

The valence of attentional bias and cancer-related rumination in posttraumatic stress and posttraumatic growth among women with breast cancer

Michelle W. C. Chan^{1,2*}, Samuel M. Y. Ho¹, Richard G. Tedeschi³ and Carmen W. L. Leung⁴

¹Positive Psychology Laboratory, Department of Psychology, The University of Hong Kong, Hong Kong SAR, China

²Department of Clinical Psychology, Queen Elizabeth Hospital, Hong Kong SAR, China

³Department of Psychology, University of North Carolina Charlotte, Charlotte, North Carolina, USA

⁴Department of Clinical Oncology, Queen Elizabeth Hospital, Hong Kong SAR, China

*Correspondence to:
University of Hong Kong,
Hong Kong. E-mail:
mwcchan@graduate.hku.hk

Abstract

Objective: To examine the effects of self-reported attentional bias on posttraumatic stress disorder (PTSD) symptoms and posttraumatic growth (PTG) through the potential mediator of cancer-related rumination.

Design: A cross-sectional survey design was used and women with breast cancer ($N = 170$) were recruited.

Measures: Attentional biases, cancer-related ruminations, PTSD symptoms, and PTG were assessed.

Results: Negative attentional bias and negative cancer-related rumination were positively related to PTSD symptoms following cancer diagnosis and treatments, but they were not related to PTG. Positive attentional bias and positive cancer-related rumination were positively related to PTG, but positive attentional bias was not related to PTSD symptoms. Findings showed that negative cancer-related rumination partially mediated the relationship between negative attentional bias and PTSD symptoms, while positive cancer-related rumination partially mediated the relationship between positive attentional bias and PTG.

Conclusion: Findings support that there are differential trajectories to PTSD symptoms and PTG with respect to different valence of habitual attentional style and cancer-related rumination. They may serve as potential therapeutic levers in the alleviation of PTSD symptoms and facilitation of PTG following cancer diagnosis and treatments.

Copyright © 2010 John Wiley & Sons, Ltd.

Keywords: breast cancer; oncology; attentional bias; posttraumatic stress disorder symptoms; posttraumatic growth

Received: 19 September 2009
Revised: 26 March 2010
Accepted: 2 April 2010

Both posttraumatic stress disorder (PTSD) symptoms and posttraumatic growth (PTG) have been documented in the aftermath of cancer diagnosis and treatments [1]. Research findings indicate that PTSD symptoms have been reported in over 20% of women with breast cancer [2,3]. Studies also show that positive changes are prevalent, reported by 53% [4] and 84% [5] of women with breast cancer [6]. These patients report greater appreciation of life and satisfaction with self, changed priorities, better relationships, and positive changes in religious beliefs and spirituality as a result of their experience with cancer [1]. Tedeschi and Calhoun [7] coined the term posttraumatic growth (PTG) to denote the perception of positive changes resulting from an individual's struggle with a traumatic event. These positive changes have also been

labeled as stress-related growth, benefit finding, or thriving [8,9].

Trauma-related rumination, PTSD symptoms, and PTG

Rumination, as a type of repetitive thought, is defined as the cognitive process of actively thinking about a stressor, the thoughts and feelings it evokes, and its implications for one's life and future [10]. Negative appraisals of the trauma and/or its sequelae has been posited [11] and shown to be one of the principal sources of PTSD symptomatology in trauma survivors [12]. On the other hand, PTG models have proposed that cognitive processing, variably referred to as rumination, accommodation and assimilation, positive appraisal and coping, and meaning-making, is an important

underlying mechanism of positive changes following highly stressful and traumatic events [13]. For growth to take place, Tedeschi and Calhoun [14] postulated that people must persist in deliberately ruminating about the trauma until they rebuild the schemas that are challenged by the traumatic experience. The more an individual ruminates, i.e. actively thinks about the circumstances and ways to make sense out of them, the more likely growth will be experienced [15,16]. Studies have shown that deliberate event-related rumination and those focusing on positive content are associated with growth [10,15,17,18].

Valence of thought content has long been suggested by cognitive theories [19] and shown to be important in determining the effects of rumination [10]. Specifically, studies have found that positive re-appraisal is associated with PTG among women with breast cancer [20,21]. On the other hand, Black and White [22] found that perceived fear of cancer recurrence is related to posttraumatic stress. Thus, it is reasonable to hypothesize that negative trauma-related rumination would be associated with PTSD symptoms, while positive trauma-related rumination would be associated with PTG.

Attentional biases and posttraumatic outcomes

Cognitive styles have been referred to as the distinctive ways that individuals come to grips with reality [23], and these dispositions have cognitive, affective, and behavioral aspects [24,25]. Noguchi and colleagues [26] postulated that there are individual differences in attending to the negative and positive aspects of events. They found that self-reported attention to negative information is related to negative affectivity, neuroticism, the behavioral inhibition system, and optimism (inversely), whereas self-reported attention to positive information is related to positive affectivity, extraversion, the behavioral approach system, and optimism. Attention to negative information and attention to positive information are not highly correlated, indicating the independence of these constructs. In the present study, *valenced attentional bias* is defined as the habitual and generalized cognitive processing style to selectively attend to negative and positive information. *Negative attentional bias* and *positive attentional bias* refer to the generalized tendency to selectively attend to the negative aspects and positive aspects, respectively, in life.

