


The effects of trait resilience and rumination on psychological adaptation to breast cancer

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Abstract

This cross-sectional study examined the effect of trait resilience and specific types of rumination on positive psychological adaptation post-diagnosis among 201 breast cancer patients. They completed self-reported measures describing trait resilience, rumination, posttraumatic growth, and health-related quality of life. Hierarchical analysis showed that trait resilience significantly predicted higher quality of life and posttraumatic growth after controlling for demographic and clinical variables. Additionally, “intrusion” and “brooding” subtypes of rumination negatively predicted quality of life, with “instrumentality” positively predicting quality of life and posttraumatic growth, suggesting the importance of trait resilience and multidimensional rumination for positive psychological changes among breast cancer survivors.

Keywords

resilience, rumination, posttraumatic growth, quality of life, breast cancer, psychological adaptation

Introduction

Breast cancer is considered the most prevalent cancer diagnosed in women worldwide. In Taiwan, the peak incidence is between 45 and 69 years, which is approximately 188–194 per 100,000 women. According to the Ministry of Health and Welfare’s statistics on the cause of death, the standardised incidence and mortality rates of female breast cancer in Taiwan are 69.1 and 12.0 per population of 100,000, respectively (Ministry of Health and Welfare, 2021). Due to advances in detection and treatment, approximately two in three adults diagnosed with cancer today may survive for more than 5 years (DeSantis et al., 2011). However, the diagnosis of breast cancer represents a set of physical and psychological threats, and its impact may extend to many years post-diagnosis, necessitating a focus on psychological well-being among breast cancer survivors (Costanzo et al., 2009). While most previous studies have focused on identifying psychological distress or impairment among cancer survivors, positive psychological adjustment or posttraumatic growth (PTG) among them is of growing interest (Cordova and Andrykowski, 2003; Cordova et al., 2001). For example, positive changes in people’s lives and developments brought about by the life challenges after

experiencing highly stressful situations have been reported among women diagnosed with breast cancer (Cordova et al., 2007). Compared to healthy controls who have experienced other stressful life events, breast cancer survivors have reported higher levels of posttraumatic growth (Ruini et al., 2013).

The occurrence of positive consequences of traumatic events is associated with engagement in cognitive processes, particularly including rumination (Tedeschi and Calhoun, 2004). Tedeschi and Calhoun (1996, 2004) argue that rumination is a type of cognitive engagement regarding how one’s struggles against stressful events lead to PTG. They construe two types of rumination: intrusive with a repetitive nature and deliberate, which attempts to make sense of a stressful event, allowing an individual to persistently think about the

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trauma to form a new adaptive schema. They assume that although intrusive rumination usually occurs with a higher level of distress, it may trigger purposeful reflection. This implies that individuals willingly think about the trauma to understand it, the changes it generated, and its future implications. Thus, intrusive rumination may function as a precursor for PTG and is perceived not only as aversive or psychologically harmful, but also as potentially constructive.

Several researchers have shown the crucial role of ruminations in the occurrence of positive post-traumatic changes (Cann et al., 2011; Kleim and Ehlers, 2009; Kilmer and Gil-Rivas, 2010; Phelps et al., 2008), but the findings are contradictory. In a meta-analysis, Helgeson et al. (2006) elucidated a positive relationship between benefit-finding and intrusive thoughts, similar to the concepts of deliberated rumination and intrusive rumination. Some studies revealed that intrusive rumination and deliberated rumination were positively associated with the development of PTG, although deliberated rumination was more strongly related to greater PTG (Cann et al., 2010; Taku et al., 2009). Conversely, some studies showed that intrusive rumination did not have a predictive role for PTG (Cann et al., 2011; Morris and Shakespeare-Finch, 2011). In addition, limited evidence in the context of cancer has also shown inconsistent findings regarding the association between rumination and psychological adjustment. For example, in a group of colon cancer patients, the baseline level of intrusive and deliberated rumination did not predict PTG measured 3 months later (Salsman et al., 2009). Two breast cancer studies supported that negative cancer-related rumination, measured by the Cancer-related Rumination Scale developed by Tedeschi, correlated with negative adjustments, whereas positive cancer-related rumination correlated with PTG (Chan et al., 2011; Yuen et al., 2014). A study of 313 cancer survivors indicated that cancer-related rumination, measured by the Rumination Inventory developed by Cann et al. (2011), revealed three components of the Exploratory Factor Analysis (EFA), including intrusive rumination, deliberated rumination of benefits, and life purpose rumination. In addition, intrusive rumination and life purpose rumination were associated with distress, whereas deliberated rumination of benefits was related to PTG (Morris and Shakespeare-Finch, 2011).

