differences in self-reported time of collection, particularly for the wakening cortisol measures, and ensure that sampling was completed within a tight timeframe surrounding each collection timepoint. The days of salivary cortisol collection could also be examined to assess for

the possible influence of differences in collection on weekdays versus weekends (Kunz-Ebrecht et al., 2004). It would also be interesting to control for differences in women who are working vs those women who are not working during the cortisol collection period. Future studies requiring at-home salivary collection should attempt to include adherence checks for salivary collection times. The current study provided pre-programmed beepers to help remind women of collection times, but it is unclear whether women used these beepers or if the beepers were helpful in increasing adherence. Ideally, salivary cortisol collection procedures could incorporate an adherence check similar to the Momentary Electronic Monitoring System (MEMS) used to check adherence to Highly Active Antiretroviral Treatment (HAART) medication regimens in patients with HIV (Knafl et al., 2010).

Despite the benefit of being a less invasive cortisol sampling method, salivary cortisol collection is still limited in that the participant burden of salivary cortisol collection is arguably quite high. In addition to collecting cortisol samples at very specific times over two consecutive days, participants were instructed to refrain from alcohol use for at least 12 hours prior to sample collection, refrain from vigorous exercise the day of collection, and avoid consuming a large meal or brushing teeth within one hour of saliva collection. Inter-individual differences in compliance with these instructions likely contribute non-specific error in the analysis of salivary cortisol concentrations. Overall, poor reliability of cortisol sampling could partially account for null relationships found among cortisol indices and between cortisol and BF in the current study.

Finally, the current study focused on women with early-stage breast cancer who were assessed within a window of time 2-10 weeks post-surgery. The combined sample

included women of higher SES, with relatively high average income and education. Although, the current sample included a greater proportion of Hispanic participants than previous studies, (Urcuyo et al., 2005), Black and other minority populations were not well represented in the current sample. Thus, the current findings may not be generalizable to women with metastatic breast cancer or women in the later phases of breast cancer survivorship. Caution may also be warranted when applying the current findings to women of low SES or to women from non-Hispanic minority groups.

Conclusions

The current study examined the factor structure of the 17-item BFS (Antoni et al., 2001; Tomich & Helgeson, 2004) as well as the relationship between BF and cortisol early in the breast cancer experience. The BFS was found to be unidimensional in post-surgical breast cancer patients, representing a departure from Weaver et al.'s (2008) recent call to replace the BFS composite score with subscale analyses based on a study of cancer survivors. Comparisons between the current study and previous BFS factor analyses suggest that the factor structure of BF may change over the period of survivorship, with domains of BF becoming more differentiated with increased time since diagnosis. This finding adds to previous work examining the influence of the measurement instrument, study population, and type of stressor on BF factor structure (Park, 2004). Longitudinal work is needed to further explore the effect of time on BF manifestation in breast cancer and to inform intervention research. Despite its limitations, the sample for the present factor analysis was large and generally diverse, arguably representing one of the strongest psychometric analyses of the BFS in breast cancer to date.

BF was largely uncorrelated with cortisol indices in the present study, which adds to the sparse literature investigating this association in breast cancer and supports previous null findings in other cross-sectional work (Moskowitz & Epel, 2006). However, post-hoc moderator relationships were found indicating that BF may predict reduced CAR in pre-menopausal women and in women with lower income. This suggests that BF may be associated with better cortisol regulation in groups experiencing higher levels of stress during the breast cancer experience. More work is needed to determine whether BF may confer a protective advantage for women in more vulnerable groups. If BF is found to predict better physiological functioning in future work, identification and facilitation of BF in breast cancer patients may be important. However, direct interventions to increase BF remain premature and controversial in the clinical setting (Tedeschi & Calhoun, 2009) as they may promote a “tyranny of positive thinking” (Holland & Lewis, 2000, p. 13).