Studies have shown that negative self cognitions [27], negative global beliefs [28], pessimistic attributional style [29], neuroticism, and introversion [30] are related to PTSD symptoms. Ho and colleagues [31] found that explanatory style for bad events is not correlated with PTG among bereaved individuals, providing some evidences that negative attentional tendency to oneself and

the world may be a vulnerability factor for PTSD symptoms, but may not be related to PTG. On the other hand, explanatory style for good events is positively correlated with PTG among bereaved individuals [31]. Positive dispositions that have been considered as cognitive processing styles, including optimism, hope, and extraversion, have been documented to be positively associated with PTG [32]. A common thread shared by these dispositions is their positive valence, with a habitual attentional focus on the 'positives' with respect to the self and world. Thus, positive attentional bias may be positively related to PTG.

Attentional biases and trauma-related ruminations in PTSD symptoms and PTG

Tedeschi and Calhoun [14] suggested that intrapersonal context has important impact on the adaptiveness of cognitive processing. Negative cognitive styles may predispose individuals to suboptimal interpretations of traumatic events, thus contribute to psychotraumatic morbidity [33]. Negative attentional bias may affect trauma-related rumination negatively, which in turn may predict PTSD symptoms. According to psychosocial models of growth [14,34], intrapersonal factors may influence cognitive appraisal processes, thereby influencing adjustment outcomes of traumatic events. Positive attentional bias may affect trauma-related rumination positively, hence influencing PTG.

The present study

The present study, to our best knowledge, is the first to examine the differential impacts of the valence (negative and positive) of habitual attentional style and cancer-related rumination on the development and maintenance of PTSD symptoms and PTG following breast cancer diagnosis and treatments. Potential mediation effects of differently valenced cancer-related rumination on the relationships between attentional biases and posttraumatic outcomes were explored. Studies show that women with breast cancer practicing a religion have higher levels of PTG than those without religion [8], and that education level and family income are both positively related to PTG [1,35,36] but inversely related to PTSD symptoms [37–39]. Thus, it was speculated that women with breast cancer practicing a religion would have more PTG than those without religion and that greater education level and greater monthly family income would be related to more PTG and less PTSD symptoms. We hypothesized that after controlling for the effects of religion, education level, and monthly family income, negative attentional bias would be related to negative cancer-related rumination, which in turn would

predict PTSD symptoms; and positive attentional bias would be related to positive cancer-related rumination, which in turn would predict PTG.

Method

One hundred and seventy women with breast cancer were recruited from the out-patient clinic of the Department of Clinical Oncology at Queen Elizabeth Hospital in Hong Kong. Inclusion criteria were as follows: aged 20–60, learned about their cancer diagnosis, able to read Chinese, and had no prior psychiatric diagnosis. Age of the participants ranged from 26 to 60 years (Mean = 48.36 years, SD = 7.00 years). Marital status included 18.8% single, 72.9% married, 6.5% divorced or separated, 1.2% widowed, and 0.6% cohabited. In the sample, 0.6% had not received formal education, 12.4% completed primary education, 26.5% attained Grade 9 level, 40.0% attained Grade 11 level, 7.6% completed secondary school, and 13% gained an undergraduate or postgraduate degree. Onset duration regarding time from breast cancer diagnosis to time of participation ranged from 4.14 to 34.30 months (Mean = 15.59 months, SD = 5.84 months), 28.8% with onset period within one year since first diagnosis, 66.5% within one to two years, and 4.7% with more than two years. Although not an inclusion criterion, all participants had undergone surgery, with 61.8% having received modified radical mastectomy and 38.2% having received lumpectomy. Radiotherapy was subsequently received by 71.8%, 64.7% received chemotherapy, and 67.6% received or were receiving hormonal therapy (Tamoxifen, Arimidex, Zoladex, or Femara). Stage 0 (ductal carcinoma *in situ*) cancer was diagnosed in 19.4%, 31.8% were diagnosed with Stage 1, 37.1% with Stage 2, and 11.8% with Stage 3. Clinical research ethics approval was obtained from the Institutional Review Board of The University of Hong Kong/Hospital Authority Hong Kong West Cluster and the Research Ethics Committee (Kowloon Central/Kowloon East) of Hospital Authority. All participants provided written informed consent.

Measures

The Chinese version of attention to positive and negative information scale (CAPNIS)

The original 40-item English-version Attention to Positive and Negative Information Scale (APNIS) [26] measures chronic individual differences in the tendency to attend to, think about, and focus on positive (or negative) information with respect to the self, others, and past and future events. There are two subscales: Attention to Negative Information (ANI) subscale (18 items) and Attention to Positive Information (API) subscale (22

items), which measure negative attentional bias and positive attentional bias respectively. Participants were asked to rate how much the statement in each item was true of them along a five-point Likert scale (1 = very untrue of me to 5 = very true of me). Translation, back-translation, and revision were used to develop the Chinese version. The Cronbach's α reliability of ANI subscale and API subscale was 0.84 and 0.87 respectively in the present sample.

The Chinese cancer-related rumination scale (CCRRS)

The Cancer-Related Rumination Scale (CRRS) is a 12-item questionnaire developed by Richard G. Tedeschi (personal communication, 2006) that is a modification of the Rumination Inventory [27], and measures rumination about the cancer experience. Translation, back-translation, and revision were used to develop the Chinese questionnaire from the original English version of the CRRS. After exploratory factor analysis (EFA), 10 items were retained in the Chinese version of CRRS (CCRRS). In the CCRRS, each item was rated along a five-point Likert scale (1 = not at all to 5 = a great deal) regarding the frequency of thought in that item. There are two subscales: Negative Cancer-Related Rumination (NCRR) subscale and Positive Cancer-Related Rumination (PCRR) subscale, which measure the frequencies of rumination about the negative aspects and positive aspects respectively in the cancer experience. The Cronbach's α reliability of NCRR subscale and PCRR subscale was 0.79 and 0.66 respectively in the present sample.

