Buffering and Direct Effect of Posttraumatic Growth in Predicting Distress Following Cancer

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Objective: Evidence regarding post traumatic growth (PTG) as a predictor of future reductions in distress has been inconclusive. The purpose of this study was to examine this relationship in a multiple-observation prospective study, to provide a more rigorous test of prediction over time. This longitudinal study extended previous work by taking into account perceptions of vulnerability and explored the buffering role of PTG on the links between vulnerability and psychological distress. We also explored whether individual differences in demographic and medical characteristics moderate the relationship of interests. Method: Participants were 312 Taiwanese women (M age = 46.7 years) who underwent surgery for breast cancer. Measures of PTG, perceived vulnerability, and distress were assessed at Day 1 and 3, 6, 12, and 24 months after surgery. Hierarchical linear modeling was used to investigate whether PTG and vulnerability and their interaction predicted distress over time. Results: A significant direct effect of PTG on distress was found: higher PTG was followed by lower distress. Analysis also yielded a significant buffering effect of PTG on vulnerability leading to distress. However, this effect was moderated by type of surgery. The buffering effect of PTG occurred only among women having mastectomy. Conclusions: We conclude that PTG tends to lead to less psychological distress overall but particularly so in a high impact context.

Keywords: posttraumatic growth, vulnerability, distress, hierarchical linear modeling, breast cancer

Receiving a breast cancer (BCa) diagnosis is a frightening and unexpected event that challenges an individual’s fundamental beliefs and leads to confrontation of one’s mortality and the inevitability of death (Tallman, Altmaier, & Garcia, 2007). On the other hand, survivors often express positive changes or posttraumatic growth (PTG), as a result of the cancer experience (Sears, Stanton, & Danoff-Burg, 2003; Taylor, 1983).

A number of theorists have analyzed PTG through the lens of Lazarus and Folkman’s (1984) model of stress and coping. PTG has been characterized as being a self-enhancing appraisal, which protects people from the detrimental effects of cancer stress (Taylor, 1983). PTG could also be a coping mechanism by itself (Affleck & Tennen, 1996), working as a meaning-making process to either construe something good from bad (assimilation) or rebuild an assumptive world that was shattered by the cancer experience (accommodation; Davis, Nolen-Hoeksema, & Larson, 1998; Park & Folkman, 1997). Such successful coping efforts may create a positive transformation (Tedeschi & Calhoun, 2004) or a transition to being a healthy person again (Brennan, 2001). Although it once was debated whether PTG is a coping process or an outcome (for reviews, see, Zoellner & Maercker, 2006), many now believe that PTG can be both a coping mechanism and a coping outcome (e.g., Affleck & Tennen, 1996; Tedeschi & Calhoun, 2004; Zoellner & Maercker, 2006).

As PTG is generally seen as a healthy adjustment effort, an intriguing question is whether PTG is related to better psychological well-being. Past research linking PTG to psychological distress in cancer patients has had inconsistent results, with some
studies showing a positive association, others a negative association, and still others no association (for reviews, see, e.g., Pascoe & Edvardsson, 2013; Sawyer, Ayers, & Field, 2010). Meta-analytic review showed that PTG and psychological distress are either not related or very weakly related to each other (Helgeson, Reynolds, & Tomich, 2006; Sawyer et al., 2010). Longitudinal studies have also been inconclusive. Among BCa patients, two studies found that PTG predicted less subsequent distress (Carver & Antoni, 2004; Tomich & Helgeson, 2002), but others found that it predicted more distress or was unrelated to subsequent distress (Bower et al., 2005; Tomich & Helgeson, 2004). These inconsistent findings cast doubt on the adaptive nature of PTG.

Theoretically, Tedeschi and Calhoun (2004) conceptualize PTG as a profound change and transformation beyond pretrauma levels of functioning. PTG occurs as a result of a shattered assumptive world and reflects profound positive changes in self-perceptions, relationships, and life philosophy in the aftermath of a life-threatening event. In contrast to this wholly constructive view of perceived PTG, Zoellner and Maercker (2006) proposed that PTG has two components, one constructive and functional and the other illusory. They argued that this accounts for the conflicting findings related to the relationship between PTG and psychological distress. Moreover, healthy adjustment involves the process that constructive PTG increases over time, and illusory PTG decreases over time. Thus, measuring PTG on multiple occasions over time should give a clearer picture of how constructive PTG functions within the course of women’s experience with BCa. If PTG reflects a constructive positive change (e.g., Tedeschi & Calhoun, 2004), it would predict reduced distress across time. But, if PTG reflects a self-deceptive coping strategy (Zoellner & Maercker, 2006), it would predict higher levels of distress across time. A limitation of these studies, even those with longitudinal design, is that the relationship between PTG and adjustment has been inferred from between-person comparisons and one’s perception of PTG has been treated as stable. As perceiving PTG in cancer may be an ongoing and fluctuating process (Danhauer et al., 2015; Davis & Novoa, 2013; Frazier, Conlon, & Glaser, 2001; Wang, Chang, Chen, Chen, & Hsu, 2014), it is possible that levels of PTG predict subsequent adjustment over time. To examine the time course of the relationship, we longitudinally tracked a sample of BCa patients following surgery. The multiple observations within each individual allowed us to examine whether varying levels of PTG over time would predict subsequent levels of psychological distress.

