The Role of Coping and Posttraumatic Stress in Fostering Posttraumatic Growth and Quality of Life Among Women with Breast Cancer

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Abstract

Tedeschi & Calhoun's model of posttraumatic growth (PTG) suggests that intrusive thoughts about a traumatic event, in combination with helpful coping strategies, facilitates PTG. This manuscript applies this model to a sample of breast cancer survivors, augments it to conceptualize coping strategies as "active" or "avoidant," and extends it to include health-related quality of life (HRQOL). This is a secondary analysis of a subset of breast cancer patients ($N = 123$) in a randomized clinical trial of Tibetan yoga, which examines the associations of coping at study entry with PTG, PTSS (i.e., intrusive thoughts and avoidance), and HRQOL (physical (PCS) and mental (MCS) component scales) reported 9 and 15 months later. Mediation analyses revealed that higher baseline active coping predicted higher 9-month PTG, which in turn predicted higher 15-month PCS [effect = .46, 95% CI (.06, 1.07)]. Exploratory moderated mediation analyses revealed that higher baseline intrusive thoughts about cancer predicted lower 9-month PTG, which in turn predicted lower 15-month PCS, but only for those reporting low active coping [effect = − .06, 95% CI (− .16, − .003)]. Active coping may play a critical role of fostering PTG and improving subsequent HRQOL in the presence of rumination about cancer.

Keywords Breast cancer · Coping · Posttraumatic growth · Posttraumatic stress · Quality of life

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Introduction

Posttraumatic Stress and Breast Cancer

Breast cancer is one of the most common forms of cancer in women and the second leading cause of cancer-related deaths in women in the United States (American Cancer Society, 2020). Receiving a breast cancer diagnosis is a stressful or even traumatic experience (Goyal et al., 2018). In fact, the previous version of the Diagnostic and Statistical Manual (DSM-IV) included life threatening illness as a potential criterion A for diagnosis of posttraumatic stress disorder (PTSD; American Psychiatric Association, 1994). Criterion A was met if an individual perceived their cancer diagnosis or treatment as a threat to their life and if they responded with fear, helplessness, or horror. Using this criterion, several studies have indicated that approximately half of cancer survivors indicated their cancer diagnosis or treatment was a traumatic stressor (Cordova et al., 2017). Though the current version of the DSM (DSM-5; APA, 2013) has revised criteria A to no longer include life threatening illness, a large body of evidence examined the

prevalence and impact of cancer-related PTSD using the prior diagnostic criteria. In addition to experiencing cancer diagnosis and/or treatment as a traumatic event (i.e., "criterion A"), patients met criteria for cancer-related PTSD if they also endorsed intrusive symptoms associated with the traumatic event (e.g., intrusive thoughts, memories, or dreams), avoidance of stimuli associated with the traumatic event, and hyperarousal (e.g., irritability, concentration difficulties, sleep disturbance). Using these criteria, it is estimated that around 13% of cancer survivors experience cancer-related PTSD at some point in their lifetime (Abbey et al., 2015). Importantly, subclinical posttraumatic stress symptoms (PTSS) are reported by many survivors, and these subclinical symptoms are associated with significant impacts on quality of life (Shelby et al, 2008). In fact, over 70% of women recently diagnosed with breast cancer reported intrusive thoughts related to their diagnosis, 7% reported avoidance symptoms, and 40% reported hyperarousal following their diagnosis (Voigt et al., 2017). Subclinical cancer-related PTSS are associated with poorer mental health and difficulties maintaining employment in life compared to those who do not endorse PTSS (Shelby et al., 2008). Furthermore, continuous measures of PTSS are moderately-to-strongly associated with depression, anxiety, distress and health-related quality of life (QOL) (Shand et al., 2015). Indeed, cancer diagnosis, particularly when it is experienced as a traumatic event, can exacerbate existing psychological distress (Cook et al., 2018) and contribute to depression, anxiety, and adjustment disorders among cancer survivors (Mitchell et al., 2011). Thus, PTSS is common and impairs QOL among those navigating diagnosis and treatment of cancer. Yet, PTSS have also been found important in supporting posttraumatic growth.

Posttraumatic Growth and Breast Cancer

Interestingly, most individuals (60–95%) also report posttraumatic growth (PTG) following their breast cancer diagnosis (Lelorain et al., 2010; Stanton et al., 2006). PTG is conceptualized as growth in five areas: enhanced appreciation of life, relationships with others, spirituality, personal strength, and recognition of new possibilities (Tedeschi & Calhoun, 2004). It is associated with less distress and greater well-being among cancer survivors (Ruini et al., 2013). Tedeschi and Calhoun (1998; 2004) proposed a seminal model of the process of developing PTG (Fig. 1). They conceptualize trauma as a "seismic event," which shakes or challenges a person's worldview (e.g., their assumptions about the safety, predictability, and controllability of the world) and life narrative. Their model proposes that, following such a challenge to one's worldview and life narrative, individuals experience automatic, intrusive rumination related to the traumatic experience, likely as a natural attempt to comprehend the traumatic experience. This rumination is impacted by coping strategies; in the presence of active coping strategies (e.g., self-disclosure about the trauma, prayer, seeking social support), rumination becomes more deliberate as the individual processes the traumatic event. This deliberate rumination generates the development of a new worldview and life narrative (which may involve letting go of goals one had prior to the trauma as well as adopting

