Dimensions of Growth: Examining the Five Factors of the Posttraumatic Growth Inventory

by

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Abstract

Posttraumatic growth (PTG) is positive transformation following a traumatic experience. PTG, commonly measured with the Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996), is postulated to occur in five distinct domains. Confirmatory factor analyses (CFA) of the PTGI have found adequate fit for the five-factor model. However, several conceptual and methodological issues remain unresolved. Specifically, model fit for the five-factor model has never been found to be good, the five factors are highly intercorrelated, and inconsistent results have been found with respect to the higher-order model. Moreover, although trauma exposure is considered necessary for experiencing PTG, many studies have included individuals who experienced non-traumatic stressors. Accordingly, the present study aimed to further examine the fit of the five-factor model and higher-order model of the PTGI, the distinctiveness of the five factors by examining their differential patterns of correlations with external variables, and the factorial invariance of the PTGI across groups exposed to either traumatic or non-traumatic stressors. Results indicated that the five-factor model provided the best fit and latent means were equivalent across groups. Last, the five factors demonstrated differential patterns of correlations with external variables. Thus, results indicate that the PTGI measures the same construct in trauma and non-trauma groups, both groups experience the same amount of PTG on average, and the five factors should be used instead of total score.

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List of Abbreviations

PTG	Posttraumatic Growth
PTGI	Posttraumatic Growth Inventory
CFA	Confirmatory factor analysis
PTSD	Posttraumatic stress disorder
PCA	Principal components analysis
EFA	Exploratory factor analysis
MGCFA	Multigroup confirmatory factor analysis
χ^2	Chi-square test statistic
CFI	Comparative fit index
SRMR	Standardized root mean square residual
RMSEA	Root mean square error of approximation
CAPS	Clinician Administered PTSD Scale
IES-R	Impact of Event Scale – Revised
PCL-C	PTSD Checklist – Civilian Version
IES	Impact of Event Scale
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition
DSM-5	Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition
LEC-5	Life Events Checklist – 5
SPSS	Statistical Package for the Social Science

CD-RISC-10	Connor-Davidson Resilience Scale – 10
GS-12	Grit Scale – 12
WSAS	Work and Social Adjustment Scale
TRFI	Trauma-related functional impairment
TLI	Tucker-Lewis index
FIML	Full information maximum likelihood
ML	Maximum likelihood
MLR	Robust maximum likelihood
CI	Confidence interval
LL	Lower limit
UL	Upper limit
Crit A	Criteron A
Non A	Non-criterion A
STDYX	Standardized solution outputted my Mplus
AL	Appreciation of Life
SC	Spiritual Change
PS	Personal Strength
NP	New Possibilities
RO	Relating to Others
REX	Reexperiencing
AVD	Avoidance
NAF	Negative affect
ANH	Anhedonia

EXT	Externalizing behavior
DYS	Dysphoric arousal
AXA	Anxious arousal
CON	Consistency of interest
PER	Perseverance of effort

Introduction

Historically, the psychological study of traumatic stress has focused heavily on negative outcomes of trauma exposure, particularly posttraumatic stress disorder (PTSD) and acute stress disorder. However, over the last 25 years, researchers have identified other salient post-traumatic trajectories including resilience and multi-faceted positive transformation. According to Carver (1998), resilience is the idea that individuals can "rebound" from experiencing a traumatic event and return to their pre-trauma level of functioning. This rebound normally occurs after a relatively brief period of reaction and adjustment. Thus, resilience is considered to be homeostatic, in that it involves a return to a pre-trauma level of functioning.

In contrast, positive transformation involves positive change in a variety of domains from pre- to post-trauma. These positive changes are considered to be so significant that one functions at a higher level post-trauma (Carver, 1998). For example, some individuals who experienced events such as terminal illness (Brunet, McDonough, Hadd, Crocker, & Sabiston, 2010; Jaarsma, Pool, Sanderman, & Ranchor, 2006), natural disasters (Lowe, Manove, & Rhodes, 2013), and war (Kaler, Erbes, Tedeschi, Arbisi, & Polusnuy, 2011; Lee, Luxton, Reger, & Gahm, 2010) have reported an increased sense of meaning and purpose in their lives. Additional research on positive change due to trauma exposure is an important direction for the field of traumatic stress; knowing more about how some individuals perceive the experience of positive change after a traumatic event might inform prevention and treatment of PTSD and other stress-related disorders, thus reducing the financial burden on the healthcare system (Carver, 1998; Morril, et al., 2008; Zoellner & Maercker, 2006).

A variety of concepts have been proposed to describe the phenomenon of positive change after trauma (Zoellner & Maercker, 2006), including finding benefits (Affleck & Tennen, 1996),

stress-related growth (Park, Cohen, & Murch, 1996) thriving (O'Leary, Alday, & Ickovics, 1998), positive psychological changes (Yalom & Lieberman, 1991), adversarial growth (Linley & Joseph, 2004), and posttraumatic growth (PTG; Tedeschi & Calhoun, 1996). Although these concepts differ in subtle ways, they overlap substantially and in large part refer to essentially the same phenomenon. The most inclusive, well-explicated, and widely accepted of these is PTG, which was put forth by Tedeschi and Calhoun, the seminal researchers of positive change after trauma (Zoellner & Maercker, 2006).

