Posttraumatic Stress, Quality of Life, Depression, and Physical Health in Cancer Survivors: The Buffering Effect of Posttraumatic Growth

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ABSTRACT

Edward Forrest Morrill: Posttraumatic Stress, Quality of Life, Depression, and Physical Health in Cancer Survivors: The Buffering Effect of Posttraumatic Growth
(Under the direction of Karen M. Gil, Ph.D.)

The current study attempted to use an online data collection system to replicate and extend our previous findings on the interaction of posttraumatic growth and post-traumatic stress disorder (PTSD) symptoms in predicting depressive symptoms and quality of life in cancer survivors (Morrill et al., 2008). Participants were 165 survivors of a diverse range of cancers who completed an Internet-based questionnaire designed to assess perceived stress, PTSD symptoms, and posttraumatic growth, and three health outcomes (distress about physical health symptoms, quality of life, and depressive symptoms). The results of this study suggest that the online questionnaire is a feasible, efficient, reliable, and "user-friendly" tool to assess bio-psychosocial health factors in cancer survivors. PTSD symptoms were associated with more distress about physical health symptoms, poorer quality of life, and more depressive symptoms ; perceived stress was associated with more depressive symptoms ; and posttraumatic growth was associated with better quality of life ($p < .01$) and fewer depressive symptoms ($p < .01$). Results failed to support the hypothesized buffering effect of posttraumatic growth. However, the interaction of PTSD symptoms and personal growth initiative accounted for a statistically significant($p < .05$) amount of the variance in quality of life indicating a potential buffering effect of personal growth on the deleterious relation between posttraumatic stress and quality of life. Finally, of the 47 participants that reported clinically significant levels of depressive and/or PTSD symptoms only 27 (57%) reported being treated for a psychiatric disorder. *Conclusions*:. The findings of the current study indicate that as many as 10% of those suffering from cancer may have clinically significant PTSD symptoms which are associated with poorer health outcomes. Only 57% of the cancer survivors in the current study who reported clinically significant symptoms of PTSD or depression reported receiving treatment for a psychiatric disorder. These results highlight the importance of screening for PTSD and depression in cancer patients and survivors in both

research and clinical settings, followed by referral for diagnostic assessment and subsequent treatment when appropriate. Additionally, Internet-based data collection may have important implications regarding screening, referral, and ongoing assessment of psychological distress in clinical care.

DEDICATION

This dissertation is dedicated to my daughter Helen Katherine Morrill who was born five days after my successful final oral examination, truly a momentous week!

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Successfully, proposing, writing, and defending a doctoral dissertation is a monumental milestone in both professional and academic development. It is a milestone that is only reached by a minority of the population, a fact that as academics we often forget. I am immensely grateful to have been afforded the opportunity to be one of the few who has been fortunate enough to complete such an enriching task. In that light I would like to thank those who have helped me along the way for without them, I would not have been able to achieve this accomplishment. I would like to express my gratitude to: my wife Johanna Saunders Morrill who has been an unwavering source of support throughout this extremely arduous process; my parents Dorothy Anne Stewart and Arthur Edward Morrill who instilled in me the work ethic and character necessary for such an undertaking; and my very dear friends Arne and Helen Hovdesven who taught me how to be a gentleman. I would like to acknowledge the contributions of the members my dissertation committee Jon Abramowitz, Noel Brewer, and Abigail Panter for their valuable input and thoughtful comments on the design and execution of the study reported herein. Lastly, but certainly not least, I wish to thank my mentors Antonio E. Puente and Karen M. Gil, both of who I am honored to count among my colleagues and friends, without their support, assistance, and encouragement throughout this process I am certain this study and subsequent dissertation would not have been completed . Additionally, I wish to express my appreciation to the National Cancer Institute and the UNC-CH Lineberger Comprehensive Cancer Center for their generous financial support of my graduate studies.

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LIST OF ABBREVIATIONS

ACS	American Cancer Society
AIDS	Acquired Immune Deficiency Syndrome
CES-D	The Center for Epidemiological Studies - Depression Measure
CHIPS	Cohen-Hoberman Inventory of Physical Symptoms
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
E-VAS	Electronic visual analogue scale
FACT-G	Functional Assessment of Cancer Therapy Scale
HIV	Human Immunodeficiency Virus
IBS	Irritable Bowel Syndrome
MDD	Major Depressive Disorder
NCI	National Cancer Institute
PCL-C	Posttraumatic Stress Checklist - Civilian Version
PGIS	Personal Growth Initiative Scale
PSS	Perceived Stress Scale
PTCI	Posttraumatic Cognitions Inventory
PTGI	Posttraumatic Growth Inventory
PTSD	Posttraumatic Stress Disorder
RSCL-PS	The Rotterdam Symptom Checklist - Physical Symptoms Subscale

INTRODUCTION

Distressing or harmful events can lead to negative outcomes such as posttraumatic stress symptoms, but these events can also lead to positive outcomes, an experience termed posttraumatic growth (Cordova & Andrykowski, 2003). In the context of a cancer diagnosis, posttraumatic growth may improve important psychological outcomes, including depression, positive well-being, health behaviors, and positive affect (Stanton, Bower, & Low, 2006). However, posttraumatic growth may also offer more complex benefits that have been previously unexplored (Helgeson, Reynolds, & Tomich, 2006). This study of cancer survivors examined the possibility that posttraumatic growth may offset some deleterious correlates of posttraumatic stress.

This cross-sectional study will investigate the relationship of perceived stress, posttraumatic stress symptoms, and posttraumatic growth to quality of life, depressive symptoms, and physical health. The current study attempted to replicate my previous findings on the interaction of posttraumatic growth and posttraumatic stress symptoms in predicting depressive symptoms and quality of life in cancer survivors (Morrill et al., 2008) and extend the prediction to physical health symptoms. Moreover, this study will utilize an online data collection system and include a more diverse sample of cancer survivors. In order to provide the relevant background for the study, this introduction will briefly summarize the research on stress, posttraumatic stress symptoms, posttraumatic growth, psychological health, and physical health especially as they relate to cancer survivorship. In addition, given that the study incorporates a newly designed internet-based data collection system, the introduction will include a brief review of electronic data collection methodologies as they relate to health psychology research.

Cancer Survivorship

The term “cancer” refers to a conglomerate of separate but related diseases with an underlying similarity, namely, uncontrolled cell growth (National Cancer Institute, 2007b). This uncontrolled cell growth can be detrimental to the body in different ways such as damaging tissue and hindering normal

body processes including digestion, cardiovascular function, and neurological function (American Cancer Society, 2010).

As of January 1 2008 the National Cancer Institute estimated there were 12 million cancer survivors living in the United States (National Cancer Institute, 2011b) representing approximately 4% of the population. According to the National Cancer Institute (2010), an estimated 1.5 million new cancer cases are diagnosed each year. Furthermore, 65% of adults diagnosed with cancer in recent years will survive for five years or more (National Cancer Institute, 2011b). Among the most common cancers in adults are lung, prostate, breast, and colorectal, although more than 200 types of cancer have been identified (National Cancer Institute, 2007a).

The most common forms of treatment for cancer are surgery, irradiation, and chemotherapy (National Cancer Institute, 2011a). Depending on the type of cancer and treatment protocol, cancer patients often experience unpleasant side effects of treatment including nausea, hair loss, fatigue, and cognitive deficits (Kangas, Henry, & Bryant, 2002). Following the active treatment phase, most cancer patients with life threatening disease attend regular follow-up appointments and many begin adjuvant medical therapies.

The physical and psychological challenges associated with the diagnosis and treatment of cancer are well documented (Bleiker, Pouwer, van der Ploeg, Leer, & Ader, 2000; Pettingale, Burgess, & Greer, 1988; Sherliker & Steptoe, 2000; Smith, Redd, Peyser, & Vogl, 1999; Trask, Paterson, Fardig, & Smith, 2003). Given the challenges facing cancer patients during the active phase of treatment, patients commonly experience stress, anxiety, fear of death, and other psychosocial consequences. Indeed, regular visits to the treatment setting can act as an ongoing reminder of diagnosis and treatment and may extend the cancer experience for many months and potentially years (Gil, Mishel et al., 2004; Smith, Redd, Peyser et al., 1999).

Additionally, depressive symptoms and lower quality of life are concerns for long-term survivors (Edelman, Bell, & Kidman, 1999). Although rates of clinical depression are not higher in long-term cancer survivors compared to healthy controls (Gotay, Isaacs, & Pagano, 2004), sub-syndromal depressive symptoms and poorer quality of life remain important adverse effects of cancer (Cordova et al., 1995; Cordova, Cunningham, Carlson, & Andrykowski, 2001b; Zabora, Brintzenhofeszoc, Curbow, Hooker, & Piantadosi, 2001). In one study, 18% of breast cancer survivors reported clinically significant levels of

psychological distress (Zabora et al., 2001). Previous research has indicated that as many as 39% of cancer patients meet criteria for a psychiatric disorder (Derogatis et al., 1983; Mehnert & Koch, 2007). According to Derogatis and colleagues (1983) the vast majority of patients who meet criteria for a psychiatric disorder suffered from depression, anxiety or both.

Many cancer survivors also continue to have fatigue, pain, swelling, and acute illnesses, and these difficulties are sometimes prolonged for years following active treatment (Abercrombie et al., 2004; Golden Kreutz, Browne, Frierson, & Andersen, 2004; National Cancer Institute, 2007b). In recognition of the significance of cancer survivorship, in 1996 the Office of Cancer Survivorship of the National Cancer Institute (NCI) was established for the purpose of enhancing the length and quality of life of the estimated 8.9 million cancer survivors in the United States and for addressing their unique and poorly understood needs (National Cancer Institute, 2007c). The NCI Office of Cancer Survivorship supports research in the areas of physical effects of disease and treatment, psychosocial factors, health disparities, intervention, family issues, financial burden, and communication among cancer survivors. The recent focus on understanding the needs of cancer survivors has led to psychosocial research in the areas of quality of life, perceived stress, depression, and anxiety (Brown, Madan-Swain, & Lambert, 2003; Carlson, Speca, Patel, & Goodey, 2003; Drageset & Lindstrom, 2003; Giovagnoli, 1999; Trask et al., 2003). Cancer survivorship research has also focused on cognitive function, fatigue, physical activity, spiritual/religious activity, and physical health (Bardwell et al., 2004; Cordova, Cunningham, Carlson, & Andrykowski, 2001a; Iconomou, Mega, Koutras, Iconomou, & Kalofonos, 2004; Mock et al., 2001).

Health psychology research in cancer survivorship has paralleled the research in other chronic diseases in that investigators have not only tried to document the specific physical and psychosocial consequences of the cancer experience but also, more importantly, have tried to identify the significant predictors of physical and psychosocial adjustment. As in research with other chronic diseases, stress has emerged as a potentially meaningful predictor of adjustment for cancer survivors (L. Cohen, Marshall, Cheng, Agarwal, & Wei, 2000; Forlenza, Latimer, & Baum, 2000; Porter et al., 2003). As Dr. George L. Engel pointed out more than 30 years ago in his challenge to biomedicine, physical health outcomes ranging from serious chronic illness to the common cold occur in the context of a complex interaction of physiological, psychological, and socio-cultural variables (Engel, 1977). This viewpoint, commonly referred to as the bio-

psycho-social model, is the underlying basis of much of the current health psychology research (Lillie et al., 2007; Morrill et al., 2008; Morrill, Richardson, Keith, & Puente, 2006; O'Neill et al., 2007; Panter & Reeve, 2002), including the current study and many studies recently conducted by our laboratory (Gil et al., 2001; Gil et al., 2003; Gil, Carson et al., 2004).

Stress

From a theoretical perspective, there have been several major contributors to the way stress is conceptualized, including Hans Selye, Richard Lazarus, and Susan Folkman. Selye originally conceptualized stress as a stimulus or event; examples include an overbearing boss, being cut off in traffic, getting married or divorced, or the loss of a loved one. However, by the 1950's his research began to focus on stress as a response to a stimulus. He coined the term "stressor" to indicate the environmental stimulus and used the word "stress" to indicate the response to the stimulus (Selye, 1956, 1976, 1982).

Selye's concept of the stress response evolved into the General Adaptation Syndrome (GAS), which emphasizes the physiological changes that occur during stress -- increased respiration and heart rate, increased secretion of adrenaline, and decreased gastrointestinal activity, among other physiological responses. The GAS consists of three phases: the alarm stage during which the body responds to a stressor in ways that lower its resistance to disease; the resistance stage during which the body gears up in order to protect against the effects of the stressor; and the exhaustion stage during which chronic stress often exerts its deleterious effects on physical and psychological health (Selye, 1982). Though revolutionary at the time, Selye's viewpoint on stress was limited in its presumption that stress was "event-based" and that a given stressor would uniformly elicit the same general physical response.

Lazarus and Cohen (1977) proposed a model incorporating three general levels of stressors: cataclysmic events; major life events, and daily hassles. Cataclysmic refer to events such as natural disasters including earthquakes, fires, and floods, as well as war. Major life events include experiences such as unemployment, divorce, or diagnosis with a serious illness. Daily hassles include day-to-day stressors such as traffic, problems at work, and too many responsibilities. Kanner and colleagues (1981) emphasized the importance of daily hassles and further conceptualized and integrated a model that incorporated measurement of minor stressors as they accumulate over time into stress research.

Stress and Perceived Stress

According to Richard Lazarus, a person's interpretation (appraisal and perception) of a stressor and their available coping resources are more important than the stressor itself (Lazarus, 1984, 1993). Lazarus and Folkman (1984) posit that stress can be characterized as a transactional relation among a person's appraisal of, vulnerability to, and ability to cope with an internal or external stressor. According to Lazarus and Folkman, appraisal consists of three phases: a primary appraisal during which a person appraises the meaning of the situation as stressful, positive, benign, or irrelevant; a secondary appraisal when a person assesses their ability to deal with the stressor; and then reappraisal when a person constantly re-appraises the meaning of a situation and their ability to deal with it as new information becomes available. Likewise, coping refers to a person's ability to utilize the psychological, physical, and social resources to manage the stressor (Lazarus & Folkman, 1984). Vulnerability refers to the degree to which a person's subjectively perceived underlying psychological, physical, or social state makes them more or less susceptible to adverse outcomes resulting from a stressor (Lazarus & Folkman, 1984).

The term "perceived stress" was coined by Cohen and Williamson (1988) and is meant to encompass the concept that stress is not inherently a result of any particular stressor (event or situation-based) but rather a person's appraisal of whether or not the threat of a given stressor is greater than the resources available to cope with the stressor. Stress has succinctly been described as a "give-and-take" interaction between a person and their environment (Folkman, Lazarus, Gruen, & DeLongis, 1986). The term anxiety refers to and is often used interchangeably with the overlapping construct, stress. Signs of anxiety include psychological symptoms (feelings of fear, agitation, and apprehension) and physical symptoms (trembling, muscle tension, headaches, sweating, dry mouth, difficulty swallowing) which may be a result of persistent and unrelenting stress (National Institutes of Health, 2008). Additionally, the experience of specific combinations of anxiety symptoms can indicate meeting diagnostic criteria for a *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV)* axis I anxiety disorder, such as panic disorder, acute stress disorder, obsessive compulsive disorder, and posttraumatic stress disorder (Abramowitz, Taylor, & McKay, 2008; American Psychiatric Association, 1994). According to psychophysiological theories, the interaction between a person and their environment, characterized by stress, causes physiological changes

such as increased secretion of adrenaline, increased respiration, increased heart rate, and potentially hypertension.

The two primary physiological mechanisms responsible for eliciting and regulating the stress response and influencing physical and psychological functioning are the hypothalamic-pituitary-adrenal axis (HPA or HTPA axis) and the sympathetic-adrenomedullary (SAM) axis (Salovey, Rothman, Detweiler, & Steward, 2000; Stone, Reed, & Neale, 1987; Vermetten & Bremner, 2002). Research has found that chronic activation of the SAM axis affects physical health through a relative decrease in antibodies such as secretory immunoglobulin A (S-IgA), which is thought to defend against illness (Salovey et al., 2000). Similarly, research in both animals and humans has demonstrated an association between chronic activation of the HPA axis and symptoms of anxiety and mood disorders such as posttraumatic stress disorder (PTSD) and depression (Fuchs, Czeh, & Flugge, 2004; Vermetten & Bremner, 2002; Vermetten, Vythilingam, Southwick, Charney, & Bremner, 2003). The stress response, although adaptive during acute periods of activation, can also lead to the development of illness and exacerbation of physical and psychological symptoms (S. Cohen, Tyrrell, & Smith, 1993; DeLongis, Folkman, & Lazarus, 1988; Gil, Carson et al., 2004; Morrill et al., 2008; Morrill et al., 2006; Reibel, Greeson, Brainard, & Rosenzweig, 2001).

Stress and Physical Health

Stress has been associated with physical health symptoms in a multitude of health problems including HIV/AIDS, cardiovascular disease, gastrointestinal disorders, musculoskeletal disorders, pain conditions, influenza, and the common cold (Carson, 1999; S. Cohen et al., 1993; DeLongis et al., 1988; Pereira et al., 2003; Takkouche, Regueira, & Gestal-Otero, 2001). For example, Pereira and colleges (2003) reported that stress was a significant predictor of genital herpes recurrence among 34 HIV+ African American women. DeLongis and colleagues (1988) reported an association between stress and health problems among 75 married couples who participated in a repeated-measure design study. Specifically, they reported that daily stress was associated with same- and subsequent-day backaches, headaches, sore throats, and influenza. Among faculty and staff at a university in Spain, Takkouche and colleagues (2001) found that higher levels of perceived stress and negative affect, as well as more stressful life events, were all independently associated with an increased risk of occurrence of the common cold. Likewise, Cohen, Tyrrell, and Smith

(1993) reported that higher stress was associated with a greater risk of developing a common cold in otherwise healthy individuals.

Stress has also emerged as a predictor of immune function (Glaser et al., 1992) and DNA repair capacity (L. Cohen et al., 2000; Glaser, Thorn, Tarr, Kiecolt-Glaser, & D'Ambrosio, 1985). In a sample of 48 second-year medical students, Glaser, and colleagues (1992) found that having less stress was related to a more functional immune system, as measured by immune response to inoculation for hepatitis B. Cohen and colleagues (2000) studied the effect of exam stress in 16 first- and second-year medical students. They report that exam stress caused elevations in DNA repair capacity (DRC), a potential measure of DNA damage, and perceived stress. Forlenza, Latimer, and Baum (2000) reported that among professional students (i.e., medical, dental, pharmacy, and law), both DRC and perceived stress were higher during the stressful exam period when compared with a non-stressful end-of-vacation assessment.

Within the context of cancer, research has demonstrated that cancer survivors have altered physiological responses that may be due to prolonged stress from their illness (Gurevich et al., 2004; Porter et al., 2003). In one study, Porter and colleagues found that breast cancer survivors had a higher baseline cortisol level and experienced a reduction in cortisol levels from baseline to the mammography period whereas healthy controls had an increase in cortisol levels for the same stressful period of time. These findings suggest that chronic stress resulting from the cancer experience may lead to heightened baseline levels of physiological arousal and may suppress typical patterns of physiological reactions in acute stressful situations.

Taken together, these results suggest that stress affects physical health in complex ways. It also seems possible that the cumulative stress caused by low intensity stressors and frustrations in daily life layered upon the stress from a major life event, such as the cancer experience, may result in the exacerbation of an already dysfunctional stress response, thereby augmenting physical health problems.