Tables

Table 1. Means and standard deviations for study variables at the baseline assessment

Variable	Sample 1 (<i>n</i> = 240)	Sample 2 (<i>n</i> = 179)	Combined (<i>n</i> = 419)
Days from Surgery to Baseline	40.65 (23.19)	37.45 (22.42)	39.15 (22.88)
Age (in years) range, 23-80	50.34 (9.03)	54.26 (10.01)	52.05 (9.68)
Stage			
0	38 (16%)	33 (19%)	71 (17.1%)
I	90 (37.8%)	96 (55.2%)	187 (45.2%)
II	91 (38.2%)	34 (19.5%)	126 (30.4%)
III	19 (8%)	10 (5.7%)	29 (7%)
IV	0 (0%)	1 (0.6%)	1 (0.2%)
Procedure			
<i>Lumpectomy</i>	122 (50.8%)	85 (47.8%)	209 (49.8%)
<i>Mastectomy</i>	118 (49.2%)	93 (52.2%)	211 (50.2%)
Education (in years)	15.58 (2.38)	15.62 (2.88)	15.61 (2.6)
Income (in thousands of dollars)	79.82 (67.12)	101.76 (76.29)	88.94 (71.72)
Race/Ethnicity			
<i>White non-Hispanic</i>	152 (63.6%)	74 (41.3%)	228 (54.3%)
<i>Hispanic</i>	61 (25.5%)	80 (44.7%)	141 (33.6%)
<i>Black/African-American</i>	21 (8.8%)	16 (8.9%)	37 (8.8%)
<i>Other</i>	5 (2.1%)	9 (5%)	14 (3.3%)
Menopausal Status			
<i>Premenopausal</i>	107 (44.6%)	58 (32.8%)	165 (39.4%)
<i>Perimenopausal</i>	30 (12.5%)	18 (10.2%)	48 (11.5%)
<i>Postmenopausal</i>	103 (42.9%)	101 (57.1%)	206 (49.2%)
Partner Status – Partnered	150 (62.5%)	116 (64.8%)	268 (63.7%)

Mean (SD) or Frequency (%)

Table 2. Geomin rotated factor loadings for BFS items

BFS item	1 Factor
1	0.74*
2	0.79*
3	0.76*
4	0.63*
5	0.73*
6	0.82*
7	0.77*
8	0.56*
9	0.71*
10	0.72*
11	0.71*
12	0.49*
13	0.71*
14	0.52*
15	0.51*
16	0.79*
17	0.77*

Note. * $p < 0.05$, ** $p < 0.01$

Table 3. BFS items, means, and standard deviations for combined sample (N = 419)

Item	<i>Mean</i>	<i>SD</i>
Having breast cancer has...		
1 led me to be more accepting of things.	3.09	1.24
2 taught me how to adjust to things I cannot change.	3.24	1.27
3 helped me take things as they come.	3.16	1.20
4 brought my family closer together.	3.34	1.35
5 made me more sensitive to family issues.	3.10	1.40
6 taught me that everyone has a purpose in life.	3.09	1.56
7 shown me that all people need to be loved.	3.31	1.54
8 made me realize the importance of planning for my family's future.	3.31	1.45
9 made me more aware and concerned for the future of all human beings.	3.11	1.41
10 taught me to be patient.	2.90	1.33
11 led me to deal better with stress and problems.	2.60	1.34
12 led me to meet people who have become some of my best friends.	2.07	1.33
13 contributed to my overall emotional and spiritual growth.	3.09	1.37
14 helped me become more aware of the love and support available from other people.	4.10	1.10
15 helped me realize who my true friends are.	3.65	1.36
16 helped me become more focused on priorities, with a deeper sense of purpose in life.	3.51	1.31
17 helped me become a stronger person, more able to cope effectively with future life challenges.	3.45	1.36

Table 4. Pearson correlations for study variables

	1	2	3	4	5	6	7	8	9
1. BF17mean score	-								
Cortisol indices									
2. Evening serum cortisol	.06	-							
3. Evening salivary cortisol	-.03	.16*	-						
4. Cortisol variability	-.04	.14	-.33**	-					
5. Cortisol awakening response	-.12	.13	.01	-.06	-				
Sociodemographic & medical variables									
6. Age	-.21**	.00	.11	-.05	.00	-			
7. Income level	-.09	.00	.08	-.11	.04	-.15	-		
8. Education level	-.08	.05	-.19*	.03	-.05	-.05	.18*	-	
9. Number of days since surgery	-.03	-.01	.01	.03	.05	.02	-.06	.07	-

Table 5. Hierarchical moderator regression analyses of benefit finding and cortisol awakening response (CAR)

	Income		Menopausal Status	
	Standardized β	ΔR^2	Standardized β	ΔR^2
<i>Main effects</i>		0.02		0.03
BF17mean	-0.12		-0.11	
Demographic Variable	0.03		0.11	
<i>Interaction effects</i>		0.05		0.04
BF17mean X Demographic Variable	0.23**		0.34*	
Final test statistic	$F(1,132) = 7.00^{**}$ $R^2 = 0.07$		$F(1,151) = 5.59^*$ $R^2 = 0.07$	