The Chinese impact of event scale-revised (CIES-R)

The 22-item CIES-R measures PTSD symptoms [40]. The original Impact of Event Scale-Revised (IES-R) [41] is a self-report measure that parallels the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [42] criteria of PTSD in response to a specific traumatic stressor. The CIES-R has good internal consistency and scale equivalence comparable to the original English version [40]. Participants were asked to indicate the degree of distress associated with each symptom (i.e. CIES-R item) with respect to breast cancer (the focused event) during the past seven days. Each item was rated along a five-point Likert scale (ranging from 0 = not at all to 4 = extremely). There are three subscales tapping intrusion, avoidance, and hyperarousal symptoms. Internal consistencies in the present study were as follows: CIES-R Total ($\alpha = 0.95$); Intrusion ($\alpha = 0.89$); Hyperarousal ($\alpha = 0.88$); and Avoidance ($\alpha = 0.85$).

The Chinese posttraumatic growth inventory (CPTGI)

The 21-item English-version Posttraumatic Growth Inventory (PTGI) developed by Tedeschi and

Calhoun [43] measures positive changes following adversity. The 15-item CPTGI [44] was developed as a Chinese version of PTGI and had acceptable internal reliabilities. Each item was rated along a six-point Likert scale (0 = not at all to 5 = extremely). The CPTGI measures two dimensions of PTG: Intrapersonal (sub-divided into Self, Spiritual, and Life Orientation domains) and Interpersonal [44]. Internal reliabilities of full scale and separate subscales in the present sample were: PTG Total ($\alpha = 0.86$); Self ($\alpha = 0.84$); Spiritual ($\alpha = 0.63$); Life Orientation ($\alpha = 0.64$); Intrapersonal ($\alpha = 0.84$); and Interpersonal ($\alpha = 0.58$). Examination of item-total statistics of the Interpersonal subscale showed that its internal reliability improved, with $\alpha = 0.73$, after item 12 was deleted. The Interpersonal subscale consisting of the remaining items was used in all statistical analyses.

Demographic and medical information

A demographic questionnaire was included to obtain personal information including age, education level, marital status, monthly family income, and whether participants practice religion or not. Medical information comprising stage of cancer diagnosed, duration since onset of cancer, and treatments was obtained from medical records.

Statistical analyses

Analyses of variance (ANOVAs), independent samples *t*-tests, and Pearson's correlation analyses were conducted to examine the relationships between demographic variables and measures, and whether disease and treatment-related variables were related to outcome variables. How different attentional biases may influence PTSD symptoms and PTG via differential cancer-related rumination were examined by mediation analyses [45] following the procedures suggested by Baron and Kenny [46]. Sobel's [47] test was used to examine the indirect effect in mediation.

Results

Descriptive statistics

Correlation analyses results showed that participants with greater years of education tended to have less negative attentional bias ($r = -0.24$, $p < 0.01$), more PTG ($r = 0.38$, $p < 0.001$), and less posttraumatic responses ($r = -0.16$, $p < 0.05$). Independent sample *t*-tests indicated that compared to participants from the lower family income group, those from the higher family income group reported less negative attentional bias ($t(168) = 2.14$, $p < 0.05$) and more PTG ($t(168) = 4.35$, $p < 0.001$). Participants practicing a religion had more PTG ($t(168) = 3.52$, $p < 0.001$) relative to those without religion. Results showed that there were no significant differences in the disease-

related variables. There were no significant age and marital status differences. Years of education, monthly family income, and religion were thus controlled in the partial correlation analyses and entered into the first step as control variables in all regressions.

Relationships among attentional biases, ruminations, PTSD symptoms, and PTG

Partial correlations

Table 1 presents the partial correlations among attentional biases, cancer-related ruminations, PTSD symptoms, and PTG. Results showed that negative attentional bias was moderately and positively correlated with positive attentional bias ($r = 0.22$, $p < 0.01$). Positive attentional bias was positively associated with positive cancer-related ruminations ($r = 0.41$, $p < 0.001$) and CPTGI scores (CPTGI total: $r = 0.60$, $p < 0.001$; $p < 0.001$ for all subscales) but not negative cancer-related rumination and posttraumatic responses. Negative attentional bias was positively associated with negative cancer-related rumination ($r = 0.41$, $p < 0.001$) and all CIESR subscales scores (CIESR total: $r = 0.50$, $p < 0.001$; $p < 0.001$ for all subscales) but not positive cancer-related rumination and CPTGI total score. Interestingly, positive cancer-related rumination was positively associated with both CPTGI total score ($r = 0.51$, $p < 0.001$) and CIESR total score ($r = 0.16$, $p < 0.05$). Negative cancer-related rumination was positively associated with CIESR total score ($r = 0.58$, $p < 0.001$) and positive cancer-related rumination ($r = 0.30$, $p < 0.001$) but not CPTGI total score.