Another argument for PTG’s relationship with psychological distress is that an understanding of the link between them must take into account perceptions of vulnerability. The concept of perceived vulnerability, defined by Bower et al. (2005) as “both specific fears of cancer recurrence and more general perceptions of physical vulnerability that are triggered by the cancer experience” (p. 237) is one of the most prominent and persistent concerns reported by BCa patients. Specifically, vulnerability here refers to negative changes in perception of physical vulnerability. This includes fear of recurrence, and also worries about side effects of cancer treatment and feeling that the world is a more frightening and dangerous place. Despite good prognosis at early stages, BCa remains a life-threatening illness, often provoking negative body image, concerns about recurrence, and a lingering sense of vulnerability (Bower et al., 2005; Crist & Grunfeld, 2013; Vickberg, 2003; Spencer et al., 1999).

PTG as a Potential Buffer Against Vulnerability

Some have proposed that PTG might not directly improve adaptation, but that the ability to find positive meaning may help to protect individuals from adverse effects of disease stress (Pakenham, 2005). In line with the stress buffering hypothesis, PTG represents a positive coping resource for women who feel vulnerable from cancer and its treatment (Morrill et al., 2008). Said differently, PTG may weaken the detrimental effect of vulnerability. Specifically, PTG may benefit persons with high perceptions of vulnerability, but may have little effect for those with low perceptions of vulnerability.

Conclusive evidence of such a buffering effect among cancer patients has yet to emerge. Some studies have found that cancer patients with higher perceptions of PTG were less affected by high vulnerability (or perceived negative impact from cancer, posttraumatic stress symptoms, or intrusive thought; Morrill et al., 2008; Park, Chmielewski, & Blank, 2010; Silva, Moreira, & Canavarro, 2012; Vickberg, Bovbjerg, DuHamel, Currie, & Redd, 2000). Other studies have failed to find support for such a buffering effect (Curbow, Somerfield, Baker, Wingard, & Legro, 1993; Klauer, Ferring, & Filipp, 1998; Park & Blank, 2012). Thus, whether PTG plays a buffering role in cancer distress awaits clarification. Nonetheless, there seems to be some evidence of the buffering effect, suggesting that additional research is warranted to explore this further. To our knowledge, all published studies on the buffering effect to date have used a cross-sectional design. Adding to the literature, we examine the buffering role of PTG as it interacts with vulnerability, prospectively predicting psychological distress.

Meta-analytic reviews have suggested that PTG may interact with individual characteristics and disease variables as predictors of distress (Helgeson et al., 2006; Sawyer et al., 2010). Other studies also found that PTG interacts with medical characteristics (e.g., stage and type of surgical procedure) to predict adjustment (Kvilemo & Bränström, 2014; Lechner, Carver, Antoni, Weaver, & Phillips, 2006; Tomich & Helgeson, 2004). As the mixed results referred to earlier cast doubt on the buffering role of PTG, we propose that the buffering role itself may be further moderated by personal or medical characteristics. That is, either PTG’s direct effect on distress or its buffering effect on vulnerability could be evident under some circumstances but not others. Failing to consider moderators in these relationships may limit the ability to fully illuminate the role of PTG in buffering the negative impact of perceived vulnerability.

No study to date has looked at possible moderators of the buffering effect. We examine four important demographic and medical characteristics suggested by the cancer literature: age, education level, disease stage, and the type of surgery (Helgeson et al., 2006; Sawyer et al., 2010; Tomich & Helgeson, 2002). We posited that these variables might attenuate or accentuate the PTG-distress relationship, or have an effect on the interaction of PTG and vulnerability.

The overall goal of this study is to examine the adaptive significance of PTG. First, we addressed whether increase or decrease in one’s PTG over time would predict subsequent distress level. Second, we examined the possible buffering role of PTG on the
links between vulnerability and psychological distress. Last, we explored potential moderators for both the PTG-distress link and the buffering effect of PTG.

On the basis of previous studies, we treated PTG as a time-varying variable (Danhauer et al., 2015; Davis & Novoa, 2013; Frazier et al., 2001; Wang et al., 2014), along with perceived vulnerability and psychological distress (Frazier et al., 2001; Helgeson, Snyder, & Seltman, 2004; Henselmann et al., 2010; Lam et al., 2010). We expanded our exploration to the individual’s change in PTG over time. If PTG is considered to have adaptive value, we hypothesized that higher level of PTG predicts lower level of distress over time, and PTG buffers the detrimental effect of vulnerability on distress. We tested but made no predictions as to how individual differences in demographic and medical characteristics influenced the PTG-distress link and the buffering effect.

Method

Participants and Procedures

From 2010 to 2012, women who were treated for BCa in a regional teaching hospital in Taiwan were invited to participate in this study during hospitalization, 1 to 2 days after they underwent BCa surgery. Women were eligible if they (a) were aware of the diagnosis of BCa; (b) did not have a history of other cancer; and (c) had no serious psychiatric history, assessed by self-report (i.e., diagnosis of psychosis, major depressive episode, suicidality, substance dependence). Written informed consent was obtained from all the participants before the beginning of the study. The study was conducted in accordance with ethical guidelines and all procedures were approved by the Institutional Review Board of Changhua Christian Hospital. Details of the recruitment process are provided elsewhere (Wang et al., 2014).