Note. * $p < 0.05$, ** $p < 0.01$

Table 6. Association between benefit finding and cortisol awakening response (CAR) at different levels of income

	Low Income		High Income	
	BF17mean	CAR	BF17mean	CAR
BF17 mean score	-	-0.54 **	-	0.12
CAR		-		-
Mean	3.23	2.69	3.06	2.28
Standard Deviation	0.97	7.74	1.06	6.93

Note. * $p < 0.05$, ** $p < 0.01$

Table 7. Association between benefit finding and cortisol awakening response (CAR) at different levels of menopausal status

	Pre-Menopausal		Peri/Postmenopausal	
	BF17mean	CAR	BF17mean	CAR
BF17 mean score	-	-0.34 **	-	0.01
CAR		-		-
Mean	3.38	1.20	3.00	3.24
Standard Deviation	0.94	8.02	1.03	6.80

Note. * $p < 0.05$, ** $p < 0.01$

Figures

Figure 1. Exploratory factor analysis scree plot showing eigenvalues for the 17-item BFS. Factors yielding eigenvalues greater than one are labeled with their corresponding eigenvalue.

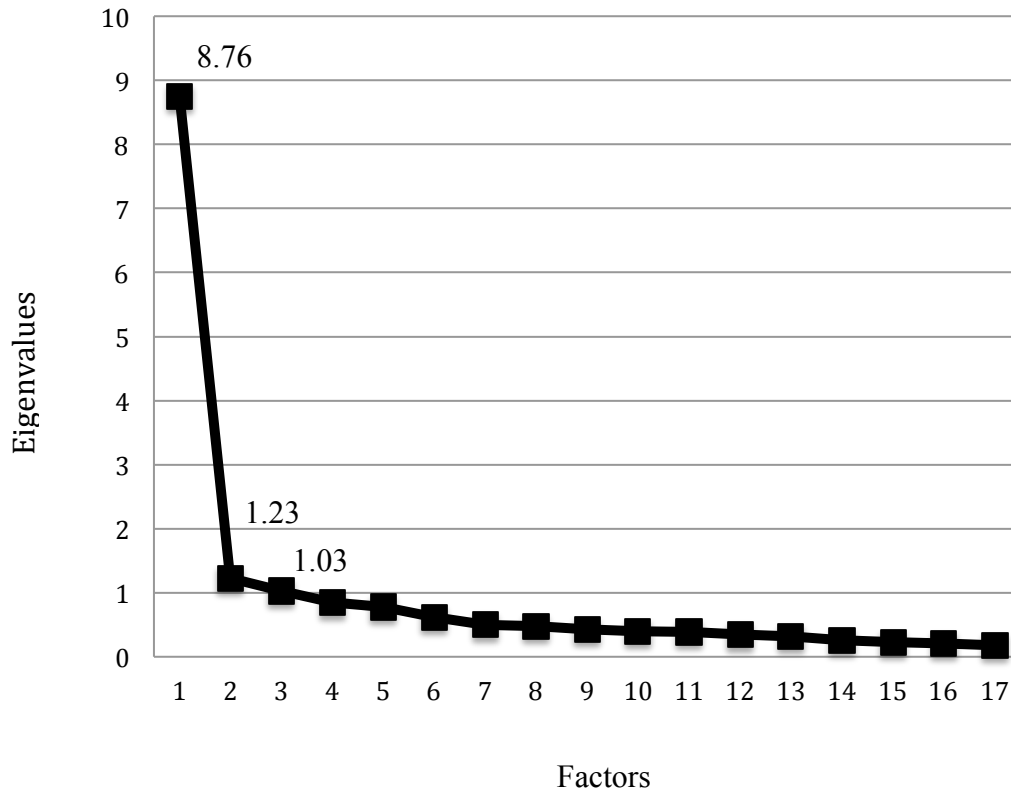
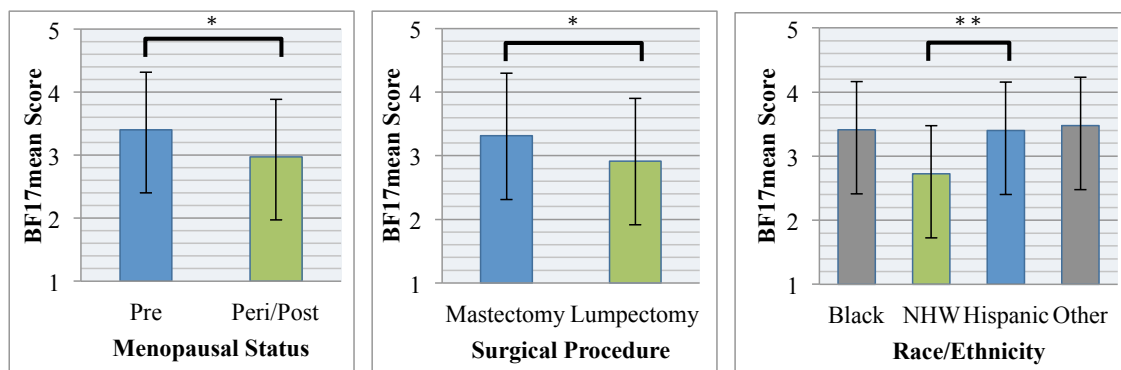