Fig. 1 Tedeschi & Calhoun's Model of Posttraumatic Growth (1998)
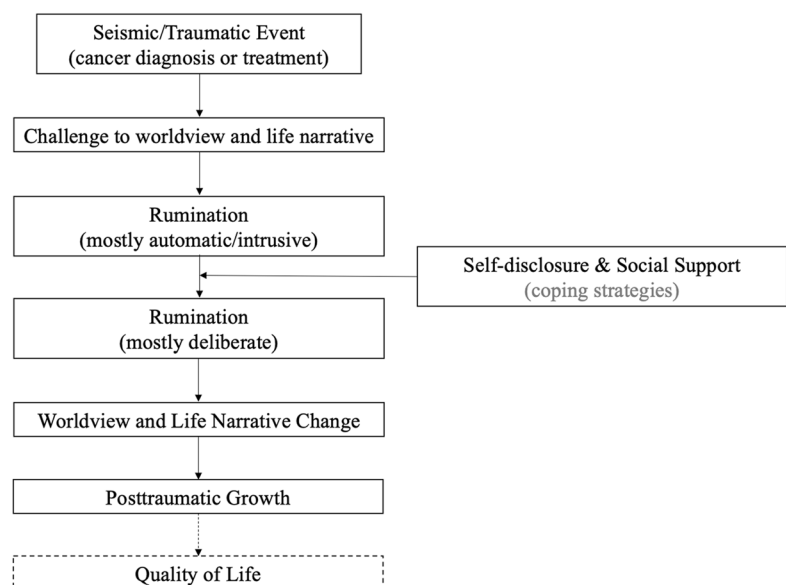
Note: Arrow and boxes with dashed line represent extensions of the original model. Text in gray represents additional language to the original model.

new goals in light of their life post-trauma), which in turn leads to posttraumatic growth in the five domains mentioned above. This growth may facilitate improved quality of life, though it is important to note that growth does not preclude distress. Indeed, survivors experiencing high posttraumatic growth may also tend to experience relatively high cancer-related worry and moderate depression symptoms months after treatment has ended (Ratcliff et al., 2018). Tedeschi & Calhoun also point out that less helpful coping strategies (e.g., denial, counterfactual thinking) may impede the development of revised life narrative and the development of posttraumatic growth. In other words, active coping strategies are proposed to be essential to the movement from distressing PTSS (i.e., intrusive thoughts) to growth following a trauma.

Many studies have provided support for Tedeschi & Calhoun's model of PTG. For example, a meta-analysis found more intrusive and avoidant thoughts (PTSS) about a stressor was associated with greater benefit-finding (a construct similar to PTG) in a wide variety of samples (Helgeson et al., 2006). Furthermore, cancer-specific stress (Groarke et al., 2017) and intrusive thoughts related to breast cancer (Chandwani et al., 2010; Morrill et al., 2008) have also been positively associated with benefit-finding and PTG. Additionally, PTG may buffer the negative effects of PTSS on mental health and QOL (Morrill et al., 2008), suggesting that intrusive thoughts, when accompanied by growth, may not be harmful to individuals. Conversely, PTSS appears to reduce the positive association of PTG and QOL among cancer patients (Li et al., 2019).

Tedeschi & Calhoun's model of PTG suggests that the coping strategies a person uses may make the difference between getting "stuck" in rumination about a traumatic event versus processing and growing after a traumatic event. Their model specifically highlights self-disclosure, prayer, and social support as adaptive coping strategies, but a broader view of active and avoidant coping strategies may be a useful augmentation. Conceptualizing coping as active (i.e., acknowledging, addressing, or adjusting to the stressor) and avoidant is particularly helpful as this aligns with many therapeutic modalities that may help facilitate PTG. For example, cognitive behavioral therapy (CBT) and acceptance and commitment therapy (ACT) both focus on acceptance of aspects of one's experience that cannot be changed and encourage behaviors in keeping with what is important to a person, and there is considerable evidence that both approaches improve QOL among cancer survivors (Zhang et al., 2022; Zhao et al., 2021; Mathew et al., 2021) and some evidence that they improve PTG (Hawkes et al., 2014; Li et al., 2020). Identifying patients who do not use active coping (or those who use avoidant coping strategies to a great extent) and offering psychosocial intervention targeting these coping strategies may be a particularly effective

way to mitigate the negative effects of PTSS and allow them to enhance PTG among cancer survivors.

Thus, active and avoidant coping strategies may be a helpful way to conceptualize the strategies that impact the development of growth from rumination and other PTSS following a trauma. There is considerable evidence that active coping, or efforts to acknowledge and/or address a stressor, has a robust association with PTG among cancer survivors in cross-sectional (Li et al., 2019; Peng et al., 2019; Tallman, 2013) and longitudinal studies (Hamama-Raz et al., 2019; Rajandram et al., 2011; Stanton et al., 2018). Active coping alongside PTSS may support the transition from trauma toward experiencing PTG. Avoidant coping, on the other hand, has a large positive association with long-term PTSS (Krause et al., 2008; Li et al., 2019; Pineles et al., 2011), which may be due to avoidant coping causing individuals to get "stuck" in intrusive rumination, preventing the development of growth. Furthermore, avoidant coping may inhibit the positive association of PTG on QOL (Li et al., 2019).