The source of these aforementioned discrepant findings is still unclear, but one of the criticisms in previous literature is the lack of a unified definition of rumination or a standardised way of measuring (Smith and Alloy, 2009). A recent study by Garcia et al. (2017), which examined how contents of rumination relate to and differ from one another in a sample of 750 adult participants who experienced a highly stressful event, pointed out that four types of

rumination (brooding, reflection, intrusive, and deliberated rumination) were differentiated constructs and representatives of a stressful event, rather than the other two-factor model, including the depressive rumination model (brooding and reflection) or the posttraumatic rumination model (intrusive and deliberated). This implies that rumination may manifest itself in different forms, and in more than two styles of self-focus after trauma. Recently, Soo and Sherman (2015) adopted multidimensional contents of rumination in a sample breast cancer population found that brooding was positively related to depression, anxiety, and stress, but was also negatively related to PTG; intrusion was positively associated with stress and PTG; and instrumental rumination was positively associated with PTG, highlighting the importance of considering all forms of rumination after a traumatic event, with regard to its relationship with PTG.

As rumination research in the context of illness is limited, other variables, such as demographic and clinical variables, as well as personality traits associated with psychological adjustment to cancer, should be considered. First, regarding demographic variables, a systematic review (Koutrouli et al., 2012) concluded that age, education, and economic status were associated with PTG. Some studies also reported that higher PTG was associated with higher educational levels (Sears et al., 2003; Weiss, 2004), and younger (Manne et al., 2004), or married and employed patients (Bellizzi and Blank, 2006). Based on clinical factors, it has been reported that survivors with a longer time since diagnosis (Manne et al., 2004; Sears et al., 2003), less severe disease (Tomich and Helgeson, 2004), or having received chemotherapy (Lelorain et al., 2010) had higher PTG. Thus, the current study included the relevant demographic and clinical factors as covariates based on previous studies, including age, education, marital and employment status after having breast cancer, time since diagnosis, cancer stage, type of treatment, and status of current treatment. Second, psychological resilience, defined as the competence or ability to cope with and adapt to changes after threatening or challenging situations, is another factor closely related to the adjustment to adversity (Bonanno et al., 2006). However, the resilience-PTG relationship is not entirely clear. Several theoretical assumptions and doubts about the relationship between resilience and PTG after traumatic events have been raised (Henson et al., 2021). Tedeschi and Calhoun (2004) and Zautra (2009) highlighted that PTG and resilience are theoretically viewed as two distinct but related constructs that enable positive adaptation after an individual is exposed to stressful situations. For example, the limited studies in the context of cancer indicated that high resilience was associated with higher quality of life, lower emotional distress, and less fatigue in cancer patients and survivors (Markovitz et al., 2015; Min et al., 2013; Strauss et al., 2007) and trait

resilience interacted with coping strategies to maintain and gain better psychological functioning and PTG after cancer diagnosis and treatment (Tu et al., 2020). Thus, trait resilience may be a protective, even facilitating, factor of cancer adaptation, favouring both personal growth and adaptation to new challenges with greater security and efficiency. However, a few researchers have argued that resilient individuals are highly unlikely to struggle with adversity or engage in meaning-making cognitive processing that is necessary for PTG (Westphal and Bonanno, 2007). For example, some studies have found that high levels of resilience are associated with lower levels of PTG (Garrido-Hernansaiz, et al., 2017; Levine et al., 2009). It seems that resilience may provide little opportunity for growth. Therefore, the relationship between resilience and PTG requires further investigation.

Taken together, little is known about the relationship between resilience, rumination, and positive psychological changes. The 5-year survival rate is commonly used as an index of cancer survival rate. A few longitudinal cancer studies found that PTG increased over time during the first 6 months following breast cancer diagnosis (Danahauer et al., 2013; McDonough et al., 2013; Tanyi et al., 2013), while others found that it steadily increased for 1.5–2 years following diagnosis but remained stable thereafter (Danahauer et al., 2015; Manne et al., 2004). Given that, the primary aim of this study was to investigate the effects of trait resilience and rumination on positive psychological changes, including psychological well-being and PTG, during the period of 6 months to 5 years post-diagnosis among Taiwanese breast cancer survivors. Considering trait resilience or the multifaceted nature of rumination may explain the varied outcomes of psychological adjustment to cancer, in response to the ruminative processes based on previous studies (Markovitz et al., 2015; Min et al., 2013; Soo and Sherman, 2015; Strauss et al., 2007; Tu et al., 2020), this study proposed that trait resilience and the different types of rumination, based on its disease-specific measurement, may be distinctly associated with psychological functioning and PTG after cancer diagnosis and treatment. Specifically, resilience may be positively associated with quality of life and PTG; the intrusion subtype of rumination may be negatively associated with quality of life and positively related to PTG; the brooding subtype of rumination may be negatively associated with psychological outcomes of adjustment, and the instrumentality subtype of rumination may positively relate to psychological outcomes of adjustment. Meanwhile, given the most robust factor of rumination in the development of PTG, as supported by previous studies (Cann et al., 2011; Kilmer and Gil Rivas, 2010; Kleim and Ehlers, 2009; Phelps et al., 2008; Tedeschi and Calhoun, 2004), the present study further proposed that the effect of rumination may be superior to trait resilience in terms of individual differences

regarding positive psychological changes among breast cancer survivors.