Posttraumatic Stress

The stress of the cancer experience has been linked to the development of posttraumatic stress disorder (PTSD; Green et al., 1998; Smith, Redd, Peyser et al., 1999). The *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* (American Psychiatric Association, 1994) defines PTSD as an

anxiety disorder that occurs following a traumatic event that involved actual or threatened death or a threat to one's physical integrity or that of others, and which evoked intense fear, helplessness or horror. Diagnostic criteria include three symptom clusters: re-experiencing in the form of recurrent and intrusive thoughts, avoidance of or numbing in response to trauma-related stimuli, and increased physiological arousal. Criteria must be met for at least one month and cause clinically significant distress or impairment.

The *DSM-IV* expanded events capable of eliciting a response of PTSD, when compared to previous editions, to include life-threatening illnesses such as cancer. The events that unfold during a cancer diagnosis and subsequent treatment are capable of producing symptoms of posttraumatic stress disorder (Green et al., 1998; Kangas et al., 2002). PTSD and sub-syndromal posttraumatic stress symptoms are associated with higher rates of depression, anxiety disorders, and lower quality of life among cancer patients and survivors (Cordova et al., 1995; Morrill et al., 2008; Schwartz & Drotar, 2006). Cancer survivors who experience posttraumatic stress symptoms also appear to experience negative physical health outcomes, suggesting the need to examine the relationship between posttraumatic stress and physical health symptoms (Barakat, Kazak, Gallagher, Meeske, & Stuber, 2000; Hegel et al., 2006; Schwartz & Drotar, 2006). For example, Schwartz and Drotar (2006) explored the relations between PTSD and psychological and physical health outcomes among childhood cancer survivors. They reported that higher levels of posttraumatic stress symptoms were associated with worse psychosocial and health outcomes including poorer mood, more depressive symptoms, and worse health-related quality of life (HRQOL) when compared with those with fewer posttraumatic stress symptoms.

While a diagnosis of PTSD is somewhat rare among patients with some types of cancer (Kangas et al., 2002), posttraumatic stress symptoms may occur in up to 50% of all cancer patients (Gurevich et al., 2004). Considering the potentially deleterious effects of posttraumatic stress symptoms and the fact that incidence of cancer diagnosis continues to rise in the United States, cancer-related symptoms of PTSD have the potential to negatively impact the lives of thousands of people every year (American Cancer Society, 2007).

Posttraumatic Growth

Although people who experience traumas such as loss of a loved one or serious illness can suffer negative bio-psycho-social consequences, they often report positive psychosocial outcomes from trauma. This experience, termed posttraumatic growth, may include feeling more fully satisfied with life, and/or having an improved quality of life after successfully navigating the traumatic event or experience (Stanton et al., 2006; Taylor, 1983; Tedeschi, Park, & Calhoun, 1998). Dimensions of posttraumatic growth include enhanced interpersonal relationships, greater appreciation for life, increased spirituality, sense of increased personal strength, and valued change in life priorities or goals (Tedeschi & Calhoun, 1996). According to relevant theories (Janoff-Bulman & Frantz, 1997), posttraumatic growth may represent an attempt to understand the value or meaning that the trauma has had in one's life. This process can help to minimize feelings of loss and to enhance a sense of purpose and meaning in life (Nolen-Hoeksema & Davis, 2002; Taylor, 1983).

According to Tedeschi and Calhoun (2004) posttraumatic growth is a psychosocial process that effectively transforms automatic, intrusive, and negative ruminations into growth-oriented and positive narrative-developing intentional thoughts. This transformation is accomplished by reducing the effect of emotional distress, management of automatic rumination, and reducing the effect of unwanted schema change. All of these transitions are brought about by a combination of internal and external self-disclosure, positive social support, active coping, cognitive reframing, and when necessary, as is often the case with chronic illness-related posttraumatic stress, disengagement from previous goals and incorporation of revised life goals.

Measuring Posttraumatic Growth. According to Park and Lechner (2006), three psychometrically validated measures are currently in use to assess positive change resulting from a traumatic experience. They are the Stress Related Growth Scale (SRGS; Park, Cohen, & Murch, 1996), the Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996), and the Benefit Finding Scale (BFS; Antoni et al., 2001). From a conceptual standpoint, the measures are very similar and are psychometrically comparable. All three are retrospective and have major shortcomings in part due to the incorporation of cognitions, feelings, and behaviors in a single construct.

Regarding reliability and validity, the SRGS has demonstrated adequate internal-reliability coefficient of .94 with two week test-retest of .81 (Park et al., 1996); the BFS has demonstrated an internal-reliability coefficient of .95 with no test-retest reliability reported (Antoni et al., 2001). The PTGI has demonstrated an internal-reliability coefficient of .90 with adequate subscale internal reliability ranging from .67 to .85 and adequate test-retest reliability (r=.71) (Tedeschi & Calhoun, 1996). Logistically the PTGI is shorter (21 items) than the SRGS (50 items) and only slightly longer than the BFS (17 items); the PTGI is more widely used than the other two scales.

Posttraumatic Growth and Personal Growth

Personal growth has been described as an important process that produces positive personal change and development. Developmental, environmental, and intentional events and processes can act as a catalyst for continued personal growth across the lifespan (Robitschek, 1998). Cancer diagnosis, treatment, and survivorship could be viewed as an example of an environmental experience that has the potential to foster ongoing personal growth. When personal growth is stimulated by a traumatic environmental event or process such as the cancer experience, it is often referred to as posttraumatic growth or benefit finding (Tedeschi & Calhoun, 1995; Widows, Jacobsen, Booth-Jones, & Fields, 2005). For example, in their discussion of trauma and transformation Tedeschi and Calhoun (1995) indicate that this type of personal development can be triggered by traumatic experiences such as cancer diagnosis, treatment, and survivorship. With regard to how posttraumatic growth compares and contrasts with other similar constructs from positive psychology including optimism, resilience, hardiness, and sense of coherence, Tedeshi and Calhoun (2004) make compelling arguments that posttraumatic growth and these positive psychology constructs differ conceptually in important ways. Generally, the positive psychology constructs describe characteristics related to coping with adversity well, whereas posttraumatic growth refers to a significant change in the way a person views the world and their life. This shift in schema not only allows a person to cope with adversity, but also to grow from it such that they exceed their pre-trauma level of functioning.

Posttraumatic Growth and Cancer

In the area of medical illnesses, researchers have found that survivors of heart attack, HIV infection, and other serious medical conditions such as cancer can experience both posttraumatic stress and

posttraumatic growth (Affleck & Tennen, 1996; Cordova & Andrykowski, 2003; Cordova et al., 2001a; Ho, Chan, & Ho, 2004; Morrill et al., 2008; Schulz & Mohamed, 2004). Between 60% and 95% of cancer survivors report posttraumatic growth as a result of a cancer diagnosis, treatment, and survivorship (Stanton et al., 2006).

Over the last decade, interest has increased in research exploring the positive life changes that cancer survivors report following diagnosis and treatment (Bellizzi et al., 2010; M. Cohen & Numa, 2011; Cordova et al., 2001a; Cordova et al., 2007; Helgeson et al., 2006; Lelorain, Bonnaud-Antignac, & Florin, 2010; Love & Sabiston, 2011; Mols, Vingerhoets, Coebergh, & van de Poll-Franse, 2009; Porter et al., 2006; Salsman, Segerstrom, Brechting, Carlson, & Andrykowski, 2009; Sears, Stanton, & Danoff-Burg, 2003; Stanton et al., 2006; Widows et al., 2005). For example, Cordova and colleagues (2001a) report that breast cancer survivors experience increased posttraumatic growth in areas of relating to others, appreciation of life, and spiritual change. Correlates of posttraumatic growth among cancer patients and survivors include demographic characteristics (socioeconomic status, ethnicity, and age), personality variables (optimism and positive personality resources, and approach-oriented coping), and psychological well-being (greater positive affect and less depression) (Helgeson et al., 2006; Stanton et al., 2006). However, studies have also reported inconclusive results or a lack of association with posttraumatic growth and perceived threat, disease severity, time since diagnosis, type or amount of treatment, marital status, avoidant-based coping, psychological distress, and quality of life (Helgeson et al., 2006; Stanton et al., 2006).

Some researchers have approached posttraumatic growth as an outcome and sought to explore associations with various predictors such as cognitive reframing, rumination, coping, emotional regulation, psychological adjustment, and religious involvement (Calhoun, Cann, Tedeschi, & McMillan, 2000; Porter et al., 2006; Wild & Paivio, 2003). Others have viewed it as a predictor and sought to design interventions aimed at increasing the likelihood of positive psychosocial outcomes resulting from potentially traumatic events through the mechanism of posttraumatic growth (Calhoun & Tedeschi, 2000). It is perhaps for these reasons that research of this construct has produced somewhat ambiguous and inconsistent results especially with regard to overall or general quality of life and psychological distress (Cordova & Andrykowski, 2003; Linley & Joseph, 2004).

Cordova and Andykowski (2003) argued that it is possible to experience cancer diagnosis, treatment, and survival as a trauma and transition, potentially leading to both positive and negative psychosocial outcomes (Cordova & Andrykowski, 2003). Posttraumatic growth is one example of the potentially positive outcomes of cancer diagnosis and treatment. As previously mentioned, posttraumatic stress symptoms have been shown to be associated with depression, poorer quality of life, and poorer physical health. However, posttraumatic growth has not been consistently demonstrated to be directly associated with psychological distress, quality of life or physical health.

The interaction between posttraumatic stress symptoms and posttraumatic growth and other bio-psychosocial constructs may be an additional reason for previous mixed findings (Morrill et al., 2008). Several previous studies have explored posttraumatic growth in moderation models with time since diagnosis, the nature of the stressor, posttraumatic stress, quality of life, depressive symptoms, intrusive thoughts, adjustment, social support, enduring distress and physical activity (Helgeson et al., 2006; Morrill et al., 2008; Park, Chmielewski, & Blank, 2010). For example, Park and colleagues (2010) report a buffering effect of posttraumatic growth on the relations between intrusive thoughts and spiritual well-being, life satisfaction, and negative affect. Thus, one possible explanation for the inconsistent results regarding posttraumatic growth may be an indirect association in the form of a moderation of the deleterious relation between posttraumatic stress symptoms and health among cancer patients.

The Buffering Effect of Posttraumatic Growth

My previous research bolsters the assertion that posttraumatic stress symptoms and posttraumatic growth can manifest simultaneously in the cancer experience and that the experience of posttraumatic growth ameliorates the deleterious relationships between posttraumatic stress symptoms and both quality of life and depressive symptoms (Morrill et al., 2008). I hypothesized that posttraumatic growth may act as a coping resource that protects cancer patients against the corrosive effects of PTSD on quality of life and depressive symptoms. Although posttraumatic growth may not successfully uproot the intrusive thoughts and cognitions that accompany PTSD, it may provide a positive buffer. More specifically, posttraumatic growth may reflect cognitive adaptation in response to cancer diagnosis (e.g., a positive reinterpretation) that can alter the global meaning of the cancer experience (Helgeson et al., 2006). Similar cognitive

reappraisal has been demonstrated to reduce the effect of posttraumatic stress symptoms on psychological distress in breast cancer survivors (Vickberg, Bovbjerg, DuHamel, Currie, & Redd, 2000).

Studies of the relation of posttraumatic growth to well-being have found inconsistent results (Helgeson et al., 2006). Several hypotheses may explain these inconsistencies, including varying levels of posttraumatic stress symptoms and posttraumatic growth within individuals. Cordova and Andrykowski (2003) argue that experiencing cancer-related stress and growth simultaneously is possible because people often view the experience as both a trauma and transition to a new phase in their lives.

Because cancer diagnoses can cause great distress, it is not surprising that some cancer survivors have elevated levels of posttraumatic stress symptoms that are associated with depressive symptoms, lower quality of life, and poorer physical health. My previous research has demonstrated a buffering effect of posttraumatic growth on the relation between posttraumatic stress symptoms and both quality of life and depressive symptoms among breast cancer survivors (Morrill et al., 2008).

In my study, we assessed posttraumatic growth using the Posttraumatic Growth Inventory, posttraumatic stress symptoms using the PTSD Checklist, depressive symptoms using the CES-D, and quality of life using the FACT-B (Morrill et al., 2008). Participants were 161 women previously treated for early stage breast cancer. Results indicated that higher levels of posttraumatic stress symptoms predicted greater depressive symptoms and lower quality of life ($p < .01$). The relation between posttraumatic stress symptoms and depression was attenuated among women with higher levels of posttraumatic growth, as evidenced by the interaction of posttraumatic stress symptoms and posttraumatic growth ($p < .05$). A similar interaction was found with regard to quality of life ($p < .01$), with posttraumatic growth weakening the posttraumatic stress symptoms - quality of life relationship. Although not reported in the original manuscript, when using the physical well-being subscale of the FACT-B as an analogue for physical health, a similar pattern of results was evident with posttraumatic growth weakening the posttraumatic stress symptoms - physical health relationship. The physical well-being scale of the FACT-B (FACT-B-PWB) assesses seven aspects of physical well-being pertinent to cancer patients and survivors on a 5-point scale ranging from 0 (not at all) to 4 (very much). The specific items of the FACT-B-PWB scale are: “I have a lack of energy”; “I have nausea”; “Because of my physical condition, I have trouble meeting the needs of

my family"; "I have pain"; "I am bothered by side effects of treatment"; "I feel ill"; and "I am forced to spend time in bed."

When taken as a whole, results of the previously mentioned studies make clear three pertinent ideas. First, although most cancer survivors experience some negative bio-psycho-social sequelae of cancer diagnosis, treatment, and survivorship, many experience positive sequelae (such as posttraumatic growth). Second, these positive sequelae have the potential to ameliorate the deleterious effect of at least a portion of the negative sequelae (such as posttraumatic stress symptoms) as they relate to quality of life and depressive symptoms. Third, this buffering effect is likely to remain true with regard to physical health symptoms.

Conceptual Model of the Buffering Effect of Posttraumatic Growth

To conceptualize the mechanism by which posttraumatic growth buffers the relation between posttraumatic stress and health outcomes among cancer patients and survivors, it is necessary to briefly review the four components involved. Specifically, I will outline theoretical underpinnings for the relation between the traumatic experience of cancer diagnosis, treatment and survivorship and posttraumatic stress symptoms; the association between posttraumatic stress symptoms and health outcomes; the processes involved in the experience of posttraumatic growth; and the buffering effect of posttraumatic growth on the deleterious relation between posttraumatic stress and health outcomes among cancer patients and survivors.

Cancer and posttraumatic stress. Traumatic experiences such as diagnosis and treatment of cancer can cause a profound shift in a person's schema, and subsequent conflict between a person's pre-trauma sense of self and world view and their post-trauma sense of self and world view. For example, prior to the experience of a trauma, such as being diagnosed with potentially lethal cancer, a person may believe, as part of their underlying schema, that the world is a relatively predictable place, that they have control over the course their life; and that plans they have made for the future will come to pass. Whereas following diagnosis and treatment they may begin to realize, as a result of their cancer experience, that the world is not as predictable as they once believed, that they have less control over the course their life will take than they once thought, that the plans they have made may not come to pass. This disparity can be extremely distressing and may lead directly to psychological distress as well as indirectly to increased physiological arousal through stimuli that remind them of the trauma of diagnosis and treatment including

negative cognitions, rumination, intrusive thoughts, ongoing medical appointments, concerns about the future, and uncertainty about recurrence. Additionally, this response to profound schema change may lead to increased negative psychological responses (i.e. anxiety, negative affect, intrusive thoughts, catastrophic thinking, posttraumatic cognitions, rumination, and intrusive thoughts) and dysregulation of one's stress response systems. The combination of maladaptive cognitions and dysregulation of the stress response systems has the potential to lead to an increase in posttraumatic stress symptoms.

Posttraumatic stress symptoms and health. I hypothesize that the deleterious effect of posttraumatic stress symptoms on both psychological and physical health results from the intense and often unremitting psycho-physiological response to traumatic experiences (both by maladaptive cognitions, negative affect and ruminations as well as the labeling of these responses as discordant with one's preferred or pre-trauma sense of self). I further theorize that the mechanisms by which posttraumatic stress leads to negative psychological outcomes potentially occur through four major pathways. Specifically, there is a direct link from (1) the experience of profound unresolved schema change, (2) re-experience/rumination of or about the traumatic experience, (3) avoidance of stimuli that remind one of the trauma, and (4) physiological arousal with subsequent experience of anxiety, and depression. With regard to the negative effect of posttraumatic stress on physical health outcomes I believe there are two primary mechanisms. First is the direct effect of prolonged physiological hyper-arousal on physical health. As outlined above this occurs through several physiological processes including prolonged activation of the hypothalamic-pituitary-adrenal axis (HPA or HTPA axis) and the sympathetic-adrenomedullary (SAM) axis. The second potential pathway by which posttraumatic stress can affect negative physical health outcomes is via negative health behaviors. Specifically, posttraumatic stress has the capacity to affect physical health through failure to engage in health promoting behaviors such as treatment adherence and attending follow-up appointments with health care providers, and engaging in unhealthy behaviors including substance use, lack of exercise, poor diet, and not getting sufficient sleep.

The process of posttraumatic growth. The current study builds on the model of posttraumatic growth put forth by Calhoun and Tedeschi. According to Tedeschi and Calhoun (2004) posttraumatic growth is a psychosocial process that effectively transforms automatic, intrusive, and negative ruminations into deliberate, growth oriented, narrative developing ruminations. This transformation is accomplished by

reducing the effect of emotional distress, management of automatic rumination, and reducing the effect of unwanted schema change. All of these transitions are brought about by a combination of internal and external self disclosure, positive social support, active coping, cognitive reframing, and when necessary, as is often the case with chronic illness related posttraumatic stress, disengagement from previous goals and incorporation of revised life goals.

Posttraumatic growth, posttraumatic stress, and health. In summary I theorize that the process of transforming automatic, intrusive and negative rumination into deliberate, growth oriented, life narrative developing ruminations ultimately results in a reduction of the effect of posttraumatic stress on health outcomes both directly and indirectly by facilitating adaptation to changes in a person's schema and reducing the effect of re-experience, avoidance and physiological arousal. Although, this reduction does not result in complete abatement of the effects of posttraumatic stress or the ensuing distress, as evidenced by the simultaneous occurrence of both posttraumatic growth and stress, it is theorized that the reduction is sufficient to ameliorate a portion of the negative health outcomes resultant from the experience of trauma and subsequent posttraumatic stress response.