Active and avoidant coping strategies are also associated with QOL. Within breast cancer patients, active coping is associated with a better QOL whereas avoidant coping is associated with poorer mental health aspects of QOL and even mortality (Elumelu et al., 2016; Lutgendorf et al., 2000; McLaughlin et al., 2013; Stanton et al., 2018). Thus, coping strategies may be a critical component to understanding how the experience of PTSS can lead to PTG and improve QOL following cancer diagnosis and treatment. A better understanding of the role of coping in Tedeschi & Calhoun's model of PTG may be useful in helping to identify individuals in particular need of psychosocial intervention, as simply assessing PTSS limits the ability to help foster PTG.

The Present Study

This is a secondary analysis of a randomized controlled trial (RCT) assessing the effects of a Tibetan Yoga program compared to stretching or waitlist control conditions on sleep and fatigue over a 15-month follow up period (Chaoul et al., 2018).

The longitudinal nature of the data allowed the present study to examine the association of coping strategies, PTSS, PTG, and health-related QOL over time, as proposed by Tedeschi & Calhoun's model of PTG. Additionally, the present study conceptualized active and avoidant coping. The present study sought first to examine the associations of active and avoidant coping strategies on the development of subsequent PTSS and PTG and, in turn, long-term health-related QOL using simple mediation models. Understanding the predictive value of coping strategies, conceptualizing as active and avoidant, may suggest expanding the screening of cancer patients from the more limited "distress" screening (just assessing one aspect of PTSS) to identify individuals

who may benefit from interventions aimed at improving PTG and long-term QOL. Specifically, we hypothesized that baseline active coping would lead to greater PTG measured 9 months post-baseline, which would in turn lead to greater health-related QOL measured 15-month post-baseline (hypothesis 1; Fig. 2a) and that baseline avoidant coping would lead to greater PTSS measured 9 months post-baseline, which would in turn lead to poorer health-related QOL measured 15-month post-baseline (hypothesis 2; Fig. 2b). Hypotheses 1 and 2 were preregistered on the Open Science Framework [https://osf.io/f4tsh/] prior to any data analyses for this project (preregistration used end-of-treatment as the reference for timepoint labels, whereas the present study uses baseline as the reference for timepoint labels; however, the time points described in the preregistration are identical to those used in the present study). Second, the study sought to examine active and passive coping as moderators of the association of intrusive thoughts (referred to as "rumination" in Tedeschi & Calhoun's model of PTG) with subsequent PTG, and the impact of PTG on subsequent QOL. Thus, we conducted an exploratory (i.e., this hypothesis was not preregistered) moderated mediation model in which we hypothesized that active coping would increase the positive association of baseline intrusive thoughts with 9-month PTG, which would in turn lead to greater 15-month mental and physical health-related QOL (hypothesis 3; Fig. 2c). Additionally, we hypothesized that avoidant coping would decrease the positive association of baseline intrusive thoughts with 9-month PTG, which would in turn lead to greater 15-month mental and physical health-related QOL (hypothesis 4; Fig. 2d).

Methods

Participants

Participants ($N = 123$) were recruited from the University of Texas MD Anderson Cancer Center (MDACC). The original study determined selection procedures and describes the methods in full (Chaoul et al., 2018). Participants were women aged ≥ 18 years with stage I-III breast cancer who were proficient in English, and were undergoing chemotherapy, scheduled to undergo neoadjuvant or adjuvant chemotherapy, or were within 12 months of completing chemotherapy at MDACC. Patients were excluded if they had lymphedema, deep vein thrombosis, a documented diagnosis of a formal thought disorder (e.g., schizophrenia), a score of ≤ 23 on the Mini-Mental State Examination, extreme mobility problems, were currently engaged in psychiatric or psychological counseling or support groups or had regularly practiced yoga in the year before their breast cancer diagnosis. Only participants who provided data at baseline, 9-month, and 15 months were included.