Methods

Participants

A total of 201 Taiwanese patients with breast cancer were recruited for this cross-sectional study. Patients were eligible to participate if their ages were between 20 and 75 years old at the time of recruitment, if they were first informed of a diagnosis of breast cancer with stages I to IV from the period of 6 months to 5 years post onset, and they were able to read, write, and understand Chinese. Patients were excluded if they did not know about the cancer diagnosis or if their relatives were reluctant to let them know, and if they had a serious psychiatric disorder, aphasia, or dementia that implied hospital admission.

The demographic and clinical characteristics of the 201 respondents are presented in Table 1. The average age of the respondents was 51.54 years ($SD = 9.7$) and the average time since diagnosis was 40.17 months ($SD = 19.35$). Sixty-two participants (30.8%) reported having received high school education, and 91 (45.3%) had college education. A total of 154 participants were married (76.6%). One hundred and twenty-three (61.2%) respondents had full-time employment, and the remainder reported being housewives, retired, or unemployed. After cancer diagnosis and treatment, forty-one (20.9%) respondents took sick leave. Among the 201 respondents, 73 (36.3%) had stage I, 97 (48.3%) had stage II, 30 (14.9%) had stage III, and 1 (0.5%) had stage IV cancer, based on the American Joint Committee on Cancer (AJCC) staging system. Most respondents ($n = 149$; 74.1%) were undergoing current treatment, 102 (50.7%) had undergone curative or palliative total mastectomy, 129 (64.2%) had received chemotherapy, and 114 (56.7%) had received radiation therapy.

Procedures

Upon obtaining ethics committee approval from the Hospital Authority, recruitment was conducted in one regional teaching hospital in Taiwan between July and September 2017. The clinical oncologist introduced the purpose of the study to 220 of the 250 suitable patients in the oncology unit; voluntary participation and data confidentiality were emphasised. The remainder ($n = 30$) were either too sick to participate or had something to do at the time of recruitment. After being informed about the study, 201 (80.4%) patients provided written consent and completed the assessment in the unit. Finally, each participant was given a gift voucher worth 3 USD as a token of appreciation for their participation.

Table 1. Baseline demographic and clinical characteristics of participants.

| | N | % |
|---------------------------------|---------------|------|
| I. Demographic variables | | |
| Age | | |
| Mean (SD) | 51.54 (9.70) | |
| Time since diagnosis | | |
| Mean (SD) | 40.17 (19.35) | |
| Education | | |
| Elementary school | 14 | 7.0 |
| Junior high school | 18 | 9.0 |
| Senior high school | 62 | 30.8 |
| College | 91 | 45.3 |
| Graduate | 16 | 8.0 |
| Marital status | | |
| Single | 31 | 15.4 |
| Married | 154 | 76.6 |
| Divorced | 11 | 5.5 |
| Widow | 5 | 2.5 |
| Pre-illness job status | | |
| Employed | 123 | 61.2 |
| Householder | 60 | 29.9 |
| Unemployed | 5 | 2.5 |
| Retired | 13 | 6.5 |
| Post-illness job status | | |
| Remained | 159 | 79.1 |
| Not remained | 42 | 20.9 |
| II. Clinical variables | | |
| Surgery | | |
| Partial mastectomy | 99 | 49.3 |
| Total mastectomy | 102 | 50.7 |
| Chemotherapy | | |
| Yes | 129 | 64.2 |
| No | 72 | 35.8 |
| Radiation therapy | | |
| Yes | 114 | 56.7 |
| No | 87 | 43.3 |
| Current therapy status | | |
| Yes | 149 | 74.1 |
| No | 52 | 25.9 |
| Cancer stage | | |
| I | 73 | 36.3 |
| II | 97 | 48.3 |
| III | 30 | 14.9 |
| IV | 1 | 0.5 |

Measures

Connor-Davidson resilience scale. The degree of resilience was measured using the 25-item Chinese version of the Connor-Davidson Resilience Scale (CD-RISC) translated by Yu and Zhang (2007), which assesses people's ability to tolerate experiences related to change, personal problems, illness, pressure, failure, and pain perception (e.g., "I am

able to adapt when changes occur" or "I tend to bounce back after illness, injury, or other hardships") (Connor and Davidson, 2003). The Chinese version of the CD-RISC has shown strong psychometric properties in an adult Chinese population (Tu et al., 2020; Wu et al., 2017; Yu and Zhang, 2007). All participants in this study were asked to rate items on a scale from "0" (not true at all) to "4" (true nearly all the time). High scores indicated a higher level of resilience. Cronbach's α for the total scale was 0.95 in the current study.