Mediation with regression analyses

How differential attentional bias may influence posttraumatic outcomes can be examined by analyses of mediation [45]. Specifically, the following two possible mediation models were tested: (i) the relationship between negative attentional bias and PTSD symptoms would be mediated by negative cancer-related rumination, and (ii) the relationship between positive attentional bias and PTG would be mediated by positive cancer-related rumination. Four regression analyses were separately performed for each model following the procedures according to the propositions of Baron and Kenny [46]. Mediation is inferred when the following criteria are met: (1) the predictor (attentional bias) must be significantly related to the potential mediator (cancer-related rumination), (2) the predictor (attentional bias) must be significantly related to the dependent variable (posttraumatic outcome), (3) the potential mediator must be significantly related to the dependent variable (posttraumatic outcome), and (4) the relationship between the predictor and dependent variable is significantly weakened after controlling for the

Table 1. Partial correlations among attentional biases, cancer-related ruminations, PTSD symptoms, and PTG

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CAPNIS Negative	—													
CAPNIS Positive	0.22**	—												
CCRRS Negative	0.41***	0.01	—											
CCRRS Positive	0.10	0.41***	0.30***	—										
CIESR Total	0.50***	-0.11	0.58***	0.16*	—									
CIESR Intrusion	0.54***	-0.07	0.62***	0.15	0.94***	—								
CIESR Hyperarousal	0.47***	-0.12	0.53***	0.11	0.95***	0.88**	—							
CIESR Avoidance	0.38***	-0.11	0.47***	0.19*	0.90***	0.73***	0.76***	—						
CPTGI Total	0.12	0.60***	-0.06	0.51***	0.03	0.08	0.02	0.00	—					
CPTGI Self	-0.01	0.55***	-0.29***	0.42***	-0.12	-0.11	-0.13	-0.09	0.86***	—				
CPTGI Spiritual	0.22**	0.42***	0.10	0.35***	0.13	0.21**	0.10	0.06	0.76***	0.48***	—			
CPTGI Life Orientation	0.28***	0.31***	0.25**	0.33***	0.28***	0.32	0.28***	0.17*	0.56***	0.24**	0.44***	—		
CPTGI Intrapersonal	0.15	0.59***	-0.09	0.48***	0.04	0.09	0.02	0.01	0.97***	0.88***	0.79***	0.57***	—	
CPTGI Interpersonal	-0.06	0.33***	0.02	0.31***	-0.05	-0.06	-0.03	-0.06	0.56***	0.32***	0.31***	0.23	0.37***	—

Partial correlation coefficients controlling for years of education, monthly family income, and religion are presented in the lower triangle of the correlation matrix. CAPNIS Negative, Negative attentional bias measured by Attention to Negative Information subscale of Chinese version of Attention to Positive and Negative Information Scale; CAPNIS Positive, Positive attentional bias measured by Attention to Positive Information subscale of Chinese version of Attention to Positive and Negative Information Scale; CCRRS Negative, Negative Cancer-Related Rumination subscale of Chinese Cancer-Related Rumination Scale; CCRRS Positive, Positive Cancer-Related Rumination subscale of Chinese Cancer-Related Rumination Scale; CIESR Total, Total score of Chinese Impact of Event Scale-Revised; CIESR Intrusion, Intrusion subscale of Chinese Impact of Event Scale-Revised; CIESR Hyperarousal, Hyperarousal subscale of Chinese Impact of Event Scale-Revised; CIESR Avoidance, Avoidance subscale of Chinese Impact of Event Scale-Revised; CPTGI Total, Total score of Chinese Posttraumatic Growth Inventory; CPTGI Self, Self subscale of Chinese Posttraumatic Growth Inventory; CPTGI Spiritual, Spiritual subscale of Chinese Posttraumatic Growth Inventory; CPTGI Life Orientation, Life Orientation subscale of Chinese Posttraumatic Growth Inventory; CPTGI Intrapersonal, Intrapersonal subscale of Chinese Posttraumatic Growth Inventory; CPTGI Interpersonal, Interpersonal subscale of Chinese Posttraumatic Growth Inventory. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

potential mediator in partial mediation, and is totally not significant in full mediation. A series of four regression equations for each hypothesis are computed to assess each criterion as outlined by Baron and Kenny [46], and mediation is considered to occur if the relationship between the predictor and dependent variables could be partially or totally accounted for by the hypothesized mediator(s) and if significant indirect effects are demonstrated [47]. The Sobel [48] test was used to examine the indirect effect in the mediation hypotheses.

For the PTSD symptoms model, the first and second regressions showed that negative attentional bias was significantly related to negative cancer-related rumination ($\beta = 0.42$, $SE = 0.52$, $t = 5.83$, $p < 0.001$) and PTSD symptoms ($\beta = 0.51$, $SE = 1.92$, $t = 7.42$, $p < 0.001$) respectively. PTSD symptoms were regressed on negative attentional bias and negative cancer-related rumination in the third and fourth regressions. After controlling for negative attentional bias, negative cancer-related rumination was significantly related to PTSD symptoms ($\beta = 0.45$, $SE = 0.25$, $t = 6.93$, $p < 0.001$). With negative cancer-related rumination as potential mediator, the relationship between negative attentional bias and PTSD symptoms decreased in strength and remained significant ($\beta = 0.32$, $SE = 1.86$, $t = 4.79$, $p < 0.001$) (see Figure 1). Results of Sobel's test indicated that this indirect effect was significant ($z = 4.46$, $p < 0.001$), thereby supporting a partial mediation model.