Of the 359 women who consented to participate, 358 (99.7%), 326 (91.8%), 306 (85.2%), 303 (84.4%), and 298 (83.0%) completed the measures at baseline (Time 1 [T1]), 3 months (Time 2 [T2]), 6 months (Time 3 [T3]), 12 months (Time 4 [T4]), and 24 months (Time 5 [T5]) after surgery, respectively. We used the data from the 312 women who completed at least three questionnaires because it is more reliable to estimate a regression model with at least three time points. Of the 47 women who missed three or more of the five assessments, all were due to dropout (withdrawing from T2 or T3). The most common reason for declining to complete the follow-up assessments was that participation was considered too burdensome (n = 17), including cognitive burden. Other reasons included being too busy at the time (n = 9), physical discomfort (n = 8), being overwhelmed with the diagnosis (n = 7), and having lost contact or moved (n = 6). Compared with participants who completed at least three questionnaires, those who completed fewer than three questionnaires (n = 47) were older (t = 5.12, p < .001), less educated (t = −7.04, p < .001), and reported significantly less PTG at T1 (t = −2.95, p = .003), but did not differ on marital status or any of the medical characteristics (disease stage, type of surgery, treatment for adjuvant radiotherapy; reaction time [RT]; chemotherapy [CT] or hormonal therapy; perceived PTG at T2; perceived vulnerability; or distress symptoms at T1 or T2).

The assessment points were chosen based on key periods in the illness trajectory of BCa: 3-months (beginning of adjuvant treatment), 6-months (active treatment phase), 12-months (completion of active treatment/reentry phase), and 24-months postsurgery (survivorship). Studies have indicated that these periods are relevant to both psycho-social adjustment and clinical outcomes (Henselmann et al., 2010). In addition, studies assessing PTG have suggested that the period shortly after the event is critical (Davis et al., 1998; Frazier et al., 2001). Hence, the first assessment was carried out immediately after surgery, to capture the initial responses to the psychologically meaningful change in BCa trajectory. We recognize that the illness trajectory varies according to the medical characteristics and physical responses of the patients. For simplicity, however, we adopted the interval suggested by studies assessing psychological adjustment in response to cancer (Helgeson et al., 2004; Henselmann et al., 2010; Hou, Law, Yin, & Fu, 2010).

In fact, 85.6% of the participants complete the first assessment between 1 and 2 days after surgery (the remainder completed T1 within 1 week to 1 month after surgery because of physical discomfort as a consequence of the surgery). The follow-up assessments were administered, on average, at T2 (93.29 days, SD = 14.41), T3 (186.68 days, SD = 12.27), T4 (371.13 days, SD = 17.56), and T5 (738.19 days, SD = 25.17) postsurgery. Of 250 women who received active adjuvant treatment (RT or CT), 97.2% (n = 243) had started the treatment before T2 administered; the remainder (n = 6) started the treatment shortly after T2 (7 to 83 days), and one woman didn’t start treatment until 95 days after she completed T3. Only 4 women indicated that they were still undergoing active treatment (CT or RT) at T4; however, 27 women were undergoing targeted therapy (e.g., Herceptin) at T4. All women treated with hormonal therapy (n = 227) had started it before T4. These statistics indicate that the assessment points fairly closely reflect the key periods we aimed to target.

Measures

Demographic data were collected via self-report at baseline, and medical data were collected via self-report and medical chart review. Psychological distress, PTG, and vulnerability were measured at all time points.

The Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) assesses perceived positive life changes in response to trauma, in this case as a result of BCa. We used the Mandarin version (Wang et al., 2014). The PTGI is a 21-item self-report measure scored on a 6-point Likert-type scale ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of my crisis). Although it is possible to differentiate among areas of growth, this study used a total score. The sum of the items was calculated; scores ranged from 0 to 105, with higher scores indicating greater PTG. In the present sample, Cronbach’s alphas ranged from .96 to .98, for T1 through T5.

Perceptions of vulnerability were measured by the Meaning and Vulnerability Scale developed by Bower et al. (2005). The Vulnerability subscale was chosen because of its specificity to BCa and its brevity. It was developed using focus groups with cancer survivors and the clinical experiences of the authors to assess key domains of change in outlook following BCa. The Vulnerability scale consists of five items that assess fears about recurrence, threats to one’s body, and safety in the world (e.g., “I feel more vulnerable now, as if the world is a more dangerous place”). It was
translated into Mandarin and back-translated. The instruction was, “Indicate for each of the statements below the degree to which you believed your outlook had changed in each way as a result of breast cancer.” Responses were scored on a five-point Likert scale (1 = not at all, 5 = very much).