Rumination scale. Soo and his colleagues (Soo et al., 2014) first developed the Multidimensional Rumination in Illness Scale (MRIS) to broaden the measurement scope of rumination in physical illness. The MRIS is a reliable and valid measure that provides a comprehensive assessment of the cognitive style of rumination in the context of both physical and mental illness, and identifies a three-factor structure, labelled as intrusive (e.g., "Once I am thinking about my illness, I cannot seem to do anything else"), brooding (e.g., "I think about what life would have been like if I had not become ill"), and instrumentality (e.g., "Thinking about my illness helps me work out what I need to do to manage it") (Soo et al., 2014). While the three MRIS dimensions were consistent with previously identified domains in prior rumination studies (Fritz, 1999; Treynor et al., 2003), the MRIS differed from other rumination measures, with a specific application to the context of illness. Thus, Soo and Sherman suggested that the MRIS is a measure of rumination used in the oncology population. Therefore, this study used the Chinese version of the 32-item Multidimensional Rumination in Illness Scale (MRIS) translated in the current study to measure rumination in response to cancer diagnosis and treatment. Participants used a 5-point Likert scale from "0" (not at all) to "4" (almost always) to rate all MRIS items according to frequency in relation to a current illness. Item scores were summed to yield subscales with possible ranges: 0–40 (intrusive), 0–56 (brooding), and 0–32 (instrumentality). Higher scores indicated a greater tendency toward rumination. High internal consistency was demonstrated for the subscales of intrusion (0.93), brooding (0.92) and instrumentality (0.86) in the current study.

Posttraumatic growth. The study used the Chinese version of the 21-item Posttraumatic Growth Inventory (PTGI) translated by Ho et al. (2013) to assess the positive changes experienced in the aftermath of cancer diagnosis and treatment (e.g., "I changed my priorities about what is important in life"). The Chinese version of the PTGI has reported good reliability and validity (Ho et al., 2013; Tu et al., 2020). Each item is rated on a 6-point scale, from 0 (I did not experience this change as a result of my cancer diagnosis and treatments) to 5 (I experienced this change to

a great degree as a result of my cancer diagnosis and treatments) with a total score of 105. A higher score indicates a higher level of positive change and growth after cancer diagnosis and treatment. The internal consistency of the total score in the current study was 0.91.

Health-related quality of life. The study used the Chinese version of the Functional Assessment of Cancer Therapy - Breast (FACT-B) scale to evaluate psychological functioning among patients with breast cancer. This questionnaire has been widely used worldwide to measure cancer patients' health functions and well-being (Hung et al., 2013; Ward et al., 1999; Yoo et al., 2005). The FACT-B comprises four subscales: physical well-being (e.g., "I have a lack of energy") (PWB; 7 items, score range 0–28), social/family well-being (e.g., "I am satisfied with family communication about my illness") (SWB; 7 items, score range 0–28), emotional well-being (e.g., "I feel nervous") (EWB; 6 items, score range 0–24), and functional well-being (e.g., "I am able to enjoy life") (FWB; 7 items, score range 0–28). All questions in the FACT-B use a five-point rating scale (0 = not at all; 1 = a little bit; 2 = somewhat; 3 = quite a bit; and 4 = very much). The total score is computed as the sum of the four subscale scores, which is referred to as the global FACT-G score. The FACT-G has a possible range of 0–108 points. Negatively worded items are reverse-scored prior to summing, so that higher total scores indicate better mental health function. The internal consistency of the total score in the current study was 0.92.

Backgrounds. Demographic (age, marital status, level of education, job status) and clinical information (cancer stage, time since cancer diagnosis, and type of current treatment) were retrieved from the patients' medical files and their own reports.

Data analysis

Patient characteristics were summarised using descriptive statistics. Correlation analysis was conducted for trait resilience, the three components of rumination, PTG, quality of life, and demographic and clinical data. One-way ANOVA and independent samples t-tests were used to examine if there were any group differences in demographic and clinical variables in quality of life and PTG. Finally, hierarchical regression analysis was performed for each outcome (method *entry*) in the three blocks. The first step was to include demographic and medical variables, which previous studies included in the regression equation as covariates; the second step included trait resilience; and the third step involved the three types of rumination. Statistical levels within the regressions were evaluated at a 0.05 alpha level. To avoid the possibility of multicollinearity, all the above predictors were standardised, and the index of

variance inflation factor (VIF) was checked in the subsequent analysis. In general, a VIF value of 10 and above indicates a multicollinearity problem. Thus, it is acceptable if the VIF value is less than 10. (O'Brien, 2007).