For the PTG mediation model, the first and second regressions found that positive attentional bias was significantly related to positive cancer-related rumination ($\beta = 0.40$, $SE = 0.58$, $t = 5.76$, $p < 0.001$) and PTG ($\beta = 0.54$, $SE = 1.31$, $t = 9.64$, $p < 0.001$) respectively. In the third and fourth regressions, PTG was regressed on positive attentional bias and positive cancer-related rumination. After controlling for positive attentional bias, positive cancer-related rumination was significantly related to PTG ($\beta = 0.28$, $SE = 0.17$, $t = 4.87$, $p < 0.001$). With positive cancer-related rumination as hypothesized mediator, the relationship between positive attentional bias and PTG decreased in strength and was significant ($\beta = 0.42$, $SE = 1.34$, $t = 7.40$, $p < 0.001$) (see Figure 1). Testing standard error of this indirect effect [48] indicated a significant mediation ($z = 3.72$, $p < 0.001$), suggesting that positive cancer-related rumination partially mediated the relationship between positive attentional bias and PTG.

Discussion

The main objective of the present study was to examine the effects of attentional biases on PTSD symptoms and PTG through the potential mediator of cancer-related rumination in women with breast cancer. Consistent with our hypotheses, the present

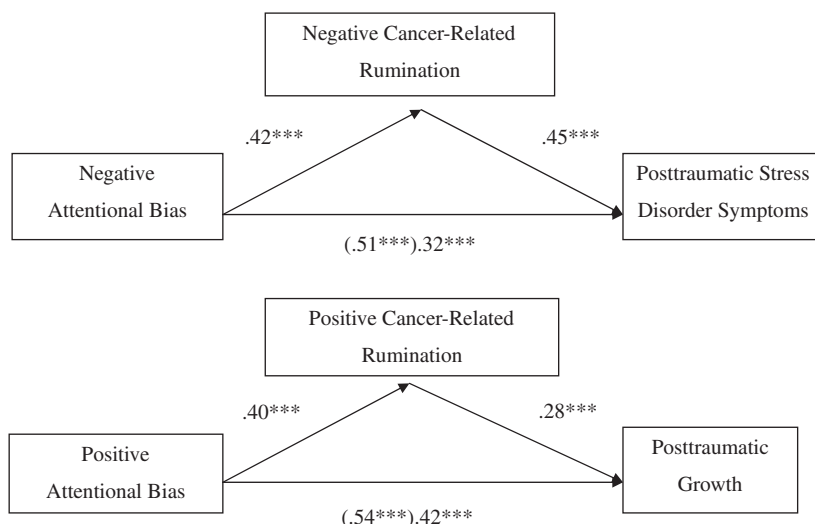


Figure 1. Model of relationships among negative attentional bias, negative cancer-related rumination, and posttraumatic stress disorder symptoms and model of relationships among positive attentional bias, positive cancer-related rumination, and posttraumatic growth in women with breast cancer. Values presented are standardized regression coefficients. The value in parentheses represents the coefficient for the direct (i.e. unmediated) path. *** $p < 0.001$

findings build on past research and extend current theories by demonstrating that different valence of attentional style may predict differential trajectories of the development of PTSD symptoms and PTG via differently valenced cancer-related rumination. These results converged to mounting evidence that adjustment to cancer may be mediated by how individuals cognitively process their disease [49].

The present study indicated that greater negative attentional bias and greater negative cancer-related rumination are related to more posttraumatic stress reactions and they are not related to PTG. Negative cancer-related rumination is found to partially mediate the effect of negative attentional bias on PTSD symptoms. This finding extends the cognitive models of PTSD [11,50,51] that self-reported negative attentional bias is an important intrapersonal factor, which may maintain PTSD symptoms by fostering a sense of serious current threat directly or indirectly through predisposing one to engage in negative trauma-related appraisals. It is in-line with the literature that selective attention to threat-related stimuli measured by experimental paradigms is central to PTSD symptoms development [52].

The present study indicated that positive cancer-related rumination is positively related to PTG, and that positive attentional bias is positively related to PTG but not PTSD symptoms. It was found that while positive attentional bias may predict PTG, the effects would at least be partially mediated by positive cancer-related rumination. Consistent with psychosocial approaches to growth [7,34,53], women with breast cancer with greater positive attentional bias may tend to shape their illness experience by engaging in more positive cancer-related rumination, thus producing more PTG. They may tend to have their attention focus on important resources or positive sides of their

cancer experience, and disengage from uncontrollable or unresolved problems [54], thereby yielding more growth directly or indirectly by influencing cancer-related rumination adaptively.

Additionally, the present finding that PTG and PTSD have no significant correlation with one another concurred with the results of several studies on breast cancer women [1,36]. No association or inconsistent associations between growth and psychopathology suggested that these constructs may be viewed as two separate, independent dimensions of experience following adversity [9], thus they may have different underlying cognitive mechanisms. This suggested that psychopathology and PTG may have differential pathways or trajectories of development. Indeed, the present study found that habitual attentional style is an important intrapersonal factor that may affect the adaptiveness of cognitive processing of the cancer experience, hence the posttraumatic outcomes.

Both PTSD and PTG have been evinced to be multidimensional and different processes may be related to their different dimensions [55–57]. Interestingly, negative attentional bias is positively related to the life orientation dimension of PTG in the present study. The life orientation dimension consists of two items regarding people’s change in life priority and belief about the changeability of things in life [44]. Perhaps, positive changes in life orientation may require people to be aware of both the negative and positive things in life before comparisons could be made regarding the relative importance of the different life aspects and changeability of things in life. Moreover, the present study found that negative attentional bias is also positively correlated with the spiritual dimension of PTG, suggesting that the tendency to attend to negative information may provide a fertile ground for processing of and positive

changes in religious beliefs and spiritual life following cancer diagnosis and treatments. Generally speaking, while the broad picture suggested by the present major findings and PTG literature is that attending to the positive aspects and thinking positively about the cancer experience may facilitate PTG, under specific circumstances, negative attentional style may also play a role in providing opportunities for growth in specific growth dimensions. Future research may explore the potential underlying cognitive processes in relation to different PTG dimensions.