To establish the factor structure of the Vulnerability subscale for this study, the full scale of the Positive Meaning and Vulnerability Scale (PPMVS; Bower et al., 2005) was used. The PPMVS consists of two subscales: the Perceived Meaning Scale (six items) and the Perceived Vulnerability Scale (five items). The sample was randomly divided into two for exploratory and confirmatory factor analyses. A principal-components analysis with Promax rotation was conducted on these items for sample 1 (n = 149) on five time points. Two factors had an eigenvalue greater than 1 (54.61–63.36% of the variance, for T1 through T5), and an examination of the scree plot supported the two-factor solution. All the factor loadings were more than .49. These two factors corresponded well to the Perceived Meaning and Vulnerability Scale, except that Item 8 (“I think about my body more”) was intended to load on the Vulnerability Scale but loaded on the Meaning Scale in our sample. Cronbach’s alpha estimates revealed that Item 8 was not coherent to the Meaning Scale, thus it was eliminated from this study. We then computed confirmatory factor analyses to assess the adequacy of the 10-item two-factor model for Sample 2 (n = 163). This model was confirmed with better model fit (χ²/df = 1.40, 1.48, 1.72, 2.03, 2.24; non-normed fit index [NNFI] = .98, .98, .96, .93; root mean square error of approximation [RMSEA] = .050, .068, .067, .085, .089; and standardized root-mean-square residual [SRMR] = .062, .057, .080, .079, .086; for T1 through T5, respectively) than the original 11-item two-factor model (χ²/df = 1.82, 2.49, 2.32, 2.48, 3.14; NNFI = .95, .93, .93, .94, .87; RMSEA = .071, .100, .091, .100, .140; and SRMR = .096, .100, .095, .110, .120; for T1 through T5, respectively). The sum of the four items was calculated for Vulnerability (range = 4–20). In this study, the alphas of the Vulnerability scores were .76, .78, .81, .81, and .82 for T1 through T5, respectively.

Psychological distress was measured using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). It is a 14-item questionnaire that assesses anxiety and depression on a four-point scale. Scores range from 0 to 42. Responses were summed across items, with higher values indicating greater disturbance. The Cronbach’s alpha coefficients in the present sample were .84, .87, .88, .90, and .89 at T1, 2, 3, 4 and 5, respectively.

Statistical Analysis

The analyses here concern how levels of PTG and vulnerability predict subsequent distress. Lagged analyses were conducted using the hierarchical linear modeling program (HLM; Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011). HLM allows the directional sensitivity of the causal relationship to be tested by predictors and time-lagged outcome variables. The study has a two-level design, in which five waves of interviews are nested within each participant. The outcome measure, distress, and the predictor measures, PTG, vulnerability, and the interaction between them, were within-person (Level 1) variables. PTG and vulnerability are each grand centered.

To make predictions, we correlated all the predictors (i.e., PTG and vulnerability) at time, with outcome variables (i.e., distress) at time, + 1. Age, education, type of surgery, and disease stage were between-person (Level 2) variables. At Level 2, we tested the extent to which the within-person effects of perceived PTG and vulnerability were moderated by one’s age, education, stage, and type of surgery. One of the questions in this study is the extent to which the interaction effect of perceived PTG and vulnerability varied as a function of one’s demographic and medical status. We tested this with three-way interactions in the Level 2 equation. See the Appendix for details of HLM equations.

Regression coefficients were estimated using restricted maximum-likelihood estimation (Raudenbush & Bryk, 2002). The statistical interaction between PTG and vulnerability is used to test the buffering hypothesis. If any interaction term was significant, the interaction was plotted following the procedure illustrated by Preacher, Curran, and Bauer (2006) for HLM two-way and three-way interactions, with conditional values of PTG (or other between-person level moderators) set at one standard deviation above and below the mean.

Because we assume that our major variables (PTG, vulnerability, distress) fluctuate over time, it is useful to assess the extent to which total variance in these variables is due to within-person change relative to individual differences. This is equivalent to the intraclass correlation (ICC; Raudenbush & Bryk, 2002). An ICC that is close to 0 indicates that the variability in the variable is attributable mostly to within-person variance, and a correlation that is close to 1 suggests that most of the variance is between persons (Snijders & Bosker, 1993). We calculated ICC before conducting the HLM analyses.

Results

Sample Demographics

Patients’ ages ranged from 26 to 70 years, with a mean of 46.7 years (SD = 8.34). Participants were diagnosed with stage 0 (n = 48), Stage I (n = 108), Stage II (n = 114), Stage III (n = 38), and Stage IV (n = 4) BCa. Most women (80.1%) were treated with either adjuvant RT or CT; of whom, 129 (41.3%) were treated with both RT and CT. Most women received hormonal therapy (72.8%). Fifty-eight percent of women had lumpectomies rather than mastectomies (42.0%). Median day of T1 assessment completion was 1 day following surgery. The majority of women were married (84.6%). Education was 26% less than high school, 39.1% high school graduate, 34.9% college graduate and above. Median years of education was 12 years. Only 40 respondents (17%) reported being employed, and the remainder reported being housewives (27.8%), retired (3.9%), or unemployed (37.9%). Thirty-four participants reported no children living at home (10.9%), 30 (9.6%) reported having one child, and 248 (89.5%) having two or more children. Ninety-two (29.5%) reported an average monthly household income of less than $1,000, 32.1% reported $1,000 to $2,000, 20.2% reported $2,000 to $3,000, and 11.5% reported an income of above $3,000.