Figure 2. Group differences in levels of benefit finding (BF) for sociodemographic and medical variables. Differences in mean BF score between menopausal status groups (premenopausal vs. peri/postmenopausal), surgical procedure groups (mastectomy vs. lumpectomy), and racial/ethnic groups (Black, non-Hispanic White, Hispanic, and other minority groups) are depicted.



Note. Significant differences are shown such that $*p < 0.05$, $**p < 0.01$

Figure 3. Scatterplot of the association between benefit finding (BF) and cortisol awakening response (CAR) with income as a moderator. Regression lines depict the association between BF and CAR in high and low income groups

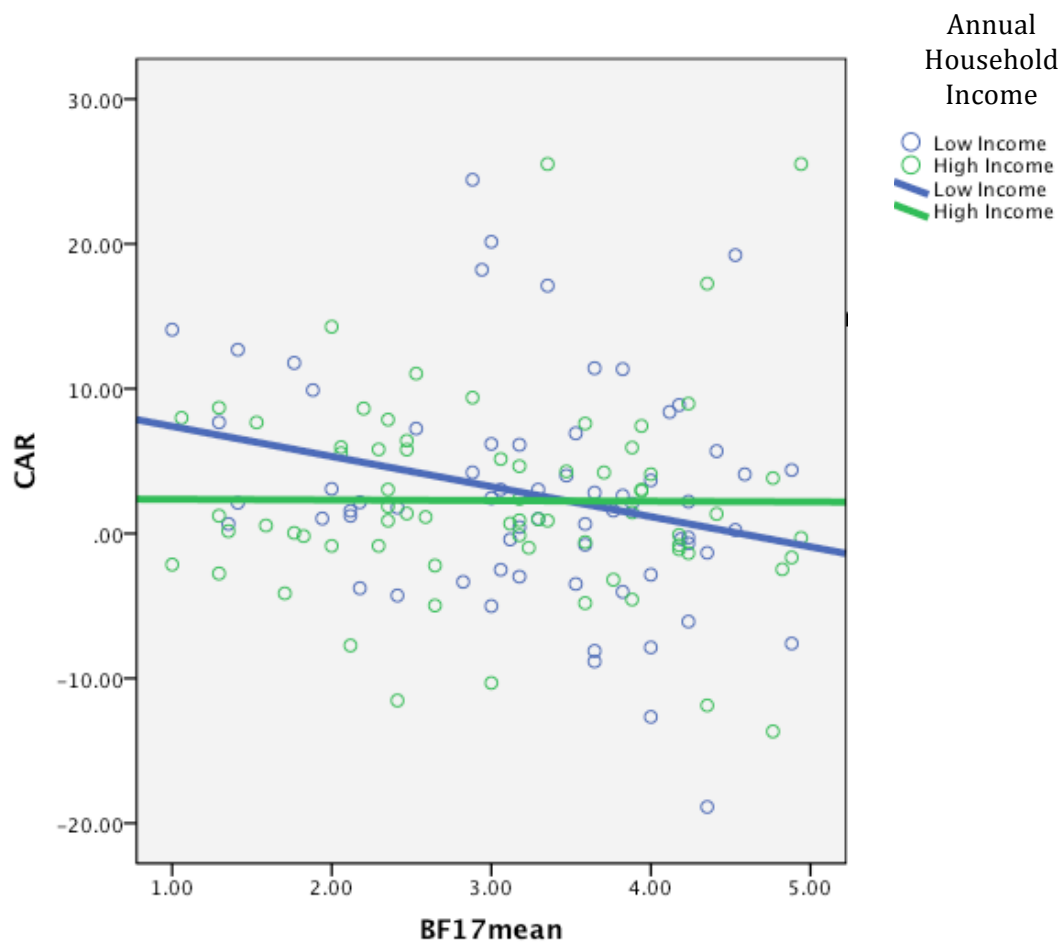
