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Benefit Finding and Physical Health: Positive Psychological Changes and Enhanced Allostasis

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Abstract

Many individuals who undergo stressful life events report that they have derived some positive benefit from the experience. Although the majority of research on benefit finding has focused on its psychological correlates, there is intriguing evidence that benefit finding may also have effects on physical health. In this paper, we review the emerging literature on benefit finding and physical health and present an integrative model in which we identify specific psychological and physiological pathways through which benefit finding may influence physical health outcomes. In particular, we consider the hypothesis that benefit finding may involve changes in a number of psychological domains – namely, changes in appraisal and coping processes, relationships, goals and priorities, and positive affect – that lead to a state of enhanced allostasis, buffering against negative effects of catabolic stress responses and promoting activity in restorative physiological systems. Empirical evidence for this model is reviewed, focusing on studies that have examined positive psychological constructs relevant to benefit finding and their effects on stress reactivity, recovery, and habituation, as well as restorative processes.

Research on stress and health has traditionally focused on negative psychological and physical effects of stressful life events. However, there is growing recognition that stressful experiences may also catalyze positive changes in a number of important life domains, including interpersonal relationships, self-perceptions, and priorities and goals. These changes have been described in various ways in the literature, including posttraumatic growth (Tedeschi & Calhoun, 1996), benefit finding (Tennen & Affleck, 2002), and finding meaning (Taylor, 1983). We use the term ‘benefit finding’ here to encompass the broad range of positive changes that emerge following stress. The first wave of research on benefit finding focused primarily on documenting and characterizing the types of changes reported by individuals in response to a variety of stressors, particularly medical illness. More recently, investigators have sought to identify predictors of benefit finding and its effects on mental health. This review will focus on the association between benefit

finding and *physical* health, building on compelling preliminary evidence of a positive association between benefit finding and physical health outcomes.

Research on Benefit Finding and Physical Health

A number of studies have linked benefit finding with morbidity, mortality, or physiological changes relevant to physical health. An early study conducted by Affleck, Tennen, Croog, and Levine (1987) examined perceptions of positive life change among 287 men who had recently experienced their first heart attack. Benefits were reported by over 50% of study participants and included learning the value of preventative health behaviors, changes in mode of life to increase enjoyment, and changes in philosophy of life or values. Results showed that the men who perceived benefits were significantly less likely to have a subsequent attack and experienced less morbidity 8 years later. These results offered the first evidence that finding benefit may have implications for physical health, although mechanisms for these effects (e.g., changes in health behavior) were not examined.

Bower, Kemeny, Taylor, and Fahey (1998) assessed benefit finding in response to the AIDS-related death of a close friend or partner among 40 men who were themselves HIV positive. Forty percent of study participants reported finding some benefit from the bereavement experience, including greater appreciation for loved ones, increased value in and enjoyment of life, and new growth goals. Men who identified benefit showed a significantly less rapid decline in CD4 T cells (a key measure of HIV progression) over a 2- to 3-year follow-up, and a lower rate of AIDS-related mortality over a 4- to 9-year follow-up. These effects were not mediated by health status at baseline, health behaviors (e.g., sleep, sexual behavior, drug use), or other potential confounds, including depressed mood.

Positive life changes were assessed by [Ickovics et al. \(2006\)](#) in a large sample of 773 HIV-positive women. Study participants were asked five questions about positive life changes attributed to HIV, such as more time spent with family. This measure was combined with a measure of positive affect and a measure of positive HIV-related expectancy to form a psychological resources index. Women with more psychological resources had a slower rate of CD4 T cell decline and a lower rate of AIDS-related mortality over a 5-year follow-up period, controlling for biobehavioral and clinical confounds. Because positive life change was grouped with other measures, it is impossible to determine whether perceptions of positive life change made a unique contribution to physical health. However, results are consistent with [Bower et al. \(1998\)](#) and support the possibility that these changes may have health relevance among individuals with HIV.

A study conducted by [Milam \(2006\)](#) examined the association between HIV-related benefit finding and changes in two key biological measures of HIV progression, CD4 T cell levels and viral load, in an ethnically diverse sample of 412 HIV-positive individuals. Benefit finding was assessed

using a modified, shortened version of the Posttraumatic Growth Inventory (PTGI) ([Tedeschi & Calhoun, 1996](#)). Results showed that benefit finding was associated with positive changes in biological markers over a 16- to 20-month follow-up among Hispanics and those who were low in optimism or low in pessimism, but not in the full sample. Effects were independent of potential biobehavioral confounds, including depression, alcohol, and illicit drug use. These findings suggest that the health effects of benefit finding may depend on individual difference factors, similar to effects seen for mental health outcomes ([Stanton & Low, 2004](#)).

Dunigan, Carr, and Steel (2007) examined the association between benefit finding, immune status, and survival in 41 patients with hepatocellular carcinoma, the majority of whom had advanced stage disease. Patients completed the PTGI to assess benefit finding in response to their cancer diagnosis. Those who scored above the median on the PTGI subscales of personal strength and spirituality showed higher levels of circulating white blood cells at a 3-month follow-up and those who scored above the median on the subscale of relating to others had higher levels of circulating lymphocytes at a 6-month follow-up. In addition, there was a trend for a positive association between PTGI scores and survival, such that individuals who scored above the median on the PTGI total scale survived somewhat longer than those who scored below the median. Due to constraints of the study design (e.g., small sample size, nonspecific measures of immune status, multiple statistical comparisons), these findings should be considered preliminary but do suggest that benefit finding may also have relevance for physical health in certain cancer populations.