Descriptive, ICC, and Correlation Analyses

Average scores across time on all variables are reported in Table 1. The ICC between persons was .62 for distress, indicating that 62% of the variance is attributable to individual differences, with the remainder (38%) representing fluctuations within persons over
time. Given sufficient variance at each level for the outcome variable, we can proceed with the testing of the HLM model. We likewise calculated the ICC for PTG and vulnerability, and the analysis yielded an ICC of .65 and .55 for PTG and vulnerability, respectively, indicating the variability in the predictors was attributable to within-person and between-person variation, supporting the use of these variables as time-varying variables.

In concurrent correlation analyses, PTG was positively related to vulnerability at T1 and T5 (r=.07, p<.05) and unrelated to vulnerability at T4 and T5 (r=.05, p=.07). PTG was negatively related to distress at T2, T3, and T4 (r=-.12, -.14, and -.11, p<.05) and unrelated to distress at T1 and T5 (r=-.03, and -.07). Vulnerability was significantly positively related to distress at each interview (r=.54 to .61, all ps<.001).

Age was negatively correlated with averaged PTG (r=-.35, p<.001). Higher education was positively correlated with averaged PTG (r=.47, p<.001). None of the medical variables (disease stage, type of surgery) was associated with the study variables (PTG, vulnerability, and distress). Neither demographic nor medical variables were associated with distress.

### HLM Model for Psychological Distress

Table 2 presents a summary of the results of the HLM analysis predicting distress scores. Elevation in perceived vulnerability predicted subsequent higher level of distress, whereas elevation in PTG predicted subsequent lower level of distress. At the between-person level, none of the demographic or medical variables was significantly related to average level of distress, as was true of bivariate correlation analyses. However, these variables can be significant moderators of the relationships of interest. The PTG by vulnerability interaction was not significant, but a three-way interaction among Surgery Type × PTG × Vul-

### Results of the Hierarchical Linear Modeling Predicting Psychological Distress

<table>
<thead>
<tr>
<th>Predictor</th>
<th>b</th>
<th>SE</th>
<th>t</th>
<th>Effect size r</th>
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<tbody>
<tr>
<td>Within-person level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTG $\beta_{1t}$</td>
<td>-0.23</td>
<td>.010</td>
<td>$-2.59^{**}$</td>
<td>.15</td>
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<tr>
<td>Vulnerability $\beta_{20}$</td>
<td>.452</td>
<td>.067</td>
<td>$6.79^{***}$</td>
<td>.36</td>
</tr>
<tr>
<td>PTG × Vulnerability $\beta_{30}$</td>
<td>-0.00</td>
<td>.002</td>
<td>-1.3</td>
<td>.01</td>
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<tr>
<td>Between-person level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age $\beta_{12}$</td>
<td>-0.62</td>
<td>.039</td>
<td>-1.57</td>
<td>.09</td>
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<tr>
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<td>.001</td>
<td>0.81</td>
<td>.05</td>
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<tr>
<td>Age × Vulnerability $\beta_{12}$</td>
<td>-0.00</td>
<td>.008</td>
<td>-0.04</td>
<td>.00</td>
</tr>
<tr>
<td>Age × PTG × Vulnerability $\beta_{12}$</td>
<td>.000</td>
<td>.000</td>
<td>1.50</td>
<td>.09</td>
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<tr>
<td>Education (years) $\beta_{21}$</td>
<td>-.208</td>
<td>.018</td>
<td>-1.92</td>
<td>.11</td>
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<tr>
<td>Education × PTG $\beta_{22}$</td>
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<td>.002</td>
<td>-0.02</td>
<td>.11</td>
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<tr>
<td>Education × Vulnerability $\beta_{22}$</td>
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<td>.018</td>
<td>-0.32</td>
<td>.02</td>
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<tr>
<td>Education × PTG × Vulnerability $\beta_{22}$</td>
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<td>.001</td>
<td>-1.64</td>
<td>.09</td>
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<tr>
<td>Surgery type $\beta_{31}$</td>
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<td>.069</td>
<td>0.06</td>
<td>.00</td>
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<tr>
<td>Surgery type × PTG $\beta_{32}$</td>
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<td>.014</td>
<td>0.57</td>
<td>.03</td>
</tr>
<tr>
<td>Surgery type × Vulnerability $\beta_{32}$</td>
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<td>.101</td>
<td>-0.75</td>
<td>.04</td>
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<td>Surgery type × PTG × Vulnerability $\beta_{33}$</td>
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<td>.003</td>
<td>$-2.25^{*}$</td>
<td>.13</td>
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<tr>
<td>Stage $\beta_{34}$</td>
<td>-2.14</td>
<td>.337</td>
<td>-6.64</td>
<td>.04</td>
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<td>Stage × PTG $\beta_{41}$</td>
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<td>.008</td>
<td>-0.87</td>
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<td>Stage × Vulnerability $\beta_{42}$</td>
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<td>$2.11^{*}$</td>
<td>.12</td>
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<tr>
<td>Stage × PTG × Vulnerability $\beta_{44}$</td>
<td>-0.004</td>
<td>.002</td>
<td>-1.72</td>
<td>.10</td>
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<tr>
<td>Constant $\beta_{50}$</td>
<td>10.61</td>
<td>.41</td>
<td>$26.24^{***}$</td>
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</table>

*Note. N = 312. PTG = posttraumatic growth. Bold type indicates significance. For surgery, lumpectomy was coded 0 and mastectomy was coded 1. Stage was coded as 0 (Stage 0), 1 (Stage I), 2 (Stage II), and 3 (Stages III and IV).