PTG is the most appropriate of these concepts for studying post-trauma outcomes for several reasons. First, it specifically references trauma in its name. It is important in this context to emphasize that the construct of interest is growth due to experiencing a traumatic event, rather than growth due to experiencing non-traumatic stressors (Zoellner & Maercker, 2006). Therefore, the names of concepts such as stress-related growth (Park, Cohen, & Murch, 1996) and adversarial growth (Linley & Joseph, 2004) do not fully capture the idea that positive change after trauma is qualitatively different from change after experiencing daily stressors (Carver, 1998). Further, names of concepts such as thriving (O'Leary, Alday, & Ickovics, 1998) and positive psychological changes (Yalom & Lieberman, 1991) do not reference a stressor or trauma at all. Thus, although these concepts emphasize positive outcomes, their names do not explicitly identify the impetus for these outcomes. Similarly, the name of the concept should clearly convey that growth has occurred. For example, the name finding benefits (Affleck & Tennen, 1996; Davis, Nolen-Hoeksema, & Larson, 1998) does not denote that an individual is psychologically healthier for having experienced a traumatic event. Rather, it only suggests that an individual is able to see a silver lining in the traumatic event, but not that this perspective shift necessarily led to lifestyle changes.

Second, using PTG reduces confusion because it encompasses similar concepts (Joseph, Linley, & Harris, 2004) and is the most widely used concept in the literature for referring to positive change after trauma (Joseph, 2011; Zoellner & Maercker, 2006). PTG acknowledges other perspectives on positive change after trauma while making it clear that Tedeschi and Calhoun's (2004) model is being referenced. For example, O'Leary and Ickovics (1995) theorized that thriving -- defined as possessing enhanced psychological capabilities after trauma exposure -- was a possible consequence of experiencing a traumatic event. While this is compatible with Tedeschi and Calhoun's model of PTG (2004), thriving does not fully capture positive change after trauma because it does not provide a theoretical background of the mechanism in which change is possible (Zoellner & Maercker, 2006). The theory of PTG, however, not only includes a description of the change that occurs, but also includes hypotheses regarding possible mechanisms or processes of change. Other models of positive change after trauma do include hypotheses regarding which variables influence achieving positive change. For example, Schaefer and Moos' (1992) model states that many factors determine if one experiences positive outcomes after a life crisis or transition, including personality type, psychological and physical health, trauma history, social support, stability of living situation, severity and timing of traumatic event, and coping style. However, this model includes ideas about both life crises and transitions. In the current paper, the focus is only on life crises, so PTG is a more appropriate theory, as it only captures changes related to a trauma.

Last, Tedeschi and Calhoun's (2004) theory of PTG is most appropriate because it states that positive change after trauma is an outcome (Zoellner & Maercker, 2006). Alternatively, positive change after trauma has also been conceptualized as a coping strategy for managing the negative psychological consequences of experiencing a traumatic event (Zoellner & Maercker,

2006). Researchers who have taken this perspective consider positive change after trauma to be one aspect of a larger coping process (Davis, Nolen-Hoeksema, & Larson, 1998; Filipp, 1999; Park & Folkman, 1997; Taylor, 1983). However, the present study considers positive change as an outcome of experiencing trauma rather than a recovery process.

According to Tedeschi and Calhoun's (2004) model, PTG is positive change due specifically to a traumatic event that conflicts with one's preconceived notions of the world. These conflicts are so distressing that the individual engages in deliberate cognitive processing to redevelop their life narrative in regards to the traumatic event. Therefore, PTG does not happen immediately—it occurs after a period of time as one finds meaning in and reassesses the implications of the traumatic event.

PTG is characterized by positive change in which the individual is more psychologically fit after the trauma than before the trauma. Change is thought to occur in five domains: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. Relating to others involves the strengthening of existing relationships and the addition of new and close relationships. New possibilities involves the realization that many different outcomes in life are possible. Personal strength is the feeling and knowledge that an individual can tackle challenging tasks. Spiritual change is a stronger connection with and deeper respect for a higher power or increased thoughtfulness about existence. Finally, appreciation of life involves cherishing each moment and feeling lucky to be alive.

To measure these five hypothesized domains, Tedeschi and Calhoun (1996) created the Posttraumatic Growth Inventory (PTGI), now the most widely used measure of PTG. The PTGI consists of 21 items assessing the five PTG domains. For each item, respondents indicate the

degree to which they have experienced a positive change due to exposure to a traumatic event. The PTGI yields a total score and five domain-specific subscale scores.

During the initial phase of test development, Tedeschi and Calhoun (1996) considered content validity evidence by conducting a literature review regarding the positive responses of individuals who experienced a traumatic event. Consistent with their model of PTG, five themes emerged: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. Thirty-four items were created from the pool of positive responses to trauma, all of which were worded in a positive direction. The instructions ask participants to rate the degree to which they believe a positive change has occurred due to a highly challenging event in their lives. The rating scale consists of six response options ranging from *0=no change* to *5=a great degree of change*. These 34 items were administered to 604 undergraduates who had experienced a "significant negative life event" in the past five years. The data were analyzed using a principal components analysis with a varimax rotation. Five factors were retained with 21 items loading at least .5 on one factor but not greater than .4 on other factors (see Figure 1). When the number of items was reduced from 34 to 21, the researchers concluded that each of the five domains of PTG remained represented.