Results

Correlations among main study variables

The bivariate correlations between the variables are reported in Table 2. Concurrent correlation showed that age and time since diagnosis had no significant relationship with FACT-G and PTG. Trait resilience has a significantly positive relationship with FACT-G and PTG. The correlation coefficient was 0.49 and 0.60, respectively. In addition, intrusion and brooding subtypes of rumination were negatively related to FACT-G and PTG, with correlation coefficients ranged from -0.22 to -0.56 . The instrumentality subtype of rumination was unrelated to FACT-G, but was significantly positively associated with PTG ($\beta = 0.21$).

Mean group differences of demographical and clinical variables in quality of life and PTG

To examine if there were any potential group differences in outcome variables, the analysis of group differences of education, marital status, cancer stage in quality of life and PTG was conducted by one-way ANOVA, and the group differences of job loss, type of surgery, status of current treatment, received CT or RT in quality of life, and PTG were examined by independent t-test. As Table 3 shows, there were no demographic/clinical groups that had significant differences in quality of life and PTG, except for education. The mean difference between the education groups in PTG was significant ($p < .01$), and Tukey's HSD post-hoc analysis showed that the education groups of senior high school, college, and graduate had higher scores of PTG than those of elementary school.

Predictors of FACT-G

The average mean of FACT-G in this study was 80.92 (SD = 13.91), which indicated that participants had an above-average level of psychological well-being after cancer diagnosis and treatment. To examine the effects of trait resilience and rumination on health-related quality of life among patients with breast cancer, this study conducted hierarchical regression analyses.

As Table 4 shows, Model 1 explained 3.6% of the variance in FACT-G, but the effect did not reach significance ($F(7,193) = 1.02, p > .05$). It showed that age, education, job loss after cancer diagnosis and treatments, time since diagnosis, cancer stage, type of surgery, and status of current treatment did not significantly predict

Table 2. Correlation between study variables.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-------------------------------|---------|--------|-------|--------|-------|-------|------|---------|---------|---------|--------|--------|
| 1 Age | 1 | | | | | | | | | | | |
| 2 Education | −0.33** | 1 | | | | | | | | | | |
| 3 Job loss | −0.01 | −0.04 | 1 | | | | | | | | | |
| 4 Time since diagnosis | 0.19** | −0.09 | −0.01 | 1 | | | | | | | | |
| 5 Cancer stage | 0.08 | −0.01 | 0.12 | 0.20** | 1 | | | | | | | |
| 6 Surgery type | 0.07 | −0.01 | −0.07 | −0.05 | 0.11 | 1 | | | | | | |
| 7 Status of current treatment | −0.07 | 0.17* | 0.02 | −0.13 | −0.06 | 0.06 | 1 | | | | | |
| 8 Resilience | 0.00 | 0.10 | −0.08 | 0.00 | 0.06 | −0.08 | 0.01 | 1 | | | | |
| 9 Intrusion | 0.00 | 0.01 | 0.07 | −0.06 | 0.03 | −0.01 | 0.05 | −0.34** | 1 | | | |
| 10 Brooding | −0.03 | 0.07 | 0.08 | −0.05 | 0.09 | −0.03 | 0.08 | −0.38** | 0.90** | 1 | | |
| 11 Instrumentality | −0.03 | 0.23** | 0.05 | −0.06 | 0.05 | 0.02 | 0.07 | 0.10 | 0.43** | 0.43** | 1 | |
| 12 FACT-G | −0.06 | 0.13 | −0.12 | 0.03 | −0.01 | 0.05 | 0.06 | 0.49** | −0.55** | −0.56** | −0.05 | 1 |
| 13 PTG | 0.02 | 0.27** | 0.03 | 0.01 | 0.04 | −0.10 | 0.08 | 0.60** | −0.22** | −0.23** | 0.21** | 0.50** |

** $p < .01$; * $p < .05$.

Table 3. Mean differences between demographical and clinical variables on FACT-G and PTG.