*p < .10.  **p < .05.  ***p < .01.  ****p < .001.
nerability was significant, showing that the PTG by vulnerability interaction effect is different by surgery type.

As shown in Figure 1, PTG moderated the vulnerability–distress relationship among women who underwent mastectomy. Simple slope analyses revealed that, for women having mastectomy, greater perceived vulnerability predicted higher distress in women reporting lower PTG, whereas among women with high levels of PTG the slopes did not differ from zero. That is, PTG buffered the negative impact of vulnerability on distress. For women with lumpectomy, significant negative prediction was found for both high and low PTG. There is very little interaction in this case, with the lines being close to parallel. The finding of a significant three-way interaction indicates that this difference in two-way interactions is significant.

In addition, education moderated the relation between PTG and distress. Simple slope analyses showed that PTG predicted less distress among women with higher education level, whereas the slopes did not differ from zero among those with lower education level (see Figure 2). Disease stage moderated the relation between vulnerability and distress. The positive association between vulnerability and distress is stronger for women with higher disease stage.

Discussion

Findings revealed that a higher level of PTG was followed by a lower level of distress, advancing our understanding of the dynamic relationship between PTG and distress, and establishing the adaptive value of PTG. Similarly, recent meta-analysis reviews focusing on breast cancer and general cancer populations found robust negative correlations between positive reappraisal coping and meaning in life and psychological distress (Kvílemo & Bränström, 2014; Winger, Adams, & Mosher, 2016). These findings implied that PTG and meaning-based coping play important adaptive roles in patients’ adjustment to cancer. On the contrary, we did not find support for the argument that PTG might represent defensive illusions, which often lead to greater distress (Zoellner & Maercker, 2006). Our findings also parallel the literature advocating that the increase or maintenance of (high) positive meaning predicts better adjustment or lower distress (Davis et al., 1998; Davis & Novoa, 2013; Frazier et al., 2001). These findings open a new avenue for PTG researchers: besides the effect of presumably stable status on PTG (differences between those who report more PTG and those who report less), much can be learned about the effect that change in PTG may have on individuals. Cancer poses a chronic threat with distinct ongoing stressors at different stages.
of cancer trajectory; thus coping and perceived PTG may evolve or change over time (Danhauer et al., 2015; Wang et al., 2014), resulting in differential adaptive significance.

Of note, although PTG and vulnerability were positively correlated with each other, they predicted distress in opposite directions. Consistent with the literature, perceived vulnerability predicted greater distress (Curbow et al., 1993; Morrill et al., 2008; Silva et al., 2012; Tomich & Helgeson, 2002). Given this, the unique relationship between PTG and distress may be obscured by the positive association between PTG and vulnerability; thus, focusing exclusively on PTG can lead to a misleading conclusion about adjustment to cancer (Bellizzi, Miller, Arora, & Rowland, 2007; Bower et al., 2005; Park & Blank, 2012). The fact that PTG independently predicted lower distress over time after controlling for level of vulnerability gives us more confidence about the adaptiveness of PTG.

Among women who had mastectomies, but not those with lumpectomies, the results suggest that PTG has a prospective beneficial effect on distress by weakening the destructive effect of vulnerability. Though we had expected this buffering effect to be more general, this was not the case. Given this pattern, however, we speculate that previous inconsistent findings regarding buffering effects of PTG (Curbow et al., 1993; Lehman et al., 1993; Morrill et al., 2008; Park et al., 2010; Silva et al., 2012; Updegraff, Taylor, Kemeny, & Wyatt, 2002; Vickberg et al., 2000) might reflect unmeasured moderators underlying the relationship. Our finding highlights the desirability of including other variables as potential moderators in studying the buffering role of PTG.

PTG had a direct beneficial effect on distress (a main effect) among women having lumpectomy, while buffering the negative impact of vulnerability on distress among women having mastectomy. It is not clear why PTG had different roles among women undergoing different modalities of treatment. Levels of vulnerability did not differ overall between women receiving mastectomy versus lumpectomy. This is in line with literature suggesting that there are no difference between the two surgery types in terms of fear of recurrence and death (Kiebert, De Haes, & Van de Velde, 1991; Spencer et al., 1999).

Of course, the sense of vulnerability extends beyond those particular fears. Mastectomy is more physically destructive and may have other life impacts on issues of concern, such as physical dysfunction and limitation, physical and sexual attractiveness, sexual functioning, attitudes toward relationships, and surgical side effects (Alicikus et al., 2009; Curran et al., 1998). Women who underwent a more destructive surgery face more diverse stressors; this may make the direct effect of PTG on distress less reliable. It is hard to see, however, why this would have led to the pattern in Figure 1. Because the moderator analysis was exploratory, these results should be interpreted with caution.