Many subsequent studies have evaluated additional psychometric properties of the PTGI. For example, total scores on the PTGI have been examined in association with scores on other measures. Consistent with the theory of PTG (Tedeschi & Calhoun, 2004), individuals who have higher scores on the PTGI have higher levels of mental functioning, better general health (Tomich & Helgeson, 2012; Tsai, El-Gabalawy, Sledge, Southwick, & Pietrzak, 2015), lower levels of depression (Helgeson, Reynolds, & Tomich, 2006), and higher quality of life (Blix, Hansen, Birkeland, Nissen, & Heir, 2013; Morrill et al., 2008). These findings support the aspect

of the theory of PTG that those who experience PTG are "better off" in a variety of domains after the trauma than before the trauma. Interestingly, individuals who are in treatment for experiencing a traumatic event have higher scores on the PTGI than individuals who are not in treatment (Wagner, Knavelsrud, & Maercker, 2007) which provides support for the idea that deliberate cognitive processing—which would occur as part of psychotherapy--fosters PTG.

Research has also shown that higher levels of PTSD symptom severity are associated with higher scores on the PTGI (Zoellner & Maercker, 2006), which is consistent with a key postulate of the theory of PTG which states one must experience distress to experience growth. Additionally, research has shown that those who experienced a life-threatening illness or injury (Tsai, El-Gabalawy, Sledge, Southwick, & Pietrzak, 2015) or those who experienced a more severe event (Tedeschi & Calhoun, 1996) were more likely to endorse PTG. These findings support the notion of "centrality of the event" from the theory of PTG, which states that the more "earth-shattering" the event, the more likely the individual will experience PTG. Further, PTGI scores do not appear to be associated with social desirability (Tedeschi & Calhoun, 1996). This is important to establish because some respondents might view PTG as the ideal outcome of experiencing a traumatic event and thus endorse high levels of growth as a result of self-favorable response bias (Tedeschi & Calhoun, 1996). These findings indicate that respondents are likely not endorsing PTG due to social expectations.

Additionally, higher scores on the PTGI have been found to be associated with higher levels of optimism, openness, and extraversion and lower levels of neuroticism (Tedeschi & Calhoun, 1996). These associations were expected since previous research had found the personality factors of optimism, openness, and extraversion to be associated with the ability to draw strength from adversity (McCrae & Costa, 1986). Additionally, the subscales new

possibilities and relating to others measure facets of these personality factors. Research has also shown that higher levels of religiosity, social support, and purpose in life are associated with higher scores on the PTGI (Cadell, Regehr, & Hemsworth, 2003; Prati & Pietrantoni, 2009; Tsai, El-Gabalawy, Sledge, Southwick, & Pietrzak, 2015). These results are promising as each of these constructs contains similar elements of the subscales spirituality, relating to others, appreciation of life, and new possibilities.

Research has also been conducted on the reliability of the PTGI. Studies have found the entire measure to have an internal consistency of around .90. Each of the subscales also have been found to have high internal consistency, ranging from .67 to .89, with appreciation of life having the lowest internal consistency and spiritual change having the highest internal consistency (Anderson & Lopez-Baez, 2008; Tedeschi & Calhoun, 1996). Test-retest reliability over a two-week period has been found to be .71 for the entire PTGI and from .37 to .74 for the subscales, with personal strength and appreciation of life having the lowest values (Tedeschi & Calhoun, 1996). These reliability coefficients are somewhat inconsistent with the theory of PTG in that level of growth should not significantly change over a short period of time.

The factor structure of the PTGI has been examined through exploratory and confirmatory factor analytic studies. Confirming the underlying factor structure of a measure is an important step in the scale development and validation process, and a measure needs extensive evaluation to ensure the construct is being measured accurately. Specifically, conducting research on the factor structure ensures that the items load on to the expected factors, informs how the measure should be scored, and provides additional construct validity evidence (Brown, 2006; Floyd & Widaman, 1995). Without accurate measurement, it will not be possible to understand the mechanisms behind achieving each domain of PTG. Once it is understood how

an individual achieves each domain, it might be possible to apply this knowledge towards prevention and treatment of the negative outcomes of trauma exposure (Zoellner & Maercker, 2006). To date, however, there has been considerable variability in the PTGI factor structure, depending on the sample used and other methodological differences (Tedeschi & Calhoun, 1996; Taku et al., 2007; Linley, Andrews, & Joseph, 2007; Powell, Rosner, Butollo, Tedeschi, & Calhoun, 2003).

The first wave of studies to explore the factor structure of the measure used principal components analysis (PCA) and found a variety of factor structures. As mentioned previously, in the initial development and validation study, Tedeschi and Calhoun (1996) found support for the five factors of relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. Three other studies used PCA and found support for five factors with items loading on the same factors as the original validation study (Anderson & Lopez-Baez, 2008; Jaarsma, Pool, Sanderman, & Ranchor, 2006; Morris, Shakespeare-Finch, Rieck, & Newberry, 2005). One study found support for four factors (relating to others, new possibilities, personal strength, spiritual change/appreciation of life; Taku et al., 2007), two studies found support for three factors (changes in self/positive life attitude, philosophy of life, and relating to others; Powell, Rosner, Butollo, Tedeschi, & Calhoun, 2003; Weiss & Berger, 2006), one study found support for two factors (general PTG and spiritual change/connectedness; Sheikh & Marotta, 2005), and one study found support for one factor (Joseph, Linley, & Harris, 2004). In summary, the studies that used PCA have found support for one to five factors of the PTGI.

The second wave of studies used the common factor method (i.e., confirmatory factor analysis [CFA], exploratory factor analysis [EFA]). One study that used EFA concluded that there was not a definitive factor structure (Osei-Bonsu, Weaver, Eisen & Vander Wal, 2012).