Benefit finding has been associated with a more distal measure of physical health, cancer patients' physician visits. In a study of 60 early-stage breast cancer patients, [Stanton et al. \(2002\)](#) evaluated whether experimentally induced benefit finding was associated with medical visits for cancer-related morbidities. Women in this study were assigned to write about positive thoughts and feelings about their experience with breast cancer (benefit finding condition), their deepest thoughts and feelings about breast cancer (emotional disclosure condition), or facts of their breast cancer experience (control condition). Those in both the benefit finding and emotional disclosure conditions had significantly fewer medical appointments for cancer-related problems than those in the control condition at the 3-month follow-up.

A handful of studies have examined physiological correlates of benefit finding, including immune, neuroendocrine, and neurobiological parameters. Antoni and colleagues (2001) investigated relationships between benefit finding and physiological parameters among 100 women with early-stage breast cancer enrolled in an intervention trial. Benefit finding was assessed before and after the 10-week intervention using the benefit finding scale, which assesses potential gains related to cancer, including acceptance, interpersonal growth, and a stronger sense of purpose in life. In analyses of the full patient cohort, Antoni et al. found a significant increase in

benefit finding among women in the intervention group. Increases in benefit finding were correlated with decreases in serum cortisol (Cruess et al., 2000) and with increases in lymphocyte proliferation (McGregor et al., 2004) in small subgroup analyses.

Benefit finding has also been linked to changes in urinary cortisol in a large sample of HIV-positive individuals (Carrico et al., 2006). Two-hundred and sixty-four men and women completed the benefit finding scale in response to living with HIV infection. Those who reported more HIV-related benefits (including enhanced sense of closeness with others, acceptance, and stronger sense of purpose) had decreased 24-hour cortisol output, suggesting a lower level of hypothalamic–adrenal–pituitary (HPA) axis activity.

A recent study explored the neural correlates of benefit finding, focusing on asymmetrical frontal activation (Rabe, Zollner, Maercker, & Karl, 2006). Eighty-two survivors of severe motor vehicle accidents completed the PTGI to assess benefit finding related to the accident and were assessed for resting electroencephalographic activity. Benefit finding was correlated with increased relative left frontal activation, controlling for positive affect. Of note, greater relative left prefrontal activation is also associated with enhancements in certain aspects of immune system function, including a more robust antibody response to vaccination and increased natural killer cell cytotoxicity (Davidson, Coe, Dolski, & Donzella, 1999; Rosenkranz et al., 2003).

Overall, the literature on benefit finding and health supports the hypothesis that individuals who are able to find benefit following stressful experiences show positive changes in various health-related outcomes, including decreases in morbidity and mortality and positive changes in immune and neuroendocrine function. It is notable that these effects have emerged with different patient populations (e.g., HIV-positive individuals, breast and liver cancer patients, individuals with cardiovascular disease) and different methods for assessing benefit finding, including interviews and self-report questionnaires. Although many of these studies were limited by small sample sizes, the majority utilized longitudinal designs and also controlled for bio-behavioral confounds (e.g., depressive symptoms and health behaviors), supporting the validity of the results.

Pathways Linking Benefit Finding and Health

Psychological pathways

The studies reviewed above provide preliminary evidence that benefit finding may be linked to positive changes in physical health. However, none of these reports have addressed potential mechanisms through which these effects might occur. In this section, we consider the following question: how might the experience of benefit finding get ‘under the skin’ to influence physical health? We have developed an integrative model that identifies specific psychological and physiological mediators linking benefit finding

and physical health (Bower, Epel, & Moskowitz, forthcoming). Beginning with psychological mechanisms, we hypothesize that changes in *appraisal processes, coping strategies and resources, interpersonal relationships, and goals and priorities* may serve as psychological pathways linking benefit finding and physical health. Theoretical and descriptive accounts of benefit finding suggest that changes in these four domains are commonly reported after stressful life experiences ([Tedeschi & Calhoun, 1995](#)). For example, one of the most commonly endorsed benefits is positive changes in relationships, including feeling closer to family and friends ([Sears, Stanton, & Danoff-Burg, 2003](#)). Individuals also report feeling stronger and better able to cope with challenges, suggesting an increase in approach-oriented coping and enhanced coping resources such as mastery, self-esteem, and self-efficacy. Furthermore, they describe feeling better able to put things in perspective and less worried by trivial things, suggesting a shift in stress appraisals. Finally, changes in goals and priorities are frequently described in the aftermath of stress, with an increased emphasis on intrinsic priorities such as relationships and personal growth as well as a greater appreciation for life.

Positive affect may serve as another psychological pathway linking benefit finding and health. Although positive affect is not a component of benefit finding, there is consistent evidence that benefit finding is associated with increases in positive affect. This relationship has been demonstrated in both cross-sectional and longitudinal studies, suggesting that benefit finding precedes changes in positive affect, and is supported by results from a recent meta-analysis of this literature ([Helgeson, Reynolds, & Tomich, 2006](#); see also Stanton, Bower, & Low, 2006). Increased positive affect may also promote the development of personal resources ([Fredrickson, 2001](#)), creating another pathway through which benefit finding may enhance health outcomes.