We should also note that we did not consider all plausible moderating factors that were not measured in this study, for example, ethnicity and time since the traumatic event (both of which were constant in this study). Other potential moderators that might be examined include demographic, medical, and personal characteristics such as personality, coping, and social support.

Integrating our findings into the existing literature, PTG may reflect cognitive adaptation in response to cancer diagnosis (Taylor, 1983). PTG is not only an outcome of struggling with cancer experiences, but an ongoing process (Affleck & Temmen, 1996; Davis et al., 1998; Park & Folkman, 1997; Updegraff et al., 2002), which may have both a direct effect on adjustment (Aldwin & Revenson, 1987; Cohen & Wills, 1985) and a stress-buffering effect. PTG provides a positive counter to perceptions of high vulnerability, either by positively reappraising the harm and limitation caused by cancer (self-enhancing appraisal; Taylor, 1983) or by making meaning out of the life-threatening events (meaning-based coping; Park & Folkman, 1997). Although perceived vulnerability is among the strongest predictors of distress, a high level of perceived PTG protected women against those adverse effects.

This study also adds to the literature by considering certain individual differences as possible moderators of the relation of PTG to distress. We found that education level plays a role in that relationship. The favorable effect of PTG occurred only among women with higher education. It is possible that women with higher education are more capable of making positive meaning from adversity. They may be more adept at getting benefit from PTG and use it to quell the uneasiness. Another explanation might be that women with lower education may have multiple stressors at the same time as the cancer, inasmuch as lower socioeconomic status means fewer resources; thus PTG itself cannot fully diminish distress.

As noted previously, these analyses were quite exploratory. The findings concur with other data indicating that the relationship between PTG and distress is moderated by other factors (Helgeson et al., 2006; Sawyer et al., 2010). Other studies addressing moderating effects found that finding more meaning was associated with increased distress among women with advanced stage (Tomich & Helgeson, 2004) and among older women (Sawyer et al., 2010). Future research should continue to examine how individual or cancer-related characteristics affect differences in the PTG-distress relationship.

Potential Intervention

The evidence reported here suggests that PTG has the potential to promote positive adjustment to cancer and thus can serve as a target for psychosocial interventions. In designing interventions, the greatest benefit may be achieved by fostering meaning-based coping, positive reappraisal, and acceptance (Park, Cohen, & Murch, 1996), but also encouraging confronting the vulnerable feelings associated with cancer.

There are well-established interventions that have been demonstrated to facilitate PTG. Cognitive-behavior stress management involves training of coping skills, positive interpretation, gaining efficient social support, and relaxation (Antoni et al., 2001). Mindfulness-based interventions such as mindfulness-based cancer recovery (Carlson et al., 2016) have been shown to lead to significantly improvements in PTG and psychological well-being relative to controls. Expressive writing involves writing about feelings and thoughts related to the cancer experience, which dis-inhibit emotional processing, generating meaning and insights (Park et al., 1996). These interventions have been shown to be effective in fostering PTG and contribute to reduction of general distress.

In terms of ways to directly enhance PTG, Tedeschi and Mc-Nally (2011) have proposed theory driven guidelines including five steps: (1) psychoeducation about psychological reactions to cancer, (2) enhancing emotional regulation skills, (3) encouraging
constructive self-disclosure, (4) development of new narratives with PTG themes, and (5) building up enhanced life principles. Moreover, it is proposed that intervention carried out in a group format can further promote PTG because group interventions help enhance support and distress disclosure, both of which are critical elements in facilitating PTG (Pat-Horenczyk et al., 2015; Ramos, Leal, & Tedeschi, 2016). Indeed, interventions that encourage BCa patients and survivors to disclose their feelings and personal stories can help them engage in reflecting on beliefs and experiences and process the fears and negative emotions associated with BCa. The expression and disclosure of one’s vulnerability can help build a supportive environment and increase their access to social support, thereby promoting PTG (Tedeschi & Calhoun, 2004).

Limitations

These results should be considered in light of several limitations. First, although our study focuses on BCa survivors, the generalizability to other types of cancers (and other adversities) merits exploration. Moreover, although being similar on nearly all medical characteristics, participants who dropped out of the study were older, less educated, and reported lower PTG at baseline than completers. This places some limitations on our ability to generalize the results. In particular, the findings apply more readily to younger and more educated patients and patients who experienced at least some PTG.

Second, it is important to note that the measure of vulnerability we used focused specifically on perceived threats to health, safety, and body image associated with cancer. Although it fails to capture the full-range of negative change after BCa, it does capture the shaking of one’s beliefs about safety and health (especially, the possibility of cancer recurrence), which is one of the most salient negative impacts that threatens people living with BCa (Spencer et al., 1999; Vickberg, 2003), and is also a moderator to the process of personal growth (Brennan, 2001). However, this does not imply that other domains of negative change, such as relationship, or financial security, are trivial. Although the Vulnerability Scale (Bower et al., 2005) was brief and convenient to the clinical population in time-limited circumstances, it sacrifices the full spectrum of negative changes following cancer. Again, future studies should refine the assessment tool to allow a fuller report on a broader range of negative experiences.