In the present study, positive cancer-related rumination is positively related to PTSD symptoms. Similarly, Taku and colleagues [18] found that distress appeared to be related to recent intrusive rumination directly, and intrusive rumination soon after bereavement and recent deliberate rumination indirectly. Continued deliberate rumination may imply an ongoing struggle with bereavement, leading to distress mediated by current intrusive ruminations [18]. Moreover, negative attentional bias is slightly positively related to positive attentional bias, suggesting that they are fairly distinct constructs. Furthermore, both intrusive negative rumination about the traumatic event and deliberate rumination designed to make sense of the event might be expected to co-occur in the immediate aftermath of a traumatic experience [15,58]. Taku and colleagues [18] found that the relationships between trauma-related intrusive rumination and deliberate rumination are relatively small, suggesting the potential usefulness of investigating these two types of rumination separately [18]. Consistently in the present study, negative cancer-related rumination is not highly correlated with positive cancer-related rumination. This suggested the co-occurrence of negative and positive cancer-related ruminations after the diagnosis and treatments of breast cancer and that they may be examined separately in relation to the different posttraumatic outcomes.

The limitations of this study include its cross-sectional nature, inability to generalize the findings to both genders and other types of cancer patients, and that the relationship of CCRRS with CIES-R and CPTGI may be inflated due to their overlapping item content. Future studies that apply prospective intervals are warranted for drawing cause-effect conclusions. They could examine the generalizability of current findings to male and other types of cancer patients and with the overlapping content removed. Future studies could examine the effects of more automatic aspects of attentional biases on PTSD symptoms and PTG using experimental paradigms, which may minimize the confounding effects between independent and dependent variables measured by self-reports.

The clinical implications are that reducing attentional tendency to negative information and negative cancer-related rumination may alleviate

psychopathology, but may not have impacts on PTG. Facilitating attentional tendency to positive information and positive cancer-related rumination may enhance PTG, but may not necessarily alleviate psychopathology. There is a wealth of literature on the effectiveness of cognitive therapy in PTSD treatment [59] and suggestive evidence that cognitive-behavioral interventions [60] and cognitive-existence approach [61] can increase PTG in cancer patients. Mansell [62] proposed that lower order automatic attentional biases may develop and modify through new information acquisition or voluntary appraisal that changes higher order schema. Thus, cognitive restructuring targeting maladaptive cancer-related appraisals may alleviate PTSD symptoms. Changing global dysfunctional beliefs or voluntary disengaging attention from negative life aspects may modify negative attentional bias, hence affecting PTSD symptoms directly or indirectly via less negative cancer-related rumination. Positive cancer-related rumination may be enhanced by adaptive reappraisal and in-depth existential thinking about the cancer experience [32]. Future research may examine innovative interventions aimed at teaching patients to deliberately attend to positive resources about oneself and the world that may facilitate PTG directly or indirectly through positive cancer-related rumination.

Appendix

EFA results of the Chinese Cancer-Related Rumination Scale (CCRRS)

	Factor	
	I	II
Negative cancer-related rumination		
2 ^a . I have thoughts about cancer and I could not get rid of them	0.784	
6. I have thought about having cancer when I didn't mean to	0.733	
8. I had trouble stopping myself from thinking about cancer	0.730	
3. I have found myself thinking how I may not survive cancer	0.714	
11. I have thought about how upset I am about having cancer	0.700	
Positive cancer-related rumination		
9. I have thought about the ways cancer has helped me appreciate what I have in life		0.709
5. I have thought about how I'm doing a good job in coping with cancer		0.700
7. I have thought about how to best manage the challenges associated with cancer		0.675
10. I have made an effort to find ways to do something to manage the symptoms associated with cancer treatment		0.586
12. I have thought about how to "make peace" with having cancer		0.508
Percentage of variance explained	29.87%	21.09%

^aItem number in the Cancer-Related Rumination Scale.