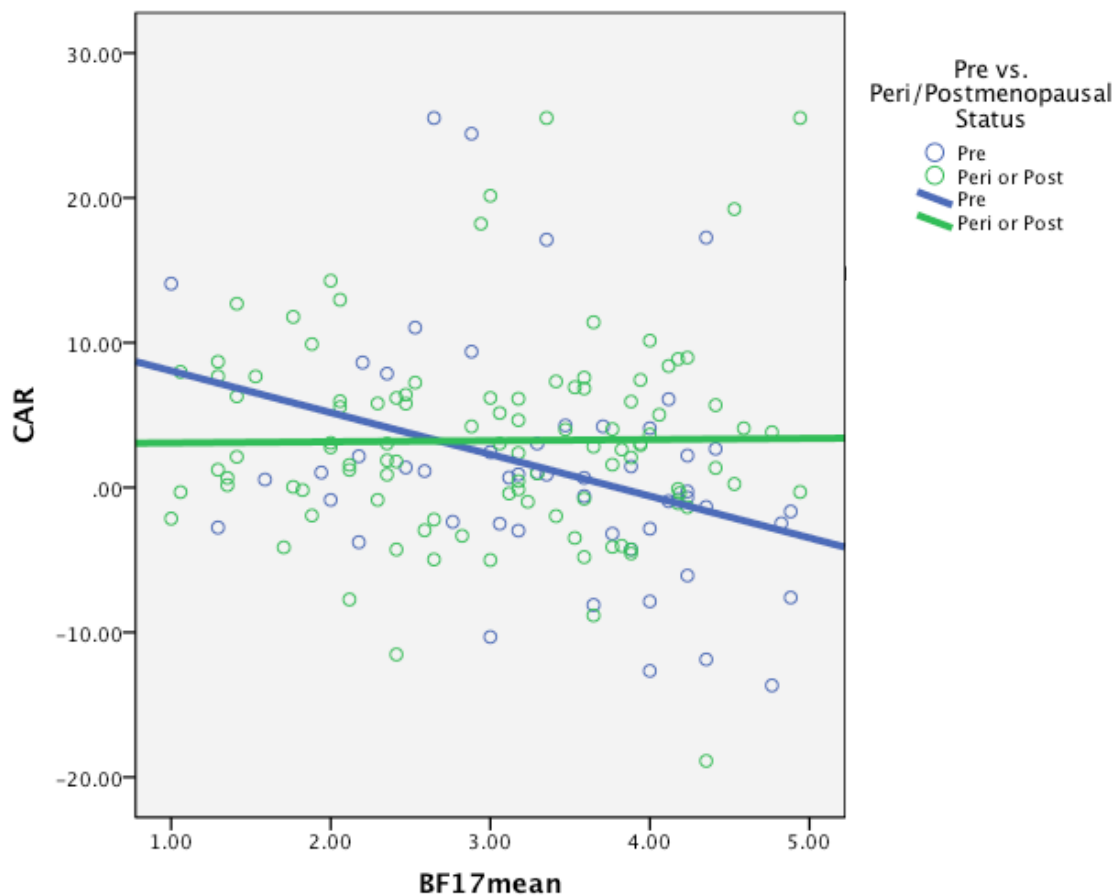


Figure 4. Scatterplot of the association between benefit finding (BF) and cortisol awakening response (CAR) with menopausal status as a moderator. Regression lines depict the association between BF and CAR in premenopausal and peri/postmenopausal groups



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Appendix of Measures

Benefit Finding Scale

Cancer patients sometimes feel that having cancer makes contributions to their lives, as well as causing problems. Indicate how much you currently agree with each of the following statements, using these response options:

- 1 = Not at all
- 2 = A little
- 3 = Moderately
- 4 = Quite a bit
- 5 = Extremely
- 9 = Does not apply to me

Having breast cancer...