Internet-Based Data Collection

As access to the internet increases, the use of Internet-based data collection methods has become more common (e.g. Bauer et al., 2004; Bliven, Kaufman, & Spertus, 2001; Fergusson, Hendry, & Freeman, 2003; Metzger, Kristof, & Yoest, 2003; Park, Armeli, & Tennen, 2004; Ritter, Lorig, Laurent, & Matthews, 2004; Whybrow et al., 2003). Several studies have set out to establish psychometric validity for the online data collection methodology and compared it directly with the more traditional paper and pencil method of data collection (Bliven et al., 2001; Metzger et al., 2003; Ritter et al., 2004). For example Ritter, Lorig, Laurent, and Matthews (2004) compared patterns of response on 16 self-report measures administered using an online versus paper and pencil methodology. They report that among 397 chronically-ill participants there were no significant psychometric differences in 14 of the 16 self-report psychological and physical health-related measures completed. Bliven and colleagues (2001) sought to explore the reliability and validity of a cross-sectional Internet-based health-related quality of life measure. They reported that in a sample of 55 cardiology outpatients, greater than 80% preferred the internet-based collection over the

paper and pencil versions, nearly 90% were comfortable using the application without additional technical support, and that data collected using electronic and paper and pencil versions were consistent (Bliven et al., 2001). Additionally, in the area of face recognition, Metzger and colleagues (2003) reported that among college students, online and paper and pencil methodologies yielded similar results. Studies such as these indicate that internet-based data collection is a valid, reliable, and often preferable method for collecting data.

In addition to being valid, reliable and often preferable, research has demonstrated that internet-based data collection has many additional benefits (Bauer et al., 2004; Bliven et al., 2001; Granello & Wheaton, 2004; Schillewaert & Meulemeester, 2005). Internet-based data collection and management is inherently more efficient when compared to paper and pencil methodologies (Bliven et al., 2001). Specifically, data entry and coding can be accomplished with a substantial reduction in labor, expense, missing data, and data entry errors compared with traditional paper and pencil daily diary methodology (Bauer et al., 2004; Schillewaert & Meulemeester, 2005). Although research indicates large disparities in Internet use remain between minority and non-minority groups, minorities are increasingly using the Internet (e.g. Fogel, Albert, Schnabel, Ditkoff, & Neugut, 2003; Gant, Turner-Lee, Li, & Miller, 2010). According to a recent report by Gant and colleagues (2010), 79% of non-Hispanic Caucasians, 69% percent of African Americans, and 59% of Hispanics currently subscribe to residential high-speed Internet, representing a continuing trend of increased minority access to the Internet. When taken together these findings indicate electronic/internet-based data collection is a feasible method of collecting bio-psycho-social data from a diverse group of cancer survivors.

The Present Study

The primary aim of the current study was to investigate the relations of perceived stress, posttraumatic stress symptoms and posttraumatic growth to three health outcome measures -- distress about physical health symptoms, quality of life, and depressive symptoms among cancer survivors.

The first hypothesis was that posttraumatic stress symptoms and posttraumatic growth would be associated with distress about physical health symptoms, quality of life, and depressive symptoms and

posttraumatic growth would moderate the relation between posttraumatic stress symptoms and the three health outcomes.

Specifically, I hypothesized that posttraumatic stress symptoms would be associated with more distress about physical health symptoms, lower quality of life, and more depressive symptoms (H1a) and posttraumatic growth would be associated with less distress about physical health symptoms, higher quality of life, and fewer depressive symptoms after controlling for posttraumatic stress symptoms (H1b). Additionally, I hypothesized that posttraumatic growth would buffer the relation between posttraumatic stress symptoms and the three health outcomes (H1c), such that increasing levels of posttraumatic growth and decreasing levels of posttraumatic stress would be associated with better health outcomes and decreasing levels of posttraumatic growth and increasing levels of posttraumatic stress would be associated with worse health outcomes (see Figure 1).

The second hypothesis was that perceived stress, posttraumatic stress symptoms and posttraumatic growth would be associated with distress about physical health symptoms, quality of life, and depressive symptoms and perceived stress would moderate the relation between posttraumatic stress symptoms and the three health outcomes.

Specifically, I hypothesized that perceived stress would be associated with more distress about physical health symptoms, lower quality of life, and more depressive symptoms (H2a) and perceived stress would remain associated with the three health outcomes after controlling for posttraumatic stress symptoms and posttraumatic growth (H2b). Additionally, I hypothesized that perceived stress would exacerbate the relation between posttraumatic stress symptoms and the three health outcomes (H1c), such that increasing levels of perceived stress and posttraumatic stress would be associated with worse health outcomes and decreasing levels of perceived stress and posttraumatic stress would be associated with better health outcomes (see Figure 2). Statistical testing for the primary hypotheses was two-tailed, with a critical alpha of .05 and controlled for relevant demographic and medical variables.

A secondary aim of the current study was to assess and describe factors related to the feasibility, acceptance, ease of use, and efficacy of the online data collection system created for this study, and to quantify the efficiency of the recruitment strategy used in the study. Specifically, it was hypothesized that the participants would find the online data collection system easy to use and they would be able to

participate from a convenient location in a reasonable amount of time. It was further hypothesized that the measures on the online questionnaire would demonstrate adequate reliability and validity and the online data collection system would improve the efficiency of data collection, as well as streamline the recruitment, screening, consent, enrollment, data entry and data management processes when compared to traditional paper and pencil questionnaires.

METHOD

Participants

Participants in this study were 168 cancer survivors who were at least 21 years of age, English speaking, not currently undergoing active treatment, and had regular internet access with an active email account. The University of North Carolina-Chapel Hill Institutional Review Board of the approved the study protocol prior to participant recruitment. The sample consisted of individuals who survived a variety of cancers: 31% breast (*n*=52); 16% ovarian (*n* =27); 14% leukemia (*n* =22); and 11% lymphoma (*n* =19). Less than 5% of participants were diagnosed with each of the following types of cancer: bladder (*n* =5); colorectal (*n* =6); endometrial (*n* =4); lung (*n* =2); melanoma (*n* =3); prostate (*n* =6); sarcoma (*n* =4); testicular (*n* =3); and thyroid (*n* =3). Participants having multiple types of cancer or other types represented 2.4 %, (*n* = 4) and 3%, (*n* = 5) of the sample respectively. Participants were on average 53 years of age (*SD* = 11.75, range 22-86 years old). They were well-educated with the majority reporting holding a minimum of a 4-year degree and 57.6% (*n* = 95) reported that their financial status provided them with expendable income. Participants were mostly women (83%), Caucasian (90%), non-Hispanic (96%), currently working (64%), and married or living with a significant other (77%). Additionally, participants were on average 7.7 years post-diagnosis (*SD* = 7.79 years, range 130 days to 35 years) with an average time since treatment of 5.5 years (*SD* = 6.73 years, range 1day to 30 years). Most participants underwent surgery (78%), received chemotherapy (69%), and/or radiation therapy (46%), with 30 participants receiving hormone therapy and four participants receiving gene therapy.

Procedure

Participants were recruited using the University of North Carolina at Chapel Hill's informational email system; email list serves (e.g. The Association of Online Cancer Resources); social networking sites (e.g. Facebook, MySpace, Twitter, NING, and LinkedIN); and by word of mouth. For the initial phase of

recruitment, a bulk email was sent to approximately 10,000 faculty/staff and 25,000 students of the University of North Carolina – Chapel Hill. In many cases, recipients forwarded these emails to family members, friends and colleagues. Some participants completed the questionnaire from as far away as Mexico, British Columbia, and the UK. The total number of potential participants to which the initial recruitment email was forwarded is unknown.

Potential participants were directed to a website that briefly described the study and ascertained interest in participation. Potential participants interested in the study completed an online form that requested their email address, a preferred password for use in the study, and information to be used in the screening process. Potential participants were informed that a researcher would contact them to either enroll them in the study or explain why they did not meet inclusion criteria. Regardless of eligibility or participation status, all potential participants were provided with an email address through which to contact study personnel if they had any questions, comments, or concerns.

Participants who did not meet inclusion criteria received an email thanking them for their interest in the study, informing them that they were ineligible, and explaining the specific inclusion criteria that they did not meet. Participant who met inclusion criteria, were sent an email with an embedded link to the online consent form and questionnaire. Eligible participants who did not complete the online questionnaire within 21 days were sent a second email reminding them of their eligibility to participate in the study and providing them with a link to the online consent form and questionnaire. Participants were considered enrolled in the study following consent to participate. Additionally participants received the following warning: "Although we will be asking you about your physical health symptoms for the purpose of this research study we are not in contact with your doctor. Thus, if you have any health concerns during the course of this study you should discuss them with a physician."

After recruitment, screening, consent, and enrollment, participants completed an online questionnaire designed to assess posttraumatic stress symptoms, posttraumatic growth, distress about physical health symptoms, quality of life, depressive symptoms, perceived stress, posttraumatic cognitions, rumination, and personal growth initiative. Additionally, the questionnaire collected information on demographics (gender, age, race, marital status, financial status, education, and history of treatment for psychiatric disorder), medical status (type of cancer, time since diagnosis, time since treatment, and type of treatment

undergone), and feasibility and acceptance of the online questionnaire. Additional measures, which were not included in the current study, were administered using the online questionnaire. Following completion of the online questionnaire, participants were offered a $10 Amazon.com gift certificate as compensation for participation and were given the opportunity to donate their compensation back to the study.

Measures

Predictor Measures to Test Primary Hypotheses

Posttraumatic stress symptoms. PTSD symptoms were assessed using the PTSD Checklist - Civilian Version (PCL-C; Weathers, Huska, & Keane, 1991). The PCL-C is a 17-item questionnaire that corresponds directly to the DSM criteria for PTSD. Items on the PCL-C are rated on a four-point Likert-type scale with responses ranging from "Not at all" to "Extremely." The PCL-C has three subscales assessing symptoms from the three DSM-IV symptom clusters, namely re-experiencing, avoidance, and increased arousal. Examples of items on each of the three sub-scales include Re-experiencing symptoms "Repeated, disturbing memories, thoughts, or images of a stressful experience?" and "Suddenly acting or feeling as if a stressful experience were happening again as if you were reliving it?"; Avoidance symptoms "Avoiding thinking about or talking about a stressful experience or avoiding having feelings related to it?" and "Feeling emotionally numb or being unable to have loving feelings for those close to you?"; and Increased Arousal "Having physical reactions (e.g., heart pounding, trouble breathing, sweating) when something reminded you of a stressful experience?" and " Feeling jumpy or easily startled?"

The PCL-C has demonstrated internal reliability with an internal consistency alpha of .93 in the current study and adequate test-retest reliability over a 6 week period coefficient = .74 (from pilot testing). The PCL-C has been used in research with cancer patients and survivors (Abercrombie et al., 2004; Andrykowski, Cordova, Studts, & Miller, 1998; Cordova et al., 1995; Cordova, Studts, Hann, Jacobsen, & Andrykowski, 2000; Jacobsen et al., 2002; Morrill et al., 2008; Smith, Redd, DuHamel, Vickberg, & Ricketts, 1999).

Posttraumatic growth. The 21-item Post Traumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) was used to assess posttraumatic growth. Participants are asked to "indicate for each item the degree to which this change occurred in your life as a result of your cancer experience" using a six-point Likert-

type scale with responses ranging from "not at all" to "a very great degree." The PTGI has five subscales: "Relating to Others"; "New Possibilities"; "Personal Strength"; "Spiritual Change"; and "Appreciation of Life." Examples of items on each of the five subscales include Relating to Others: "I put more effort into my relationships"; New Possibilities: "New opportunities are available which wouldn't have been otherwise"; Personal Strength: "I have a greater feeling of self-reliance"; Spiritual Change: "I have a better understanding of spiritual matters"; Appreciation of Life: "I changed my priorities about what is important in life."

The PTGI demonstrated adequate internal validity with an internal consistency alpha of .94 in the current study and adequate test-retest reliability has been demonstrated over a two-month period coefficient =.70 in previous research (Tedeschi & Calhoun, 1996). Researchers have used this scale to assess posttraumatic growth, positive psychosocial outcomes, and benefit finding among cancer survivors (Cordova et al., 2001a; Ho et al., 2004; Morrill et al., 2008).

Perceived stress was assessed using an electronic visual analogue scale (E-VAS) based upon the approach used by Stone and colleagues (Stone, Broderick, Porter, & Kaell, 1997; Stone & Neale, 1982, 1984). The paper and pencil measure used by Porter and colleagues (2000) was converted into an electronic format. Specifically, participants were asked to describe, “What stressful situations have you been dealing with over the past two weeks,” to identify the most stressful situation, and to select one of five categories which best described this situation: work; marital/romantic relationships; other relationships such as family or friends; cancer related; or other. Finally, participants were asked to rate the perceived level of overall stress for the preceding two weeks using an electronic visual analogue scale (E-VAS) stress measure. The E-VAS was anchored at “not at all stressful” and “as stressful as I can imagine.” The paper and pencil version of this method to assess perceived stress has demonstrated adequate reliability and validity (Gil et al., 2003).

Health Outcome Measures

Distress from physical health symptoms was assessed using a modified version of the Cohen-Hoberman Inventory of Physical Symptoms (CHIPS; S. Cohen & Hoberman, 1983). The CHIPS is a 33-item self-report measure in which respondents are asked to rate how much a particular physical symptom (e.g., cold, cough, heart pounding, nausea, sleep problems) distressed them on a five-point scale anchored

at “not at all” and “extremely.” In addition to assessing the degree to which participants were bothered by a particular symptom participants were asked to indicate if they experienced each symptom during the preceding two weeks. The CHIPS demonstrated adequate internal reliability with Cronbach's alpha = .90 in the current study.

In addition, the physical symptoms subscale of the Rotterdam Symptom Checklist (RSCL-PS; de Haes, van Knippenberg, & Neijt, 1990) was also used to assess distress about physical symptoms. The RSCL-PS is an inventory of physical symptoms designed to assess physical symptoms in cancer patients and survivors, and has been used extensively in research with cancer patients and survivors (e.g. de Haes & Olschewski, 1998; Eiser, Havermans, Craft, & Kernahan, 1997; Hardy, Edmonds, Turner, Rees, & A'Hern, 1999). The RSCL-PS demonstrated adequate internal reliability with Cronbach's alpha = .79 in the current study.

Depressive symptoms. Symptoms of depression were assessed using the 20-item Center for Epidemiological Studies-Depression Measure (CES-D) (Radloff, 1977). The CES-D demonstrated adequate internal consistency with a coefficient alpha of .94 in the current study. Test re-test reliability has been established with both cancer patients ($r = 0.51$, $p < 0.001$) and healthy controls ($r = 0.57$, $p < 0.001$) (Hann, Winter, & Jacobsen, 1999). The CES-D is a widely used measure of depressive symptoms in relevant studies (Fredrickson, Tugade, Waugh, & Larkin, 2003; Grant, Gil, Floyd, & Abrams, 2000; Morrill et al., 2008; Ostir, Markides, Peek, & Goodwin, 2001; Wison et al., 1999).

Quality of life. Quality of life was measured using the 28-item Functional Assessment of Cancer Therapy Scale (FACT-G) (Cella et al., 1993). Each item is rated on a 5-point scale ranging from “not at all” to “very much” with regard to how true each item has been during the past 7 days. The FACT-G demonstrated adequate internal validity with an internal consistency alpha of .92 in the current study. The FACT-G total scale has demonstrated adequate test-retest reliability ($r = .92$, $p < .01$) at 3-7 days (Cella et al., 1993). The FACT-G has been used extensively in cancer-related studies (e.g. Brady et al., 1997; Dharma-Wardene et al., 2004; Ferrell, Dow, Leigh, Ly, & Gulasekaram, 1995).

Demographic and Medical Characteristics

Participants were asked for information about their gender, age, race, marital status, financial status, education, and history of treatment for psychiatric disorder. To assess education participants were asked

"What is the highest grade in school you completed?" and responses included 10 categories from "Less Than High School" to "Advanced Degree (Masters, PhD, MD, JD)." Education was converted into four ordinal groupings: "High School Graduate/GED"; "Associates or Technical Degree"; "Bachelors Degree"; and "Advanced Degree." Regarding marital status participants were asked "What is your current marital status?" Responses included the following choices: "Never married"; "Engaged"; "Married"; "Separated"; "Divorced"; "Widowed"; "Living with partner"; and "Other, (please specify)." Marital status was dichotomized into two categories, "married or living as married" or "not married or living as married." Participants were asked "What is your race?" responses included the following choices: "American Indian or Alaska Native"; "Asian"; "Black or African American"; "Native Hawaiian"; "Pacific Islander"; "White or Caucasian"; " Bi/Multi Racial"; and "Other, please specify." Additionally participants were asked if they consider themselves Hispanic or Latina/Latino.

To assess financial status participants were asked "Without giving exact dollars, how would you describe your household's financial situation right now?" Responses included "After paying the bills, you still have enough money for special things that you want"; "You have enough money to pay the bills, but little spare money to buy extra or special things"; "You have money to pay the bills, but only because you have cut back on things"; and "You are having difficulty paying the bills, no matter what you do" (Rimer et al., 2002). Participants were asked, "Have you ever been treated for a psychiatric disorder?" Regarding medical status participants were asked what type of cancer they had been diagnosed with, when their first diagnosis was, when their first and last treatments were, and what type(s) of treatments they had undergone (i.e. surgery, radiation therapy, chemotherapy, hormone therapy, or gene therapy).

Variables to Assess Feasibility, Acceptance, and Ease of Use of the Online Questionnaire

Feasibility and participant acceptance of the online data collection system was assessed using items from the assessment tool implemented by the Office of Information and Technology Services at the University of North Carolina at Chapel Hill to assess the efficacy of online course evaluations. Specifically participants were asked where they completed the questionnaire, how long it took to complete, and how difficult it was to complete. To assess difficulty participants were asked how difficult they found the online questionnaire to complete; responses were given using an electronic visual analogue scale (E-VAS) anchored at "Not difficult at all" and "Extremely difficult."

Measures to Assess Additional Psychosocial Constructs

Posttraumatic cognitions. Posttraumatic cognitions were assessed using the 36-item Posttraumatic Cognitions Inventory (PTCI; Beck et al., 2004; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). The PTCI is a 36-item measure designed to assess posttraumatic cognitions. It consists of three factors: negative cognitions about self; negative cognitions about the world; and self-blame. Exemplar items include; "People can't be trusted"; "I am inadequate"; "The event happened to me because of the sort of person I am"; and "I have permanently changed for the worse." The PTCI demonstrated adequate internal validity with an internal consistency alpha of .94 in the current study. Posttraumatic cognitions were also assessed with a modified version of the rumination scales used by Calhoun and colleagues (2000). The items on both scales retrospectively assess intrusive and deliberate thoughts, shortly after the trauma and in the preceding two weeks, that are common in posttraumatic cognition. The scales include items such as "Thoughts about the experience came into my mind and I could not get rid of them" and "I deliberately think about the event to try to make sense out of it." The derived "rumination" scale demonstrated adequate internal consistency with alpha coefficients of .84.

Personal growth initiative. The Personal Growth Initiative Scale (PGIS; Robitschek, 1998) was incorporated to explore the relation between the constructs of personal and posttraumatic growth. The PGIS is a 9-item measure designed to assess personal growth initiative, including items such as "I know how to change specific things that I want to change in my life," "If I want to change something in my life, I initiate the transition process," and "I know what my unique contribution to the world might be." The PGIS demonstrated adequate internal validity with an internal consistency alpha of .92 in the current study.

Data Management and Analysis

All data were entered by participants into an Adobe Flash™ based user interface and transmitted via the internet to a secure server on the UNC network using 128-bit encrypted Secure Socket Layer (SSL) protocol and Microsoft Active Server Pages (ASP)™ into a MySQL™ database on a password protected web-server located on the UNC-CH internal network. Data were imported into Microsoft Excel for visual inspection and de-identification of the data set. The data set was subsequently imported into SPSS for further data management and analysis.

