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Posttraumatic Growth and PTSD Symptomatology among Colorectal Cancer Survivors: A Three-Month Longitudinal Examination of Cognitive Processing

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Abstract

Introduction—The experience of cancer can be understood as a psychosocial transition, producing both positive and negative outcomes. Cognitive processing may facilitate psychological adjustment.

Methods—Fifty-five post-treatment, colorectal cancer survivors (M=65.9 years old; SD=12.7), an average of thirteen months post-diagnosis, were recruited from a state cancer registry and completed baseline and three-month questionnaires assessing dispositional (social desirability), cognitive processing (cognitive intrusions, cognitive rehearsal) and psychological adjustment variables (posttraumatic growth (PTG), posttraumatic stress disorder (PTSD) symptomatology, depression, anxiety, positive affectivity).

Results—PTSD symptomatology was positively associated with depression, anxiety and negatively associated with positive affectivity. In contrast, PTG scores were unrelated to PTSD symptomatology, depression, anxiety, and positive affectivity. In addition, PTG was independent of social desirability. Notably, after controlling for age at diagnosis and education, multiple regression analyses indicated cognitive processing (intrusions, rehearsal) was differentially predictive of psychological adjustment. Baseline cognitive intrusions predicted three-month PTSD symptomatology and there was a trend for baseline cognitive rehearsal predicting three-month PTG.

Conclusions—Additional research is needed to clarify the association between PTG and other indices of psychological adjustment, further delineate the nature of cognitive processing, and understand the trajectory of PTG over time for survivors with colorectal cancer.

Keywords

posttraumatic growth; PTSD symptomatology; cognitive processing; psychological adjustment; cancer; oncology

Introduction

The experience of being diagnosed with, receiving treatment for, and surviving cancer can be stressful. Concerns regarding diagnosis and prognosis, coping with the side effects of surgery and adjuvant treatment, and fears of recurrence are common. These negative sequelae can be particularly burdensome and lead to increased psychological distress [1–3], depression and anxiety symptoms [4] and cancer-related health concerns such as worries about recurrence or a second primary tumor [5]. Prevalence rates of psychological distress, identified by *definition of caseness* [6], range from 29.6% for gynecologic cancers to 43.4% for lung cancer [3], underscoring the negative effects of the cancer experience for many individuals.

Occasionally, the cancer experience has a traumatic quality that produces intrusive thoughts, avoidance behavior, and heightened arousability [7–10], a triad of symptom clusters that comprise posttraumatic stress disorder (PTSD [11]). One study suggests a PTSD diagnosis is no more common among cancer survivors than among individuals without cancer [12], but estimates vary from 0% to 32% regarding the incidence of a PTSD *diagnosis* following cancer (see [13] for a review), and the presence of PTSD *symptoms* is common among cancer patients and survivors [14–17]. Moreover, other anxiety and depressive disorders are found to be highly comorbid with PTSD [10,18]. Thus, overall disruptions in mood and psychological functioning are common and are indicative of the stress associated with adjusting to the threat of cancer and the resulting negative sequelae.

In spite of the fact many cancer survivors report increased stress and poor adjustment, many survivors also report positive outcomes and periods of psychosocial growth after their diagnosis. The term posttraumatic growth (PTG) was coined by Tedeschi and Calhoun [19]to describe positive life changes following a stressful experience. These changes are often manifested through new possibilities, relating to others, personal strength, spiritual change, and appreciation of life [20]. PTG or stress-related growth has been observed in cases of sexual assault [21], HIV infection [22], bereavement [23], and cancer [23–29]. In cancer survivors specifically, indices of general distress or well-being have been uncorrelated with PTG [24,29], but indices of cancer-related distress such as perceived stress [27]and perceived life threat [24], have been predictive of higher levels of PTG. Evidence remains mixed on the relationship between psychological adjustment and PTG after cancer [30], but similar to other traumatic events, the cancer experience can provide a catalyst for deriving meaning and growth from an otherwise stressful experience.

In sum, the experience of cancer is not a source of uniformly negative outcomes, rather it has the potential for both positive and negative sequelae. In fact, the experience of cancer can be understood as a psychosocial transition [31–33]. This perspective emphasizes a broad conceptualization of adjustment, accounting for both positive and negative outcomes. Similarly, Tedeschi and Calhoun [34] note that distress and growth may coexist, and in fact, elevated levels of initial distress are sometimes thought to be an essential factor in promoting subsequent growth. With the exception of a few studies [27,35,36], much of the research literature has failed to examine simultaneously both positive and negative outcomes in cancer patients and survivors, and only one study [29] has included an index of PTSD symptoms as well as a measure of PTG in describing how individuals adjust to their cancer diagnosis and treatment.

Interestingly, both PTSD and PTG may have similar initial pathways. In fact, Calhoun and Tedeschi [37] suggest PTG often coexists with many symptoms of PTSD. Both PTG and PTSD occur in response to an initial, traumatic event or stressor that elicits heightened levels of psychological distress. Typically, this distress is characterized by unwanted, intrusive

thoughts or a "re-experiencing" of the trauma. Occasionally, these intrusive thoughts have a ruminative quality as individuals attempt to "work through" their experience [38]. According to clinical and theoretical literature, some distress is a necessary catalyst for growth [39,40], and rumination may be a central cognitive process in facilitating PTG given its associations with changes in beliefs, goals, behaviors, and identity [41,42].