| Variables | | FACT-G | | | PTG | | |
|-----------------------------|--------------------|--------|----------------------------|----------------|-------|----------------------------|----------------|
| | | Mean | <i>F</i> or <i>t</i> value | <i>p</i> value | Mean | <i>F</i> or <i>t</i> value | <i>p</i> value |
| Education | Elementary school | 74.29 | 1.02 | 3.98 | 57.14 | 4.97** | .001 |
| | Junior high school | 79.33 | | | 64.00 | | |
| | Senior high school | 81.11 | | | 72.18 | | |
| | Collage | 81.79 | | | 73.60 | | |
| | Graduate | 82.81 | | | 74.13 | | |
| Marital status | Single | 78.81 | 1.34 | .262 | 68.71 | 1.56 | .201 |
| | Married | 81.76 | | | 71.42 | | |
| | Divorced | 79.73 | | | 78.64 | | |
| | Wisdom | 70.80 | | | 63.40 | | |
| Job loss | Remained | 81.75 | 1.66 | .098 | 70.94 | −0.454 | .650 |
| | Not remained | 77.76 | | | 72.17 | | |
| Cancer stage | I | 80.84 | 0.05 | .955 | 71.37 | 0.94 | .391 |
| | II | 81.18 | | | 70.04 | | |
| | III & IV | 80.32 | | | 74.42 | | |
| Type of surgery | Partial mastectomy | 80.3 | −0.61 | .543 | 71.21 | 0.01 | .991 |
| | Total mastectomy | 81.51 | | | 71.19 | | |
| Status of current treatment | No | 79.60 | −0.80 | .43 | 69.12 | −1.13 | .261 |
| | Yes | 81.38 | | | 71.93 | | |
| Received chemotherapy | No | 80.78 | −0.11 | .914 | 69.65 | −1.06 | .292 |
| | Yes | 81.00 | | | 72.06 | | |
| Received radiotherapy | No | 80.63 | −0.26 | .798 | 69.63 | −1.25 | .211 |
| | Yes | 81.14 | | | 72.39 | | |

** $p < .01$.

FACT-G. Model 2 significantly added 23.6% of the variance in FACT-G ($F(1,192) = 62.13, p < .001$). After controlling for demographic and clinical variables, trait resilience positively predicted the FACT-G ($\beta = 0.49, p < .001$). Model 3 significantly added 17.1% of the variance in FACT-G ($F(3,189) = 20.85, p < .001$). After controlling for demographic and clinical variables and trait resilience, the results

showed that instrumental rumination significantly positively predicted FACT-G ($\beta = 0.13, p < .05$). Additionally, intrusive and brooding subtypes of rumination significantly negatively predicted FACT-G, with regression coefficients of -0.24 and -0.30 , respectively. The VIF index of all the above predictors was less than 10, indicating that no multicollinearity existed in these regression models.

Table 4. Hierarchical regression analysis of predictors of FACT-G.

| | | Variables | Model 1 | Model 2 | Model 3 |
|-------------|---|-----------------------------|---------|----------|----------|
| DV = FACT-G | 1 | (Constant) | | | |
| | | Age | −0.04 | −0.06 | −0.05 |
| | | Education | 0.11 | 0.06 | 0.07 |
| | | Job loss | −0.11 | −0.06 | −0.06 |
| | | Time since diagnosis | 0.06 | −0.06 | 0.03 |
| | | Stage | −0.01 | −0.05 | 0.00 |
| | | Surgery type | 0.05 | 0.10 | 0.06 |
| | | Status of current treatment | 0.04 | 0.04 | 0.07 |
| | 2 | Resilience | | 0.49*** | 0.28** |
| | 3 | Intrusion | | | −0.24** |
| | | Brooding | | | −0.30** |
| | | Instrumentality | | | 0.13* |
| | | ΔR^2 | 0.036 | 0.236*** | 0.181*** |

Note. ΔR^2 refers to the r-square change.

*** $p < .01$; ** $p < .05$.

Table 5. Hierarchical regression analysis of predictors of PTG.

| | | Variables | Model 1 | Model 2 | Model 3 |
|----------|---|-----------------------------|---------|----------|---------|
| DV = PTG | 1 | (Constant) | | | |
| | | Age | 0.13 | 0.10 | 0.10 |
| | | Education | 0.31*** | 0.24*** | 0.22*** |
| | | Job loss | 0.03 | 0.09 | 0.08 |
| | | Time since diagnosis | 0.01 | 0.02 | 0.02 |
| | | Stage | 0.04 | −0.01 | 0.00 |
| | | Surgery type | −0.11 | −0.05 | −0.07 |
| | | Status of current treatment | 0.05 | 0.04 | 0.05 |
| | 2 | Resilience | | 0.59*** | 0.53*** |
| | 3 | Intrusion | | | −0.02 |
| | | Brooding | | | 0.11 |
| | | Instrumentality | | | 0.16* |
| | | ΔR^2 | 0.102** | 0.335*** | 0.018 |

Note. ΔR^2 refers to the r-square change.