Individually, each of the psychological constructs identified above has been linked to positive changes in physical health, supporting the possibility that they may mediate benefit finding effects on health outcomes (Bower et al., forthcoming). Together, this constellation of changes portrays an individual who, as a result of increases in social and personal resources, changes in coping strategies, shifts in priorities and perspectives, and increases in positive affect, is able to respond more effectively and more efficiently to subsequent stressors. Indeed, theoretical accounts of adjustment to trauma suggest that benefit finding may promote a state of 'psychological preparedness' that protects against psychological effects of future traumas ([Janoff-Bulman, 2006](#)).

The possibility that benefit finding may buffer against the deleterious effects of stress on psychological outcomes has been evaluated in only a few empirical studies. A cross-sectional study of 138 women living with HIV/AIDS found that benefit finding moderated the association between a physical stressor (HIV-related physical symptoms) and psychological distress; among women who reported more benefits from their illness experience, physical symptoms were not associated with depressive symptoms or anxiety

([Siegel & Schrimshaw, 2007](#)). However, benefit finding did not moderate the association between social conflict and distress. A second study of 404 individuals with multiple sclerosis found that one dimension of benefit finding moderated the association between stress appraisal and global distress ([Pakenham, 2005](#)). Individuals who scored higher on family relations growth (a factor analytically derived subscale of the benefit finding scale that includes family-related benefits) and had high levels of perceived stress were less likely to be distressed than individuals who scored lower on family relations growth and had high levels of stress. No buffering effects of benefit finding were seen with the personal growth factor of the benefit finding scale.

These findings provide preliminary support for a stress buffering role of benefit finding on psychological distress, although they are limited by the cross-sectional nature of the study designs. Further evidence comes from research on constructs related to benefit finding, such as psychological resilience. Resilience is characterized by coping flexibility and the ability to 'bounce back' from stressful experiences ([Tugade & Fredrickson, 2004](#)). This behavioral phenotype is consistent with our conceptualization of someone who has found benefit from a stressful event and as a result, is able to respond to future stressors more adaptively and efficiently. A series of daily diary studies found that resilience moderated the association between stress and negative mood, such that individuals who were more resilient showed less mood reactivity to and faster mood recovery from daily stressors ([Ong, Bergeman, Bisconti, & Wallace, 2006](#)). Psychological processes linked to benefit finding in our model have also been shown to act as stress buffers, including coping ([Aldwin & Revenson, 1987](#)) and social support ([Cohen & Wills, 1985](#)). There is also compelling evidence that positive affect may buffer against the deleterious psychological effects of stress. For example, [Zautra, Johnson, and Davis \(2005\)](#) found that positive affect buffered the effect of high pain and high interpersonal stress on negative affect among women with fibromyalgia and osteoarthritis.

Of note, our model focuses on psychological processes that may influence physical health through their effect on response to subsequent stressors. Another potentially important pathway linking benefit finding and physical health that is *not* included in our model is changes in health behaviors. Individuals frequently report making positive changes in health-related behaviors in the aftermath of stressful life events, including positive changes in diet, exercise, and screening behaviors. These changes are particularly prominent among individuals diagnosed with cancer and other illnesses ([Affleck et al., 1987](#); [Sears et al., 2003](#)) and may have beneficial effects on future health outcomes.

Physiological pathways

If finding benefit alters the way individuals respond psychologically to future challenges, those who find benefit may also exhibit more adaptive

physiological responses to subsequent stressors, leading to better physical health. We have termed this stress response profile ‘enhanced allostasis’ (Bower et al., forthcoming; [Epel, McEwen, & Ickovics, 1998](#)). ‘Allostasis’ refers to the normal fluctuations that the body’s regulatory systems exhibit to maintain homeostasis in a constantly changing environment ([McEwen, 1998](#); [Sterling & Eyer, 1988](#)). McEwen introduced the concept of ‘allostatic load’ to reconcile the seemingly paradoxical protective and damaging effects of the physiological stress response on the body. According to this model, the cascade of physiological changes that are initiated in response to challenge is designed to protect us and to prepare us to react behaviorally. To meet the demands of our environment, the sympatho–adrenal–medullary (SAM) and HPA axes must increase circulating levels of catecholamines and corticosteroids under threat, sustain this activation for an appropriate interval, and then turn the responses off once the stressor has terminated. Over time, these repeated fluctuations are thought to exact a cumulative toll on physiological systems and lead to disease (e.g., [Seeman, McEwen, Rowe, & Singer, 2001](#)). Allostatic load is especially marked if regulatory mechanisms are inefficient, as cells and tissues may be exposed to excessive levels of circulating stress hormones.

McEwen (1998) delineates four specific stress response profiles that can lead to allostatic load. The first involves frequent, repeated stressors, leading to an accumulation of physiological ‘hits’ that can cause wear and tear on physical systems. The second type of allostatic load involves a failure to adapt, or habituate, to repeated stressors that may cause repeated or prolonged exposure to stress hormones. The third type of allostatic load involves inefficient recovery of allostatic systems, where SAM- and HPA-axis activity is slow to return to baseline following a stressor. This response profile may occur if perseverative thoughts about a stressful experience prolong emotional and physiological activation after the threat has passed ([Brosschot, Pieper, & Thayer, 2005](#)). Finally, blunted or inadequate responses of one allostatic system may cause counterregulatory increases in other systems, as when a failure of the HPA system to respond to challenge leads to an increase in circulating levels of proinflammatory cytokines ([Bower et al., 2007](#)).