Third, although this study used a prospective design, it cannot eliminate all problems associated with inferring causality from nonexperimental designs. However, it does allow a more confident understanding about the relationship in temporal order. Fourth, moderation effects were tested by a limited range of demographic and cancer-related variables. Future studies should consider other potential moderators that might be associated with the PTG-distress link and PTG’s buffering effect.

Last, although our goal was not to address cultural factors, it seems reasonable to assume that cultural framework plays a role in the process of PTG (Calhoun & Tedeschi, 2004). A study of Hong Kong Chinese people suggests that the factor structure of PTG might be culturally bounded, and that growth could be broadly dichotomized into interpersonal and intrapersonal dimensions (Ho, Chan, & Ho, 2004). As Chinese culture emphasizes relational and interdependent values, the interpersonal dimension of PTG might have additional implications for Chinese women, in comparison to their Western counterparts. Future studies should investigate if and how interpersonal and intrapersonal dimensions of PTG are likely to be different processes of PTG and, subsequently, impact distress differentially.

Despite these limitations, this study extends the literature on the adaptive role of PTG in three ways. First, multiple measurement occasions were used in the postcancer trajectory. This allowed us to establish the relationship between PTG and psychological distress in a temporal direction: greater PTG being followed by lower distress. Second, this study extended existing literature by investigating longitudinally the interactive effects of PTG and vulnerability on predicting distress. To our knowledge, this is the first study that examined the buffering role of PTG in a longitudinal study. Third, the findings add to our understanding of the buffering role of PTG. It suggests that findings regarding the buffering role of PTG have been inconsistent because the underlying moderators are overlooked. Based on these accounts, our findings help to illustrate the role of PTG in adjusting to BCa and to whom PTG mitigated distress directly and to whom it offset the negative impact of perceived vulnerability on distress.

References


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Appendix

Equations for HLM Analyses

Our Level 1 equation is represented as follows:

\[ Y_{it} = \beta_{0i} + \beta_{1i}(\text{PTG}_i) + \beta_{2i}(\text{Vulnerability}_i) \]
\[ + \beta_{3i}(\text{PTG}_i \times \text{Vulnerability}_i) + \epsilon_{it} \]  

where \( \beta_{1i} \) is person i’s effect of perceived PTG, \( \beta_{2i} \) is person i’s effect of perceived vulnerability, and \( \beta_{3i} \) represents the interactions of PTG and vulnerability. To make prediction, all the predictors at time \( t \) were correlated with outcome variables (Y; distress) at time \( t \). The individual intercepts (\( \gamma_{0i} \)) and slopes (\( \gamma_{1i} \) through \( \gamma_{3i} \)) are then modeled at the between-person level (Level 2) to determine the extent to which they differ as a function of age, education, type of surgery, and disease stage.

\[ \beta_{0i} = Y_{00} + Y_{01}(\text{Age}_i) + Y_{02}(\text{Education}_i) + Y_{03}(\text{Surgery}_i) \]
\[ + Y_{04}(\text{Stage}_i) + \epsilon_{0i} \]  

In this equation, \( \gamma_{00} \) represents the intercept (or average) of the Level 1 intercepts, \( \gamma_{01} \) through \( \gamma_{04} \) represent the main effect of demographic and medical variables on distress.

We then tested, at Level 2, the extent to which the within-person effects of perceived PTG and vulnerability (\( \beta_{1i} \) and \( \beta_{2i} \)) varied as a function of one’s age, education, stage, and type of surgery with the equations:

\[ \beta_{1i} = Y_{10} + Y_{11}(\text{Age}_i) + Y_{12}(\text{Education}_i) + Y_{13}(\text{Surgery}_i) \]
\[ + Y_{14}(\text{Stage}_i) + \epsilon_{1i} \]  

\[ \beta_{2i} = Y_{20} + Y_{21}(\text{Age}_i) + Y_{22}(\text{Education}_i) + Y_{23}(\text{Surgery}_i) \]
\[ + Y_{24}(\text{Stage}_i) + \epsilon_{2i} \]  

where \( \gamma_{10} \) reflects the average slope for within-person PTG across all participants, \( \gamma_{11} \) represents the moderating effect that one’s age has on individual slopes for PTG, and \( \gamma_{12} \) represents the moderating effect that one’s educational level has on individual slopes for PTG, and so forth.

To test the extent to which the interaction effect of perceived PTG and vulnerability (\( \beta_{3i} \)) varied as a function of one’s demographic and medical status, we used the following equations:

\[ \beta_{3i} = Y_{30} + Y_{31}(\text{Age}_i) + Y_{32}(\text{Education}_i) + Y_{33}(\text{Surgery}_i) \]
\[ + Y_{34}(\text{Stage}_i) + \epsilon_{3i} \]  

where \( \gamma_{31} \) through \( \gamma_{34} \) reflects the three-way interaction. For example, \( \gamma_{31} \) reflects the moderating effect that one’s age has on the interaction term of PTG by vulnerability.

Received July 15, 2016
Revision received December 27, 2016
Accepted January 17, 2017