Three studies (one published, two dissertations) using CFA did not find support for the five factors found in the original validation study of the PTGI (Hooper, Marotta, & Depuy, 2009, Roe-Berning, 2013; Schmidt, 2013). However, six studies using CFA found support for five factors with the same items loading on to the same factors as the original validation study of the PTGI (see Table 1 for fit statistics). Five of these studies also tested a higher-order model with all five factors loading on to a single PTG factor. Although some of these studies concluded that this higher-order model also provided an acceptable fit, they did not use χ^2 difference testing to examine if the higher-order model significantly worsened the fit. After conducting the χ^2 difference tests, the higher-order model significantly worsened the fit in four studies (Lee, Luxton, Reger, & Gahm, 2010; Linley, Andrews, & Joseph, 2007; Prati & Peitrantoni, 2013; Taku, Cann, Calhoun, & Tedeschi, 2008) and did not significantly worsen the fit in one study (Palmer, Graca, & Occhietti, 2012). See Table 2 for fit statistics of the higher-order models.

Although six CFA studies found support for the five factors, fit statistics for these models were adequate, but not good. The comparative fit index (CFI) ranged from 0.91 to 0.98, the standardized root mean square residual (SRMR) ranged from 0.05 to 0.06, and root mean square error of approximation (RMSEA) ranged from 0.07 to 0.10. Although CFI and SRMR were within the acceptable range for good fit, RMSEA was often well above the suggested range. Further, the RMSEA confidence intervals indicated that the fit of the models was poor according to the close-fit and poor-fit hypotheses (Kline, 2011).

The variability in number of factors across studies might be due to the high intercorrelations among the five factors of the PTGI. Some studies found correlations among factors that ranged from 0.56 to 0.85 (Taku, Cann, Calhoun, & Tedeschi, 2008) and from 0.62 to 0.83 (Tedeschi & Calhoun, 1996). These high correlations indicate that the factors might be

measuring overlapping constructs rather than five distinct constructs. However, according to Tedeschi and Calhoun's theory, each domain of growth should be associated with distinct traits, characteristics, and behaviors (Calhoun, Tedeschi, Cann & Hanks, 2010; Tedeschi & Calhoun, 1996; Tedeschi & Calhoun, 2004). For example, relating to others involves "increased self-disclosure" that "provide[s] an opportunity to try out new behaviors that can then be directed at the most appropriate persons in the support network," "recognition of one's vulnerability [that] lead[s] to more emotional expressiveness, willingness to accept help" which leads to "utilization of social supports that had previously been ignored," "increased sensitivity to other people," "increased efforts directed at improving relationships," "making decisions in [one's] own best interests, including protecting [oneself] from abuse in … relationships," (Tedeschi & Calhoun, 1996) and "greater compassion toward others in general" (Calhoun, Tedeschi, Cann, & Hanks, 2010).

New possibilities involves the "possibility of taking a new and different path in life," such as a change in career (Tedeschi & Calhoun, 2004), or the "possibility of new relationships" (Calhoun, Tedeschi, Cann, & Hanks, 2010). Personal strength involves "feeling stronger and more self-assured," an increase in "assertiveness" (Tedeschi & Calhoun, 1996), or as if one "can handle almost anything (Tedeschi & Calhoun, 2004). However, "the identification of strength is often correlated with an increased sense of being vulnerable," (Tedeschi & Calhoun, 2004) and the "person may still be experiencing significant psychological distress and major challenges to adjustment and adaptation" (Calhoun, Tedeschi, Cann, & Hanks, 2010).

Spiritual change involves "greater engagement with fundamental existential questions" and the belief that God played a role in surviving the trauma (Tedeschi & Calhoun, 2004). Additionally, "the strengthening of religious beliefs may lead to an increased sense of control,

intimacy, and finding meaning (Tedeschi & Calhoun, 1996).” Appreciation of life involves “appreciation for the smaller aspects of life,” “feeling lucky” (Tedeschi & Calhoun, 2004), and “taking life easier and enjoying it more” (Tedeschi & Calhoun, 1996).

Although Tedeschi and Calhoun’s descriptions of the domains seem distinct, no study has systematically evaluated the distinctiveness of the factors through examination of their differential patterns of association with external correlates. Linley, Andrews, and Joseph (2007) suggested that this set of analyses be conducted, but the majority of studies use only total score when comparing the PTGI to external correlates. Importantly, using total score might produce inaccurate results in research if the five-factor model has been shown to have superior fit to the higher-order model.

Therefore, the literature was reviewed to examine the five factors of the PTGI’s associations with external correlates. Twenty studies were found that conducted correlations of the five factors with external correlates. These studies used observed scores in a sample that had experienced a stressful or traumatic event. Most of these studies conducted correlations among a variety of constructs and the subscales of the PTGI to determine which constructs accounted for the most variance in PTG or other constructs using multiple regression. No study tested for heterogeneity of the factors with the external correlates or the effect size of the differences between the strengths of the correlations. Therefore, effect sizes were examined in each external correlate by first comparing the highest and lowest correlations of the five subscales of the PTGI to determine the largest possible effect size for each external correlate.

Ninety-six relevant external correlates were examined, but no strong or clear pattern of subscale differentiation emerged. For example, much of the literature discusses the association between PTSD and PTG, yet few studies have examined the correlations between the subscales

of the PTGI and measures of PTSD. Total PTSD symptom severity was examined in seven studies. Only one study found a large effect size between any of the subscales (i.e., personal strength and spiritual change; Zoellner, Rabe, Karl, Maercker, 2008). The effect size between these two subscales was small in five studies (Cordova et al., 2007; Grubaugh & Resick, 2007; Morris, Shakespeare-Finch, Rieck, and Newberry, 2005; Nenova, DuHamel, Zemon, Rini, Redd, 2013; Nishi, Matuoka, & Kim, 2010) and was essentially zero in one study (Smith, Samsa, Ganz, & Zimmerman, 2013).