In contrast, enhanced allostasis describes adaptive responding to stress that may be a consequence of benefit finding and other forms of psychological thriving (Bower et al., forthcoming; [Epel et al., 1998](#)). Figure 1 depicts four response profiles reflective of enhanced allostasis. Of note, these stress profiles can be contrasted both with allostatic load and with the typical stress response, as they represent a more efficient, circumscribed, and tightly regulated response to stress. In the first panel, the psychosocial changes that accompany benefit finding result in fewer ‘hits’, or fewer physiological responses to frequent stressors. For example, a cancer survivor who has discovered new priorities and perspective as a result of cancer may no longer ‘sweat the small stuff’, appraising fewer external events as stressful and therefore initiating fewer HPA and SAM responses over time. The second

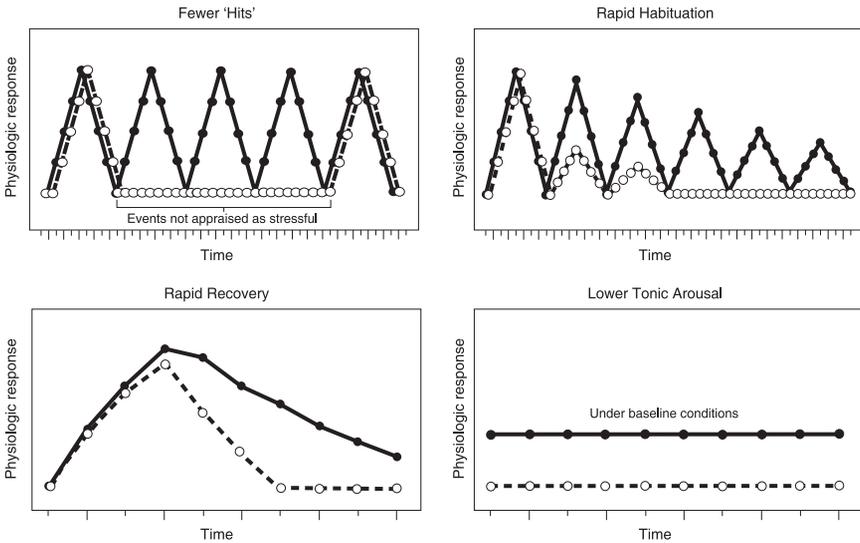


Figure 1 Four profiles of enhanced allostasis.

These panels depict four physiological profiles illustrative of enhanced allostasis. Enhanced allostasis describes a pattern of adaptive physiological responding to stress which we hypothesize may be a consequence of benefit finding and accompanying changes in cognitive, affective, social, and motivational domains. Panel 1 depicts a pattern of fewer physiological responses ('hits') to external events, Panel 2 depicts rapid habituation to repeated stressors, Panel 3 depicts a peak response with rapid recovery to baseline following termination of a stressor, and Panel 4 depicts a pattern of lower tonic arousal in physiological stress systems due to baseline differences in restorative physiological processes.

panel illustrates rapid physiological habituation to repeated stress exposure. In this case, an individual mounts a full physiologic response when first exposed to a stressor but quickly turns down this response when reexposed to a stressor of the same type. For example, a woman living with HIV who has developed her personal and social resources for coping with HIV may initially feel stressed when having her blood drawn for immune evaluation but, drawing upon her enhanced sense of self-efficacy (and possibly bringing along a friend), will respond less strongly at her next medical visit and will eventually mount no response to this stressor. The profile depicted in the third panel focuses on response to an individual stressor and is characterized by a peak response with rapid recovery following termination of the stressor. This response profile would be exemplified by an individual who mounts a physiological response to a stressful event but is able to cope more effectively and efficiently and experiences more positive emotions in the aftermath of the stressor, limiting the duration of SAM and HPA activation. Finally, the fourth panel suggests that the changes in appraisal processes, coping strategies and resources, relationships, and goals and priorities that underlie benefit finding may be accompanied by health-enhancing changes in

restorative physiological processes (e.g., higher heart rate variability, higher levels of anabolic hormones), resulting in lower tonic sympathetic or catabolic physiological arousal (Epel, Burke, & Wolkowitz, 2007). One caveat to Figure 1 is that these response profiles of enhanced allostasis assume that the adrenal is not hyposensitized, which would lead to inefficient cortisol output in response to stress, increasingly recognized as a common phenotype of stress-related dysregulation or allostatic load (Fries, Hesse, Hellhammer, & Hellhammer, 2005; Raison & Miller, 2003).

Research on Benefit Finding and Enhanced Allostasis

While the full 'enhanced allostasis' model has not been tested, studies examining pieces of the model have yielded promising results. We focus here on reports that have evaluated acute responses to laboratory and naturalistic stressors, as these allow us to disentangle effects of benefit finding and related constructs on physiological reactivity, recovery, and habituation.