*** $p < .001$; ** $p < .01$; * $p < .05$.

Predictors of PTG

The average mean PTG in this study was 71.20 (SD = 15.50), which showed that participants experienced an above-average level of positive psychological changes after cancer diagnosis and treatment. As Table 5 shows, Model 1 explained 10.2% of the variance in PTG ($F(7,193) = 3.13, p < .01$). The results showed that only the level of education positively predicted PTG ($\beta = 0.31, p < .001$). Model 2 significantly added 33.5% of the variance in PTG ($F(1,192) = 114.17, p < .001$). After controlling for demographic and clinical variables, trait resilience significantly positively predicted PTG ($\beta = 0.59, p < .001$). Model 3 added 1.4% of the variance in PTG, but the change effect did not reach significance ($F(3,189) = 2.06, p > .05$). After controlling for demographic and clinical variables and trait resilience, the results showed that only instrumental rumination

significantly positively predicted PTG ($\beta = 0.16, p < .05$). Intrusive and brooding subtypes of rumination did not significantly predict PTG. The VIF index of all the above predictors was less than 10, indicating that no multicollinearity existed in these regression models.

Discussion

The current study investigated the effects of trait resilience and disease-specific types of rumination on positive psychological changes, including psychological well-being and PTG, during the period of 6 months to 5 years post-diagnosis among Taiwanese breast cancer survivors. The main findings are summarised as follows: first, with regard to psychological well-being, the hierarchical regression analysis showed that demographic and clinical variables

showed no significant prediction on quality of life; trait resilience added 23.6% of the variance in quality of life and had a positive association with it; the three subtypes of rumination further increased 18.1% of variance in quality of life, and intrusion and brooding subtypes of rumination had a negative association with quality of life, but instrumentality had a positive relation to it. Second, with regard to personal growth, the hierarchical regression analysis found that only the level of education positively predicted PTG in all demographic and clinical variables in this study, but the effect of education on PTG decreased after including trait resilience and rumination. Additionally, trait resilience and instrumentality subtypes of rumination had a significantly positive association with PTG, but intrusion or brooding had no significant relationship with PTG. Third, in both models of positive psychological changes, trait resilience and the three subtypes of rumination were vital in ensuring quality of life, but trait resilience showed a relatively stronger effect than illness-specific rumination in improving PTG in the cancer context.

As hypothesised, this cross-sectional study established that trait resilience was strongly associated with higher levels of quality of life and PTG. This indicates that higher levels of trait resilience may enable individuals to increase their quality of life and perceived growth. These findings are in line with previous reports on the relationship between resilience and favourable mental health outcomes in patients with various cancer diagnoses and in diverse cultural contexts (Markovitz et al., 2015; Strauss et al., 2007; Tu et al., 2020). These findings also suggest the applicability of Zautra's two-part model of resilience (Zautra, 2009) to explain cancer adaptation, which assumes that resilience consists of interactive processes between sustainability and recovery functioning in psychological adaptation. Similar findings, which showed a significant negative relationship between resilience and anxiety or depression, were reported in a sample of hospitalised cancer patients undergoing treatment in South Korea (Min et al., 2013) and in a sample of Chinese patients receiving treatment (Tina and Hong, 2014). Given that conceptualisations of resilience may be shaped by different cultural contexts (Ungar, 2012), the above findings in Asian countries are remarkable, indicating that the central construct of resilience in the face of major life stress had a protective impact on quality of life or psychological well-being, and even acted as a facilitator to increase psychological growth after a major life-threatening event, such as cancer diagnosis and treatment.

Additionally, our results showed that not only trait resilience, but also illness-specific rumination, showed equal importance to psychological adjustment to cancer. Consistent with previous research (Morris and Shakespeare-Finch, 2011; Taku, 2014), the results of the present study revealed that instrumental rumination, viewed as a

deliberate and positive coping-related introspection, may help in the development of positive life changes after traumatic events, as supported by the model developed by Tedeschi and Calhoun (2004). Instrumental rumination is likely to be both purposeful and deliberate, working out solutions to issues arising from the cancer experiences (Tedeschi and Calhoun, 1999), or indirectly fostering positive changes by choosing other efficient coping strategies, including positive reappraisal, concentration on the problem, appeal to religion, and attributing special meaning to experienced situations (Cann et al., 2011). Accordingly, this study indicated that instrumental rumination represents an active processing of content, and may help people understand changes in circumstances after diagnosis and treatment.