This process of rumination, while often considered a maladaptive response, can also be characterized in more neutral terms as "cognitive processing." Theories of cognitive adaptation to trauma [38,43] emphasize the role of cognitive processing as a means of facilitating schema revision or trauma reappraisal [44]. Since traumatic events have the inherent ability to cause people to question beliefs and assumptions about themselves and the world [43], repeated confrontation with memories of the trauma may be useful in facilitating cognitive processing and promoting healthy adaptation [44]. Some researchers [45,46] have focused on applications of cognitive processing theory for purposes of clinical intervention among trauma victims. Though cognitive processing theory provides a foundation for cognitive processing therapy, this manuscript is focused on the more *descriptive* nature of cognitive processing theory in contrast to the *prescriptive* nature of cognitive processing therapy.

Cognitive processing [47] has been associated with positive outcomes such as increased growth and meaning, as well as negative outcomes such as prolonged distress. Accordingly, distinguishing between cognitive processes that promote integration and those that prolong distress is important [44]. Intrusive thoughts, by definition, are often uncontrolled and indicative of the stress response to trauma [38]. In contrast, thoughts that are brief and controllable are considered more beneficial [44]. Controlled thoughts are associated with less negative and more positive content, whereas uncontrollable thoughts are inherently intrusive and disruptive [47]. Deliberate, effortful processing of a trauma experience is more likely to result in decreased distress levels and subsequent increases in potential for PTG [37]. Relatedly, the amount of control over intrusive thoughts may reflect habituation and predict a resolution of cognitive processing efforts [38]. Therefore, the relationship between cognitive processing and psychological adjustment among cancer survivors likely varies depending upon whether cognitive processing is operationalized as an automatic (i.e., uncontrolled) versus an effortful (i.e., controlled) process.

A final focus of this study concerns the association between social desirability and PTG. Although reports of benefits or psychological growth from the cancer experience have been well-documented, the veracity of these claims is occasionally questioned as researchers speculate about the potential for inflated claims of growth due to socially desirable responding [48]. It is plausible that some cancer patients or survivors believe they *should* derive psychological growth from their experience and subsequently may report such growth regardless of a personal experience of positive change or benefit. Similarly, some cancer patients know thinking and talking positively about their cancer experience will elicit positive attention from others [49]. One study [50] found no relationship between social desirability and reports of positive psychosocial behavior change, but research addressing this question is scarce.

Study Aims and Hypotheses

Few studies have examined a broad range of psychosocial sequelae among cancer survivors in a longitudinal fashion. Research including positive and negative outcomes of stressful events, incorporating multiple measures of cognitive processing would represent an advance in the literature. In addition, colorectal cancer survivors remain a relatively understudied population, and consequently, little is known about psychological adjustment among this sample.

The aims of this study are threefold. First, to describe associations among PTG, PTSD symptomatology, and mental health (i.e., anxiety, depression, positive affect). PTG and PTSD symtomatology are expected to be uncorrelated, but PTSD symptomatology is expected to be positively correlated with anxiety, depression, and negatively correlated with positive affect. Second, to identify the impact of cognitive processing on psychosocial outcomes. Based on clinical and theoretical literature reviewed, it is hypothesized that cognitive processing will be predictive of both positive (i.e., PTG) and negative (i.e., PTSD symptomatology) outcomes of colorectal cancer. More specifically, cognitive intrusions will be positively associated with PTG and PTSD symptomatology and effortful processing will be positively associated with PTG and negatively associated with PTSD symptomatology. Third, to examine the association between social desirability and PTG. It is hypothesized PTG will be uncorrelated with social desirability.

Methods

Sample

Participants were identified and recruited through the Kentucky Cancer Registry (KCR). The KCR is part of the National Cancer Institute's Surveillance Epidemiology and End Results (SEER) program. Criteria for inclusion in the present study consisted of being a colorectal cancer survivor, stage 0-III at diagnosis, currently post-treatment (i.e., surgery, radiation, and chemotherapy) and within six to eighteen months post-diagnosis. Exclusion criteria include: 1) having a prior history of cancer in addition to colorectal cancer, 2) experiencing a recurrence since initial diagnosis, 3) being under the age of 18, and 4) not being able to understand or read English. Using these criteria, the KCR identified 286 individuals who were study eligible. Of these, 114 (40%) provided active consent to the KCR to be contacted by study researchers, and 76 (67% of those contacted) provided informed consent to participate in the study. Of these 76 individuals, 3 had experienced a recurrence, 6 had a prior history of cancer, and 3 were currently receiving treatment, making them ineligible for the current study. An additional 8 participants dropped out of the study prior to completing any assessments, and 1 participant completed a baseline assessment but was too ill to complete a follow-up assessment. Thus, the final study sample consisted of 55 participants who completed baseline and three-month assessments.