Measures

Coping strategies were measured using the Brief COPE (Carver et al., 1997). The Brief COPE is a 28-item measure with 14 subscales consisting of two questions each. Participants rated how often they used the coping strategy using a 4-point Likert scale with 1 = "I haven't been doing this at all" and 4 = "I've been doing this a lot." Three subscales
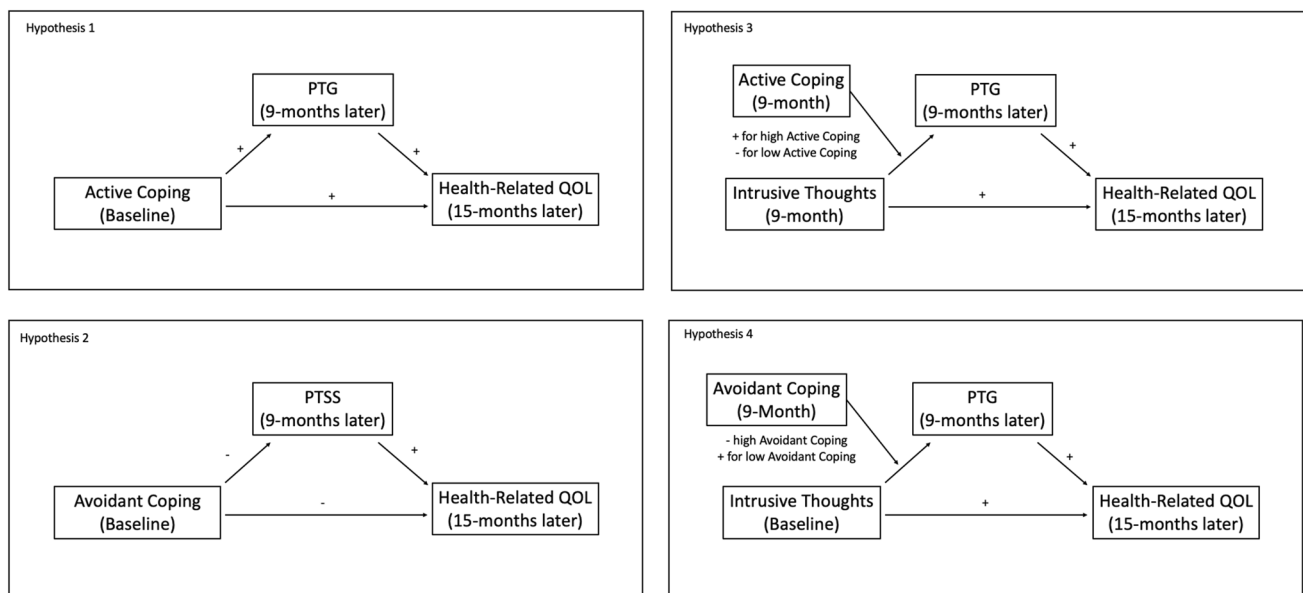

Fig. 2 Conceptual models of hypotheses

were not administered in the original study, which were seeking instrumental support, acceptance, and self-blame. Exploratory factor analysis of the Brief COPE at baseline revealed a two-factor solution with one factor deemed active coping (eigenvalue 2.5) and the other termed avoidant coping (eigenvalue 1.5). The active coping scale consists of an average of five scales: emotional support, positive reframing, planning, active coping, and religious coping with factor loadings of 0.6 to 0.38 (i.e., the 5 scales were summed then divided by 5). The avoidant scale consists of an average of three subscales: denial, behavior disengagement, and venting with factor loadings of 0.39 to 0.38 (i.e., the 3 scales were summed then divided by 3). The subscales of humor, self-distraction, and substance use did not load on any factors (< 0.35) and subsequently were not utilized in analyses. Internal reliability was high for the active (Chronbach's $\alpha = 0.93$) and avoidant (Chronbach's $\alpha = 0.82$) scales.

Post-traumatic growth (PTG) was assessed using the Posttraumatic Growth Inventory (PTGI) (Tedeschi & Lawrence, 1996). The PTGI is a 21-item measure used to capture people's positive change as a result of a traumatic experience. The PTGI has five factors: New Possibilities, Relating to Others, Personal Strength, Spiritual Change, and Appreciation of Life. Participants rated their degree of change with $0 =$ "I did not experience this change as a result of my crisis" and $5 =$ "I experienced this change to a very great degree as a result of my crisis". The PTGI is scored by summing all the responses; a higher score means more growth has occurred. Internal consistency was high (Chronbach's $\alpha = 0.98$).

Post-traumatic stress symptoms (PTSS) were measured using the Impact of Event Scale (IES) (Horowitz et al., 1979). The IES is a 15-item measure of PTSS which occur as a result of a traumatic event. The IES has the two subscales of intrusive thoughts (IES-intrusion) and avoidance (IES-avoidance) as well as a total score (IES-total). Participants rated their level of distress experienced per item using a 4-point Likert scale with $0 =$ "not at all" to $4 =$ "extremely." Participants answer the following statements such as, "I had trouble falling asleep or staying asleep because of pictures or thoughts about it that came into my mind" in the context of the past seven days. Higher scores indicates more PTSS. Internal consistency was high for the total (Chronbach's $\alpha = 0.96$), intrusion (0.91) and avoidant (0.92) subscales.

Health-related QOL was assessed using the 36-item Medical Outcomes Study Short Form Survey (SF-36) (Ware, 1999). The SF-36 measures patients' perspectives of their health-related QOL. Patients rated their level of health using 3-point and 6-point Likert-type scales. The questionnaire consists of eight subscales which includes physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. Additionally, there are two overall component scales of physical and mental health (PCS and MCS), which were used for the present

study. Higher MCS and PCS scores indicate better health-related QOL. Given the complexity of calculating internal consistency scores of scales that have heterogeneous item weights, Chronbach's α were not computed for these scales using the present sample. However, the internal consistency of these component scales on similar samples has been demonstrated (Reulen et al., 2006).