Fewer physiological 'hits'

Physiological reactivity to stressors, or the degree to which physiological systems are activated following stress, has received significant attention as a risk factor for morbidity and mortality (Cacioppo et al., 1998; Carroll et al., 2001). As described above, frequent activation of the HPA and SAM systems may contribute to allostatic load and compromise physical well-being. For example, physiological reactivity is a prognostic factor for development of cardiovascular disease (Jennings et al., 2004; Krantz & Manuck, 1984; Matthews, Zhu, Tucker, and Whooley, 2006) and respiratory illnesses (Boyce et al., 1995) and may increase risk for disease progression in HIV/AIDS (Cole, Kemeny, Fahey, Zack, & Naliboff, 2003).

A number of studies have examined the association between constructs related to benefit finding and physiological reactivity. Focusing first on social factors, there is compelling evidence that social support may buffer physiological stress responses. For example, the presence of an affiliative companion reduces cardiovascular responses to stressful laboratory tasks (Kamarck, Manuck, & Jennings, 1990; Kamarck, Peterman, & Raynor, 1998; Uchino & Garvey, 1997). Furthermore, individuals who interact more regularly with supportive individuals in their daily lives show reduced cortisol reactivity to a laboratory social stressor (Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007). Cortisol responses to stress are reliably *increased* in the presence of social evaluative threat, where task performance can be negatively evaluated by others (Dickerson & Kemeny, 2004). It is possible that individuals who have developed a stronger sense of themselves and are more focused on their personal goals and priorities may be less sensitive to social evaluation, thereby buffering HPA-axis reactivity.

Self-esteem, a personal resource that may be enhanced as part of benefit finding, buffers cortisol responses to experimental psychological stress in older adults ([Seeman et al., 1995](#)). Affirmation of personal values has also been associated with reduced cortisol responses to social stress ([Creswell et al., 2005](#)). In this study, individuals who were randomly assigned to affirm their personal values before a laboratory stressor exhibited significantly lower cortisol responses than those assigned to the control condition, although no differences in cardiovascular reactivity were observed. We speculate that this type of value affirmation may occur more frequently among individuals who have reordered their goals and priorities in the aftermath of stress.

Positive affect may also buffer against physiological reactivity. For example, individuals who reported higher levels of happiness showed lower plasma fibrinogen responses to experimental stress ([Steptoe, Wardle, & Marmot, 2005](#)). Fibrinogen is an inflammatory marker and predictor of future coronary heart disease ([Rauch et al., 2001](#)). Of note, happiness was not associated with cardiovascular stress responses in this study, similar to [Creswell et al. \(2005\)](#). Although not a direct test of the reactivity hypothesis, this study also found that happier individuals had lower levels of daily cortisol (averaged across eight saliva samples) and lower ambulatory heart rate. Positive affect has also been associated with diminished blood pressure reactivity to negative affective states in naturalistic studies assessing daily blood pressure and mood ([Ong & Allaire, 2005](#); [Shapiro, Jamner, Goldstein, & Delfino, 2001](#)). Similar results emerged for social connectedness, another component of benefit finding ([Ong & Allaire, 2005](#)).

Psychological processes relevant to benefit finding may influence the *type* of cardiovascular reactivity to stress. In particular, challenge appraisals, which are characterized by greater effort than distress, are associated with a more positive profile of sympathetic reactivity characterized by high cardiac output. In contrast, threat appraisals are associated with a more malignant response characterized by lower cardiac output and greater peripheral vasoconstriction ([Tomaka, Blascovich, Kibler, & Ernst, 1997](#)).

Rapid habituation to repeated stress

Normal habituation is defined as a gradual decrease in response magnitude during repeated or prolonged presentations of a stressor ([Haynes, Gannon, Orimoto, O'Brien, & Brandt, 1991](#)). Lack of habituation to repeated stressors is characterized by repeated hits with no eventual habituation (at least in laboratory studies with limited numbers of repeated stressors). Lack of habituation appears to have low genetic heritability ([Wust, Federenko, van Rossum, Koper, & Hellhammer, 2005](#)), but is related to psychological factors, such as exhaustion ([Kudielka et al., 2006](#)). In contrast to these two profiles, an enhanced allostasis profile is thought to be characterized by an initial response to novelty with habituation by the second or third exposure, which we characterize as *rapid habituation* ([Dienstbier, 1989](#)).

Although habituation has received significantly less attention than a snapshot of one acute stress response, there is preliminary evidence that benefit finding is associated with more rapid HPA habituation to repeated stress. In one study, healthy women were exposed to a standardized laboratory stressor on three consecutive days (Epel et al., 1998). Benefit finding was measured at baseline using the PTGI. Women who did not habituate to the stressor (approximately one third of the sample) had the lowest scores on the PTGI, particularly the subscales of appreciation of life and spiritual growth. In contrast, those in the highest tertile on spiritual growth showed a positive reactivity curve to novel stress and habituation by the second stressor. Using cross-sectional correlations, PTGI scores were only associated with area under the curve response to the third stressor, highlighting the importance of examining responses to repeated stress.