Procedure

The study protocol was approved by the Institutional Review Board of the University of Kentucky College of Medicine and in compliance with current APA standards for the ethical conduct of research with human subjects. After IRB approval was obtained, the KCR contacted physicians of eligible participants to obtain passive consent for participation in this research study. The KCR then contacted eligible participants via mail and telephone to obtain active consent. After receiving contact information from the KCR, potential participants were mailed information packets describing the study in detail and providing an informed consent form to complete and return by mail. Once informed consents were received, participants were sent a baseline and, three-months later, a follow-up questionnaire packet. Answers to questionnaires were obtained during a scheduled phone interview. Participants were compensated $20 for each assessment for a total of $40. During the three-month follow-up, participants completed the same questionnaire as the baseline packet with the exception of demographic, clinical, and dispositional questions.

Study Measures

Participants completed a variety of self-report questionnaires assessing: (a) demographic and clinical information; (b) dispositional variables; (c) cognitive processing variables; and (d) psychological adjustment variables.

Demographic and Clinical Information—Demographic information obtained included age, race, marital status, education, and annual household income. Clinical information obtained through the KCR included stage of cancer at diagnosis, adjuvant treatments received, age at diagnosis, time since diagnosis, and family history (i.e., parent, grandparent, child, sibling, aunt or uncle) of colorectal cancer. Participant responses were coded "yes" for a positive family history of colorectal cancer, or "no" for a negative/unknown family history of colorectal cancer.

Dispositional Variable—Social desirability was assessed with the Marlowe-Crowne Form C [51]. The MC-C consists of 13 items that assess participants' tendency to engage in impression management. Response options are "true" or "false." Higher scores are indicative of greater impression management. Coefficient alpha for this study was .74.

Cognitive Processing Variables—Cognitive processing was assessed with the Impact of Events Scale (IES [52]) and a rumination measure. The IES is a 15-item self-report measure of intrusive and avoidant cognition, and is frequently used in evaluating stress reactions after traumatic experiences. Using a 4-point scale, subjects report how often they experienced specific symptoms during the past week. The scale ranges from "not at all" to "often." The IES was keyed to the experience of colorectal cancer (i.e., "Indicate how frequently these comments were true for you during the past 7 days with respect to your experience with cancer"). For this study, the intrusions subscale was of particular interest. Coefficient alphas at baseline and three-month follow-up for the intrusions subscale was .88 and .90.

The Rumination Scale [42] is a 10-item measure of conscious, repetitive, and persistent thoughts. Factor analyses have yielded two subscales, a six-item subscale measuring lack of control and distractibility (e.g., "Sometimes I feel I have no control over my thoughts") and a four-item subscale measuring cognitive rehearsal and processing (e.g., "When I have a problem, I tend to think of it a lot of the time"). Items were keyed to participants' experience of cancer (i.e., "Indicate how frequently these comments were true for you during the past 7 days with respect to your experience with cancer"). Coefficient alpha was .47 and .36 for the cognitive distractibility subscale and .69 and .75 for the cognitive rehearsal subscale, at baseline and three-month assessments, respectively. Given the poor reliability for the cognitive distractibility subscale, only the cognitive rehearsal subscale was used in subsequent analyses.

Psychological Adjustment Variables—PTG, mental health, and PTSD symptomatology were assessed as indices of psychological adjustment. PTG was assessed using the Posttraumatic Growth Inventory (PTGI [20]). This 21-item measure assesses positive changes experienced after trauma and yields a total PTG score. Participants rated the extent to which they experienced various changes since their cancer diagnosis, ranging from "0" = "I did not experience this change as a result of having cancer" to "5" = "I experienced this change to a very great degree as a result of having cancer". Coefficient alphas were .97 and .98 at baseline and three-month assessments, respectively.

Mental health was assessed using the 18-item short form of the Mental Health Inventory (MHI [53]). This scale yields subscale scores for depression, anxiety, and positive affectivity, among others. Higher scores are indicative of better mental health and more positive psychological adjustment. Coefficient alphas for the three subscales used ranged from .82 to .85 for the baseline and .76 to .81 for the three-month assessments.

The 17-item PTSD Checklist, Civilian Version (PCL-C [54,55]) was used to assess PTSD symptoms. Respondents answered the questions with reference to their cancer diagnosis.

The PCL yielded a total score. Coefficient alpha was .93 for baseline and three-month assessments.

Analyses

Differences between participants and non-participants were examined using chi-square and t-tests as indicated. Given the sample size of research participants (N=55), power was sufficient (i.e., .80) to detect a moderate effect size of d = .5 when comparing participants and nonparticipants (N=218), a moderate effect size of r = .33, and a moderate to large effect size of R^2 = .19 in a regression model with 4 predictors.

Results

Descriptive Characteristics of Sample

Study participants (N=55) had a mean age of 65.9 years (SD=12.7), were primarily female (58.9%), Caucasian (98.2%), currently married/partnered (62.5%), had some college education (52.7%), and were retired (50.9%). An equal number of participants reported an annual income of less than $20,000 (25.5%) and $41,000 to $60,000 (25.5%). No significant differences were found between study participants and non-participants (N=218) on key demographic variables, including age, gender, and race.