Inclusion, exclusion, feasibility, and acceptance. Data on inclusion in the study were calculated based on the estimated number of participants that were initially contacted, interested in participating, met inclusion criteria, and ultimately participated in the study. Information on feasibility and acceptance was generated based on the results of the inclusion/exclusion calculations and descriptive statistics from the feasibility and acceptance questions.

Descriptive statistics including mean, standard deviation, and 95% confidence intervals were calculated for all demographic (gender, age, race, and education), medical status (type of cancer, time since diagnosis and having had surgery, chemotherapy or radiation), primary predictor (posttraumatic growth, posttraumatic stress symptoms), health outcome (physical health symptoms, quality of life, and depressive symptoms), feasibility/acceptance, and alternative model (perceived stress, rumination, posttraumatic cognitions, and personal growth initiative) variables. In order to assess the reliability of the measures on the questionnaire, internal reliability analyses (Cronbach's Alpha) were calculated. In order to assess construct validity Pearson-product moment correlations were calculated to evaluate the strength, direction, and significance of the relations between all primary predictor, primary outcome, and alternative model variables.

Hypothesis testing. Bivariate correlations (Pearson's *r* and Spearman's *rho* for continuous and ordinal variables, respectively) between each demographic, medical, predictor, and health outcome variable were calculated to identify potential covariates. All demographic and medical variables that were correlated at the $p < .10$ level with any of the three health outcome variables were included in subsequent multivariate analysis. As recommended by Aiken and West (1991), mean centered scores for all continuous independent variables were calculated and used in all subsequent analysis. Additionally, interaction terms (e.g. posttraumatic stress symptoms X posttraumatic growth) were calculated by multiplying the previously centered variables. Statistical testing was two-tailed, with a critical alpha of .05 and controlled for relevant demographic and medical variables.

To test Hypotheses 1 a series of multivariate analyses of variance (MANOVA) was conducted in which scores for each health outcome variable (distress about physical health symptoms, quality of life, and depressive symptoms) were regressed on posttraumatic stress symptoms (Hypothesis 1a.); posttraumatic

stress symptoms and posttraumatic growth (Hypothesis 1b); and posttraumatic stress symptoms, posttraumatic growth and their interaction (Hypothesis 1c).

To test Hypotheses 2, a series of MANOVA was conducted in which scores for the three health outcome variables were regressed on perceived stress (Hypothesis 2a.); perceived stress, posttraumatic stress symptoms and posttraumatic growth (Hypothesis 2b.); and perceived stress, posttraumatic stress symptoms, posttraumatic growth and the interaction of perceived stress and posttraumatic stress symptoms (Hypothesis 2c).

RESULTS

The results section begins with a summary of the data pertaining to recruitment, inclusion, eligibility, participation, feasibility and acceptance of the online data collection system. Second. Second, simple descriptive statistics and the results of reliability and validity testing are presented. Third, detailed results of testing the specific hypotheses, exploring the relations between posttraumatic stress, perceived stress and posttraumatic growth and distress about physical health symptoms, quality of life and depression are given. Fourth, the results of post-hoc analyses, exploring the relative effects of rumination, posttraumatic cognitions, personal growth initiative, and having a history of treatment for a psychiatric disorder on the three health outcome variables are presented.

Inclusion, Exclusion, Missing Data, Feasibility, and Acceptance

Of the 257 potential participants that voluntarily responded to the call for participants, 20 were found to be ineligible based on inclusion criteria (17 indicated they were undergoing active treatment, 2 indicated they were not at least 21 years old, and 1 indicated they had not been diagnosed with cancer). Of the remaining 237 eligible potential participants, 29% (n = 69) decided not to enroll in the study and the remaining 71% of potential participants (n = 168) were enrolled in the study. Data from one participant who enrolled but did not complete several key components of the questionnaire were excluded from further analysis. Two participants' data were excluded from further analysis due to scores on one or more of the outcome measures that were considered to be extreme outliers (i.e. more than 3.5 times the inter-quartile range above or below the median). Hence, the results below represent findings based on 165 participants. The entire process from recruitment through data entry for 165 participants in the current study occurred in the 106 days between 09/15/2010 and 01/01/2011. Of a possible 75,405 data points, less than .01% (n =73) were missing and subsequently replaced with the series mean. On average, participants took 55 minutes to complete the online questionnaire (SD = 22.15 minutes, range 26 - 108 minutes). Overall, participants rated participation as relatively easy with a mean score on the E-VAS difficulty item of 18 out of a possible 100

(range 0 - 83). Most participants completed the questionnaire at home (69.7%) or work (25.5%). Additionally, of the original 168 participants in the study, 67 (39.9%) opted to donate their $10 Amazon.com gift card back to the study. These results indicate that participants readily accepted the study modality, did not have significant difficulty completing the questionnaire, and many were willing to participate in the study without compensation. Additionally, the online data collection system was demonstrated to be a well accepted, user friendly, and efficient tool for collecting bio-psychosocial data from cancer survivors.

Descriptive Statistics

Means, standard deviations, and 95% confidence intervals for all psychosocial variables are depicted in Table 1. Of particular interest to the hypotheses of the current study, participants reported higher levels of posttraumatic stress symptoms with mean PCL-C scores of 32 (*SD* = 12.1, 95% CI = 30.4 - 34.1) when compared to breast cancer patients in my previous research (mean = 24, *SD* = 7.6, 95% CI = 22.9 - 25.3) (Morrill et al., 2008). Eighteen participants (10.9%) met or exceeded the recommended cutoff score of 50 on the PCL-C, indicating they would likely meet DSM-IV criteria for PTSD (Weathers et al., 1991). Participants had relatively lower levels of posttraumatic growth with mean PTGI scores of 65 (*SD* = 21.0, 95% CI = 61.9 – 68.3) when compared with breast cancer survivors in my previous research (mean 73, *SD* = 21.0) (Morrill et al., 2008).

On visual inspection of the raw data from the modified Cohen Hoberman Inventory of Physical Symptoms (CHIPS), a response pattern was observed whereby participants responded only for symptoms that they indicated they had experienced during the preceding two weeks, resulting in 302 missing data points. Due to the potential for spurious findings from this response pattern, and the high correlation of $r = .838$, $p < .01$ between the CHIPS and the physical symptoms subscale of the Rotterdam Symptom Checklist RSCL-PS (the other measure of distress about physical health symptoms), the CHIPS was dropped from the study.

Participants' average level of distress from physical symptoms as measured by the RSCL-PS (mean = 30, *SD* = 6.5, 95% CI = 29.00 - 31.02) was similar to previous research with a comparably heterogeneous sample of cancer survivors (mean = 29, *SD* = 7.1) (de Haes et al., 1990). Participants'

quality of life scores (mean = 82, *SD* = 17.6, 95% CI = 80.2 -85.6) were nearly identical to those of a group of 466 mixed cancer patients in the validation study for the FACT-G (mean = 82, *SD* = 15.9) (Cella et al., 1993). Levels of depressive symptoms as measured by the CES-D (mean = 13, *SD* = 11.6, 95% CI = 11.0 - 14.5) were relatively higher than breast cancer patients (mean = 8, *SD* = 7.7) in previous research (Morrill et al., 2008) and relatively higher than healthy controls (mean = 8, *SD* = 7.5) reported by Hann and colleagues (1999). Using the traditional cutoff score of 16, a total of 46 participants (27.9 %) in the current study reported clinically significant depressive symptoms (Radloff, 1977).

Participants reported a similar level of perceived stress on the E-VAS stress item (mean = 27, *SD* = 22.36, 95% CI = 23.7 - 30.7) when compared with my previous research with a similarly heterogeneous sample of cancer survivors (mean = 32.52, *SD* = 16.05). Participants reported that their biggest stressors were related to work 32.1% (*n*=53); cancer 24.8% (*n*=41); romantic/marital 6.1% (*n*=10); and other 33.3% (*n*=55). Additionally, 39 participants (23.6%) reported having received treatment for a psychiatric disorder. Finally, 17 of the 18 participants with PCL-C scores greater than or equal to 50 (indicating a likelihood that they would currently meet DSM-IV criteria for PTSD) also reported clinically significant levels of depressive symptoms, indicating substantial co-morbidity between depressive and posttraumatic stress symptoms among the participants in the current study.

Reliability and Validity

As shown in Table 2, posttraumatic stress symptom scores were positively associated with perceived stress, posttraumatic cognitions, ruminations, distress about physical health symptoms and depressive symptoms, and negatively associated with personal growth initiative and quality of life. Posttraumatic growth was positively associated with personal growth initiative and quality of life and negatively associated with posttraumatic cognitions and depressive symptoms. Regarding associations among the outcome measures, distress about physical symptoms negatively associated with quality of life and positively associated with depressive symptoms. Quality of life was negatively associated with distress about physical symptoms and depressive symptoms. Depressive symptoms were positively associated with distress about physical symptoms and negatively associated with quality of life.

Although these results suggest a great deal of inter-variable correlation, they represent adequate associations between measures of similar constructs with relatively larger correlations between more similar constructs, all of which are in the expected direction indicating acceptable convergent and discriminate validity. As shown in Table 3, results of analysis of internal reliability indicate similar levels of internal validity for all study variables when compared with paper and pencil versions of the same measures from previous research (Beck et al., 2004; Cella et al., 1993; Foa et al., 1999; Hann et al., 1999; Morrill et al., 2008; Radloff, 1977; Robitschek, 1998; Tedeschi & Calhoun, 1996). As this was a cross-sectional design study, no data on test retest reliability are available for this sample.

Preliminary Analyses

With regard to normality, preliminary analyses indicated the need for transformation of the quality of life and depressive symptoms variables. However, no notable differences appeared in results using the transformed variables versus non-transformed variables, and thus the results of analyses using the non-transformed variables are reported.

In order to determine whether any of the demographic or medical variables were associated with any of the outcome or primary predictor variables, bivariate correlations (Pearson's *r* and Spearman's *rho* for continuous and ordinal variables, respectively) were calculated. As depicted in Table 4, age, gender, education, financial status, time since diagnosis, and time since treatment were associated with one or more of the outcome measures at the $p < .10$ level. Due to the near perfect correlation between time since diagnosis and time since treatment ($r = .97$, $p < .01$) time since treatment was dropped from further analysis.

To evaluate the significance of the association between distress about physical symptoms, quality of life and depressive symptoms and the demographic and medical variables, MANOVA was conducted regressing the three health outcome variables on age, gender, education level, marital status, financial status, and time since diagnosis. Specifically, participants who were older reported lower levels of depressive symptoms; women reported higher levels of distress about physical health symptoms; participants who were married or living as married reported better quality of life and lower levels of

depressive symptoms; and participants with greater financial means reported less distress about physical health symptoms, better quality of life, and lower levels of depressive symptoms.

Interestingly, participants who were further out from diagnosis reported poorer quality of life. A graphical representation of the data (scatterplot) suggested that this counter-intuitive finding was a result of three participants who were more than 25 years post-diagnosis and reported very low levels of quality of life. Results of a bivariate correlation between time since diagnosis and quality of life while excluding these participants statistically confirmed this observation. Consequently, all subsequent analyses were conducted with and without the data from these three potentially problematic participants. There were no substantial differences between the two sets of results. As such there was no statistical justification for excluding the participants, as they were not extreme outliers regarding time since diagnosis or quality of life. Moreover, the three participants represent an important subset of the cancer survivors (i.e. long term survivors with poor quality of life). Therefore, the results of analysis including these three participants are reported below.

As presented in Table 5, results indicate that age, gender, time since diagnosis, marital status and financial status remained associated with one or more of the health outcome variables at the $p < .10$ level following the initial regression. The entire model accounted for 13%, 19%, and 21% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. All subsequent statistical testing was two-tailed, with a critical alpha of .05 and controlled for relevant demographic and medical variables.

Hypothesis 1 Posttraumatic Stress, Posttraumatic Growth, and Health

As presented in Table 6, results of MANOVA for Hypothesis 1 indicate that posttraumatic stress symptom scores were associated with distress about physical symptoms, quality of life, and depressive symptoms (H1a) and posttraumatic growth was associated with quality of life and depressive symptoms while controlling for posttraumatic stress symptoms (H1b). This model accounted for 43%, 58% and 67% of the variance in distress about physical symptoms, quality of life, and depressive symptoms, respectively. Posttraumatic growth accounted for 3% and 2% of the variance in quality of life and depressive symptoms over and above posttraumatic stress symptoms. However, the interaction between posttraumatic stress

symptoms and posttraumatic growth was not significantly associated with any of the three health outcomes at the $p < .05$ level (H1c).

Hypothesis 2 Perceived Stress, Posttraumatic Stress, Posttraumatic Growth, and Health

As presented in Table 7 results of MANOVA indicate that perceived stress was associated with the three health outcomes (H2a). However, after controlling for posttraumatic stress symptoms and posttraumatic growth, perceived stress remained associated with depressive symptoms only (H2b). This model accounted for 44%, 56% and 68% of the variance in distress about physical symptoms, quality of life, and depressive symptoms, respectively. Posttraumatic growth accounted for 3% and 2% of the variance in quality of life and depressive symptoms over and above perceived stress and posttraumatic stress symptoms. However, the interaction between perceived stress and posttraumatic stress symptoms was not significantly associated with any of the three health outcomes at the $p < .05$ level (H2c).

When taken together the results for the main hypotheses indicate that posttraumatic stress symptoms were associated with worse health outcomes; posttraumatic growth was associated with higher levels of quality of life and lower levels of depressive symptoms, and perceived stress was associated with higher levels of depressive symptoms. Additionally, neither the interaction of posttraumatic growth and posttraumatic stress symptoms nor the interaction of perceived stress and posttraumatic stress symptoms were associated with any of the health outcomes. These results indicate that PTSD symptoms are of primary importance when assessing bio-psychosocial health among cancer survivors.

Post Hoc Analyses

Although the evaluation of the effect of rumination, posttraumatic cognitions, personal growth initiative, and having a history of treatment for a psychiatric disorder on the three health outcome variables was not the original aim of the study, as described in detail below, there was sufficient theoretical and empirical rationale for examining the effects of these psychosocial constructs. Thus, the current study examined six alternative models exploring the relations between these potentially salient constructs, the two primary predictor variables (posttraumatic stress symptoms and posttraumatic growth) and the three health outcomes (distress about physical health symptoms, quality of life, and depressive symptoms). For

ease of comparison between models, post hoc analyses were conducted using a similar analytic strategy to that described for Hypothesis 1. As such, statistical testing for the post hoc analyses was two-tailed, with a critical alpha of .05 and controlled for relevant demographic and medical variables.

Omnibus model. The initial post-hoc analysis (model three) was conducted using MANOVA. Specifically, scores for the three health outcome variables were regressed on posttraumatic stress symptoms, posttraumatic growth, perceived stress, rumination, posttraumatic cognitions, personal growth initiative, and a history of treatment for a psychiatric disorder while controlling for the relevant demographic and medical variables. As presented in Table 8, results indicate that posttraumatic stress symptoms scores were significantly associated with distress about physical symptoms, quality of life, and depressive symptoms. Perceived stress was associated with depressive symptoms. Posttraumatic cognition scores were associated with quality of life and depressive symptoms. Personal growth initiative was associated with quality of life and depressive symptoms. Posttraumatic growth, having a history of treatment for a psychiatric disorder, and rumination were not significantly associated with any of the three health outcomes at the $p < .05$ level. The entire model accounted for 45%, 66%, and 72% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively.

Results of analysis testing the omnibus model indicate that, even while controlling for all other study variables, higher levels of posttraumatic stress symptoms were associated with poorer health outcomes; higher levels of posttraumatic cognitions were associated with worse quality of life and more depressive symptoms. Higher levels of personal growth initiative were associated with better quality of life and fewer depressive symptoms, and more perceived stress was associated with higher levels of depressive symptoms. Additionally, results of the omnibus test highlights the importance of assessing posttraumatic stress from both symptoms- and cognitions based perspectives as each have a significant effect on bio-psychosocial health in cancer survivors.

To explore the effect of each individual variable of interest on the three health outcomes in more detail than was possible in the omnibus model, five additional models (models 3-7) were tested using MANOVA. Specifically, the three health outcome variables were regressed on each of the variables of interest (i.e. ruminations, posttraumatic cognitions, personal growth initiative, or having a history of treatment for a psychiatric disorder) in the initial step. The second step in the analytic procedure included posttraumatic

stress symptoms and posttraumatic growth in the model. If the particular model being tested included an interaction term, it was added and evaluated in step three. The final post-hoc model (model eight) evaluated the significance of the association between depressive symptoms and distress about physical symptoms and quality of life using the previously described analytic procedure.

Models 4 and 5: Rumination and posttraumatic cognitions. Researchers have emphasized the importance of rumination and posttraumatic cognitions in the development and maintenance of posttraumatic stress symptoms (Beck et al., 2004; Calhoun et al., 2000; Foa et al., 1999). Several items on the measures used in the current study to assess ruminations and posttraumatic cognitions could be used to assess factors on both the re-experiencing and avoidance symptom clusters as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; American Psychiatric Association, 1994). The potential theoretical overlap between the constructs of posttraumatic stress symptoms, rumination, and posttraumatic cognitions is bolstered by the results of preliminary data analyses in the current study as evidenced by the moderate to high correlations between posttraumatic stress symptoms and rumination ($r = .54$, $p < .01$) and posttraumatic cognitions ($r = .73$, $p < .01$).

As previously outlined, both of these relevant constructs play an important role in the theoretical framework of posttraumatic growth. Specifically the transformation of automatic, intrusive, negative ruminations, posttraumatic cognitions, and intrusive thoughts into positive, growth oriented, narrative-developing intentional thoughts is central to Tedeschi and Calhoun's (2004) model of the psychosocial process by which posttraumatic growth develops. Thus, models three and four evaluated the relative effect of rumination, posttraumatic cognitions, and the interactions of posttraumatic growth with rumination, and posttraumatic cognitions on the three health outcomes

Model 4 examined the relative effect of rumination on the three health outcomes. As presented in Table 9, results indicate that rumination was significantly associated with distress about physical symptoms, quality of life and depressive symptoms. The entire model accounted for 26%, 32%, and 30% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Rumination accounted for 13%, 14%, and 8% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms over and above relevant demographic and medical variables. However, after including posttraumatic stress symptoms and posttraumatic growth in the model,

results indicate that rumination did not remain significantly associated with any of the health outcomes measures at the $p < .05$ level. The entire model accounted for 44%, 59%, and 67% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Posttraumatic growth accounted for 3% and 2% of the variance in quality of life and depressive symptoms over and above rumination and posttraumatic stress symptoms. Additionally the interaction of rumination and posttraumatic growth was not significantly associated at the $p < .05$ level with any of the three outcomes.

Model 5 examined the relative effect of posttraumatic cognitions on the three health outcomes. As presented in Table 10, results indicate that posttraumatic cognitions were significantly associated with distress about physical symptoms, quality of life, and depressive symptoms. The entire model accounted for 35%, 55%, and 58% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Posttraumatic cognitions, as measured by the PTCI, accounted for 22%, 36%, and 36% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms over and above relevant demographic and medical variables.

After including posttraumatic stress symptom and posttraumatic growth in the model, results indicate that posttraumatic cognition scores remained associated with all three health outcomes. The entire model accounted for 45%, 64%, and 70% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Posttraumatic growth accounted for 2% and 1% of the variance in quality of life and depressive symptoms over and above posttraumatic cognitions and posttraumatic stress symptoms. However, the interaction of posttraumatic cognition scores and posttraumatic growth was not significantly associated with any of the three outcomes at the $p < .05$ level.