References

1. Cordova MJ, Giese-Davis J, Golant M, Kronenwetter C, Chang V, Spiegel D. Breast cancer as trauma: posttraumatic stress and posttraumatic growth. *J Clin Psychol Med S* 2007;**14**:308–319.
2. Cordova MJ, Andrykowski M. Posttraumatic growth following diagnosis and treatment of breast cancer. Growth and Transformation Following Stressful Life Experiences, Park C (Chair) Symposium. Presented at the 107th meeting of the American Psychological Association, Boston, MA, 1999.
3. Naidich JB, Motta RW. PTSD-related symptoms in women with breast cancer. *J Psychother Indepen Pract* 2000;**1**:35–54.
4. Taylor SE, Lichtman R, Wood J. Attributions, beliefs about control, and adjustment to breast cancer. *J Pers Soc Psychol* 1984;**46**:489–502.
5. Collins R, Taylor S, Skohan L. A better world or a shattered vision? Changes in perspectives following victimization. *Soc Cogn* 1990;**8**:263–285.
6. Lechner SC, Carver CS, Antoni M, Weaver KE, Phillips KM. Curvilinear associations between benefit finding and psychosocial adjustment to breast cancer. *J Consult Clin Psych* 2006;**74**(5):828–840.
7. Tedeschi RG, Calhoun LG. *Trauma and Transformation: Growing in the Aftermath of Suffering*. Sage Publications: Thousand Oaks, CA, 1995.
8. Helgeson VS, Reynolds KA, Tomich, PL. A meta-analytic review of benefit finding and growth. *J Consult Clin Psych* 2006;**74**(5):797–816.
9. Linley PA, Joseph S. Positive change following trauma and adversity: a review. *J Trauma Stress* 2004;**17**:11–21.
10. Watkins ER. Constructive and unconstructive repetitive thought. *Psychol Bull* 2008;**134**(2):163–206.
11. Ehlers A, Clark DM. A cognitive model of posttraumatic stress disorder. *Behav Res Ther* 2000;**38**:319–345.
12. Ehlers A, Mayou RA, Bryant B. Cognitive predictors of posttraumatic stress disorder in children: results of a prospective longitudinal study. *Behav Res Ther* 2003;**41**:1–10.
13. Park CL, Helgeson VS. Introduction to the special section: growth following highly stressful life events—current status and future directions. *J Consult Clin Psych, Special Issue: Benefit-Finding* 2006;**74**(5):791–796.
14. Tedeschi RG, Calhoun LG. Posttraumatic growth: conceptual foundations and empirical evidence. *Psychol Inq* 2004;**15**(1):1–18.
15. Calhoun LG, Cann A, Tedeschi RG, McMillan J. A correlational test of the relationship between posttraumatic growth, religion, and cognitive processing. *J Trauma Stress* 2000;**13**(3):521–527.
16. Calhoun LG, Tedeschi RG. Posttraumatic growth: future directions. In *Posttraumatic Growth: Positive Changes in the Aftermath of Crisis*, Tedeschi RG, Park CL, Calhoun LG (eds). Lawrence Erlbaum Associates: Mahwah, NJ, 1998; 215–238.
17. Bower JE, Kemeny ME, Taylor SE, Fahey JL. Cognitive processing, discovery of meaning, CD4 decline, and AIDS-related mortality among bereaved HIV-seropositive men. *J Consult Clin Psych* 1998;**66**:979–986.
18. Taku K, Calhoun LG, Cann A, Tedeschi RG. The role of rumination in the coexistence of distress and posttraumatic growth among bereaved Japanese university student. *Death Stud* 2008;**32**:428–444.
19. Segerstrom SC, Stanton AL, Alden LE, Shortridge BE. A multidimensional structure for repetitive thought: what's on your mind, and how, and how much? *J Pers Soc Psychol* 2003;**85**(5):909–921.
20. Sears SR, Stanton AL, Danoff-Burg S. The yellow brick road and the emerald city: benefit finding, positive reappraisal coping, and posttraumatic growth in women with early-stage breast cancer. *Health Psychol* 2003;**22**(5):487–497.
21. Urcuyo KR, Boyers AE, Carver CS, Antoni MH. Finding benefit in breast cancer: relations with personality, coping, and concurrent well-being. *Psychol Health* 2005;**20**(2):175–192.
22. Black EK, White CA. Fear of recurrence, sense of coherence and posttraumatic stress disorder in haematological cancer survivors. *Psycho-Oncology* 2005;**14**:510–515.
23. Klein GS. The personal world through perception. In *Perception: An Approach to Personality*, Blake RR, Ramsey GV (eds). Ronald Press: New York, 1951.
24. Costa PT, McCrae RR. Influence of extraversion and neuroticism on subjective well-being: happy and unhappy people. *J Pers Soc Psychol* 1980;**38**:668–678.
25. DeNeve KM, Cooper H. The happy personality: a meta-analysis of 137 personality traits and subjective well-being. *Psychol Bull* 1998;**124**:197–229.
26. Noguchi K, Gohm CL, Dalsky DJ. Cognitive tendencies of focusing on positive and negative information. *J Res Pers* 2006;**40**(6):891–910.
27. Bryant RA, Guthrie RM. Maladaptive self-appraisals before trauma exposure predict posttraumatic stress disorder. *J Consult Clin Psych* 2007;**75**(5):812–815.
28. Dunmore E, Clark DM, Ehlers A. Cognitive factors involved in the onset and maintenance of posttraumatic stress disorder (PTSD) after physical or sexual assault. *Behav Res Ther* 1999;**37**:809–829.
29. McCormick RA, Taber JI, Kruegelbach N. The relationship between attributional style and posttraumatic stress disorder in addicted patients. *J Trauma Stress* 1989;**2**:477–487.
30. Lauterbach D, Vrana S. The relationship among personality variables, exposure to traumatic events, and severity of posttraumatic stress symptoms. *J Trauma Stress* 2001;**14**(1):29–45.
31. Ho SMY, Chu KW, Yiu J. The relationship between explanatory style and posttraumatic growth after bereavement in a non-clinical sample. *Death Stud* 2008;**32**:461–478.
32. Zoellner T, Maercker A. Posttraumatic growth in clinical psychology—a critical review and introduction of a two component model. *Clin Psychol Rev* 2006;**26**(5):626–653.
33. Aidman EV, Kollaras-Mitsinikos L. Personality dispositions in the prediction of posttraumatic stress reactions. *Psychol Rep* 2006;**99**:569–580.
34. Schaefer JA, Moos RH. Life crises and personal growth. In *Personal Coping: Theory, Research, and Application*, Carpenter BN (ed.). Praeger: Westport, CT, 1992; 49–170.
35. Bower JE, Meyerowitz BE, Desmond KA, Bernaards CA, Rowland JH, Ganz PA. Perceptions of positive meaning and vulnerability following breast cancer: predictors and outcomes among long-term breast cancer survivors. *Ann Behav Med* 2005;**29**(3):236–245.
36. Cordova MJ, Cunningham LLC, Carlson CR, Andrykowski MA. Posttraumatic growth following breast cancer: a controlled comparison study. *Health Psychol* 2001;**20**(3):176–185.
37. Andrykowski MA, Cordova MJ. Factors associated with PTSD symptoms following treatment for breast cancer: test of the Andersen model. *J Trauma Stress* 1998;**11**(2):189–203.
38. Cordova MJ, Andrykowski MA, Kenady DE, McGrath PC, Sloan DA, Redd WH. Frequency and correlates of PTSD-like symptoms following treatment for breast cancer. *J Consult Clin Psych* 1995;**63**:981–986.