Regarding important clinical characteristics, at the time of the baseline assessment, study participants were approximately a year post-diagnosis (M=1.07 years; SD=0.19; range=0.67–1.54) with various stages of disease (Stage 0:14.9%; Stage 1: 25.5%; Stage 2: 44.7%; and Stage 3:14.9%). Many participants had received only surgical treatment (66.1%) or had no family history of colorectal cancer (57.1%). Non-Participants were not significantly different from participants in any of the clinical characteristics with one exception. Study non-participants had more advanced colorectal cancer than study participants (X^2 (3) = 8.280; p = .041).

Identification of Covariates

Prior to evaluating study hypotheses, bivariate relationships were examined between the clinical/demographic variables and PCL-C and PTGI in order to identify potential covariates. Gender, race, education, social desirability, age at diagnosis, time since diagnosis, disease stage, adjuvant treatment (yes vs. no), and family history of colorectal cancer (yes vs. no) were all examined as potential covariates. Age at diagnosis was positively correlated with 3-month PCL-C scores (r=.292, p=.031) and negatively correlated with baseline (r=−.301, p=.026) and 3-month PTGI scores (r=−.282, p=.037). Education was negatively correlated with 3-month PTGI scores (r=−.271, p=.046). Age at diagnosis and education were used as covariates, when appropriate, in subsequent analyses. No other significant correlations were identified. As hypothesized, social desirability was not significantly associated with baseline or three-month PTGI scores.

Associations among Psychosocial Outcome Variables

Descriptive statistics for the social desirability, cognitive processing, and psychological adjustment measures are shown in Table 1. Higher MHI subscale scores are indicative of better mental health. Intercorrelations among cognitive processing, MHI subscales, PCL-C, and PTGI scores are shown in Table 2. Notably, correlations among the indices of psychological adjustment varied. As hypothesized, MHI subscales (i.e., anxiety, depression) were significantly associated with PCL-C scores (rs=−.409 to −.742, all ps<.01), but were not associated with PTGI scores. Similarly, positive affectivity was significantly associated with PCL-C scores (rs=−.45 to −.64, all ps<.001) but not with PTGI scores. So participants who reported less anxiety, less depression, and more positive affectivity were more likely to

report lower PCL-C scores. As expected, participants' scores on the PCL-C were uncorrelated with scores on the PTGI.

Predictors of PTSD Symptomatology and PTG

In order to examine these relationships more closely and to clarify the impact of cognitive processing over time, a series of regression analyses were performed. First, after controlling for age at diagnosis, baseline intrusions were examined as a predictor of baseline PCL-C scores. Second, after controlling for age at diagnosis and baseline PCL-C scores, baseline intrusions were examined as a predictor of three-month PCL-C scores. These two regression models were then repeated with respective baseline and three-month PTGI scores as the dependent variables and education as an additional covariate. We hypothesized that intrusions would be positively associated with PCL-C and PTGI scores. Results of these four regressions are shown in Table 3. Baseline intrusions significantly predicted baseline PCL-C scores ($\beta = .378$, $p = .005$) and three-month PCL-C scores ($\beta = .330$, $p = .004$). This model accounted for the most variance (R^2=47.1%) in outcomes. In contrast, baseline intrusions were not significantly associated with baseline ($\beta = .210$, $p = .105$) or three-month PTGI scores ($\beta = -.061$, $p = .595$).

Given overlap in item content from the IES-Intrusions subscale and the PCL-C, the first two regression models were re-analyzed after modifying the PCL-C by omitting two items that assess an intrusive thought component (i.e., "Repeated, disturbing memories, thoughts, or images of a stressful experience", "Repeated, disturbing dreams of a stressful experience"). Results were essentially unchanged. Baseline intrusions significantly predicted the modified baseline PCL-C scores ($\beta = .371$, $p = .006$) and modified three-month PCL-C scores ($\beta = .322$, $p = .005$), with the later model accounting for significant overall variance (R^2=46.1%).

To examine the relationship between intentional, effortful processing and PTSD symptoms and between intentional, effortful processing and PTG, a parallel series of regression analyses were performed substituting cognitive rehearsal scores for intrusions. We hypothesized that intentional, effortful processing would be negatively associated with PCL-C scores and positively associated with PTGI scores. Results are shown in Table 4. Baseline cognitive rehearsal predicted baseline PCL-C scores ($\beta = .426$, $p = .001$) but not three-month PCL-C scores ($\beta = .228$, $p = .060$), though the later relationship suggests a trend. In contrast, baseline cognitive rehearsal was not predictive of baseline PTGI scores ($\beta = .147$, $p = .272$) nor predictive of three-month PTGI scores ($\beta = .207$, $p = .069$), though this later relationship also suggests a trend.