There are several possible reasons that no pattern of differentiation emerged when examining total PTSD symptom severity. First, studies used different measures for PTSD in their analyses. For example, researchers used the Clinician Administered PTSD Scale (CAPS; Blake et al., 1995) in two studies (Grubaugh & Resick, 2007; Zoellner, Rabe, Karl, Maercker, 2008), the Impact of Event Scale – Revised (IES-R; Weiss & Marmar, 1996) in two studies (Morris, Shakespeare-Finch, Rieck, and Newberry, 2005; Nishi, Matuoka, & Kim, 2010), and the PTSD Checklist – Civilian Version (PCL-C; Weathers et al., 1991) in three studies (Cordova et al., 2007; Nenova, DuHamel, Zemon, Rini, Redd, 2013; Smith, Samsa, Ganz, & Zimmerman, 2013). However, even when studies using the same measures were compared, no definitive pattern emerged either. For the CAPS, stronger statistically significant correlations and one large effect size between the personal strength and spiritual change subscales were found in one study (Zoellner, Rabe, Karl, Maercker, 2008) and weaker statistically insignificant correlations and only a small effect size between the personal strength and spiritual change subscales were found in the other study (Grubaugh & Resick, 2007). For the PCL-C, two studies found weaker statistically insignificant correlations and small effect sizes between the personal strength and spiritual change subscales (Cordova et al., 2007; Nenova, DuHamel, Zemon, Rini, Redd, 2013),

and one study found weaker statistically insignificant correlations for all subscales but appreciation of life and no effect size between the personal strength and spiritual change subscales (Smith, Samsa, Ganz, & Zimmerman, 2013).

A second possible reason that total PTSD symptom severity did not differentiate the PTGI subscales is that PTSD is a heterogeneous construct, and as such it might be inappropriate to expect the PTSD total score to differentiate the five subscales in a systematic way. A third reason is that it is possible that all five subscales have theoretically comparable associations with PTSD total score. Therefore, as part of the literature review, subscales of the PCL-C (avoidance, intrusion, hyperarousal), Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979; avoidance, intrusion), and IES – R (avoidance, intrusion, hyperarousal) were examined with respect to their associations with the five factors of the PTGI. For example, the intrusion subscale appears to be the most relevant to PTG, as researchers state the importance of rumination in the development of PTG. Across the PCL-C, IES-R, and IES, the intrusion subscale showed a slight pattern of differentiation such that the appreciation of life subscale was differentiated by the intrusion subscale in five studies (Cordova et al., 2007; Morris, Shakespeare-Finch, Rieck, & Newberry, 2005; Nishi, Matuoka, & Kim, 2010; Slavin-Spenny, Cohen, Oberleitner, & Lumley, 2011; Smith, Samsa, Ganz, & Zimmerman, 2013). For the PCL-C intrusion subscale, one study found a small effect size between the personal strength and appreciation of life subscales with the personal strength subscale having the strongest association with the intrusion subscale (Cordova et al., 2007). Another study found a small effect size between the relating to others and appreciation of life subscales with the appreciation of life subscale having the strongest association with intrusion (Smith, Samsa, Ganz, & Zimmerman, 2013).

For the IES-R intrusion subscale, one study found a small effect size between the appreciation of life subscale and the three subscales of relating to others, personal strength, and new possibilities with the appreciation of life subscale having the strongest association with the intrusion subscale (Nishi, Matuoka, & Kim, 2010). The other study found a medium effect size between the appreciation of life and relating to others subscales and between the new possibilities subscale and the two subscales of personal strength and relating to others with the new possibilities and appreciation of life subscales having the strongest associations with the intrusion subscale (Morris, Shakespeare-Finch, Rieck, and Newberry, 2005). For the IES intrusion subscale, two studies found no effect across subscales (Cordova et al., 2001; Jaarsma et al., 2006) and one study found a small effect size between the spiritual change subscale and the two subscales of relating to others and personal strength with the spiritual change subscale having the strongest association with the intrusion subscale (Slavin-Spenny, Cohen, Oberleitner, & Lumley, 2011). It is possible that a more definitive pattern of differentiation was not found in the three-factor or two-factor model of PTSD because more recent research on the factor structure of PTSD indicates that a four-factor (American Psychiatric Association, 2013), six-factor (Liu et al., 2014), or seven-factor model (Armour et al., 2015) represent the construct of PTSD most accurately. Therefore, clearer patterns of differentiation might have emerged if the construct of PTSD would have been accurately modeled.

Interestingly, constructs that more obviously relate to a certain subscale did not show stronger differentiation or a pattern of differentiation either. For example, four studies used measures that represent the construct of social support. In one study, the correlation between the construct of social support and the relating to others subscale showed no effect size when compared to its correlation with the spiritual change subscale and only a small effect size when

compared to its correlations with the new possibilities, personal strength, and appreciation of life subscales (Paul et al., 2010). In another study, the correlation between the construct of social support and the relating to others subscale was not even the largest. Further, there was no effect size when this correlation was compared to its correlation with any of the other subscales (Weiss, 2004). Additionally, in another study, the correlation between the construct of social support and the relating to others subscale showed no effect size when compared to its correlations with the appreciation of life and personal strength subscales. However, there was a small effect size when the correlation between the construct of social support and the relating to others subscale was compared to the correlations with the spiritual change and new possibilities subscales (Lelorain, Bonnaud-Antignac, & Florin, 2010).