Constructs linked to benefit finding in our model have also been associated with rapid physiological habituation. In a study of younger adults, those who reported higher self-esteem showed more rapid neuroendocrine habituation to repeated stress (Kirschbaum et al., 1995). In a series of experiments, we recently demonstrated that expression of stress-related emotions facilitates heart rate habituation (Low, Stanton, & Danoff-Burg, 2006), particularly if participants are accepting of their emotional responses (Low, Stanton, & Bower, forthcoming). These preliminary reports suggest that benefit finding may promote efficient physiological habituation to repeated stressors by enhancing adaptive coping resources and processes (i.e., self-esteem and approach-oriented emotional expression).

Rapid recovery

Prolonged physiological arousal following psychosocial stressors is gaining increased attention as a predictor of cardiovascular morbidity and mortality (Cole, Blackstone, Pashkow, Snader, & Lauer, 1999; Heponiemi et al., 2007; Schuler & O'Brien, 1997; Steptoe & Marmot, 2006). The ability to rapidly recover from stress-related increases in SAM and HPA activation is indicative of younger, healthier systems, as older people recover more slowly from stressors than younger people (Epel et al., 2007; Seeman & Robbins, 1994). Such flexibility in these physiological systems may be associated with constructs related to benefit finding. For example, the duration of cardiovascular reactivity to a laboratory stressor has been linked to psychological resilience (Tugade & Fredrickson, 2004). This effect was mediated by the tendency of resilient individuals to appraise stressors as less threatening and to experience more positive emotions during the stressor, highlighting the role of positive emotions and stressor appraisals in facilitating recovery. Furthermore, a study of male firefighters reported that men who reported high levels of social support exhibited more rapid blood pressure recovery following a mental arithmetic and speech task (Roy, 2004).

There is also evidence that positive affect might ‘undo’ the cardiovascular effects of negative emotion and facilitate rapid recovery. In a series of experiments, Fredrickson and Levenson (1998) and Fredrickson, Mancuso, Branigan, and Tugade (2000) elicited anxiety by either showing participants a fear-inducing film or asking them to prepare a speech. Subjects were then shown one of four films designed to elicit contentment, amusement, sadness, or no affect (neutral condition). Measures of heart rate, blood pressure, finger pulse amplitude, and pulse transmission time to finger and ear indicated that those individuals who were shown the contentment or amusement film after the anxiety induction had faster recovery to baseline than subjects shown the sad or neutral film.

Other psychosocial processes relevant to benefit finding have been linked to the duration of physiological activation following stress. One proposed psychological mechanism of prolonged autonomic activation after stress is rumination about the stressor. In support of this hypothesis, experimentally inducing rumination about laboratory stressors that were emotionally evocative (i.e., mental arithmetic and shock avoidance) delayed blood pressure recovery following the tasks, whereas introducing a distractor task after the stressor (presumably preventing rumination) facilitated rapid cardiovascular recovery ([Glynn, Christenfeld, & Gerin, 2002](#)). Relatedly, writing about stress-related emotions in an accepting rather than a ruminative way led to faster heart rate recovery after writing (Low et al., forthcoming). Taken together, the aforementioned studies suggest that benefit finding may speed cardiovascular recovery from future stressors to the extent that it increases the experience of positive emotions, alters appraisals of stressors, reduces ruminative cognition about stressors, or increases social support.

Relative to research on the SAM axis, the association between HPA recovery and psychological constructs has received minimal attention. However, prolonged elevations in cortisol following the offset of a stressor may also indicate allostatic load ([McEwen, 1998](#)). Preliminary evidence suggests that women who report greater marital satisfaction demonstrate better recovery of cortisol responses following high workload days at work (Saxbe, Repetti, & Nishina, forthcoming). This research is relevant to benefit finding as enhanced closeness to spouse and other family members is frequently reported following stressful life events.

Baseline physiological processes

Finding benefit in a traumatic life event may also affect the baseline activity of physiological systems at rest or when asleep, when engaged in ‘housekeeping’ homeostasis. Of particular relevance here are processes that serve restorative functions, including heart rate variability and anabolic hormones. These processes work in opposition to catabolic hormones, reducing tonic arousal and buffering HPA and SAM responses to stress, resulting in the low arousal profile shown in panel 4 of Figure 1.

Heart rate variability (HRV) is defined as the extent to which heart rate varies from beat to beat and provides a measure of parasympathetic nervous system activity. HRV is often viewed as an indicator of autonomic flexibility, or the degree to which physiological activity can be modulated to respond to changing environmental demands ([Appelhans & Luecken, 2006](#)). Low HRV has been linked to negative physical and mental health outcomes, including depression, anxiety, and mortality ([Friedman & Thayer, 1998](#); [Rottenberg, 2007](#); [Tsuji et al., 1996](#)). In contrast, high HRV has been correlated with measures of adaptive coping that may be relevant to benefit finding. Among undergraduates, higher resting heart rate variability was positively associated with self-reported emotion regulation and constructive coping (computed as a composite of instrumental and social support seeking minus venting and drug use) ([Fabes & Eisenberg, 1997](#)). In a sample of recently bereaved adults, individuals with higher resting HRV scored higher on measures of active coping and acceptance and lower on passive coping ([O'Connor, Allen, & Kaszniak, 2002](#)). Similarly, in a recent study of breast cancer survivors, we found that higher resting HRV was associated with approach-oriented coping, especially spiritual coping ([Low, Bower, Epel, & Moskowitz, 2006](#)). Given recent evidence that the parasympathetic nervous system may serve as an 'anti-inflammatory pathway' ([Tracey, 2002](#)), reducing systemic inflammation ([Sloan et al., 2007](#)) and associated risk of depression, diabetes, cardiovascular disease, and cancer, these findings suggest a direct pathway linking benefit finding and physical health.