Conversely, partly consistent with our hypothesis, the brooding subtype of rumination, treated as a series of repetitive and negative cognitive processes, was negatively related to quality of life, but had no association with PTG in this study. The negative relationship between brooding and PTG (Soo and Sherman, 2015) was not supported in this study, which may be explained by the longer survivorship in the Soo and Sherman study, potentially offering a longer time frame to examine the detrimental effect of brooding rumination on PTG. Thus, our results may indicate that the brooding subtype of rumination, involving thoughts of what life might have been like if the cancer diagnosis had not occurred, may interfere with disengagement from a prior worldview, thereby weakening the quality of life in physical, social, emotional, and functional domains during the first 5 years of cancer diagnosis and treatment.

In turn, the results of this study found that the intrusion subtype of rumination only had a harmful effect on quality of life, but had no beneficial influence on PTG. Previous psycho-oncology studies have also shown a relationship between intrusive rumination and psychological distress (Morris and Shakespeare-Finch, 2011) and depressive symptoms (Steiner et al., 2014). Therefore, it was suggested that automatic and uncontrollable characteristics of intrusion in the period of 6 months to 5 years post-diagnosis may hinder an individual's quality of life and have little chance to influence perceived growth among women with breast cancer. Moreover, previous studies have also assumed that intrusive rumination plays a dual role in an automatic, invasive, uncontrollable response to trauma (Stockton et al., 2011) and acts as a trigger for purposeful reflection (Tedeschi and Calhoun, 1996). Ideally, intrusive ruminations that initially keep the event in mind are replaced by the deliberated style of rumination, so that the work of rebuilding a meaningful assumptive world can progress. However, excessive and prolonged intrusive rumination may result in serious psychological distress. Helgeson et al. (2006) also stressed that the time needed to examine the problem may serve to work through the trauma, giving it a

new meaning, and thus contributing to PTG. Hence, the lack of a relationship between intrusive rumination and PTG in the current study may reflect that the timing of rumination should be taken into consideration, and it would be worthwhile to adopt a longitudinal approach to examine how patterns of rumination might differentially affect psychological adjustment along with the trajectory of cancer.

Finally, regarding demographic/clinical variables, the current study found that higher PTG was only associated with higher educational levels and those with an elementary educational level had a significantly lower possibility of PTG, which is partly consistent with the findings of previous studies (Manne et al., 2004; Sears et al., 2003; Weiss, 2004). One Hong Kong study of a sample of breast cancer patients also assumed that individuals with a higher educational level can approach problems from a more comprehensive point of view. Their understanding of life may be more comprehensive and profound, which may lead to more positive psychological changes. Therefore, they tend to exhibit a more optimistic explanatory style for negative life events and report greater PTG (Ho et al., 2011). Accordingly, although the exact pathways are unclear, this finding of the current study implies that education may equip individuals with skills that facilitate opportunities for PTG. This is worthy of further investigation in future studies.

Implications

The current study contributes to our knowledge of the link between trait resilience, illness-specific rumination, psychological well-being, and psychological growth. Theoretically, this study supported resilience as an essential factor in improving positive psychological changes after cancer diagnosis and treatment. Knowledge of trait resilience offers a way to enhance wellness and may be useful in a clinical setting. For example, screening for resilience among cancer patients can lead to the early detection of patients with low resilience. Moreover, they can be offered resilience-enhancing interventions or taught emotional-regulation strategies to change the focus of rumination in education programs by allied health professionals in cancer services. Finally, it is also suggested that clinicians may actively help those with an elementary educational level to reappraise and to explain the implications of cancer diagnosis and treatment in order to improve breast cancer survivors' positive psychological changes.

Limitations and conclusions

This study had some limitations. One was the cross-sectional characteristic of the study, which did not allow for inferences about the cause-effect relationship. Further research should extend this study to a longitudinal design.

Moreover, this study was based on a female-only breast cancer sample; it was not possible to explore the influence of gender, demonstrated to be important in the context of rumination, or to generalise the findings among other cancer groups. The negative consequences of cancer experiences, such as psychological distress or cancer-related psychological and physical symptoms, were not analysed. Finally, it should be noted that the tools used were based on self-reports, leading to the possibility of bias due to the potential involvement of a social approval variable.

Overall, by examining the differential impacts of trait resilience and illness-specific rumination on quality of life and PTG, these findings suggest that personality and cognitive factors, such as trait resilience and ruminative thoughts, have distinct relationships with positive psychological changes following diagnosis and treatment. It was suggested that assessing the level of trait resilience and specific types of rumination was necessary, because this may be helpful in evaluating cancer survivors' anti-pressure ability, providing them with an opportunity to improve their well-being, while facilitating the development of psychological growth with the chronic cancer trajectory.

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Ethical approval

This study received ethical approval from the Chairperson of the Institutional Review Board at Taichung Tzu Chi Hospital in Taiwan (ref. REC106-27).

Informed consent

All participants in this study provided written informed consent.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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