Another study by Nenova, DuHamel, Zemon, Rini, & Redd (2013) found the exact opposite. There was a near-zero effect size when the correlation between the construct of social support and the relating to others subscale was compared with the new possibilities and spiritual change subscales. However, there was a small effect size when the correlation between the construct of social support and the relating to others subscale was compared to the correlations with the personal strength and appreciation of life subscales. Although some studies found effect sizes when examining correlations between the five subscales and social support, these effect sizes were small, indicating that other subscales besides the relating to others subscale might also be measuring aspects of social support (Lelorain, Bonnaud-Antignac, & Florin, 2010; Nenova, DuHamel, Zemon, Rini, & Redd, 2013; Paul et al., 2010).

However, there is some evidence that the spiritual change subscale is distinct from the other four subscales. Schultz, Tallman, Atmaier (2010) found that the construct of religious/spiritual importance had the strongest association with spiritual change. Additionally,

when the correlation between the construct of religious/spiritual importance and the spiritual change subscale was compared to the correlations between the construct of religious/spiritual importance and the other four subscales, small to medium effect sizes emerged. These results support the idea that the spiritual change subscale measures a distinct construct.

To summarize all findings of the examination of the studies that provided external correlates with the five factors of the PTGI, there were 14 instances where external correlates showed no differentiation as evidenced by Cohen's *q* effect sizes of less than .1 among the subscales (Anderson & Lopez-Baez, 2008; Shakespeare-Finch & Barrington, 2012; Cordova et al., 2001; Jaarsma et al., 2006; Morris, Shakespeare-Finch, Rieck, and Newberry, 2005; Nenova, DuHamel, Zemon, Rini, Redd, 2013; Zoellner, Rabe, Karl, & Maercker, 2008). There were 66 instances where external correlates produced small effect sizes as evidenced by Cohen's *q* effect sizes between .1 and .3 (Anderson & Lopez-Baez, 2008; Shakespeare-Finch & Barrington, 2012; Cordova et al., 2001; Cordova et al., 2007; Grubaugh & Resick, 2007; Ho,Chu Yiu, 2008; Jaarsma et al., 2006; Lelorain, Bonnaud-Antignac, & Florin, 2010; Mols et al., 2009; Morris, Shakespeare-Finch, Rieck, and Newberry, 2005; Nenova, DuHamel, Zemon, Rini, Redd, 2013; Nishi, Matuoka, & Kim, 2010; Paul et al., 2010; Schultz, Tallman, & Atmaeir, 2010; Slavin-Spenny, Cohen, Oberleitner, & Lumley, 2011; Smith, Samsa, Ganz, & Zimmerman, 2013; Weiss, 2004; Zhang, Yan, Du, & Liu, 2013; Zoellner, Rabe, Karl, & Maercker, 2008). Within the external correlates that were found to have instances of small effect sizes, there were many examples of external correlates where effect sizes were expected to be larger because they should have high convergent validity with a specific subscale of the PTGI (e.g., personal growth, purpose in life, life satisfaction, meaningfulness, satisfaction with social support, quality of

relationship-support, social functioning). Interestingly, these were found to only have small effect sizes indicating the subscales might not be well-differentiated.

Further, there were fifteen instances of external correlates that produced medium effect sizes as evidenced by Cohen's *q* effect sizes between .3 and .5 (Cobb, Tedeschi, & Calhoun, 2006; Morris, Shakespeare-Finch, Rieck, and Newberry, 2005; Nishi, Matuoka, & Kim, 2010; Schultz, Tallman, & Atmaeir, 2010; Zhang, Yan, Du, & Liu, 2013). There were two instances of external correlates that produced a large effect size as evidenced by a Cohen's *q* effect size greater than .5 (Zhang, Yan, Du, & Liu, 2013; Zoellner, Rabe, Karl, & Maercker, 2008).

Of note, these effect sizes were calculated by comparing the highest and lowest correlation for each external correlate, so not all possible pair-wise comparisons were tested. This is important because most of the studies had external correlates with highly similar correlations on three or four of the subscales, which produced no effect size. Therefore, in general, no clear pattern in subscale differentiation emerged. These findings indicate that the subscales of the PTGI might not be measuring entirely distinct constructs and that a higher-order model might be justified. However, due to the results of the above-mentioned CFAs on the higher-order model, further investigation of the fit of the higher-order model is necessary.

In addition to high intercorrelations among the factors, another potential source of variability in the PTGI factor structure is variation in methodology across studies, especially differences in analytic approaches and sampling. For example, PCA is not appropriate for examining underlying constructs such as the five dimensions of PTG because PCA is meant for data reduction rather than construct validation (Brown, 2006). In the investigation of construct validity, the correlations between the items, rather than the variance the items account for, is important. Therefore, analyses that use the common factor method (i.e., CFA, EFA) are more

appropriate methods to use. Additionally, PCA often does not reflect the findings of EFA or CFA, and EFA and CFA are considered to be more accurate than PCA (Floyd & Widaman, 1995). Therefore, the studies that used PCA will not be discussed further.