Anabolic hormones play an important role in restoring homeostasis and repair mechanisms after stress. The prototypical anabolic hormones include the androgens (dehydroepiandrosterone (DHEA) and testosterone in men) and hormones of the growth hormone axis (growth hormone and insulin-like growth factor). There is evidence that low levels of anabolic hormones, or an imbalance of anabolic and catabolic hormones, is linked to age-related health conditions such as increased adiposity and decreased bone density ([Epel et al., 2007](#); [Wolkowitz & Reus, 2000](#)). Other hormones that can be considered anabolic and may also be important for health include oxytocin and neuropeptide Y (NPY).

Psychological correlates of anabolic hormones have been examined in only a handful of studies. There is preliminary evidence that positive affect may trigger release of anabolic hormones. For example, testosterone levels can increase acutely in men after a positive event such as a success experience, an imagined success, or a vicarious success (i.e., watching one's favorite sports team win) ([Gonzalez-Bono, Salvador, Serrano, & Ricarte, 1999](#); [McCaul, Gladue, & Joppa, 1992](#)). Furthermore, socially related positive emotions such as love and trust are associated with oxytocin release ([Gonzaga, Turner, Keltner, Campos, & Altemus, 2006](#); [Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005](#)), and administration of oxytocin induces feelings of trust ([Zak, Kurzban, & Matzner, 2005](#)). Positive affect is also related to higher levels of growth hormone ([Epel, Adler, Ickovics, McEwen, & Clayton,](#)

2001), as are other benefit finding-related constructs such as active coping (Epel, Adler, Ickovics, & McEwen, 1999).

Anabolic hormones have also been linked to positive psychological processes in the context of stress. In one study, a positive stressor that induced challenge appraisals also increased DHEA reactivity (Mendes, Ayduk, Epel, Akinola, & Gyurak, 2007). Furthermore, strong positive emotions were linked to greater DHEA reactivity during the stressor. In two recent studies of veterans, DHEA was associated with total coping as well as recovery from combat trauma (i.e., posttraumatic stress disorder symptom improvement) and NPY was associated with positive coping and resilience to combat trauma (i.e., combat exposure without posttraumatic stress disorder) (Yehuda, Brand, Golier, & Yang, 2006; Yehuda, Brand, & Yang, 2006). NPY has also been associated with lower levels of psychological distress among military personnel undergoing survival training (Morgan et al., 2002; Morgan et al., 2000). These reports implicate anabolic hormones in resilience to and recovery from stress, clinical constructs that are highly relevant to benefit finding.

Conclusions and Recommendations for Future Research

Many individuals report positive life changes in the aftermath of stressful life events, and there is compelling preliminary evidence that benefit finding may have beneficial effects for physical health. We have proposed that benefit finding may involve changes in a number of psychological domains – namely, changes in appraisal and coping processes, relationships, goals and priorities, and positive affect – that lead to a state of enhanced allostasis, buffering against negative effects of catabolic stress responses and promoting restorative processes such as heart rate variability and anabolic hormone production. Although few studies have directly examined associations between benefit finding and physiological stress responses, there is evidence that the dimensions of benefit finding identified in our model and related constructs (i.e., resilience) are associated with a more positive stress response profile, as indicated by reduced reactivity, faster habituation and recovery, and enhanced anabolic activity. Thus, individuals who find benefit in stressful experiences – and show a corresponding change in their stress appraisals, approach-oriented coping strategies, and personal and social resources – may show a more efficient and balanced response to future stressors.

This review is intended to be speculative and to suggest avenues for future research. Many of the critical links in our model are hypothetical and have not yet been tested empirically. Indeed, the central premise of the model, that benefit finding is associated with more positive profiles of stress responsiveness, has been directly evaluated in only one report (Epel et al., 1998). Studies demonstrating links between benefit finding and baseline neuroendocrine and immune function provide preliminary evidence for links between these systems (Crueess et al., 2000; McGregor et al., 2004),

but the stress buffering and direct effects of benefit finding on allostatic systems require empirical evaluation. Furthermore, the hypothesis that stress profiles reflective of enhanced allostasis are associated with health benefits has not been examined. There is growing evidence that biological profiles indicative of allostatic load are associated with negative health outcomes (e.g., [Seeman et al., 2001](#)), and that individuals who show more pronounced and persistent physiological reactivity to stress are at greater risk for disease, particularly cardiovascular disease (e.g., [Cole et al., 1999](#); [Jennings et al., 2004](#)). However, it is unclear whether changes in stress physiology that minimize exposure to catabolic stress hormones and other potentially damaging aspects of the stress response lead to improvements in health, and particularly whether benefit finding induces changes in these systems that are of the type, magnitude, and duration to significantly influence long-term health outcomes. Links between benefit finding, restorative processes, and health are even more speculative.