When taken together, the results of analyses for rumination and posttraumatic cognitions indicate that higher levels of posttraumatic cognitions were associated with worse health outcomes; however, rumination was not significantly associated with any of the health outcomes while controlling for posttraumatic stress symptoms and posttraumatic growth. Furthermore, the interaction of posttraumatic growth with posttraumatic cognitions and the interaction of posttraumatic growth with rumination were not significantly associated with any of the three health outcomes at the $p < .05$ level.

Model 6: Personal growth initiative. As previously discussed, personal growth has been described as an important process that produces positive personal change and development. Developmental, environmental, and intentional events and processes can act as a catalyst for continued personal growth across the lifespan (Robitschek, 1998). Cancer diagnosis, treatment, and survivorship could be seen as an example of a traumatic environmental experience that has the potential to foster ongoing personal growth. When personal growth is stimulated by a traumatic environmental event or process such as the cancer experience, it is often referred to as posttraumatic growth or benefit finding (Widows et al., 2005). In their discussion of trauma and transformation Tedeschi and Calhoun (1995) indicate that this type of personal development can be triggered by traumatic experiences such as cancer diagnosis, treatment, and survivorship. In addition to the theoretical overlap between the constructs of personal and posttraumatic growth, results of preliminary analysis indicate that there are moderate to high correlations between personal growth and posttraumatic growth and all three health outcome variables are significant at the $p < .01$ level. Thus, model 6 evaluated the relative effect of personal growth initiative, posttraumatic stress symptoms, posttraumatic growth and the interaction of personal growth initiative with posttraumatic stress symptoms on the three health outcomes.

As presented in Table 11, results indicate that personal growth initiative was associated with distress about physical symptoms, quality of life, and depressive symptoms. The entire model accounted for 24%, 46%, and 47% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Personal growth initiative, as measured by the PGIS accounted for 11%, 28%, and 26% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms over and above relevant demographic and medical variables.

After including posttraumatic stress symptom and posttraumatic growth in the model, results indicate that personal growth initiative remained associated with quality of life and depressive symptoms. However, posttraumatic growth was not significantly associated with any of the health outcomes at the $p < .05$ level. The entire model accounted for 44%, 64%, and 70% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Additionally, the association between the interaction of personal growth initiative and posttraumatic stress symptoms was associated

with quality of life at the $p < .05$ level. The entire model accounted for 44%, 64%, and 70% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively.

To explicate the significant interaction, multiple linear regression analysis was conducted in which quality of life was regressed on personal growth initiative, posttraumatic stress symptoms, and the interaction of personal growth initiative and posttraumatic stress symptoms while controlling for demographic and medical variables that were associated with quality of life at the $p < .10$ level. The interaction effect was explicated using Aiken and West's (1991) method for probing interactions among continuous variables. Specifically the results of the aforementioned analysis were used to plot simple slopes with points at one standard deviation above and below the mean for personal growth initiative, and from the lowest level to the highest level in the sample for posttraumatic stress symptoms. The graph depicted in Figure 3 indicates that increasing levels of personal growth initiative and decreasing levels of posttraumatic stress were associated with better health outcomes, and decreasing levels of personal growth initiative, and increasing levels of posttraumatic stress were associated with worse health outcomes.

Results of these analyses indicate that participants who reported more personal growth initiative experienced better quality of life and fewer depressive symptoms. Posttraumatic growth was not significantly associated with any of the three health outcomes while controlling for posttraumatic stress and personal growth initiative, indicating potential mediation of the relation between posttraumatic growth and quality of life and depressive symptoms by personal growth initiative. Additionally, personal growth initiative appeared to buffer the relation between posttraumatic stress symptoms and quality of life.

Models 7 and 8: Previous psychiatric diagnosis and depressive symptoms. Research has indicated that as many as 39% of cancer patients meet criteria for a psychiatric disorder (Derogatis et al., 1983; Harrison, Maguire, Ibbotson, MacLeod, & Hopwood, 1994; Mehnert & Koch, 2007). According to Derogatis and colleagues (1983) the vast majority of patients who meet criteria for a psychiatric disorder suffered from depression, anxiety, or both. As discussed by Clark and Watson (1991) there is considerable overlap between the symptoms of anxiety disorders such as PTSD and depression. In fact, research in both humans and animals have demonstrated physiological underpinnings that explain the overlap in symptomatology of anxiety and mood disorders such as PTSD and depression (Fuchs et al., 2004; Vermetten et al., 2003). Given the substantial overlap in symptoms of depression and PTSD, the elevated

levels of depressive and posttraumatic stress symptoms, and high co-morbidity reported by participants in the current study, it is important to evaluate the extent to which current depression or a history of treatment for a psychiatric disorder may have a role in explaining psychosocial health among cancer survivors. Thus, models 7 and 8 evaluated the relative effect of having a history of treatment for a psychiatric disorder on the three health outcomes and the effect of depressive symptoms on the other two health outcomes, distress about physical health symptoms and quality of life, respectively.

Model 7 examined the relative effect of having a history of treatment for a psychiatric disorder on the three health outcomes. As presented in Table 12, results indicate that having a history of treatment for a psychiatric disorder was associated with distress about physical symptoms, quality of life, and depressive symptoms. The entire model accounted for 18%, 25%, and 24% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Having a history of treatment for a psychiatric disorder accounted for 5%, 6%, and 3% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms over and above relevant demographic and medical variables.

After adding posttraumatic stress and posttraumatic growth to the model, results indicate that a history of treatment for a psychiatric disorder did not remain significantly associated with any of the three health outcomes at the $p < .05$ level. The entire model accounted for 44%, 59%, and 66% of the variance in distress about physical health symptoms, quality of life, and depressive symptoms, respectively. Posttraumatic growth accounted for 2% and 1% of the variance in quality of life and depressive symptoms over and above having a history of treatment for a psychiatric disorder and posttraumatic stress symptoms.

Model 8 examined the relative effect of depressive symptoms on distress about physical symptoms and quality of life. As presented in Table 13, results indicate that depressive symptoms were associated with distress about physical symptoms and quality of life. The entire model accounted for 49% and 62% of the variance in distress about physical health symptoms and quality of life. Depressive symptoms, as measured by the CES-D, accounted for 35% and 44% of the variance in distress about physical health symptoms and quality of life over and above relevant demographic and medical variables.

After adding posttraumatic stress symptoms and posttraumatic growth to the model, results indicate that depressive symptoms remained associated with distress about physical symptoms and quality of life.

Posttraumatic stress symptoms scores were associated with distress about physical symptoms and quality of life, and posttraumatic growth was associated with quality of life. The entire model accounted for 51% and 66% of the variance in distress about physical health symptoms and quality of life, respectively. Posttraumatic growth, as measured by the PTGI, accounted for less than 1% of the variance in quality of life over and above depressive symptoms and posttraumatic stress symptoms.

When taken together, the results of analyses for a history of treatment for a psychiatric disorder and depressive symptoms indicate participants with higher levels of depressive symptoms experienced more distress about physical health symptoms and poorer quality of life. However, having a history of treatment for a psychiatric disorder did not remain associated with any of the health outcomes while controlling for posttraumatic stress symptoms scores and posttraumatic growth.

Summary of Results

For ease of comparison between the models tested in the current study, the amount of variance in each health outcome accounted for by each predictor and ensuing model for the main hypotheses and post hoc analyses are depicted in Table 14 and Table 15, respectively.

When taken as a whole the previously described results partially support Hypotheses 1. Posttraumatic stress symptoms were associated with poorer health outcomes (H1a), posttraumatic growth was associated with better quality of life and fewer depressive symptoms (H1b), and these results remained relatively unchanged with both posttraumatic stress symptoms and posttraumatic growth in the model (H1c). However, the buffering effect of posttraumatic growth on the relation between posttraumatic stress symptoms and the three health outcomes was not supported (H1d). Additionally, regarding Hypothesis 2 perceived stress was associated with poorer health outcomes (H2a), although after controlling for posttraumatic stress symptoms and posttraumatic growth, perceived stress remained associated with depressive symptoms only (H2b). Furthermore, the exacerbating effect of perceived stress on the relations between posttraumatic stress symptoms and the three health outcomes was not supported (H2c).

The results of post-hoc analyses indicate participants with higher levels of posttraumatic cognitions or more depressive symptoms reported more distress about physical health symptoms. Participants with lower levels of posttraumatic cognitions and/or higher levels of personal growth initiative reported better quality

of life. Participants who experienced lower levels of perceived stress, fewer posttraumatic cognitions, or higher levels of personal growth initiative reported less depressive symptoms. Rumination and having a history of treatment for a psychiatric disorder did not account for a significant amount of the variance in any of the health outcomes while controlling for posttraumatic stress symptoms and posttraumatic growth.

Overall, posttraumatic stress symptoms accounted for a significant amount of the variance in all three health outcomes across all models while controlling for all predictors. Thus, the results of the current study indicate posttraumatic stress is of primary importance when assessing bio-psychosocial health among cancer survivors. Although posttraumatic growth accounted for a significant amount of variance in quality of life and depressive symptoms in all models except for models controlling for personal growth initiative, the unique contribution of posttraumatic growth was relatively small (range R^2 = .09% - R^2 = 3.1%).

Results of analyses exploring the effect of posttraumatic growth and personal growth initiative on the three health outcomes may indicate potential mediation of the relations between posttraumatic growth and quality of life and depressive symptoms by personal growth initiative. Finally, personal growth initiative appeared to buffer the relation between PTSD symptoms and quality of life at the $p < .05$ level.

Generally, these results highlight potential ramifications of posttraumatic stress, growth and cognitions as they relate to distress about physical health symptoms, quality of life and depressive symptoms in cancer survivors. Additionally, these results indicate the importance of assessing posttraumatic stress from both symptoms and cognitions based perspectives as each have a significant effect on bio-psychosocial health in cancer survivors. Finally, results highlight the potential importance of personal growth and its buffering effect on the relation between PTSD symptoms and quality of life and when making inferences about the effect of posttraumatic growth on quality of life and depressive symptoms.

DISCUSSION

The discussion section is organized as follows: First, I provide an overview of the findings of the study regarding the posttraumatic growth and posttraumatic stress as they relate to the conceptual model put forth in the introduction; Second, findings regarding the role of perceived stress, the feasibility and acceptance of the online data collection system, and post-hoc analyses as they relate to previous research are presented; third, limitations of the study are discussed; and fourth, implications of the results of the current study as they relate to future research and clinical practice are presented.

Overview

Building on cognitive theory and positive psychology this cross-sectional study sought to examine a theoretical model of the buffering effect of posttraumatic growth on the relation between posttraumatic stress symptoms and health outcomes among cancer survivors. Specifically, I examined four principle components of the model: the relation between the experience of cancer diagnosis, treatment, and survivorship and posttraumatic stress; the relation between posttraumatic stress and well-being; the relation between posttraumatic growth and well-being; and the potentially buffering effect of posttraumatic growth on the relation between posttraumatic stress and well-being.

Cancer and posttraumatic stress. For many, the cancer experience starts with apprehension and ambiguity prior to a screening test, such as mammography or colonoscopy. For others the cancer experience begins with a problematic symptom, lump, or other physical manifestation such as a seizure or the rapid onset of severe and debilitating pain that might lead to an emergency room visit (American Cancer Society, 2010). Regardless of how a person's cancer experience begins, the most common forms of treatment following diagnosis are surgery, irradiation, chemotherapy, and in many cases, some form of maintenance therapy to prevent recurrence (National Cancer Institute, 2011a). Cancer patients often experience unpleasant side effects from prolonged treatment including nausea, hair loss, fatigue, and cognitive deficits (Kangas et al., 2002).

In general, the initial phases of diagnosis and active treatment seem to be the most traumatic or life-altering aspects of the cancer experience. However, many cancer survivors continue to have fatigue, pain, swelling, acute illnesses, fears of recurrence, and psychological distress for many years following active treatment (Abercrombie et al., 2004; Gil, Mishel et al., 2004; Golden Kreutz et al., 2004; Morrill et al., 2008; National Cancer Institute, 2007b).

Although, the prevalence of diagnosable psychiatric disorders in cancer survivors is similar to that found in the general population (Mehnert & Koch, 2007), many individuals who survive cancer appear to be at risk for significant psychological problems that may persist for years after the conclusion of treatment (Gurevich et al., 2004; Kangas et al., 2002). In the current study of cancer survivors, who were up to 35 years post-diagnosis, as many as 11% of participants likely met criteria for PTSD. This level of occurrence of PTSD symptoms supports the theorized relation between cancer diagnosis, treatment, and survivorship and posttraumatic stress and demonstrates a substantial number of cancer survivors may suffer from PTSD symptoms which may in turn lead to poorer physical and psychological health outcomes.

Posttraumatic stress and well-being. Findings regarding the link between posttraumatic stress symptoms and well-being support the theoretical model of the study and extend previous research that has reported associations between PTSD symptoms and well-being among cancer patients and survivors (Cordova et al., 1995; Morrill et al., 2008; Schwartz & Drotar, 2006). As predicted the current study found a positive association between PTSD symptoms and distress about physical health symptoms and depressive symptoms as well as a significant negative association between PTSD symptoms and quality of life. In our previous research we found similar results regarding the prediction of quality of life and depressive symptoms in a sample of breast cancer survivors (Morrill et al., 2008), but physical health symptoms were not measured. The current findings suggest a link between PTSD symptoms and distress about physical health symptoms in cancer survivors in addition to quality of life and depressive symptoms. This finding is important since not only are physical health symptoms problematic in their own right, it is possible that they may trigger uncertainty about cancer recurrence, potentially leading to more distress (Gil, Mishel et al., 2004).

Although cancer-related PTSD is not substantially more common among cancer survivors than the general population, up to half of cancer patients and survivors may experience posttraumatic stress

symptoms as a result of their disease (Gurevich et al., 2004). Thus considering the link between cancer-related PTSD symptoms well-being and the fact that there are nearly 12 million cancer survivors in the United States, cancer-related posttraumatic stress symptoms have the potential to negatively impact the lives of millions of cancer survivors (National Cancer Institute, 2011b).

Posttraumatic growth and well-being. The current study put forth the hypotheses that in the context of the cancer experience, posttraumatic growth may improve important psychological outcomes, including distress about physical health symptoms, quality of life, and depression. Results of the current study support the conceptual model, and are consistent with previous research that has reported associations between posttraumatic growth and quality of life and depressive symptoms (Helgeson et al., 2006; Morrill et al., 2008; Stanton et al., 2006). For example, in a meta-analytic review of 87 cross-sectional studies, Helgeson and colleagues (2006) found consistent associations between posttraumatic growth and fewer depressive symptoms in various samples of cancer patients and survivors. As a result of their comprehensive review of the literature on posttraumatic growth, Stanton and colleagues (Stanton et al., 2006) found mixed results regarding the association between posttraumatic growth and quality of life, with some studies finding significant positive associations, other studies finding significant negative associations, and most studies reporting no significant findings. Thus, results from the current study bolster research reporting a link between posttraumatic growth and depressive symptoms and quality of life and highlight the importance of posttraumatic growth regarding psychosocial health among cancer survivors.

The buffering effect of posttraumatic growth. Tedeschi and Calhoun (2004) proffered the idea that posttraumatic growth may also offer more complex benefits than those previously explored in the literature. Based on this supposition, the current study put forth a conceptual model that included a theorized buffering effect of posttraumatic growth on the relation between posttraumatic stress and well-being in cancer survivors. The findings of the current study failed to support this component of the theoretical model and were inconsistent with previous research (Morrill et al., 2008; Park et al., 2010). Although Park and colleagues did not utilize an omnibus measure of PTSD symptoms, they report a buffering effect of posttraumatic growth on the relations between intrusive thoughts and spiritual well-being, life satisfaction, and negative affect.

Some of the differences in results between the current study and our previous research may be sample-related. The current study sample which included survivors of any type of cancer was more heterogeneous than our previous research focusing on breast cancer survivors (Morrill et al., 2008). Specifically, the inclusion of participants with multiple types and stages of cancer diagnoses in the current study introduces extraneous variance in the outcome variables due to disease characteristics. This type of variance is not present in a sample comprising survivors of a single type of cancer.

Relative levels of psychopathology among participants may also have led to the disparity in results. Participants in the current study reported higher levels of posttraumatic stress symptoms when compared to breast cancer patients in our previous research (Morrill et al., 2008). In the current study, 10.3% (n = 16) of participants met or exceeded the recommended cutoff score of 50 on the PCL-C, indicating they would likely meet DSM-IV criteria for PTSD (American Psychiatric Association, 1994; Weathers et al., 1991). Levels of depressive symptoms as measured by the CES-D in the current study were relatively higher than breast cancer patients in our previous research (Morrill et al., 2008). Using the traditional cutoff score of 16, nearly 30% of participants reported clinically significant depressive symptoms (Radloff, 1977). Additionally, 23.6% of participants reported having received treatment for a psychiatric disorder whereas our previous research excluded participants with a history of serious psychiatric diagnosis (Morrill et al., 2008). Additionally, participants in the current study reported lower levels of posttraumatic growth when compared to our previous research (Morrill et al., 2008). Thus, the increased presence of potential psychopathology may have mitigated the hypothesized buffering effect of posttraumatic growth. Specifically, it is possible that the buffering effect of posttraumatic growth is moderated by severity of psychopathology.

Conceptual summary. When taken together findings of the current study indicate that many cancer survivors experience profound changes between their pre sense of self and world view and their sense of self and world view following diagnosis and treatment. This disparity may lead to PTSD symptoms, which cancer survivors may experience for years following diagnosis. Additionally, this response to profound schema change may lead to increased negative psychological responses (i.e. anxiety, negative affect, intrusive thoughts, catastrophic thinking, posttraumatic cognitions, rumination, and intrusive thoughts).

Furthermore, PTSD symptoms may play an important role in quality of life and both physical and psychological health among cancer survivors.

Despite the negative bio-psycho-social outcomes of cancer and cancer related PTSD symptoms many cancer survivors experience posttraumatic growth which may include a transformation of their automatic, intrusive, and negative ruminations into deliberate, growth oriented, narrative developing ruminations by a combination of internal and external self disclosure, positive social support, active coping, cognitive reframing, and disengagement from previous goals and incorporation of revised life goals. Additionally findings of the current study indicate a link between posttraumatic growth and better quality of life, and lower levels of depressive symptoms.

Although findings of the current study did not support the theorized buffering effect of posttraumatic growth, personal growth, a closely related construct, did appear to moderate the relation between PTSD symptoms and quality of life in beneficial ways. These results indicate that a broader conceptualization may be needed to capture the growth that may occur during the cancer experience and highlight the importance of assessing personal growth in addition to posttraumatic growth in future research attempting to elucidate the potential positive outcomes of inherently negative life experiences.