In order to evaluate the trend relationships more thoroughly, analyses were repeated with covariates omitted. Although this is a less conservative approach, it maximized statistical power for this study. When controlling for baseline PCL-C scores and excluding age at diagnosis, baseline cognitive rehearsal does not predict three-month PCL-C scores ($\beta = .169$, $p = .175$). In contrast, after controlling for baseline PTGI scores and excluding both age at diagnosis and education, baseline cognitive rehearsal predicts three-month PTGI scores ($\beta = .245$, $p = .033$). Taken together, this suggests the relationship between cognitive rehearsal and PCL-C scores weakens from baseline to three-month assessments, whereas the relationship between cognitive rehearsal and PTGI appears to strengthen over the same time frame.

Discussion

The aim of this study was to identify factors associated with and predictive of psychological adjustment among colorectal cancer survivors. Few studies have simultaneously included both positive and negative indices of psychological adjustment such as PTSD and PTG

outcomes. In addition, previous studies of cancer survivors have yielded mixed results regarding the influence of cognitive processing, an important theoretical link to both PTSD and PTG. Therefore, this study sought to extend our understanding of the coping process, in general, and cognitive processing theory, more specifically, by examining the differential impact of cognitive processing on PTSD symptomatology and PTG among colorectal cancer survivors. Though colorectal cancer is the third most common cancer in men and women [56], few studies have examined psychosocial outcomes among colorectal cancer survivors. As a result, this study was designed to address these omissions in the research literature and provide valuable descriptive and theory-driven data about adjustment among colorectal cancer survivors.

In general, clinical and demographic variables were unrelated to cognitive processing and psychosocial outcome variables. Only age at diagnosis and education demonstrated significant associations with greater PTG more likely to be reported among younger and less well-educated colorectal cancer survivors. Though age and education were unrelated to PTG in breast cancer patients [24,27], younger age and lower education levels were associated with more PTG in bone marrow transplant patients [29]. Surprisingly, older age was associated with greater three-month PTSD symptomatology.

A closer examination of mean scores on the PCL-C, revealed lower average scores (23.2 & 21.4) compared to mean PCL-C scores of 33.5 from breast cancer patients [14] and 27.1 from breast cancer survivors [57]. Comparable mean PCL-C scores of 22.4 were found in a study of bone marrow transplant survivors [58]. With regard to intrusive cognitions, this sample of colorectal cancer survivors reported average scores at baseline of 7.0 and at three-month follow-up of 5.9. By comparison, studies of breast cancer patients yielded higher average intrusion scores of 8.7 to 13.6 [26] and 11.9 [27]. Similarly, breast cancer survivors an average of two years post-treatment reported average scores of 11.1 [24]. However, lower mean intrusion scores (M=7.4) were obtained in a sample of breast cancer survivors an average of two and a half years post-treatment [57], scores comparable to those from the current sample. Indicators of cancer-related distress were generally lower relative to other cancer sites, though no comparable data exists for colorectal cancer patients and survivors.

On measures of PTG, average scores were 43.8 and 51.5 for baseline and three-month assessments, respectively. In contrast, prior research with breast cancer patients and survivors reported mean PTGI scores ranging from 49.0 to 64.1 (see [24,26,27,59]). Similarly, patients receiving bone marrow transplants reported mean PTGI scores of 64.7 [29]. However, mean PTGI scores of 46.6 were reported among a sample of prostate cancer survivors [28], scores similar to those in this current study sample. In general, however, PTGI scores from this sample were lower than the majority of PTGI scores reported from other cancer patients.

One possible explanation for the lower mean IES-Intrusion, PCL-C, and PTGI scores relative to other studies of cancer patients and survivors emphasizes the impact of gender on psychological distress. Evidenced is mixed on this issue. While some studies of cancer patients report gender differences on indices of psychological adjustment, specifically females reporting higher distress scores than men [58,60], other research suggests that gender has no impact on the trajectory of the stress response after a trauma [61] or on reports of psychological distress among cancer patients [3]. In this sample, gender was unrelated to key psychosocial variables, including cancer-related intrusions, PTSD symptomatology, and PTG.

An alternative explanation is the lower distress scores are a byproduct of lower distress associated with early stage disease. In this study, 85.1 % of participants were diagnosed with

Stage 0-II disease. Moreover, analyses revealed those individuals who were study eligible but declined to participate, were more likely to have later stage disease. Though lower distress scores among colon cancer patients relative to other cancer patients has been reported [3], this restriction of range may have also contributed to lower distress scores. Overall, this sample of colorectal cancer survivors was reporting fewer problems with psychological adjustment and less PTG relative to other cancer populations studied.

It was hypothesized that cognitive processing would be predictive of both positive and negative psychosocial outcomes of colorectal cancer, but the nature of the association would vary as a function of the cognitive processing variable assessed. Cognitive processing was measured using the IES-Intrusions subscale as well as a subscale examining effortful, deliberate processing (cognitive rehearsal). We expected that cognitive intrusions would be positively associated with PTG and PTSD symptomatology and effortful processing would be positively associated with PTG and negatively associated with PTSD symptomatology. Results for these hypotheses were mixed.