Procedure

This study was preformed in accordance with the ethical standards of the institution (MDACC) and the principals of the Declaration of Helsinki. The protocol was approved by the MDACC Institutional Review Board, and patients were recruited between 2007 and 2012. Participants were recruited during clinic appointments. Participants provided informed consent, per the IRB approved protocol, completed baseline measures, and were randomized into a 3-month yoga group, 3-month stretching group, or waitlist control group. Participants completed measures across five time points: baseline (e.g., study entry), 3 months into the study (i.e., immediately after the intervention), 6 months into the study (i.e., 3 months post-intervention), 9 months (i.e., 6 months post-intervention), and 15 months (i.e., 12 months post-intervention). Further information about the procedure and a Consolidated Standards Of Reporting Trials (CONSORT) diagram illustrating participant flow from recruitment to final follow up can be found in the original study publication (Chaoul et al., 2018).

Statistical Methods

Hypothesis 1 and 2: The indirect effect of baseline coping style on 15-month health-related QOL via 9-month PTSS or PTG was examined using the bias-corrected bootstrap test of indirect effects via the PROCESS-macro v 3.3 for SPSS (model 4) (Hayes, 2013). Before formally testing for mediation, detection-tolerance and the variance inflation factor (VIF) were used to assess multicollinearity. *Exploratory Hypotheses 3 and 4*: We examined whether the indirect effect of baseline intrusive thoughts (IES-intrusion) on 15-month health-related QOL via 9-month PTG changed as a result of 9-month active coping (hypothesis 3) or as a result of 9-month avoidant coping (hypothesis 4) using PROCESS-macro (model 7). The following covariates were preregistered based on a review of the literature indicating an association with PTG, PTSS, and/or health-related QOL: age, stage of cancer, whether or not the participants were receiving surgery, treatment group (yoga, stretching, waitlist), education, and the baseline levels of the outcome and mediator/moderator variables. At the time of analyses one additional covariate was added, based on its conceptual importance: the type of treatment the participants were

receiving (radiation, chemotherapy, hormone treatment, or no treatment). All models covaried for these seven variables. Direct and indirect effects were determined significant when the mean of the indirect effect across all 5000 bootstrap samples was associated with a bias-corrected confidence interval that did not include 0. Power was estimated using the method proposed by Pan et al. (2018) to determine the sample size needed to detect mediation effects using longitudinal data. Given high interclass correlations between measures at the three time points (ICC of 0.7), a sample size of 122 would allow a mediation model to be detected as statistically significant at alpha of 0.05 with 80% power using a bootstrapped approach if the associations between the predictor and mediator and between the mediator and outcome were small-to-moderate (e.g., $\beta = 0.26$). A total of 8 models (i.e., 4 hypothesized simple mediation and 4 exploratory moderated mediation models) were run.

Results

Sample Characteristics

Participant characteristics can be seen in Table 1 and means for study variables at each time point can be seen in Table 2. Only participants who provided data at baseline, 9-month, and 15 months were include ($N = 123$). Over 90% were still undergoing active treatment and 93% were within 6 weeks of their diagnosis at study entry. There were no systematic differences between those with complete data ($N = 123$) and those without ($N = 104$) on any demographic, clinical, or self-report data, with one exception; those with incomplete data reported slightly higher baseline MCS scores ($M = 37.21$) than those with complete data ($M = 34.02$, $p = 0.036$).

Hypotheses 1 and 2: Simple Mediation Analyses

The indirect effect of baseline active coping on 15-month PCS via 9-month PTG was significant [$n = 122$, effect = 0.46, 95% CI (0.06, 1.07)]. Specifically, baseline active coping was positively associated with 9-month PTG ($\beta = 0.31$, $p = 0.001$), which was in turn positively associated with 15-month PCS ($\beta = 0.18$, $p = 0.031$). Figure 3 presents unstandardized regression coefficients. The indirect effect of baseline active coping on 15-month MCS via 9-month PTG was non-significant [$n = 121$, effect = 0.04, 95% CI (-0.40, 0.48)].

The indirect effects of baseline avoidant coping on 15-month MCS [$n = 119$, effect = 0.19, 95% CI (-0.60, 1.19)] and PCS [$n = 120$, effect = -0.06, 95% CI (-0.55, 0.20)] via 9-month IES-Total were non-significant.

Table 1 Demographic and medical characteristics

| Characteristics ($N = 123$)	M/N	SD/%
Age, M, SD	50.4	10.3
Ethnicity, n, %		
White/European American	78	63.4
Hispanic/Latino	19	15.4
Black/African American	18	14.6
Asian American	4	3.3
Native American	2	1.6
Prefer not to answer	2	1.6
Marital status, n, %		
Married or living with partner	88	71.6
Married but living apart	2	1.6
Divorced	12	9.8
Widowed	3	2.4
Never married	22	8.1
Prefer not to answer	5	4.1
Education, n, %		
High school	13	11.0
Some college	18	14.6
College grad	58	47.2
Graduate school	29	23.6
Prefer not to answer	5	4.1
Income, n, %		
≤ 75 K	59	48.0
> 75 K	50	40.7
Prefer not to answer	14	11.3
Stage, n, %		
I	24	19.5
II	66	53.7
III	33	26.8
Time since diagnosis (d), n, %	21	23.7
Type of treatment planned, n, %		
Chemotherapy (currently on)	104	84.5
Radiation	15	12.2
Hormone therapy	4	3.3
Menopausal, n, %	65	52.8
BMI, M, SD	28.1	6.8