39. Jacobsen PB, Widows MR, Hann DM, Andrykowski MA, Kronish LE, Fields KK. Posttraumatic stress disorder symptoms after bone marrow transplantation for breast cancer. *Psychosom Med* 1998;**60**:366–371.
40. Wu KK, Chan KS. The development of the Chinese version of Impact of Event Scale-Revised (CIES-R). *Soc Psychiatr Psychiatr Epidemiol* 2003;**38**:94–98.
41. Weiss DS, Marmar CR. The impact of event scale-revised. In *Assessing Psychological Trauma and PTSD*, Wilson JP, Keane TM (eds). Guilford: New York, 1997; 399–411.
42. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders* (4th edn). American Psychiatric Association: Washington, DC, 1994.
43. Tedeschi RG, Calhoun LG. The posttraumatic growth inventory: measuring the positive legacy of trauma. *J Trauma Stress* 1996;**9**:455–471.
44. Ho SMY, Chan CLW, Ho RTH. Posttraumatic growth in Chinese cancer survivors. *Psycho-Oncology* 2004;**13**(6):377–389.
45. MacKinnon DP, Luecken LL. How and for whom? Mediation and moderation in health psychology. *Health Psychol* 2008;**27**(2 Suppl):S99–S100.
46. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations. *J Pers Soc Psychol* 1986;**51**:1173–1182.
47. MacKinnon DP, Fairchild AJ, Fritz MS. Mediation analysis. *Annu Rev Psychol* 2007;**58**:593–614.
48. Sobel ME. Asymptotic confidence intervals for indirect effects in structural equation models. In *Sociological Methodology* 1982, Leinhardt S (ed.). American Sociological Association: Washington, DC, 1982; 290–312.
49. Lepore SJ. A social-cognitive processing model of emotional adjustment to cancer. In *Psychosocial Interventions for Cancer*, Baum A, Andersen B (eds). American Psychological Association: Washington, DC, 2001; 99–118.
50. Creamer M, Burgess P, Pattison P. Reaction to trauma: a cognitive processing model. *J Abnorm Psychol* 1992;**101**(3):452–459.
51. Foa EB, Ehlers A, Clark D, Tolin DF, Orsillo SM. The posttraumatic cognitions inventory (PTCI): development and validation. *Psychol Assess* 1999;**11**:303–314.
52. Devineni T, Blanchard EB, Hickling EJ, Buckley TC. Effect of psychological treatment on cognitive bias in motor vehicle accident-related posttraumatic stress disorder. *J Anxiety Disord* 2004;**18**:211–231.
53. Park CL. Stress-related growth and thriving through coping: the roles of personality and cognitive processes. *J Soc Issues* 1998;**54**:267–277.
54. Aspinwall LG, Richter L, Hoffman RR. Understanding how optimism works: an examination of optimists' adaptive moderation of belief and behavior. In *Optimism and Pessimism: Implications for Theory, Research, and Practice*, Chang EC (ed.). American Psychological Association: Washington, DC, 2001, 217–238.
55. Buckley TC, Blanchard EB, Neill WT. Information processing and PTSD: a review of the empirical literature. *Clin Psychol Rev* 2000;**28**:1041–1065.
56. Janoff-Bulman R. Posttraumatic growth: three explanatory models. *Psychol Inq* 2004;**15**:30–35.
57. Taku K, Cann A, Calhoun LG, Tedeschi RG. The factor structure of the posttraumatic growth inventory: a comparison of five models using confirmatory factor analysis. *J Trauma Stress* 2008;**21**(2):158–164.
58. Calhoun LG, Tedeschi RG. The foundations of posttraumatic growth: an expanded framework. In *Handbook of Posttraumatic Growth: Research and Practice*, Calhoun LG, Tedeschi RG (eds). Lawrence Erlbaum Associates: Mahwah, NJ, 2006; 3–23.
59. Amstadter AB, McCart MR, Ruggiero KJ. Psychosocial interventions for adults with crime-related PTSD. *Prof Psychol Res Pract* 2007;**38**(6):640–651.
60. McGregor BA, Antoni MH, Boyers A, Alferi SM, Blomberg BB, Carver CS. Cognitive-behavioral stress management increases benefit finding and immune function among women with early stage breast cancer. *J Psychosom Res* 2004;**56**:1–8.
61. Kissane DW, Bloch S, Smith GC et al. Cognitive-existential group psychotherapy for women with primary breast cancer: a randomized controlled trial. *Psycho-Oncology* 2003;**12**:532–546.
62. Mansell W. Conscious appraisal and the modification of automatic processes in anxiety. *Behav Cogn Psychother* 2000;**28**:99–120.

Copyright of Psycho-Oncology is the property of John Wiley & Sons, Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.