As expected, higher cancer-related intrusions were positively associated with PTSD symptomatology. Specifically, baseline intrusions accounted for unique variance in three-month PTSD symptoms above and beyond age at diagnosis and baseline PTSD symptoms. Although both the IES and PCL-C include an intrusive thought component, thus strengthening the association between these measures, this finding cannot be entirely accounted for by an overlap in item content. Secondary analyses demonstrated the relationship between intrusive thoughts and PTSD symptomatology remained even after removing intrusive thought items from the PCL-C. In addition, the directions for the IES asked participants to indicate how *frequently* the items were true whereas the directions for the PCL-C asked participants to indicate how much they had been *bothered* by the problem, permitting an important comparison between the *occurrence* of an experience or symptom to the *distress* associated with it. Moreover, individual item content supports this distinction. For example, sample IES-Intrusion items are, “I had dreams about it” and “Other things kept making me think about it” and sample PCL-C items are, “Feeling very upset when something reminded you of a stressful experience” and “Repeated, disturbing memories, thoughts, or images of a stressful experience.” In sum, this finding supports research suggesting the IES is a measure of subjective psychological distress related to a specific stressor [61], underscoring the inherently distressing nature of uncontrollable thoughts and the importance of these thoughts in predicting how quickly PTSD symptoms will decrease over time.

Contrary to the hypothesis, frequency of cancer-related intrusions did not reliably predict PTG. As Horowitz [38] has suggested, higher levels of intrusive cognitions are often evidence of incomplete processing. As a result, this incomplete processing may be more predictive of PTSD symptomatology and not PTG, which typically arises after more effortful processing. Relatedly, the two assessments occurred several months after the initial diagnosis and may not have captured adequate variability in psychological adjustment. Though PTG has been thought to occur as early as 2-weeks to four-months following a traumatic event [62], it has also been suggested that PTG may occur over the course of several years until a successful resolution of the crises leads to a decline in both negative and positive sequelae [63]. At baseline assessment, the average time since diagnosis was thirteen months, and this may be a suboptimal amount of time for measuring PTG. It is also possible the intensity of the stressful event was too low to disrupt the assumptions individuals hold about their lives, often considered a critical element of PTG [20]. A final possibility is that IES-Intrusions scores are capturing more of a general stress response instead of a true cognitive processing mechanism. This is plausible since the IES-Intrusion

scores are positively associated with MHI-Anxiety and negatively associated with MHI-Positive Affect scores.

In contrast to the lack of associations between automatic, intrusive cognitions and PTG, more intentional effortful processing was weakly associated with higher levels of PTG. Though baseline cognitive rehearsal was not associated with baseline PTG, the relationship between baseline cognitive rehearsal and three-month PTG suggested a trend. So, while deliberate, cognitive engagement with the cancer experience does not translate into immediate growth, results may suggest later PTG is a product of this cognitive rehearsal, though an extended time span for evaluation is necessary for firmer conclusions to be reached. This is a particularly important finding since no studies to date have examined the impact of a deliberate, effortful component of cognitive processing on PTG.

Interestingly, cognitive rehearsal predicted PTSD symptomatology at baseline but the relationship was weaker at the three-month follow-up, suggesting only a trend. Taken together with the above data, it is possible individuals who were experiencing higher levels of intrusive thoughts along with additional PTSD symptoms were also engaging in more deliberate reflection as a means to begin processing their cancer experience. Three months later, those who had engaged in higher levels of cognitive rehearsal were less likely to report higher levels of PTSD symptoms and more likely to report higher levels of PTG. As hypothesized, cognitive processing (intrusions, cognitive rehearsal) was differentially predictive of PTG and PTSD symptoms.

Given these results, it is possible that cognitive rehearsal is simply another form of cognitive reappraisal that serves as an adaptive coping strategy and facilitates adjustment to a particular stressor. A notable difference between our measure of cognitive rehearsal and typical measures of cognitive reappraisal is the absence of particular “goals” for each item that is commonly found in cognitive reappraisal measures (e.g., “I have tried to make something good come out of my struggle”, “I have reminded myself of some of the benefits that came from adjusting to the traumatic experience”). The cognitive rehearsal measure used in this study was unconfounded by meaning-based content. In contrast to intrusive thoughts, cognitive rehearsal and reappraisal both represent more effortful, deliberate cognitive processes, but cognitive rehearsal suggests a preliminary cognitive process in anticipation of more deliberate reappraisal.

In spite of the contrasting associations between cognitive processing and psychological adjustment variables, the relationship between PTG and PTSD remains unclear. As noted above, Calhoun and Tedeschi [37] have argued that PTG often coexists with PTSD symptoms and other clinical and research data have emphasized the importance of psychological distress as a catalyst for PTG. Interestingly, the empirical literature reveals mixed results regarding the presence of intrusions and PTG. In related studies, researchers have found no associations [26] between PTG and intrusive thoughts and between PTG and negative mood states [29]. Other studies have found positive associations between intrusive thoughts and PTG [27,28].