Hypotheses 3 and 4: Exploratory Moderated Mediation Analyses

PROCESS model 7 revealed significant moderated mediation, such that the indirect effect of baseline IES-intrusion on 15-month PCS via 9-month PTG depended on 9-month active coping ($n = 120$, effect = 0.04, 95% CI [0.001, 0.11]; Fig. 4). Specifically, the association of baseline IES-intrusion on 9-month PTG was conditional on 9-month active coping ($\beta = 0.68$, 95% CI [0.13, 1.24], $p = 0.02$), such that baseline IES-intrusion was negatively associated with 9-month PTG only at low levels of active coping ($\beta = -0.96$,

Table 2 Summary of descriptive statistics for main study measures across time points

| | Time point | | | | | | | | | |
| | Baseline | | 3 Months | | 6 Months | | 9 Months | | 15 Months | |
	M	SD	M	SD	M	SD	M	SD	M	SD
Active coping	6.45	1.11	6.32	1.10	6.29	0.96	6.13	0.98	5.96	1.24
Avoidant coping	2.83	0.70	2.80	0.68	2.90	0.77	2.80	0.73	2.73	0.82
IES-total	21.04	13.96	17.90	13.95	18.20	13.07	16.52	14.59	14.57	14.74
IES-intrusion	9.30	7.24	7.62	7.25	8.14	7.39	7.49	7.40	6.23	7.06
IES-avoidance	11.73	8.75	10.28	8.09	10.05	7.27	9.01	8.72	8.33	8.66
PTGI	39.98	11.37	62.40	25.09	63.74	25.59	63.35	26.02	64.53	24.92
PCS	22.44	3.85	42.02	8.87	43.39	9.45	46.04	9.45	48.07	9.14
MCS	34.08	11.77	49.30	8.94	49.18	10.31	51.08	10.23	51.69	9.06

This table reflects M and SD for the $N = 123$ participants with data at baseline, 9- and 15-month, as those are the participants included in the mediation analyses

Fig. 3 Mediation model exploring the effect of baseline active coping on 15-month physical health-related QOL through the proposed mediator of 3-month posttraumatic growth
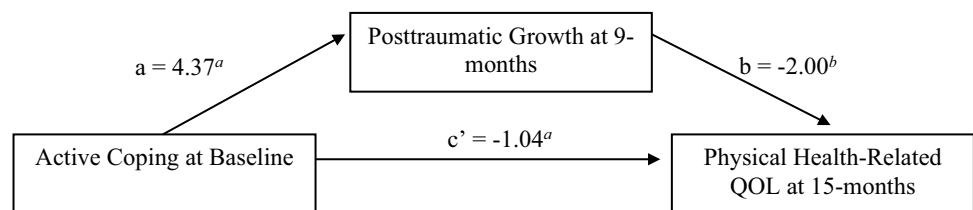
Note. Values are unstandardized path coefficients. [a] $p < .05$ [b] $p < .01$

Fig. 4 Moderated mediation model exploring the effect of baseline intrusive thoughts on 15-month mental health-related QOL through the 9-month posttraumatic growth, conditional upon 9-month active coping
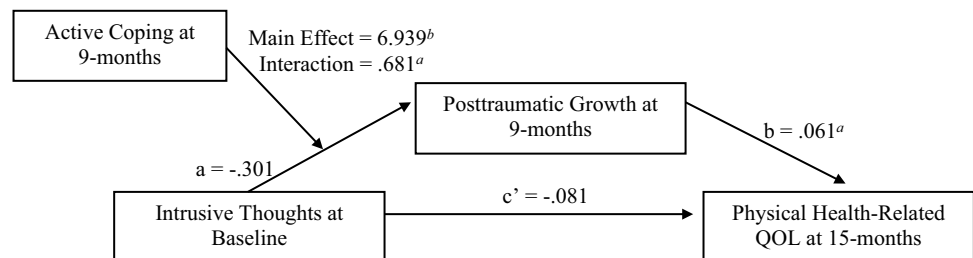
Note. Values are unstandardized path coefficients. [a] $p < .05$ [b] $p < .01$

95% CI [− 1.82, − 0.10], $p = 0.03$), but not mean ($\beta = − 0.30$, 95% CI [− 0.97, 0.36], $p = 0.37$), or high ($\beta = 0.36$, 95% CI [− 0.49, 1.21], $p = 0.40$) levels of active coping (Fig. 5). PTG at 9-month was, in turn, positively associated with 15-month PCS ($\beta = 0.06$, 95% CI [0.002, 0.12], $p = 0.04$). Additionally, examination of conditional indirect effects of baseline IES-intrusion on 15-month PCS via 9-month PTG revealed significant mediation only at low levels of active coping ($n = 121$, $\beta = − 0.06$, 95% CI [− 0.16, − 0.003]). In other words, for those with low levels of active coping, IES-interference led to less PTG, which in turn led to lower PCS scores. There was no evidence for moderated mediation when examining MCS as the outcome variable ($n = 117$, $\beta = − 0.001$ 95% CI [− 0.06, 0.05]).