- _____ 1 has led me to be more accepting of things.
- _____ 2 has taught me how to adjust to things I cannot change.
- _____ 3 has helped me take things as they come.
- _____ 4 has brought my family closer together.
- _____ 5 has made me more sensitive to family issues.
- _____ 6 has taught me that everyone has a purpose in life.
- _____ 7 has shown me that all people need to be loved.
- _____ 8 has made me realize the importance of planning for my family's future.
- _____ 9 has made me more aware and concerned for the future of all human beings.
- _____ 10 has taught me to be patient.
- _____ 11 has led me to deal better with stress and problems.
- _____ 12 has led me to meet people who have become some of my best friends.
- _____ 13 has contributed to my overall emotional and spiritual growth.
- _____ 14 has helped me become more aware of the love and support available from other people.
- _____ 15 has helped me realize who my true friends are.
- _____ 16 has helped me become more focused on priorities, with a deeper sense of purpose in life.
- _____ 17 has helped me become a stronger person, more able to cope effectively with future life challenges.

Saliva Collection Instructions

As part of the Coping and Recovery Project, you are requested to collect eight samples of your saliva over the course of two days. This will happen three times during the study - at your entry into the study, at the 6-month follow-up, and at the 12-month follow-up. We will be using your saliva in order to measure your cortisol levels, which are related to stress. Cortisol levels naturally change over the course of the day, so you will be asked to take four samples on each collection day so that we can look at how your cortisol levels change with time. It is very important that you read these instructions carefully and follow them exactly.

You have been provided with a **nylon carrying bag** which contains **nine labeled tubes** and a **timer**. This timer is already set to go off four times a day when you are required to collect your saliva. Your first saliva collection will be at the wake-up time you indicated during the phone screen (), the second is 30 minutes after wake-up, the third is at 4pm and the last is at 9pm. You will also find an **instructional DVD** in the bag, which will show you step-by-step instructions of how to collect your saliva. One of the tubes is labeled “TEST” – you can use this tube to practice collecting your saliva while you watch the DVD. The other eight tubes will be used to collect saliva at the pre-determined times listed above. Lastly, the carrying bag also contains a **freezer pack**. Please put this pack in your freezer to chill it the night before your first saliva collection. On collection days, keep the frozen pack at the bottom of the nylon carrying bag in order to keep your saliva samples cool.

Sample-Day Instructions

On the days that you are taking saliva samples, please follow these guidelines:

- Do not brush your teeth before you take a sample
- Do not exercise vigorously on a collection day (it can affect your cortisol levels)
- Do not eat a large meal for at least 1 hour before you take a sample
 - Do not eat anything during the 30 min. between your 1st and 2nd samples
- Do not have any alcohol for at least 12 hours before you take a sample

Step-by-Step Instructions

1. When the timer we give you starts to beep, take out the pointed tube that matches the day and sample number. (FOR EXAMPLE: If it is your first day of collecting saliva, and it is the first collection of the day, take out the tube labeled “Day 1, Sample 1”.)
 - To turn off the alarm, push the “ALM” button (the top button).
 - Note: You do not need to re-set the alarm. It will still go off the next day automatically.
2. Remove the smaller tube from inside the pointed tube, and take out the piece of cotton.
3. Put the cotton piece in your mouth. Do not swallow the cotton, and DO NOT CHEW ON THE COTTON. Some people place the cotton under their tongue, but please do whatever feels the most comfortable for you.
4. Keep the cotton in your mouth until is it very wet (at least 2 minutes). Some people think about lemons in order to make their mouths water more.
5. Once the cotton is completely wet, put it back into the smaller tube and put on the cap. Then put the small tube into the larger pointed tube so that it looks the same as when you started. Put the tube back into the bag with the **freezer pack**.
 - After your fourth collection of the day (9pm), put the freezer pack and the used collection tubes in the freezer overnight (in the nylon bag).
 - DO NOT put the timer in the freezer – please keep the timer and the tube labeled “Day 2, Sample 1” near your bed so that you do not miss your wake-up collection time on Day 2.
6. You will repeat these steps four times a day over two consecutive days, for a total of eight collections.
7. PLEASE REMEMBER to bring your **bag** with all the **samples**, the **timer**, the **DVD** and the **freezer pack** to your appointment with Coping and Recovery the day after Collection Day 2.