In this study, PTG was unrelated to more “traditional” measures of adjustment (i.e., PTSD, anxiety, or depression), whereas PTSD symptoms were positively correlated with both anxiety and depression. Though no specific hypothesis was advanced regarding associations between PTG and depression, anxiety, and positive affect, a recent meta-analysis of benefit finding and growth [64] found the relationship between PTG and psychological adjustment among individuals exposed to various traumas varies as a function of time. More specifically, within the first 2 years after a trauma, PTG was related to more global distress and less anxiety. Whereas 2 years or more beyond a trauma, PTG was related to less

depression and greater positive affect. Interestingly, in a longitudinal sample of women treated for breast cancer, Lechner et al. [65] found more robust relationships among PTG and positive outcomes (e.g., positive affect) than negative outcomes (e.g., depression, negative affect). In a comprehensive review of PTG after cancer, Stanton et al.[30] noted the majority of the evidence examining PTG and psychological distress has yielded nonsignificant findings whereas evidence examining PTG and positive affect suggest that PTG may enhance positive affect over time. While this does not explain the lack of an association between PTG and positive affect, it underscores the perspective that cancer is a psychosocial transition, capable of positive and negative psychosocial outcomes. A research focus emphasizing only the presence or absence of distress, omits the important aspect of enhanced well-being and growth. Accordingly, assessment for adaptation to the cancer experience should incorporate both positive and negative indices of adjustment.

Finally, social desirability was not significantly associated with reports of PTG. Though it is plausible that some cancer patients and survivors adhere to demand characteristics or engage in impression management, artificially inflating reports of PTG, results from this study found no association between social desirability and PTG. Only one prior study of cancer patients with a heterogeneous group of cancer diagnoses [50] has examined the association between social desirability and reports of positive psychosocial behavior change. This study replicated and extended these results by focusing on a homogeneous group of cancer survivors and a particular type of psychosocial change (i.e., PTG).

From a clinical perspective, cognitive processing theories have been adapted for therapeutic purposes and effectively used with individuals who have experienced a trauma due to sexual assault [45,46], but the applicability of these therapeutic approaches to survivors of a cancer-related trauma is unknown. Regardless of whether cancer survivors met criteria for a formal PTSD diagnosis, basic cognitive restructuring techniques [66] could prove beneficial for some survivors coping with significant psychological distress secondary to their diagnosis and treatment. In fact, cognitive-behavioral interventions have been utilized with breast cancer survivors and demonstrated decreases in depression, and increases in optimism and benefit-finding [35]. Though some have argued that focusing on interventions to facilitate growth is premature given concerns over the validity of PTG [67], clinical guidebooks to facilitate PTG have been developed [68].

A few caveats should be considered when interpreting these data. First, our sample size was limited to a relatively small number of colorectal cancer survivors. Even though participants were comparable to nonparticipants on demographic and clinical characteristics, generalizability to other cancer survivors is likely limited. Second, only one ethnic minority was represented in this sample. Examining differences among cognitive processing and psychosocial outcomes among ethnic minorities is essential to advancing research on psychological adaptation to cancer more fully. Third, the average baseline assessment occurred over one year after the initial cancer diagnosis. To understand the trajectory of PTG more completely and its relationship to cognitive processing and to PTSD symptoms, an extended time range of assessments accurately capturing more variability in distress levels is needed.

In spite of these limitations, this study provided informative data regarding the impact of cognitive processing on psychological adjustment among colorectal cancer survivors. First, PTG is uncorrelated with traditional measures of psychological adjustment, which focus on maladjustment and distress. To more fully understand cancer as a psychosocial transition, assessment of positive psychological adjustment to the cancer experience is needed. Second, PTG is independent of socially desirable responding in this sample, thus suggesting reports of PTG are more than impression management. Third, cognitive processing differentially

predicted psychosocial outcomes. Specifically, cancer-related intrusions were associated with PTSD symptomatology whereas cognitive rehearsal was associated with PTG. Much work remains to further delineate the nature of cognitive processing, understand the developmental trajectory of PTG, and clarify the association between PTG and other indices of psychological adjustment.

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Table 1

Descriptive statistics for study measures

Measures	Expected Range	Obtained Range	M	SD
Social Desirability (MC-C)	0–13	1–12	8.9	2.9
Intrusions (IES) – Baseline	0–35	0–23	7.0	6.1
Intrusions (IES) – 3-month	0–35	0–31	5.9	6.4
Cognitive Rehearsal – Baseline	0–12	0–11	4.8	3.0
Cognitive Rehearsal – 3-month	0–12	0–12	4.7	3.0
PTSD Symptomatology (PCL-C) – Baseline	17–85	17–49	23.2	8.0
PTSD Symptomatology (PCL-C) – 3-month	17–85	17–46	21.4	6.9
Posttraumatic Growth (PTGI) – Baseline	0–105	1–98	43.8	29.6
Posttraumatic Growth (PTGI) – 3-month	0–105	0–102	51.5	30.1
Anxiety (MHI) – Baseline	0–100	28–100	78.7	16.5
Anxiety (MHI) – 3-month	0–100	48–100	79.6	14.3
Depression (MHI) – Baseline	0–100	40–100	84.0	14.9
Depression (MHI) – 3-month	0–100	45–100	85.5	14.1
Positive Affect (MHI) – Baseline	0–100	30–100	73.3	17.5
Positive Affect (MHI) – 3-month	0–100	35–100	73.5	16.3

Note. N = 55. MC-C = Marlowe-Crowne Form C. IES = Impact of Events Scale. PCL-C = PTSD Checklist – Civilian Version. PTGI = Posttraumatic Growth Inventory. MHI = Mental Health Inventory.