Perceived Stress, Posttraumatic Stress Symptoms, Posttraumatic Growth and Health

The results of the current study indicate that perceived stress accounted for a substantial amount of variance in distress about physical health symptoms, quality of life, and depressive symptoms (H2a). However, after controlling for posttraumatic stress symptoms and posttraumatic growth, perceived stress remained associated with only depressive symptoms (H2b). The results regarding the main effects of perceived stress as it relates to bio-psychosocial health partially support the hypotheses and are generally consistent with previous research in cancer survivors and other chronically ill groups (S. Cohen et al., 1993; DeLongis et al., 1988; Gil, Carson et al., 2004; Reibel et al., 2001). For example, Cohen and colleagues (1993) report significant associations between perceived stress, negative affect and negative health outcomes in a sample of healthy participants who were exposed to a common cold virus and monitored for the presence of clinical illness. When PTSD symptoms and posttraumatic growth were added to the model, perceived stress did not remain associated with physical symptoms and quality of life. This indicates the

possibility that PTSD symptoms mediate the association between perceived stress and physical health symptoms and quality of life. Furthermore, results did not support the hypothesized exacerbating effect of perceived stress on the relations between posttraumatic stress symptoms and the three health outcomes (H2c).

Thus, results of the current study emphasize the importance of PTSD symptoms regarding bio-psychosocial health among cancer patients and survivors. Furthermore, because PTSD symptoms may confound the relations between perceived stress and well-being, results highlight the necessity of assessing PTSD symptoms in research exploring the associations between perceived stress, physical health symptoms, and quality of life among cancer survivors. These findings have important implications regarding increased screening for PTSD among cancer patients and survivors. Ideally screening should lead to referral for further diagnostic assessment and treatment of PTSD where clinically appropriate.

Internet-Based Data Collection

Over the past decade, researchers have become increasingly interested in use of Internet-based data collection methods (Bauer et al., 2004; Bliven et al., 2001; Fergusson et al., 2003; Park et al., 2004; Whybrow et al., 2003). This is partially due to increasing levels of internet access, the inherent ability to reach participants where and when it is convenient for them, and the superior efficiency of internet-based data collection when compared to face-to-face and paper and pencil methodology.

For the current study, I designed an easy to use Internet-based data collection system to assess bio-psychosocial factors among cancer survivors. The current study extends research on internet-based data collection by evaluating bio-psychosocial health in cancer survivors. Consistent with previous research, results of this study indicate that participants were comfortable using the online application and did not have difficulty completing the questionnaire without additional technical support (Bliven et al., 2001). Additionally, the internet-based data collection system used in this study increased the efficiency of data collection. Compared to traditional paper and pencil questionnaires that are commonly returned by mail and hand-scored with subsequent manual data entry and coding, the online system streamlined the recruitment, screening, consent, enrollment, data entry, and data management processes. Specifically, in the current study recruitment, screening, consent, enrollment, data entry and coding were accomplished for 168

participants in 108 days with a substantial reduction in labor, expense, and missing data when compared to traditional paper and pencil survey methodology.

The online data collection application took, on average, less than one hour to complete. Most participants completed the questionnaire in their home or at work and indicated that they found the online questionnaire easy to use. Additionally, nearly 40% of participants opted to donate their gift card back to the study. These results indicate that participants readily accepted the study modality, they did not have significant difficulty completing the questionnaire, and many were willing to participate in the study without compensation.

As depicted in Table 3 internal reliability of the electronic measures was comparable with that of paper and pencil versions of the same measures reported in previous research (Beck et al., 2004; Cella et al., 1993; Foa et al., 1999; Hann et al., 1999; Morrill et al., 2008; Radloff, 1977; Robitschek, 1998; Tedeschi & Calhoun, 1996). These findings extend previous research on internet-based data collection into the area of psycho-oncology (Bliven et al., 2001; Cantrell & Lupinacci, 2007; Metzger et al., 2003; Ritter et al., 2004).

For example, Ritter, and colleagues (2004) reported that among chronically ill participants no significant psychometric differences were found in 14 of the 16 self-report psychological and physical health related measures completed. Bliven and colleagues (2001) reported that in a sample of cardiology outpatients, more than 80% preferred the internet-based collection over the paper and pencil versions, nearly 90% were comfortable using the application without additional technical support, and that data collected using electronic and paper and pencil versions were consistent.

Furthermore, the current study extends research on internet-based data collection by evaluating the effects of posttraumatic stress symptoms and posttraumatic growth on distress about physical health symptoms, quality of life, and depressive symptoms in cancer survivors. Implications for future research include the use of the online data collection system designed for this study in conjunction with physiological measures or neuropsychological assessment. Clinical implications of the results include the use of ongoing online assessment of bio-psychosocial health in conjunction with face-to-face and telehealth based clinical services.

Despite the advantages, however, issues specific to internet-based data collection arose. For example, not all cancer patients and survivors have reliable internet access, limiting samples to those with access, thus reducing potential inclusion and therefore generalizability.

The Role of Demographic and Medical Variables

Results of the current study indicate that participants who were older reported lower levels of depressive symptoms; women reported higher levels of distress about physical health symptoms; and participants who were married or living as married reported better quality of life and lower levels of depressive symptoms. Additionally, participants with greater financial means reported less distress about physical health symptoms, better quality of life, and lower levels of depressive symptoms. Although age, gender, and marital status each was associated with one or more health outcomes, financial status was the strongest demographic or medical predictor of positive health outcomes among cancer survivors. Thus, it is possible that having greater financial resources may be associated with increased access to physical and mental healthcare services, more social support, and increased psychosocial resources with which to cope with cancer and non-cancer related stressors.

Post Hoc Analyses

Omnibus model. The first post-hoc model examined the associations between all of the primary and alternative model predictors and the three health outcomes simultaneously to assess their unique contribution while controlling for all other study variables. Results indicate that even while controlling for all other predictors, PTSD symptoms were associated with poorer health outcomes; posttraumatic cognitions were associated with poorer quality of life and higher levels of depressive symptoms; personal growth initiative was associated with better quality of life and lower levels of depressive symptoms; and perceived stress was associated with higher levels of depressive symptoms.

Results of the omnibus test highlight the importance of assessing posttraumatic stress from both symptoms and cognitions-based perspectives as each are independently associated with well-being in cancer survivors.

Posttraumatic cognitions. Researchers have emphasized the importance of posttraumatic cognitions in the development and maintenance of posttraumatic stress symptoms (Beck et al., 2004; Calhoun et al., 2000; Foa et al., 1999). For example, Foa and colleagues (1999) reported that the posttraumatic cognitions inventory (PTCI) was able to discriminate between traumatized individuals with and without PTSD even after controlling for depression and anxiety. Although posttraumatic cognitions and intrusive thoughts are similar but distinct constructs, many of the items on the PTCI form the content of common intrusive thoughts among cancer survivors. Previous research conducted by Whitaker and colleagues (2009) has reported similar effects for both intrusive thoughts and posttraumatic cognitions on psychosocial health among cancer patients and survivors using the eight-item intrusive thoughts subscale of the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979).

Posttraumatic cognitions play an important role in the theoretical framework of posttraumatic growth. Specifically the transformation of automatic ruminations, posttraumatic cognitions, and intrusive thoughts with a negative valence into deliberate, growth-oriented, positive narrative developing intentional thoughts is central to Tedeschi and Calhoun's (2004) model of the psychosocial process by which posttraumatic growth develops. Thus, the current study evaluated the relative effect of posttraumatic cognitions, and the interaction of posttraumatic growth and posttraumatic cognitions on the three health outcomes.

Posttraumatic cognitions were associated with the three health outcomes, while controlling for posttraumatic stress symptoms and posttraumatic growth. These results bolster previous research reporting associations between intrusive thoughts and bio-psychosocial health among cancer patients and survivors (Vickberg et al., 2000; Whitaker et al., 2009). For example, Whitaker and colleagues (2009) report that nearly 50% of anxious cancer patients in their study had frequent uncontrollable intrusive cognitions that were associated with severity of depression. Additionally, the current study extends previous research by establishing an association between the construct of posttraumatic cognitions (per se) and distress about physical health symptoms and quality of life among cancer patients.

Personal growth initiative. Personal growth has been described as a process by which developmental, environmental, and intentional experiences act as a catalyst for continued personal growth that produces positive personal change and development across the lifespan (Robitschek, 1998). When personal growth is stimulated by a traumatic environmental event or process such as the cancer experience,

it can be interpreted as posttraumatic growth (Tedeschi & Calhoun, 1995). Thus, this study evaluated the relative effect of personal growth initiative, posttraumatic stress symptoms, posttraumatic growth and the interaction of personal growth initiative with posttraumatic stress symptoms on the three health outcomes.

Results indicate that personal growth initiative was associated with better quality of life and fewer depressive symptoms while controlling for PTSD symptoms and posttraumatic growth. Additionally, in this analysis, posttraumatic growth was not associated with any of the three health outcomes and personal growth initiative appeared to buffer the relation between posttraumatic stress symptoms and quality of life. These results highlight the importance of assessing personal growth in addition to posttraumatic growth in future research attempting to elucidate the potential positive outcomes of inherently negative life experiences.

Depressive symptoms. As discussed by Clark and Watson (1991) there is considerable overlap between the symptoms of anxiety disorders such as PTSD and depression. Given the substantial overlap in symptoms of depression and PTSD, and the elevated levels of depressive and posttraumatic stress symptoms reported by participants in the current study, it is important to evaluate the extent to which current depression affects bio-psychosocial health among cancer survivors. Thus, the current study evaluated the relative effect of depressive symptoms on distress about physical health symptoms and quality of life.

The results indicate that depressive symptoms were associated with increased distress about physical health and poorer quality of life while controlling for posttraumatic stress symptoms and posttraumatic growth. The prevalence of depressive symptoms in this sample and the association between those symptoms and health outcomes are consistent with previous research (Derogatis et al., 1983; Harrison et al., 1994; Mehnert & Koch, 2007). Meaning that in addition to PTSD symptoms, many cancer survivors have clinically significant levels of depressive symptoms that often begin shortly after diagnosis and may last for years following the conclusion of treatment. These findings again highlight the importance of adequate psychological screening in research and clinical settings leading to diagnostic assessment and treatment when appropriate.

When taken as a whole, the results previously described indicate that in addition to PTSD symptoms and posttraumatic growth, posttraumatic cognitions, personal growth initiative, and perceived stress were

the strongest correlates of bio-psychosocial health among cancer survivors. Future longitudinal research may be beneficial in elucidating causal relations between and among these constructs and well-being in cancer patients and survivors.

The Real and Illusory Nature of Posttraumatic Growth

Conflict continues over the real or illusory nature of the construct of posttraumatic growth. Some researchers view posttraumatic growth as real developmental growth and positive modification of one's personal identity that extends beyond a patient's pre-morbid level of functioning. It is seen as a result of the struggle with the traumatic experience rather than the changes caused by the experience itself (Tedeschi & Calhoun, 1995). Conversely, others view posttraumatic growth as illusory and liken it to avoidant based coping focused on finding meaning in an adverse event. This is viewed as an attempt to maintain the perception of internal locus of control while trying to bolster self-esteem and a personal sense of value (Taylor & Armor, 1996). As Sumalla and colleagues (2009) describe it, one of the central concepts of the argument that posttraumatic growth may be illusory is found in the occurrence of negative distortion of perception of past function. This distortion has potential for erroneous perception of improvement following a traumatic life experience, and misattribution of that perceived improvement as posttraumatic growth. For example, Widows and colleagues (2005) reported that the results of their longitudinal study of bone marrow transplant patients indicate that negatively distorted perceptions of pre-procedure psychological distress were associated with higher post-procedure reports of posttraumatic growth.

Sumalla and colleagues (2009) conclude that quantifying objectively the subjective experience of positive identity change is impossible. Therefore, we are left with the question as to whether it is more therapeutically appropriate to attempt to destroy potential illusions of personal growth through adversity or to assist patients in adaptively coping with their trauma by helping them to engage in cognitive restructuring of the meaning of their cancer experience. Given the potential for differences in the cancer experience of the estimated 12 million cancer survivors and the plausibility of both sides of this argument, it is likely that posttraumatic growth is illusory for some, real for others, and both illusory and real for many depending on how far along they are on their journey through cancer survivorship. The existence of this controversy highlights the need for continued longitudinal or RCT studies, and the creation and

implementation of measures of growth following adversity that are more objective, perhaps in the form of third-party report, or measures that assess quantifiable milestones in development across the lifespan.

Limitations

The cross-sectional design of the current study limits our ability to infer causal relations among the study constructs. Distress about physical symptoms, quality of life, or depressive symptoms may affect posttraumatic growth and posttraumatic stress symptoms or an unmeasured variable may be the causal link to all of these constructs. In addition to the cross-sectional design, the current study has several shortcomings that fall into four broad categories: sample-related difficulties; shortcomings with measures and data collection; difficulties related to data analysis; and potential confounding factors or other variables or measures that were not measured.

Sample related shortcomings. Of the 237 potential participants that voluntarily responded and were eligible to participate, 29% (n = 69) decided not to enroll in the study. The percentage of eligible participants that voluntarily responded who participated in the current study was 71% which is higher than the 43.5% rate reported by Owen and colleagues (2005). Experience has demonstrated that many cancer survivors participate in psychological research because of an interest in the research topic, an internal sense of curiosity, or a sense of duty. By withholding information about compensation in the initial call for participants and screening documents, I intentionally attempted to avoid enrolling participants who would only complete the questionnaire in order to receive the $10 amazon.com gift card without thoughtfully answering the questions or perhaps without even being cancer survivors. Thus the number of potential participants who voluntarily responded and subsequently the number of participants in the study could have been increased by disclosing information about compensation in the initial call for participants and screening form.

The study sample was extremely homogeneous with regard to gender, race, education, and financial status, while simultaneously being heterogeneous with regard to type of cancer and time since diagnosis. This pattern of variation, and lack thereof, presented problems regarding generalizability and inflated variance. On one hand, the homogeneity of the sample with regard to demographic variables provides little in the way of generalizability, while the heterogeneity with regard to medical variables most likely

increased the variance in both the independent and dependent variables. Future studies should attempt to achieve greater heterogeneity with regard to demographic variables. A much larger sample, of perhaps 1000 or more (which is possible with Internet-based data collection), may accomplish both of these goals and potentially allow for comparisons between types and perhaps stages of cancer.

Measures-related shortcomings. The current study relied entirely on self-report measures. As such, the associations reported herein may be inflated, and therefore suspect due to common method variance. As evidenced by the results of analyses to establish convergent and discriminant validity, there was a great deal of inter-correlation between measures. Although results indicate adequate convergent and discriminant validity, analyses to establish construct validity may have benefitted from use of non-self-report measures used in previous research such as assessment of serum cortisol (Porter et al., 2003). Porter and colleagues (2003) explored the relations between cortisol levels and reactivity and several psychosocial constructs among breast cancer survivors. Although they reported no significant association between any of the cortisol measures and the paper and pencil version of the same measure of perceived stress used in the current study, they found associations between cortisol reactivity and both perceived risk and positive affect. These results indicate the inherent value of using non-self-report measures in conjunction with self-report measures to assess well-being in cancer survivors.

Additionally, self-report measures are subjective, and therefore may not represent an objective assessment of symptoms. For example, Kangas and colleagues (2002) report that between 5% and 19% of cancer patients and survivors were likely to meet diagnostic criteria for PTSD based on self-report assessment measures similar to the measure used in the current study. However, estimates of the prevalence of PTSD in cancer survivors is lower, 0%-6%, when using structured clinical interviews to assess DSM-IV criteria (Kangas et al., 2002). Thus, self-report measures may be better for screening than diagnosis, as they have increased sensitivity and decreased specificity.

The assessment of distress about physical health symptoms also presented some measure-related shortcomings. Specifically, a modified version of the Cohen-Hoberman Inventory of Physical Symptoms (CHIPS; S. Cohen & Hoberman, 1983) was used for the current study. In this instrument, a symptom checklist was integrated with the items assessing distress about physical symptoms. Visual inspection of the raw data from the CHIPS revealed a pattern of participants responding to the distress about physical

symptoms on the CHIPS scale only for symptoms they had previously indicated experiencing during the preceding two weeks. Future research designed to assess the incidence of physical symptoms, in addition to the distress caused by them, could employ two separate but parallel measures, one to assess incidence of physical symptoms one to assess distress about those physical symptoms.

Data analysis. To test the primary hypotheses, post hoc models and explicate the significant interaction, the current study employed a somewhat complex data analysis strategy requiring more than 80 separate analyses. This included 30 individual MANOVA and one simultaneous linear regression. The analytic strategy for the alternative models was viewed as a single omnibus MANOVA and five sets of subsequent post-hoc analyses to explore the effects of each variable in more detail than was possible in the omnibus model. The results of the subsequent models exploring the individual predictors were consistent with the findings from the initial omnibus model; however, the initial model regressed three outcome variables on twelve predictors. Even though the current study had 165 participants and the ratio of participants to predictors falls within the generally accepted range of 10 - 20 participants per predictor, it falls in the lower end of the recommended range (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). Future research may be better served a larger sample and/or fewer variables, or by the use of more sophisticated analytic methods such as structural equation modeling, which would allow both exploratory and confirmatory modeling with the potential to test causal inferences.

Potential confounding factors or other missing variables or measures. Several groups of researchers have explored the relations between intrusive thoughts and health outcomes (e.g. Bleiker et al., 2000; Kazak et al., 2004; Lechner, Carver, Antoni, Weaver, & Phillips, 2006; Lewis et al., 2001; Manne et al., 2004; Park et al., 2010; Vickberg et al., 2000; Whitaker et al., 2009). Rather than use an omnibus measure of PTSD symptoms, many of these researchers have used the intrusive thoughts subscale of the Impact of Events Scale (IES; Horowitz et al., 1979). Several studies have explored moderation models with the constructs of negative appraisal, global meaning, and posttraumatic growth (Park et al., 2010; Vickberg et al., 2000; Whitaker et al., 2009). For example, Park and colleagues (2010) reported that among the younger adult cancer survivors, posttraumatic growth buffered the relations between intrusive thoughts and positive and negative affect, life satisfaction, and spiritual well-being. The inclusion of a measure of

intrusive thoughts (per se) would have added breadth to the findings on the relations between the multifaceted factors of posttraumatic stress and bio-psychosocial health among cancer survivors.

Implications for Future Research

Results of the current study have implications for future research with regard to the mechanisms involved in the association between posttraumatic stress and health, and the use of online methodology to explore those mechanisms. The current study demonstrated that the online data collection system created for the study is a reliable and valid measure of posttraumatic stress, posttraumatic growth and bio-psychosocial health among cancer survivors. If used in conjunction with physiological measures or neuropsychological assessment, it could be an integral part of the process of elucidating the relations between and among posttraumatic and perceived stress, posttraumatic growth, and health outcomes among cancer patients and survivors. Future research might also focus on longitudinal studies exploring causal relations and mediation models between and among posttraumatic stress, posttraumatic growth, posttraumatic cognitions, intrusive thoughts, personal growth and well being among cancer survivors.

The current study used an entirely online data collection methodology that may allow researchers to collect data from increasing numbers of participants, from potentially global geographic areas, in naturalistic settings with minimal experimental impact on participants. In this study, participants completed the questionnaire from as far away as Mexico, British Columbia, and the UK. More than 75,000 data points were collected, entered, and coded from 165 participants in about 100 days with no data entry errors and only .01% missing data.

Similar to Bauer and colleagues (2004), this study showed that relatively large scale data collection, entry and coding could be accomplished with a substantial reduction in labor, expense, missing data, and data entry errors when compared with traditional paper and pencil survey methodology. The data for the current study was collected from only 165 participants; however, after the initial design and implementation of the online data collections system, it could have easily been 1,650 participants given sufficient resources (money and time) for recruitment and compensation of participants, with very little additional effort with regard to data coding, entry, management, and analysis. Additionally, the online data

collection system created for the current study has implications for future research in conjunction with neuropsychological assessment and physiological measures such as serum cortisol.