We have reviewed literature showing that psychological processes that are conceptually related to benefit finding are associated with physiological stress responses, including cognitive appraisals, approach-oriented coping strategies, self-esteem, social support, and positive affect. However, with the exception of positive affect, it is unclear whether benefit finding is actually related to changes in these psychological processes and the others outlined in our model. Few studies have specifically examined whether reports of feeling stronger and better able to cope with life's challenges, for example, translate into greater use of approach-oriented coping strategies in response to subsequent stressors. Given concerns that reports of growth may be illusory, or may represent a form of avoidance or denial, it will be important to determine whether benefit finding is indeed linked to changes in these psychological domains, and whether these changes mediate benefit finding effects on stress responsiveness and health.

Our model focuses on particular cognitive, emotional, and motivational constructs that either fall within the conceptual frame of benefit finding or have been associated with benefit finding in empirical research (i.e., positive affect). It is possible that some of these constructs may be more relevant to stress physiology than others. For example, shifts in goals and priorities may influence stress reactivity primarily by changing appraisals of future stressors. In addition, it is possible that different psychological processes may regulate different components of the stress response. For example, appraisals and social support may be particularly important for regulating initial responses to stress, whereas coping and positive emotion may play a stronger role in recovery. Identifying the links between these constructs, and particularly their links with physiological systems, is an important topic for future research.

Specifying the biological mechanisms through which benefit finding influences physical health is also critical for advancing our understanding of this area. One potentially important mediator of stress effects on physical

health is inflammation. Inflammation is associated with a variety of negative health outcomes, including cardiovascular disease, depression, diabetes, and cancer ([Coussens & Werb, 2002](#)). Indeed, inflammatory markers such as C-reactive protein and IL-6 have emerged as the strongest predictors of mortality in studies looking at multiple biomarkers ([Gruenewald, Seeman, Ryff, Karlamangla, & Singer, 2006](#)). Stress is known to lead to increases in circulating inflammatory markers and in production of proinflammatory cytokines by immune cells (e.g., [Miller, Rohleder, Stetler, & Kirschbaum, 2005](#)). These effects may be mediated by activation of the sympathetic nervous system and release of stress hormones such as catecholamines ([Johnson et al., 2005](#)). It is also possible that stress may alter the expression and/or function of receptors for stress hormones, with resulting effects on inflammatory processes. For example, chronic stress may lead to a decrease or downregulation of glucocorticoid receptors on immune cells, reducing the sensitivity of immune cells to the anti-inflammatory effects of glucocorticoids and increasing proinflammatory cytokine production ([Miller, Cohen, & Ritchey, 2002](#)). The association between benefit finding and inflammatory processes merits focused attention in future studies.

There is increasing attention to positive psychological constructs and their importance for mental and physical well-being. We believe that identification of the psychological and physiological pathways through which benefit finding influences physical health is an important topic for future research, and represents an exciting opportunity for social and personality psychologists to extend their work into new domains. While tests of the model will ultimately require longitudinal studies, social psychologists are uniquely qualified to perform proof of concept studies that manipulate positive appraisals and possibly laboratory simulations of benefit finding, and examine effects on short-term physiological responses to stress.

Short Biographies

Julienne E. Bower's research focuses broadly on interactions between psychological processes and immune function in the context of stress. She is particularly interested in how positive psychological responses to trauma, such as benefit finding, influence immune status and health. In addition, Dr. Bower investigates how changes in the immune system influence psychological states, focusing on neuroendocrine and immune mechanisms for cancer-related fatigue. She holds a BA from Brown University and a PhD in Psychology from the University of California, Los Angeles (UCLA). Dr. Bower completed a postdoctoral fellowship in psychoneuroimmunology at the Cousins Center for Psychoneuroimmunology at UCLA, and is currently an Assistant Professor in the UCLA Departments of Psychology and Psychiatry and Biobehavioral Sciences.

Carissa A. Low is a PhD candidate in Clinical Psychology at UCLA and a clinical intern at Western Psychiatric Institute and Clinic in Pittsburgh. She specializes in behavioral medicine, with research interests including psychological adjustment to cancer and other medical illnesses, the links between coping and biological stress processes, and the potential for stressful experiences to catalyze improvements in health.

Judith Tedlie Moskowitz is an Assistant Professor in the Department of Medicine and the Osher Center for Integrative Medicine at UCSF. She received her PhD in Social Psychology from Dartmouth, and her MPH in Epidemiology from UC Berkeley. Her research is focused on coping and emotion in the context of chronic stress. In particular, she studies the impact of positive emotion on psychological and physical adjustment to serious illness.

Saviz Sepah is a PhD candidate in Clinical Psychology at UCLA. He holds a MA in Psychology from UCLA, and a BA in Psychology from Harvard University. His current research interests lie at the intersection of positive psychology and psychoneuroimmunology. He ultimately hopes to use basic science research to develop positive psychological interventions that improve immune system functioning. His research is supported by UCLA Cota-Robles and NSF Graduate Research Fellowships.

Elissa Epel's research aims to understand, from a psychological and biological perspective, factors that promote resilience from the negative effects of chronic stress. She has long-standing interests in the impact of stress physiology on 'metabolic health', including food intake, insulin resistance, obesity, and premature aging at the cellular level. She also studies how health enhancing interventions might enhance regulation in these metabolic systems. Dr. Epel received her training in psychology from Stanford and Yale University, with a focus on health psychology and behavioral medicine. She is an Assistant Professor in the UCSF Department of Psychiatry, and director of research for the new UCSF center for obesity (COAST).

Endnote

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