Table 2

Intercorrelations among study variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13
1. IES: Intrusions – T1													
2. IES: Intrusions – T2	.59***												
3. Cog. Rehearsal – T1	.56***	.35**											
4. Cog. Rehearsal – T2	.36**	.44***	.67***										
5. Anxiety – T1	−.36**	−.27*	−.27*	−.01									
6. Anxiety – T2	−.43**	−.47***	−.39**	−.23	.70***								
7. Depression – T1	−.26	−.13	−.40**	−.08	.76***	.67***							
8. Depression – T2	−.21	−.23	−.27*	−.18	.50***	.71***	.61***						
9. Positive Affect – T1	−.31*	−.34*	−.24	−.16	.77***	.74***	.65***	.63***					
10. Positive Affect – T2	.−18	−.19	−.24	−.16	.62***	.66***	.64***	.77***	.74***				
11. PCL-C – T1	.37**	.27*	.41**	.13	−.68***	−.51***	−.74***	−.44***	−.60***	−.45***			
12. PCL-C – T2	.47***	.33*	.37**	.29*	−.45***			−.62***	−.64***	−.58***	.57***		
13. PTGI – T1	.23	.29*	.22	.23	.00	−.08	−.09	−.06	−.01	−.00	.11	.04	
14. PTGI – T2	.07	.32*	.36**	.42**	.04	−.10	−.12	.02	.00	.05	.13	.03	.57***

Note. N = 55. Table shows Pearson Correlations.

* p<.05,

** p<.01,

*** p<.001.

T1 = baseline assessment. T2 = three-month assessment. Cog. Rehearsal = Cognitive Rehearsal. PCL-C = PTSD Checklist – Civilian Version. PTGI = Posttraumatic Growth Inventory.

Table 3

Cognitive Intrusions Predicting PTSD Symptomatology and PTG

Step and measure	R^2	ΔR^2	F for Δ in R^2	df	Final Beta
Dependent variable: Baseline PCL-C Scores					
Step 1: Age at Diagnosis	.009	.009	0.478	1, 53	.117
Step 2: Baseline Intrusions	.152	.143**	8.751	1, 52	.378**
Dependent variable: 3-month PCL-C Scores					
Step 1: Age at Diagnosis	.378	.378***	15.829	2, 52	.271*
Baseline PCL-C Scores					.419***
Step 2: Baseline Intrusions	.471	.093**	8.957	1, 51	.330**
Dependent variable: Baseline PTGI Scores					
Step 1: Age at Diagnosis	.130	.130*	3.881	2, 52	−.320*
Education					−.195
Step 2: Baseline Intrusions	.174	.044	2.721	1, 51	.210
Dependent variable: 3-month PTGI Scores					
Step 1: Age at Diagnosis	.386	.386***	10.703	3, 51	−.171
Education					−.225†
Baseline PTGI Scores					.499***
Step 2: Baseline Intrusions	.390	.004	0.286	1, 50	−.061

Note. N=55.

† p<.10,

* p<.05

** p<.01

*** p<.001.

PTSD = Posttraumatic Stress Disorder. PTG = Posttraumatic Growth. PCL-C = PTSD Checklist – Civilian Version. PTGI = Posttraumatic Growth Inventory.

Table 4

Cognitive Rehearsal Predicting PTSD Symptomatology and PTG

Step and measure	R^2	ΔR^2	F for Δ in R^2	df	Final Beta
Dependent variable: Baseline PCL-C Scores					
Step 1: Age at Diagnosis	.009	.009	0.478	1, 53	.154
Step 2: Baseline Cognitive Rehearsal	.187	.178**	11.380	1, 52	.426**
Dependent variable: 3-month PCL-C Scores					
Step 1: Age at Diagnosis	.378	.378***	15.829	2, 52	.281*
Baseline PCL-C Scores					.448***
Step 2: Baseline Cognitive Rehearsal	.420	.042†	3.691	1, 51	.228†
Dependent variable: Baseline PTGI Scores					
Step 1: Age at Diagnosis	.130	.130*	3.881	2, 52	−.308*
Education					−.173
Step 2: Baseline Cognitive Rehearsal	.150	.021	1.233	1, 51	.147
Dependent variable: 3-month PTGI Scores					
Step 1: Age at Diagnosis	.386	.386***	10.703	3, 51	−.148
Education					−.194†
Baseline PTGI Scores					.452***
Step 2: Baseline Cognitive Rehearsal	.426	.040†	3.444	1, 50	.207†

Note. N=55.

† p<.10,

* p<.05

** p<.01

*** p<.001.

PTSD = Posttraumatic Stress Disorder. PTG = Posttraumatic Growth. PCL-C = PTSD Checklist – Civilian Version. PTGI = Posttraumatic Growth Inventory.