There are other potential methodological problems with the studies that used the common factor method and did not find support for five factors. In the EFA study, the researchers used a small sample size (Dimitrov, 2010), capitalized on chance fluctuations in the dataset, and disregarded fit statistics (Osei-Bonsu, Weaver, Eisen & Vander Wal, 2012). Further, one CFA study found support for five factors after excluding three items of the PTGI (χ^2 = 215.35, *df* = 125; RMSEA = 0.07 [.06 - .09]; Hooper, Marotta, & Depuy, 2009). However, rather than testing the factor structure of the 18-item version of the PTGI in a new dataset, it was tested again in the same dataset. Therefore, the researchers capitalized on chance fluctuations in the data when concluding that the five-factor model did not fit the 21-item version of the PTGI. Similarly, one of the dissertations found support for four factors in a model that had been heavily respecified by correlating and deleting items. The researchers did not test the respecified model in a new dataset; thus, they capitalized on chance fluctuations in the data when concluding that the five-factor model did not fit the 21-item version of the PTGI (χ^2 = 205.70, *df* = 81; RMSEA = 0.05; CFI = .97; Schimdt, 2013). The other dissertation concluded that no factor structure adequately fit the data (Roe-Berning, 2013). Interestingly, the fit statistics for their five-factor model had similarities with some of the fit statistics of the CFAs that will be presented below in which the researchers concluded that the five-factor structure was supported (χ^2 = 494.18, *df* = 179; RMSEA = 0.09; CFI = .88).

Some other potential problems with the factor structure might be due to the samples examined. Four CFA studies and the EFA included samples of individuals who had experienced

a diverse range of events not all meeting *DSM-5* Criterion A (Linley, Andrews, & Joseph, 2007; Osei-Bonsu, Weaver, Eisen & Vander Wal, 2012; Roe-Berning, 2013; Schmidt, 2013; Taku, Cann, Calhoun, & Tedeschi, 2008;). Four CFA studies included samples of individuals who had experienced specific events that were stressful or traumatic. One study included individuals who experienced parentification (Hooper, Marotta, & Depuy, 2009), one study included individuals who had survived breast cancer (Brunet, McDonough, Hadd, Crocker, & Sabiston, 2010), and two studies included individuals who had experienced combat (Lee, Luxton, Reger, & Gahm, 2010; Palmer, Graca, & Occhietti, 2012).

The type of samples used in these CFAs is noteworthy because some researchers discuss the importance of distinguishing stressors from traumatic events, since traumatic events are more likely to elicit the coping processes necessary for growth to occur (Zoellner & Maercker, 2006). In fact, some studies that have examined PTG have purposefully excluded "lower level, or mild stressors" from their analyses of PTG (Shakespeare-Finch & Barrington, 2012). Therefore, there is debate as to whether including less severe events when examining PTG is justified.

However, some literature indicates that it is not the event that matters, but the distress and rumination that results from the event that drives PTG (Boals, Steward, & Schuettler, 2010; Calhoun, Cann, Tedeschi, and McMillan, 2000). Although Tedeschi and Calhoun's (2004) theory does not specifically reference *DSM* guidelines when determining whether an event can elicit PTG, they do state that the event must have a significant impact on the individual (i.e., "centrality of event"). In fact, some research has shown that experiencing a *DSM* Criterion A event elicits more distress than non-Criterion A events (Boals & Schuettler, 2009). Therefore, classifying events through the DSM system ensures that these events will be more impactful.

The *DSM-5* Criterion A guidelines for a traumatic event state that an individual must have experienced, witnessed, or learned about "death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence." While there is debate about which events meet Criterion A (Weathers, Marx, Friedman, & Schnurr, 2014), there is a general consensus that traumatic events must be sudden or violent, and if one learns about this type of event happening to someone else, this individual must be a close friend or relative. Common examples of these events include experiencing a natural disaster, fire, or severe transportation accident or being physically or sexual assaulted. Non-Criterion A events are not necessarily life threatening or sudden, and, if learned about, did not happen to close friends or relatives or were not accidental or violent. Common examples of these events include expected death due to illness, divorce, bullying, moving, and harassment.

Thus far in the research on the factor structure of the PTGI, only two studies involved samples that unequivocally met *DSM-5* Criterion A (i.e., combat exposure; Lee, Luxton, Reger, & Gahm, 2010; Palmer, Graca, & Occhietti, 2012). While parentification is considered to be a non-Criterion A event, there is debate as to whether breast cancer meets Criterion A (Kangas, 2013). Therefore, there is a lack of research on the factor structure of the PTGI for specifically trauma-exposed populations as measured by *DSM* criteria. Because exposure to trauma is a central focus in the PTG literature, more studies on this population should be conducted when examining the factor structure of the PTGI.

In fact, the PTGI claims to measure growth due to trauma which, according to the theory of PTG, is qualitatively different from growth due to regular processes of development. So far, studies have shown that individuals who experience a traumatic event have higher levels of growth (as evidenced by higher scores on the PTGI) than individuals who experience a stressful

event (Tedeschi & Calhoun, 1996). In one study, individuals who were asked to describe a personal traumatic event rather than a personal stressful event scored higher on overall PTG, relating to others, appreciation of life, and spiritual change (Kastenmuller, Greitmeyer, Epp, Frey, & Fischer, 2012). It could be that although experiencing a normal life-stressor leads to growth, it is not as impressive or as transformative as PTG. Therefore, the growth resulting from normal life-stressors leads to lower scores on the PTGI while the growth resulting from traumatic events leads to higher scores on the PTGI. However, if the PTGI is accurately measuring the construct of PTG, there should be differences in the factor structure and the latent means for individuals who experienced non-Criterion A and Criterion A events. Unfortunately, research on the factor structure of the PTGI thus far only shows configural invariance, i.e., that the five-factor structure is an adequate fit in both groups.