Second, we examined avoidant coping at 9 months as a moderator in the same models and found it

was non-significant (PCS as the outcome: $n = 119$, effect $= − 0.03$, 95% CI [− 0.10, 04]; MCS as the outcome: $n = 118$; $\beta = 0.0003$, 95% CI [− 0.04, 0.03]).

Discussion

The present study examined the impact of active and avoidant coping strategies on the development of subsequent PTG and PTSS and, in turn, long-term health-related QOL. Results partially supported the hypotheses. Baseline active coping was associated with greater PTG, assessed 9 months post-baseline, which in turn was associated with greater physical health-related QOL, assessed 15-month post-baseline. This finding was consistent with prior research demonstrating a positive association of active

Fig. 5 Conditional effects of baseline IES-Intrusion on 9-month PTG at levels of 9-month active coping
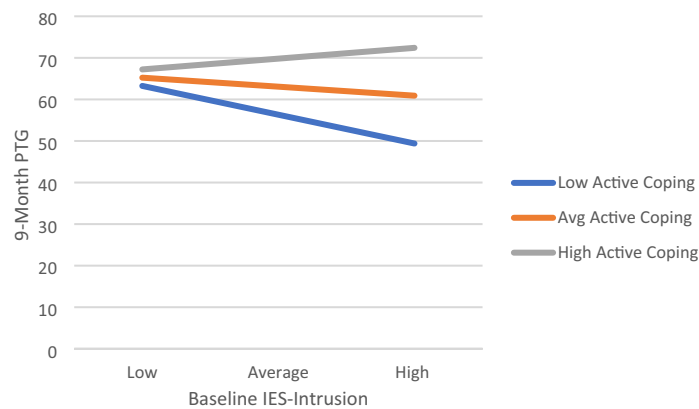
Note: PTG = Posttraumatic Growth Inventory; IES = Impact of Event Scale. Active Coping was measured 9-months after baseline.

coping with subsequent PTG (Hamama-Raz et al., 2019; Rajandram et al., 2011; Stanton et al., 2018) and physical health-related QOL (Elumelu et al., 2016; McLaughlin et al., 2013; Ruini et al., 2013) and a positive association of PTG with increased physical wellbeing among cancer survivors (Ruini et al., 2013).

The study also examined active and avoidant coping as moderators of the association of intrusive thoughts with subsequent PTG, and the impact of PTG on subsequent QOL. Consistent with hypotheses, the association between intrusive thoughts related to patients' cancer experience (referred to as "rumination" in Tedeschi & Calhoun's model of PTG) and subsequent PTG depended on active coping, though the direction of the interaction effect was somewhat surprising. Specifically, intrusive thoughts were negatively associated with later PTG only for women who engaged in low levels of active coping. In other words, intrusive thoughts were not associated with lower PTG for women who engaged in average or high levels of active coping. Interestingly, it seems that the absence of active coping, rather than the presence of avoidant coping, is particularly important when it comes to developing PTG in the presence of intrusive thoughts (i.e., rumination). Women who engage in low active coping may refrain from the self-disclosure and seeking social support that Tedeschi and Calhoun highlighted as being essential to the development of PTG. This may include avoiding talking about their thoughts and feelings related to their diagnosis with friends and family (e.g., low seeking emotional support), avoiding thinking about their diagnosis in the form of prayer or meditation (e.g., low religious coping), or discounting potentially positive impacts that their diagnosis and treatment may have in their life (e.g., low positive reframing).

The current outcomes are in contrast to our expectation, based on Tedeschi and Calhoun's model of PTG, that intrusive thoughts would facilitate PTG for those who engaged in active coping, as other studies have found intrusive thoughts to be positively associated with benefit finding and PTG (Chandwani et al., 2010; Groarke et al., 2017; Helgeson et al., 2006). Instead, the current findings suggest that active coping may serve to buffer the negative effects of PTSS on PTG rather than to facilitate a positive association of PTSS with PTG, and that PTSS were not positively associated with PTG. This may be due to the fact that the women in this study were still undergoing treatment, and as such were still experiencing the stressor of cancer diagnosis and treatment. PTSS may facilitate PTG through active coping in situations where people are experiencing more acute traumatic stressors. Moreover, over the course of the study QOL improved into the normative range, as the majority of women were no longer undergoing treatment at the 9-month time point and none by 15 months.

The intrusive thought by active coping moderation effect on PTG was found in the context of a larger moderated mediation model examining the association of intrusive thoughts with subsequent PTG, and the association of PTG on subsequent QOL. As discussed above, intrusive thoughts were negatively associated with later PTG only for women who engaged in low levels of active coping. PTG, in turn, maintained its positive association with subsequent physical health-related QOL. Taken together, these results suggest that for those with low levels of active coping, intrusive thoughts may inhibit PTG, which in turn my lead to poorer physical health-related QOL. These findings are similar those of Li et al. (2019), who found that PTSS lessened the positive association between PTG and QOL. Thus, as Tedeschi and Calhoun's model suggests, high or at least average levels of active coping appears to be a critical aspect in the development of PTG in the presence of intrusive thoughts about the trauma in this breast cancer population. Additionally, the present study extends the Tedeschi and Calhoun

model to highlight the impact of PTG on subsequent physical health-related QOL.