Implications for Clinical Practice

Of the 47 participants that reported clinically significant levels of depressive and/or PTSD symptoms only 27 (57%) reported having a history of receiving treatment for a psychiatric disorder. Thus, 43% of participants who reported clinically significant symptoms of a psychiatric disorder within two weeks of participating in the study reported never having received treatment. These results bolster previous research by Kadan-Lottick and colleagues (2005) indicating that up to 50% of cancer survivors who meet criteria for a DSM-IV psychiatric disorder do not readily access mental health services, and highlight the importance of screening, diagnostic assessment, and subsequent treatment of psychiatric disorders in cancer survivors in clinical settings.

Given the link between posttraumatic stress and health, and the relatively high levels of posttraumatic stress symptoms in this sample there are also important implications for clinical practice. Specifically, screening of all cancer patients and survivors for PTSD and depressive symptoms should be standard care. Following a positive screen for either PTSD or depression, patients should be referred for diagnostic assessment and subsequent implementation of empirically supported treatments. These include exposure-based treatments for PTSD such as prolonged exposure or cognitive processing therapy or cognitive behavior therapy for depression.

Although the size of the associations between posttraumatic and personal growth and well-being in the current study were relatively small when compared with PTSD symptoms or posttraumatic cognitions, previous research has demonstrated an association between increased personal growth, peer support, social support, and well-being (Dunn, Campbell, Penn, Dwyer, & Chambers, 2009; Love & Sabiston, 2011). Thus, clinical interventions designed to increase the experience of positive identity change may be of benefit to cancer patients and survivors across the cancer continuum. Thus, interventions focused on peer and social support may be effective in fostering increased developmental growth.

Internet-based data collection systems similar to the one used in the current study may have important implications regarding screening, referral for diagnostic assessment, and subsequent treatment of

psychiatric disorders. This line of translational research could effectively bring information and referral resources to populations who, as the current study and previous research indicate, have significant psychiatric co-morbidity but do not readily access mental health services (Kadan-Lottick et al., 2005).

Additionally, the data collection system designed for the current study may be a useful tool for use in data collection and assessment in clinical care. Of particular interest is the potential for its use in ongoing assessment in both face-to-face and telehealth-based treatment across the cancer continuum.

Conclusion

In the current study, PTSD symptoms, posttraumatic cognitions, personal growth initiative posttraumatic growth, and perceived stress were the strongest predictors of bio-psychosocial health among cancer survivors. Additionally, results indicate it is likely that having more expendable income affords cancer survivors access to greater resources with which to cope with cancer and non-cancer related stressors.

The results of the current study supports previous research indicating that between 5% and 19% of those suffering from cancer may meet diagnostic criteria for PTSD, which often persists for many years after treatment is completed, and is associated with higher levels of distress about physical health symptoms, lower quality of life and higher levels of depressive symptoms (Kangas et al., 2002). Additionally, results of the current study bolster previous research that has reported as many as 50% of cancer survivors who report clinically significant symptoms of a psychiatric disorder do not readily access mental health services (Kadan-Lottick et al., 2005).

Although, debate over the real or illusory nature of the construct of posttraumatic growth continues, interventions designed to increase the experience of positive identity change may be of benefit to cancer patients and survivors. These results highlight the importance of using a multifaceted approach in assessing both posttraumatic stress symptoms and posttraumatic growth in both research and multidisciplinary health care settings.

The results of this study suggest that the online data collection system designed for the study is a feasible, reliable, and useful tool to assess distress about physical health symptoms, quality of life, and depressive symptoms in cancer survivors. Internet-based data collection may have important implications

regarding screening and referral for treatment of psychiatric disorders in research and clinical care, especially with regard to ongoing assessment in face-to-face and telehealth-based provision of clinical services.

Thus, in light of the rapidly growing population of long-term cancer survivors, these results are especially important to both short-term functioning of cancer patients and long-term outcomes in cancer survivors (National Cancer Institute, 2010).

FIGURES

Figure 1. Model for the Interaction between Posttraumatic Growth and Posttraumatic Stress Symptoms in Predicting Health Outcomes.

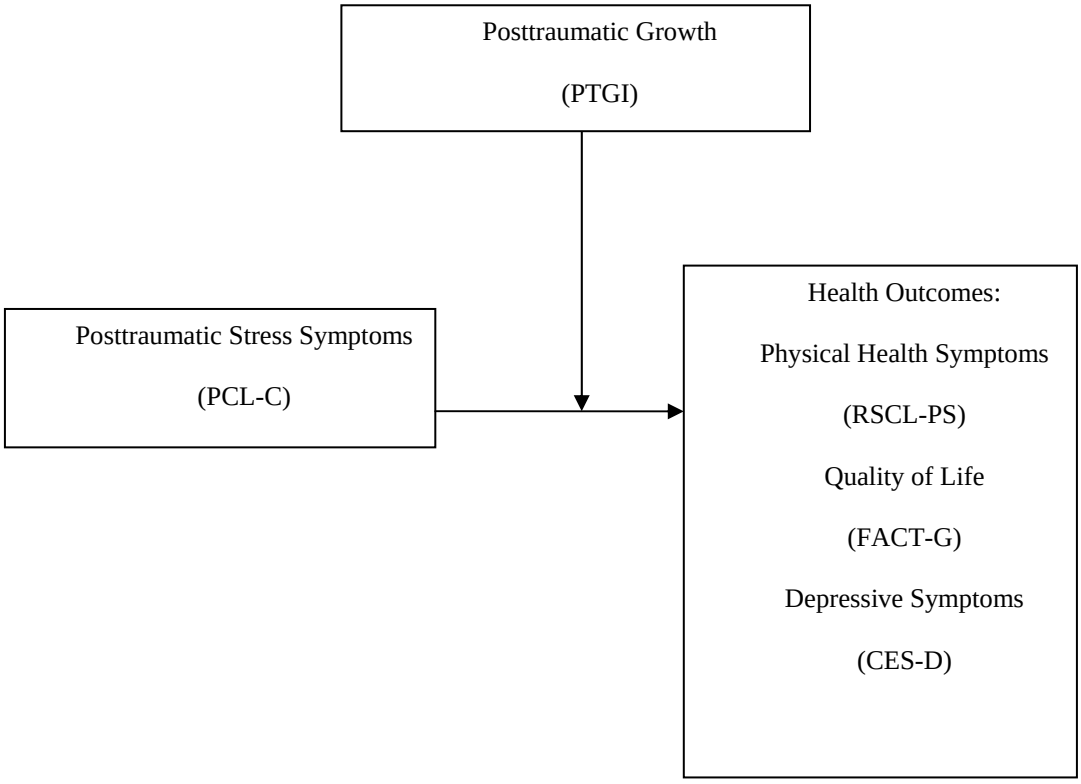


Figure 2. Model for the Interaction between Perceived Stress and Posttraumatic Stress Symptoms in Predicting Health Outcomes.

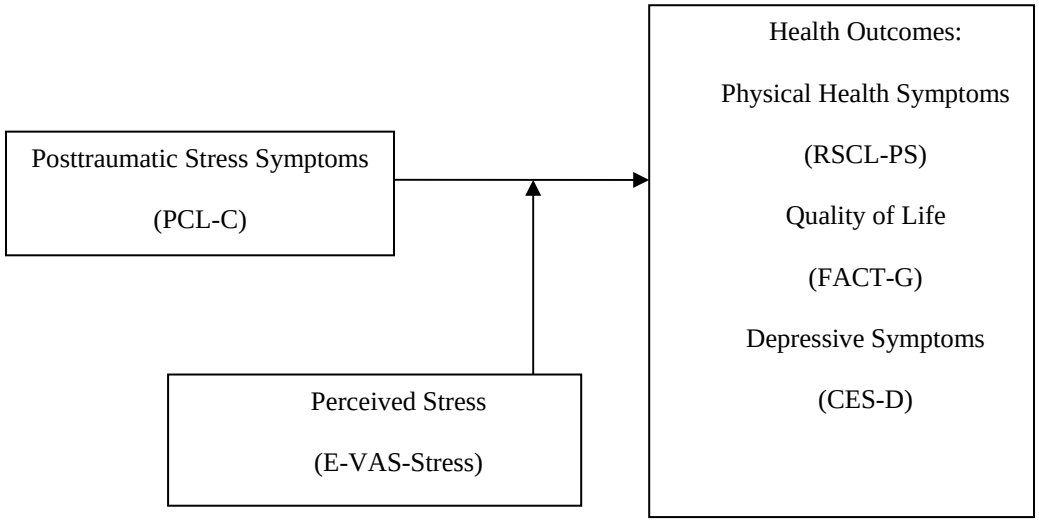
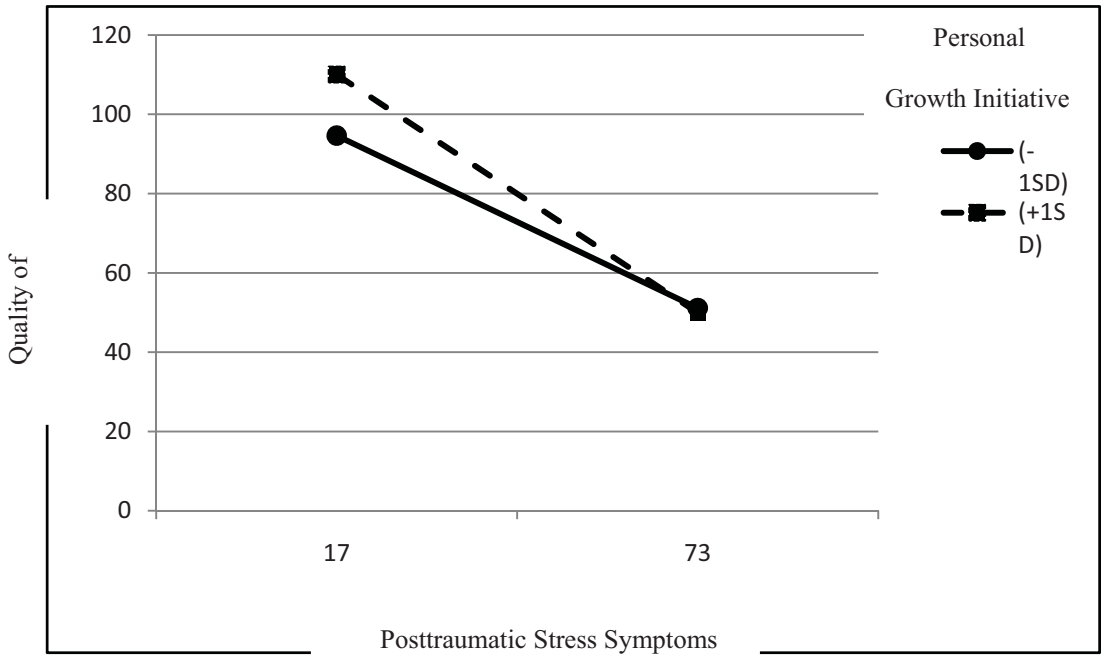


Figure 3. Explication of the interaction between personal growth initiative and posttraumatic stress symptoms on quality of life.



TABLES

Table 1

Means, Standard Deviations, and 95% Confidence Intervals (95% CI) for Predictor and Outcome Variables.

	Mean	SD	(95% CI)
Primary Predictor Variables			
Posttraumatic Stress Symptoms (PCL-C)	32.24	12.15	(30.37 - 34.11)
Posttraumatic Growth (PTGI)	27.22	22.36	(61.88 - 68.30)
Perceived Stress (E-VAS-Stress)	27.21	22.36	(23.78 - 30.66)
Primary Outcome Variables			
Distress About Physical Health Symptoms (RSCL-PS)	30.01	6.56	(29.00 - 31.02)
Quality of Life (FACT-G)	82.86	17.61	(80.15 - 85.56)
Depressive Symptoms (CES-D)	21.08	12.74	(10.96 - 14.51)
Variables to Test Alternate Models			
Posttraumatic Cognitions (PTCI)	60.48	24.92	(56.65 - 64.31)
Personal Growth Initiative (PGIS)	38.76	9.25	(37.34 - 40.19)
Rumination	14.75	4.81	(14 - 15.5)

Note: PCL-C = Posttraumatic Stress Checklist - Civilian Version; PTGI = Posttraumatic Growth Inventory; PTCI = Posttraumatic Cognitions Inventory; PGIS = Personal Growth Initiative Scale; RSCL-PS = The Rotterdam Symptom Checklist - Physical Symptoms Subscale; CES-D = The Center for Epidemiological Studies - Depression Measure; FACT-G = Functional Assessment of Cancer Therapy Scale.

Table 2

Correlations between Predictor and Outcome Variables to Establish Construct Validity

	Primary Predictor Variables			Primary Outcome Variables			Variable for Alternative Models		
	PCL-C	PTGI	Stress	RSCL	FACT	CES-D	RUM	PTCI	PGIS
PCL-C	----	-.06	.42**	.62**	-.71**	.79**	.54**	.73**	-.58**
PTGI		----	-.08	-.02	.20*	-.20**	.04	-.17*	.33**
Stress			----	.35**	-.39**	.47**	-.66**	.38**	-.33**
RSCL				----	-.78**	.65**	-.42**	.54**	-.41**
FACT					----	-.78**	-.33**	-.73**	.64**
CES-D						----	-.64**	.75**	-.64**
RUM							----	.39**	-.33**
PTCI								----	-.66**
PGIS									----

Note: *p < 0.05; ** p < 0.01; PCL-C = Posttraumatic Stress Checklist - Civilian Version; PTGI = Posttraumatic Growth Inventory; RSCL = Rotterdam Symptom Checklist - Physical Symptoms Subscale; FACT-G = Functional Assessment of Cancer Therapy Scale; CES-D = The Center for Epidemiological Studies - Depression Measure; RUM = Rumination Scale; PTCI = Posttraumatic Cognitions Inventory; and PGIS = Personal Growth Initiative Scale.

Table 3

Comparison of Results of Internal Reliability Analysis between the Current Study and Previous Research

	Cronbach's Alpha	
	Current Study	Previous Research
Posttraumatic Stress Symptoms (PCL-C)	.92	.94
Posttraumatic Growth (PTGI)	.94	.90-.96
Distress about Physical Symptoms (RSCL-PS)	.79	.82 - .87
Quality of Life (FACT-G)	.92	.86 - .89
Depressive Symptoms (CES-D)	.94	.84 - .90
Rumination	.84	Not available
Posttraumatic Cognitions(PTCI)	.94	.86 - .97
Personal Growth Initiative (PGIS)	.92	.90

Note: PCL-C = PTSD Checklist - Civilian Version; PTGI = Posttraumatic Growth Inventory; RSCL-PS = Rotterdam Symptom Checklist - Physical Symptoms Subscale; FACT-G = Functional Assessment of Cancer Therapy Scale CES-D = The Center for Epidemiological Studies - Depression Measure; PTCI = Posttraumatic Cognitions Inventory; PGIS = Personal Growth Initiative Scale.

Table 4
Bivariate Correlations (Pearson's r and Spearman's Rho) between Demographic/Medical and Outcome Variables to Inform Models

	Physical Symptoms	Quality of Life	Depressive Symptoms	Posttraumatic Stress	Posttraumatic Growth	Perceived Stress
Age	.01	.05	-.17*	-.20*	.18*	-12
Gender	.17*	-.08	.09	.15*	.08	.07
Education Level (Rho)	-.12	.06	-.01	-.05	-.15	-.007
Marital Status	-.08	.27**	-.32**	-.30**	.14	-.19*
Financial Status (Rho)	-.26**	.29**	-.28**	-.29**	-04	-.23**
Time Since Diagnosis	.12*	-.20*	.04	-.01	.03	-.05
Chemotherapy	-.01	-.00	.00	.01	.23**	.07
Time Since Treatment	.14	-.16*	.01	-.01	.02	-.05

Note: *p < 0.05; ** p < 0.01; Statistic for Education Level and Financial Status is Spearman's Rho; all others are Pearson's r.

Table 5

F and p-values from MANOVA Regressing Health Outcomes on Demographic and Medical Variables

Variable	(df_1,df_2)	Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
		F	*p*	F	*p*	F	*p*
Step 1							
Corrected Model	(6,156)	5.424	.000	7.179	.000	8.208	.000
Age	(1,156)	.038	.846	.607	.437	4.333	.039
Gender	(1,156)	4.956	.027	.094	.760	.055	.815
Education	(1,156)	2.440	.120	1.253	.265	.522	.471
Marital Status	(1,156)	.078	.781	10.373	.002	15.752	.000
Financial Status	(1,156)	15.419	.000	16.108	.000	18.998	.000
Time Since Diagnosis	(1,156)	2.513	.115	4.707	.032	.056	.814
Step 2							
Corrected Model	(5,157)	5.97	.000	8.35	.000	9.78	.000
Age	(1,157)	.08	.776	.51	.476	4.19	.042
Gender	(1,157)	4.66	.032	.07	.792	.04	.836
Marital Status	(1,157)	.02	.898	9.77	.002	15.40	.000
Financial Status	(1,157)	18.35	.000	18.51	.000	21.04	.000
Time Since Diagnosis	(1,157)	2.72	.101	4.93	.028	.07	.788

Table 6
F and p-values from MANOVA Regressing Health Outcomes on Posttraumatic Stress Symptoms, Posttraumatic Growth and the Interaction of Posttraumatic Growth and Posttraumatic Stress Symptoms

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Hypothesis 1a							
Corrected Model	(6,156)	21.73	0.000	34.34	0.000	49.97	0.000
Age	(1,156)	4.27	0.040	1.40	0.238	0.16	0.688
Gender	(1,156)	3.51	0.063	0.39	0.534	0.78	0.380
Marital Status	(1,156)	5.31	0.023	1.04	0.309	3.72	0.056
Financial Status	(1,156)	3.88	0.051	2.96	0.088	3.52	0.063
Time Since Diagnosis	(1,156)	5.01	0.027	10.48	0.001	0.48	0.489
PTSD Symptoms (PCL-C)	(1,156)	84.66	0.000	129.98	0.000	191.60	0.000
Hypothesis 1b							
Corrected Model	(7, 155)	18.65	0.000	33.24	0.000	47.30	0.000
Age	(1,155)	4.68	0.032	3.45	0.065	0.05	0.821
Gender	(1,155)	3.79	0.053	0.04	0.837	0.23	0.632
Marital Status	(1,155)	5.71	0.018	0.20	0.653	1.93	0.167
Financial Status	(1,155)	4.03	0.046	3.96	0.048	4.59	0.034
Time Since Diagnosis	(1,155)	4.93	0.028	10.82	0.001	0.43	0.511
PTSD Symptoms (PCL-C)	(1,155)	84.36	0.000	138.90	0.000	204.01	0.000
Posttraumatic Growth (PTGI)	(1,155)	0.52	0.470	12.04	0.001	11.36	0.001
Hypothesis 1c							
Corrected Model	(8,154)	16.28	0.000	28.90	0.000	42.25	0.000
Age	(1,154)	4.45	0.036	3.38	0.068	0.12	0.725
Gender	(1,154)	3.40	0.067	0.05	0.831	0.06	0.807

Marital Status	(1,154)	5.41	0.021	0.21	0.651	1.55	0.215
Financial Status	(1,154)	4.31	0.040	3.86	0.051	3.24	0.074
Time Since Diagnosis	(1,154)	5.14	0.025	10.67	0.001	0.22	0.643
PTSD Symptoms (PCL-C)	(1,154)	83.01	0.000	133.57	0.000	190.51	0.000
Posttraumatic Growth (PTGI)	(1,154)	0.26	0.610	10.67	0.001	14.06	0.000
Interaction (PTGI*PCL-C)	(1,154)	0.33	0.568	0.01	0.936	2.88	0.091

Table 7
F and p-values from MANOVA Regressing Health Outcome Variables on Perceived Stress, Posttraumatic Stress Symptoms, Posttraumatic Growth and the Interaction of Perceived Stress and Posttraumatic Stress Symptoms

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Hypothesis 2a							
Corrected Model	(6,156)	8.31	.000	10.89	.000	14.10	.000
Age	(1,156)	0.44	.508	0.13	.715	3.02	.084
Gender	(1,156)	4.73	.031	0.03	.855	0.01	.914
Marital Status	(1,156)	0.28	.600	6.56	.011	11.22	.001
Financial Status	(1,156)	11.98	.001	11.93	.001	13.40	.000
Time Since Diagnosis	(1,156)	4.06	.046	6.97	.009	0.43	.513
Perceived Stress	(1,156)	16.99	.000	18.86	.000	27.49	.000
Hypothesis 2b							
Corrected Model	(8, 154)	16.92	.000	29.67	.000	43.59	.000
Age	(1,154)	4.84	.029	3.55	.061	0.07	.794
Gender	(1,154)	3.84	.052	0.04	.838	0.24	.628
Marital Status	(1,154)	6.26	.013	0.13	.718	1.61	.206
Financial Status	(1,154)	3.29	.072	3.28	.072	3.55	.062
Time Since Diagnosis	(1,154)	5.52	.020	11.59	.001	0.70	.404
Perceived Stress (E-VAS-Stress)	(1,154)	3.07	.082	2.48	.118	6.31	.013
PTSD Symptoms (PCL-C)	(1,154)	65.02	.000	111.51	.000	162.62	.000
Posttraumatic Growth (PTGI)	(1,154)	0.39	.533	11.47	.001	10.72	.001
Hypothesis 2c							
Corrected Model	(9,153)	15.22	0.000	26.57	0.000	38.59	0.00
Age	(1,153)	5.28	0.023	3.94	0.049	0.09	0.76
Gender	(1,153)	3.40	0.067	0.05	0.831	0.06	0.81
Marital Status	(1,153)	5.84	0.017	0.20	0.658	1.69	0.20
Financial Status	(1,153)	3.40	0.067	3.39	0.068	3.58	0.06

Time Since Diagnosis	(1,153)	6.13	0.014	12.41	0.001	0.80	0.37
Perceived Stress (E-VAS-Stress)	(1,153)	3.70	0.056	3.04	0.083	6.54	0.01
PTSD Symptoms (PCL-C)	(1,153)	65.78	0.000	110.94	0.000	155.41	0.00
Posttraumatic Growth (PTGI)	(1,153)	0.59	0.443	12.33	0.001	10.93	0.00
Interaction (E-VAS-STRESS*PCL-C)	(1,153)	1.33	0.250	1.32	0.253	0.27	0.60

Table 8
F and p-values from MANOVA Regressing Health Outcome Variables on All Primary and Alternative Predictors

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Corrected Model	(12,146)	11.86	.000	25.84	.000	34.99	.000
Age	(1,146)	3.32	.071	4.36	.039	0.32	.573
Gender	(1,146)	3.91	.050	0.20	.656	0.26	.613
Marital Status	(1,146)	6.15	.014	0.01	.926	0.15	.703
Financial Status	(1,146)	3.01	.085	2.00	.159	2.05	.154
Time Since Diagnosis	(1,146)	4.73	.031	7.92	.006	0.01	.904
PTSD Symptoms (PCL-C)	(1,146)	15.24	.000	18.90	.000	51.40	.000
Posttraumatic Growth (PTGI)	(1,146)	0.00	.979	3.06	.082	3.42	.066
Perceived Stress (E-VAS-Stress)	(1,146)	1.71	.193	0.80	.373	4.94	.028
Rumination (RUM)	(1,146)	2.29	.132	2.11	.148	1.90	.170
Posttraumatic Cognitions (PTCI)	(1,146)	2.65	.106	10.37	.002	10.05	.002
Personal Growth Initiative (PGIS)	(1,146)	0.00	.967	6.86	.010	7.50	.007
Treatment for Psychiatric Disorder (PSY)	(1,146)	1.50	.223	0.23	.631	1.74	.190

Table 9
F and p-values from MANOVA Regressing Health Outcome Variables on Rumination

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Step 1							
Corrected Model	(6,156)	10.37	.000	13.83	.000	12.41	.000
Age	(1,156)	0.73	.396	0.03	.856	2.85	.093
Gender	(1,156)	2.31	.130	0.33	.567	0.20	.653
Marital Status	(1,156)	0.01	.942	10.19	.002	15.74	.000
Financial Status	(1,156)	13.30	.000	13.31	.000	16.04	.000
Time Since Diagnosis	(1,156)	4.65	.033	8.07	.005	0.36	.547
Rumination (RUM)	(1,156)	27.37	.000	32.76	.000	19.73	.000
Step 2							
Corrected Model	(8, 154)	16.85	.000	29.95	.000	41.25	.000
Age	(1,154)	4.89	.028	3.65	.058	0.05	.832
Gender	(1,154)	3.06	.082	0.18	.675	0.17	.684
Marital Status	(1,154)	4.98	.027	0.40	.530	1.75	.188
Financial Status	(1,154)	4.09	.045	4.02	.047	4.56	.034
Time Since Diagnosis	(1,154)	5.50	.020	11.81	.001	0.38	.540
Rumination (RUM)	(1,154)	2.80	.096	3.39	.067	0.34	.559
PTSD Symptoms (PCL-C)	(1,154)	51.38	.000	87.79	.000	159.79	.000
Posttraumatic Growth (PTGI)	(1,154)	0.68	.412	12.94	.000	11.05	.001
Step 3							
Corrected Model	(9,153)	14.90	.000	26.46	.000	36.45	.000
Age	(1,153)	4.80	.030	3.60	.060	0.05	.826
Gender	(1,153)	2.91	.090	0.19	.664	0.15	.702
Marital Status	(1,153)	4.99	.027	0.38	.536	1.76	.186
Financial Status	(1,153)	4.06	.046	4.00	.047	4.54	.035

Time Since Diagnosis	(1,153)	5.54	.020	11.77	.001	0.36	.551
Rumination (RUM)	(1,153)	2.85	.093	3.41	.067	0.36	.549
PTSD Symptoms (PCL-C)	(1,153)	51.13	.000	87.03	.000	157.53	.000
Posttraumatic Growth (PTGI)	(1,153)	0.49	.484	11.48	.001	10.51	.001
Interaction (PTGI*RUM)	(1,153)	0.10	.756	0.04	.847	0.05	.829

Table 10
F and p-values from MANOVA Regressing Health Outcome Variables on Posttraumatic Cognitions

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Step 1							
Corrected Model	(6,156)	15.59	.000	33.53	.000	37.78	.000
Age	(1,156)	1.21	.272	0.06	.815	2.38	.125
Gender	(1,156)	7.79	.006	0.66	.418	0.58	.449
Marital Status	(1,156)	4.95	.028	0.12	.735	1.69	.195
Financial Status	(1,156)	8.21	.005	6.93	.009	8.96	.003
Time Since Diagnosis	(1,156)	1.77	.186	4.38	.038	0.29	.588
Posttraumatic Cognitions (PTCI)	(1,156)	53.67	.000	126.16	.000	135.83	.000
Step 2							
Corrected Model	(8, 154)	17.33	.000	36.40	.000	49.15	.000
Age	(1,154)	4.20	.042	2.83	.094	0.00	.968
Gender	(1,154)	4.84	.029	0.10	.749	0.00	.993
Marital Status	(1,154)	7.60	.007	0.12	.725	0.48	.492
Financial Status	(1,154)	3.62	.059	3.40	.067	4.02	.047
Time Since Diagnosis	(1,154)	3.85	.052	8.41	.004	0.02	.889
Posttraumatic Cognitions (PTCI)	(1,154)	4.85	.029	24.03	.000	20.49	.000
PTSD Symptoms (PCL-C)	(1,154)	28.85	.000	36.07	.000	65.95	.000
Posttraumatic Growth (PTGI)	(1,154)	0.11	.743	7.76	.006	7.36	.007
Step 3							
Corrected Model	(9,153)	15.54	.000	32.16	.000	44.21	.000
Age	(1,153)	3.77	.054	2.86	.093	0.01	.928
Gender	(1,153)	4.46	.036	0.11	.739	0.01	.920
Marital Status	(1,153)	7.59	.007	0.12	.726	0.47	.492
Financial Status	(1,153)	3.76	.054	3.35	.069	3.84	.052
Time Since Diagnosis	(1,153)	4.11	.044	8.24	.005	0.00	.961
Posttraumatic Cognitions (PTCI)	(1,153)	5.76	.018	21.94	.000	16.41	.000

PTSD Symptoms (PCL-C)	(1,153)	29.41	.000	35.61	.000	64.99	.000
Posttraumatic Growth (PTGI)	(1,153)	0.00	.962	7.51	.007	8.96	.003
Interaction (PTGI*PTCI)	(1,153)	1.16	.284	0.04	.833	2.03	.156

Table 11
F and p-values from MANOVA Regressing Health Outcome Variables on Personal Growth

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Step 1							
Corrected Model	(6,156)	9.68	.000	24.13	.000	24.95	.000
Age	(1,156)	2.56	.112	2.45	.119	0.00	.955
Gender	(1,156)	8.43	.004	2.10	.149	1.82	.180
Marital Status	(1,156)	0.84	.360	3.28	.072	7.72	.006
Financial Status	(1,156)	10.01	.002	7.69	.006	9.77	.002
Time Since Diagnosis	(1,156)	1.35	.247	2.62	.108	0.54	.462
Personal Growth Initiative (PGIS)	(1,156)	23.88	.000	81.59	.000	77.11	.000
Step 2							
Corrected Model	(8, 154)	16.60	.000	35.71	.000	47.99	.000
Age	(1,154)	5.46	.021	7.01	.009	0.73	.393
Gender	(1,154)	4.52	.035	0.24	.623	0.02	.891
Marital Status	(1,154)	5.99	.016	0.08	.774	1.66	.199
Financial Status	(1,154)	3.29	.071	2.12	.147	2.74	.100
Time Since Diagnosis	(1,154)	4.01	.047	7.60	.007	0.00	.959
Personal Growth Initiative (PGIS)	(1,154)	1.69	.195	21.79	.000	17.53	.000
PTSD Symptoms (PCL-C)	(1,154)	54.04	.000	73.79	.000	120.51	.000
Posttraumatic Growth (PTGI)	(1,154)	0.06	.809	3.60	.060	3.69	.057
Step 3							
Corrected Model	(9,153)	14.91	.000	33.14	.000	42.42	.000
Age	(1,153)	5.11	.025	6.38	.013	0.69	.407
Gender	(1,153)	4.16	.043	0.11	.742	0.01	.910
Marital Status	(1,153)	4.91	.028	0.47	.496	1.74	.189
Financial Status	(1,153)	3.95	.049	3.47	.064	2.82	.095

Time Since Diagnosis	(1,153)	4.28	.040	8.56	.004	0.00	.944
Personal Growth Initiative (PGIS)	(1,153)	1.66	.199	22.11	.000	17.39	.000
PTSD Symptoms (PCL-C)	(1,153)	52.41	.000	79.52	.000	105.73	.000
Posttraumatic Growth (PTGI)	(1,153)	0.14	.707	4.78	.030	3.76	.054
Interaction (PGIS*PCL-C)	(1,153)	1.20	.274	5.07	.026	0.10	.756

Table 12
F and p-values from MANOVA Regressing Health Outcome Variables on Having a History of Treatment for a Psychiatric Disorder

		Distress About Physical Symptoms		Quality of Life		Depressive Symptoms	
Variable	(df_1,df_2)	F	*p*	F	*p*	F	*p*
Step 1							
Corrected Model	(6,152)	6.90	.000	9.65	.000	9.51	.000
Age	(1,152)	0.04	.850	0.56	.457	4.32	.039
Gender	(1,152)	5.84	.017	0.23	.632	0.19	.666
Marital Status	(1,152)	0.01	.914	8.86	.003	13.76	.000
Financial Status	(1,152)	16.42	.000	16.67	.000	18.66	.000
Time Since Diagnosis	(1,152)	2.66	.105	4.85	.029	0.03	.865
Treatment for Psychiatric Disorder (PSY)	(1,152)	9.90	.002	13.57	.000	7.72	.006
Step 2							
Corrected Model	(8,150)	16.29	.000	28.82	.000	39.47	.000
Age	(1,150)	3.53	.062	3.05	.083	0.08	.783
Gender	(1,150)	4.00	.047	0.04	.847	0.20	.658
Marital Status	(1,150)	5.11	.025	0.34	.562	1.84	.177
Financial Status	(1,150)	4.02	.047	4.05	.046	4.53	.035
Time Since Diagnosis	(1,150)	4.85	.029	10.59	.001	0.38	.540
Treatment for Psychiatric Disorder (PSY)	(1,150)	2.75	.100	2.53	.114	0.04	.846
PTSD Symptoms (PCL-C)	(1,150)	70.24	.000	120.19	.000	182.92	.000
Posttraumatic Growth (PTGI)	(1,150)	0.04	.833	8.66	.004	10.05	.002

Table 13
F and p-values from MANOVA Regressing Health Outcome Variables on Depressive Symptoms

		Distress About Physical Symptoms		Quality of Life	
Variable	(df_1,df_2)	F	*p*	F	*p*
Step 1					
Corrected Model	(6,156)	26.57	.000	45.39	.000
Age	(1,156)	4.19	.042	1.30	.256
Gender	(1,156)	6.92	.009	0.03	.870
Marital Status	(1,156)	8.77	.004	0.12	.732
Financial Status	(1,156)	2.68	.104	1.66	.200
Time Since Diagnosis	(1,156)	3.68	.057	8.81	.003
Depressive Symptoms (CES-D)	(1,156)	109.07	.000	182.35	.000
Step 2					
Corrected Model	(8, 154)	21.88	.000	39.96	.000
Age	(1,154)	4.98	.027	3.78	.054
Gender	(1,154)	5.19	.024	0.00	.998
Marital Status	(1,154)	9.61	.002	0.03	.869
Financial Status	(1,154)	1.65	.201	1.34	.248
Time Since Diagnosis	(1,154)	4.49	.036	11.00	.001
Depressive Symptoms (CES-D)	(1,154)	24.61	.000	35.40	.000
PTSD Symptoms (PCL-C)	(1,154)	7.50	.007	16.61	.000
Posttraumatic Growth (PTGI)	(1,154)	0.30	.586	4.61	.033

Table 14
Percent of Variance (Adjusted R^2) Accounted for by Each Hypothesis Model

Model	Adjusted R^2			(Adjusted R^2 Change)		
	RSCL-PS	FACT-G	CESD	RSCL-PS	FACT-G	CESD
Age, Gender, Marital Status, Financial Status, and Time since Diagnosis	0.133	0.185	0.213	------	------	------
Hypothesis 1						
H1a. PCL-C	0.434	0.553	0.645	0.301	0.368	0.432
H1c. PCL-C and PTGI	0.433	0.582	0.667	0.3	0.397	0.454
PTGI				-0.001	0.029	0.022
H1d. PCL-C, PTGI and PTGI*PCL-C	0.43	0.579	0.671	0.297	0.394	0.458
Hypothesis 2						
H2a. Perceived Stress	0.213	0.268	0.327	0.08	0.083	0.114
H2b. Stress, PCL-C, and PTGI	0.44	0.586	0.678	0.227	0.318	0.351
PTGI				-0.002	0.028	0.02
2c. PCL-C, PTGI, Stress, and E-VAS-Stress * PCL-C	0.441	0.587	0.676	0.308	0.402	0.463

Note: PCL-C = Posttraumatic Stress Checklist - Civilian Version; PTGI = Posttraumatic Growth Inventory; RSCL-PS = The Rotterdam Symptom Checklist - Physical Symptoms Subscale; FACT-G = Functional Assessment of Cancer Therapy Scale CES-D = The Center for Epidemiological Studies - Depression Measure; PTCI = Posttraumatic Cognitions Inventory; PGIS = Personal Growth Initiative Scale.

Table 15
Percent of Variance (Adjusted R^2) Accounted for by Post Hoc Models

Model	Adjusted R^2			(Adjusted R^2 Change)		
	RSCL-PS	FACT-G	CESD	RSCL-PS	FACT-G	CESD
Age, Gender, Marital Status, Financial Status, and Time since Diagnosis	0.133	0.185	0.213	------	------	------
Model 3: The Omnibus Model PCL_C, PTGI, Perceived Stress, PTCI, Rumination, PGIS and Psychiatric Treatment	0.452	0.654	0.721	0.319	0.469	0.508
Model 4 Rumination (RUM)	0.258	0.322	0.297	0.125	0.137	0.084
PCL-C, PTGI and Rumination	0.439	0.588	0.665	0.306	0.403	0.452
PTGI				-0.001	0.031	0.021
3c. PCL-C, PTGI, RUM, and PTGI*RUM	0.436	0.586	0.663	-0.003	-0.002	-0.002
Model 5 Posttraumatic Cognitions (PTCI)	0.351	0.546	0.577	0.218	0.361	0.364
PCL-C, PTGI and PTCI	0.446	0.636	0.704	0.313	0.451	0.491
PTGI				-0.004	0.016	0.012
PCL-C, PTGI, PTCI, and PTGI*PTCI	0.447	0.634	0.706	0.314	0.449	0.493
Model 6 Personal Growth Initiative (PGIS)	0.243	0.461	0.47	0.11	0.276	0.257
PCL-C, PTGI and PGIS	0.435	0.632	0.699	0.302	0.447	0.486
PTGI				-0.004	0.007	0.005
PCL-C, PTGI, PGIS, and PGIS*PCL-C	0.436	0.641	0.697	0.303	0.456	0.484
PGIS*PCL-C					0.009	
Model 7 Previous Psychiatric Treatment (PSY)	0.183	0.247	0.244	0.05	0.062	0.031

PCL-C, PTGI and PSY	0.436	0.585	0.661	0.303	0.4	0.448
PTGI				-0.004	0.021	0.021
Model 8 Depressive Symptoms (CES-D)	0.486	0.622	------	0.353	0.437	------
CES-D, PCL-C, and PTGI	0.508	0.658	------	0.375	0.473	------
PTGI	------	------	------	-0.002	0.008	------

Note: PCL-C = Posttraumatic Stress Checklist - Civilian Version; PTGI = Posttraumatic Growth Inventory; RSCL-PS = The Rotterdam Symptom Checklist - Physical Symptoms Subscale; FACT-G = Functional Assessment of Cancer Therapy Scale CES-D = The Center for Epidemiological Studies - Depression Measure; PTCI = Posttraumatic Cognitions Inventory; PGIS = Personal Growth Initiative Scale.

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