Contrary to hypotheses, PTG did not mediate the association between active coping and mental health-related QOL. This may be due to a ceiling effect, as the mean of mental health-related QOL at the 15-month follow-up was at the normative range (Ware, 1999). Additionally, PTSS did not mediate the association between avoidant coping and physical or mental health-related QOL. Previous research suggests a robust positive association between avoidant coping and PTSS (Krause et al., 2008; Liu et al., 2020; Pineles et al., 2011), as well as strong negative associations of both avoidant coping (Elumelu et al., 2016; McLaughlin et al., 2013; Lutgendorf et al., 2000) and PTSS (Shand et al., 2015) with health-related QOL. Avoidant coping was even shown to inhibit the positive association of PTG on QOL in one prior study (Li et al., 2019). However, women in the present study reported very low levels of avoidant coping (means near 1 on a 1–4 scale at each time point; Table 2), suggesting the lack of significant results may be due to a floor effect. Alternatively, the three scales of denial, behavioral disengagement, and venting may have been an inadequate assessment of avoidant coping, as each did not load as strongly onto the avoidant coping factor compared to the five scales that loaded on to the active coping factor (emotional support, positive reframing, planning, active coping, and religious coping). More comprehensive measures of avoidant coping may be prudent for future research in this area.

Study Limitations

This study has several limitations. This is a secondary analysis of an RCT and, though group assignment was included a covariate in all analyses, it is possible that group may have influenced results. The data for this study were collected nearly 10 years before this secondary analysis study, however, the basic standard of care for breast cancer treatment for patients with stage I-III disease remains relatively unchanged except for changes in post treatment hormone therapy options. Additionally, because it is a secondary analysis, the methods and sample are limited by the primary study. Specifically, there was some heterogeneity of when women were recruited relative to their initial diagnosis and starting treatment. The associations between coping, PTG, PTSS, and QOL may have been more well defined with a more homogeneous sample. However, 93% of the women were within 6 weeks of their initial diagnosis, 84% were within the first two cycles of chemotherapy, 12% were about to start radiotherapy, with only 3% about to start hormone therapy and only 3 patients 4–5 months post-diagnoses. This suggests that the women were still in the early stages of coping with diagnosis and treatment. By the 15-month follow-up most women were off treatment, except hormone therapy,

and there was also an improvement in QOL and reduction in PTSS relative to baseline. Additionally, nearly half of the sample reported a household income of $75,000 or greater, well above the national median income of $69,000 per year (United State Census Bureau, 2020). This study also excluded women who were currently engaged in psychiatric services, psychological counseling, support groups, or disclosed the need to seek psychological or psychiatric services. As such, the exclusion criteria likely restricted the range of mental health symptom severity, including PTSS, mental health-related QOL, and avoidant coping, which may have had an impact on the results and limits the generalizability of the findings. Additionally, the effect sizes for this study were relatively small indicating the findings will need to be replicated. Furthermore, the number of models run may have led to an inflated type one error rate; thus, caution should be used when interpreting the results, particularly those from the exploratory analyses.

Conclusions

Overall, results highlight active coping as a crucial skill for facilitating posttraumatic growth which in turn can lead to improved physical health-related QOL in breast cancer patients. Active coping was particularly important for fostering posttraumatic growth and subsequent QOL in the presence of intrusive thoughts related to cancer, which were deleterious to PTG in the absence of active coping. Patients reporting infrequent active coping (e.g., low engagement in positive reframing, obtaining emotional support from others, engaging in prayer or meditation, planning, taking action related to the diagnosis and treatment) may benefit from psychosocial interventions designed to increase use of active coping strategies during the cancer treatment process. Cognitive-behaviorally based and acceptance and commitment interventions are designed to increase active coping and are associated with improved QOL (Antoni, 2013; Zhao et al., 2021) and increased posttraumatic growth (Hawkes et al., 2014; Li et al., 2020) among cancer survivors, and therefore may be ideally suited for distressed individuals who infrequently use active coping strategies. The present study highlighted the effects of active coping at the beginning of treatment on subsequent growth and quality of life, suggesting early intervention to increase active coping may be beneficial. However, future studies should examine the timing of an intervention in relation to diagnosis and treatment to determine the ideal intervention period. Extending the standard screening beyond distress screening to also identify patients who are not using active coping and offering evidence-based psychosocial interventions targeting active coping strategies may be a particularly effective way to mitigate the harms of PTSS, facilitate PTG, and enhance

health-related QOL among cancer survivors in the months and even years following diagnosis and treatment.

Data Availability Data are available upon request.

Code Availability Not applicable.

Declarations

Conflict of interest Authors Amy R. Senger, Chelsea G. Ratcliff, Robin Semelsberger, Alejandro Chaoul and Lorenzo Cohen declare that they have no conflict of interest.

Ethical Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the MD Anderson Institutional Review Board (Protocol#: 2005—0035).

Informed Consent Informed consent was obtained from all individual participants included in the study.

Consent for Publication Not applicable.

Human and Animal rights A statement modeled after the Springer sample statements for ethics approval of research involving human participants has been included as the first sentence in the Procedures section.

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