Therefore, the present study had three major aims. The first aim was to replicate the five-factor model of the PTGI and evaluate the viability of the higher-order model of the PTGI through χ^2 difference testing. The second aim was to extend previous findings by evaluating the distinctiveness of the five factors by examining their patterns of correlations with external variables. The third aim was to extend previous findings by examining the factorial invariance of the PTGI across groups whose worst stressor was either a *DSM-5* Criterion A event or a non-Criterion A event.

The first and third aims were examined using multigroup CFA (MGCFA). The first hypothesis was that the five-factor model and the higher-order model would demonstrate at least adequate fit in both groups. If the fit of these two models was not significantly different as indicated by χ^2 difference testing, the plan was to retain the higher-order model for the remaining steps of the MGCFA for the sake of parsimony. The second hypothesis was that the latent means

across groups would not be equivalent, specifically that individuals who experienced Criterion A events would have higher levels of PTG on average than individuals who experienced non-Criterion A events.

Although the ultimate goal of the MGCFA was to determine if the latent means were equivalent across groups, this could not be tested until other conditions within the MGCFA had been met. Specifically, the factor loadings and the intercepts first had to be found to be equivalent across groups before latent means could be compared. Factor loading equivalence indicates that the test has the same meaning and structure for the Criterion A and non-Criterion A groups (Millsap & Olivera-Aguilar). Specifically, this level of equality indicates that response patterns of individuals in both groups have the same association with the five latent factors (Gregorich, 2006) and that the latent factors account for differences in the observed covariances (Millsap & Olivera-Aguilar). This level of equality also indicates that it is permissible to compare the groups on their associations with latent factors and external variables because a one-unit change in the Criterion A group would be equal to a one-unit change in the non-Criterion A group (Dimitrov, 2010). Intercept equivalence indicates that the latent means of the groups can be meaningfully compared (Dimitrov, 2010; Gregorich, 2006; Millsap & Olivera-Aguilar, 2012). It further indicates that if differences in the latent means of the groups do exist, these differences are unbiased, can be attributed to true differences in means, and will be reflected in the observed means (Gregorich, 2006).

Inequality of latent means provides evidence for construct validity because, according to the theory of PTG, individuals who experience more severe events should score higher on the PTGI. To date, however, no study has tested this hypothesis on latent means. It is possible that Criterion A and non-Criterion A groups should not be compared using observed scores because

of inequality of factor loadings or item intercepts. If factor loadings and item intercepts are not equal across groups, this would provide further construct validity evidence because the construct of PTG should not function the same across groups.

The second aim was addressed through examination of the heterogeneity of correlations between the five factors and several conceptually relevant external correlates. Since this aim was largely exploratory, a priori pairwise predictions were not made. However, the third hypothesis was that the five factors would have differential patterns of associations with the chosen external correlates. To address gaps in the literature concerning the comparison of the PTGI to outdated models of PTSD, one of the chosen constructs was a seven-factor hybrid model of PTSD proposed by Armour et al. (2015), including re-experiencing, avoidance, negative affect, anhedonia, externalizing behaviors, anxious arousal, and dysphoric arousal. The fourth hypothesis was that the five factors of the PTGI and the seven factors of PTSD would be positively associated, as past literature has shown PTSD symptoms to have a curvilinear (Currier, Holland, & Neimeyer, 2012) or positive (Bensimon, 2012; Dekel, Ein-Dor, Solomon, 2012; Zoellner, Rabe, Karl, Maercker, 2008) association with PTG. While seven studies conducted correlations between PTSD symptoms and the PTGI subscales, none of them included a measure of functional impairment. When Lelorain, Bonnaud-Antignac, & Florin (2010) included a measure of functional impairment, they found insignificant correlations and a small effect size among subscales. Of note, they did not account for functional impairment present before experiencing a traumatic event. Therefore, the present study included a measure of trauma-related functional impairment (TRFI) to examine only functional impairment due to experiencing a stressful or traumatic event. The fifth hypothesis was that functional impairment

would be positively associated with the five factors of the PTGI, as past research has shown them to be positively associated (Blix, Hansen, Birkeland, Nissen, & Heir, 2013).

Additionally, in the literature review for studies that examined the PTGI subscales with external correlates, many studies examined positive constructs that are closely related to growth (e.g., well-being, benefit finding, personal growth, flourishing). However, these studies used a variety of different measures, so it was difficult to find a clear pattern of differentiation. Therefore, the present study examined two prominent positive constructs in association with the PTGI. The first positive construct was resilience, which is particularly interesting because some researchers state that resilience should not be highly associated with PTG, given that resilient individuals by definition are not adversely affected by experiencing a traumatic event (Joseph, 2011). Nonetheless, resilience has been shown to be positively associated with PTG (Bensimon, 2012), so the sixth hypothesis was that resilience would be positively associated with the five factors of the PTGI. The second positive construct was grit, which has two factors, consistency of interest and perseverance of effort. No known research has been conducted on grit and PTG, yet grit might play a role in the development of PTG, as it is concerned with persisting over a long period of time despite difficulties and setbacks. Further, since it is hypothesized that grit can be cultivated (Duckworth, Peterson, Matthews, & Kelly, 2007), if grit is associated with PTG, then aiming to enhance grit after experiencing a stressful event might increase the likelihood of developing PTG. Therefore, the seventh hypothesis was that the five factors of the PTGI would be positively associated with both factors of grit due to resilience's positive associations with grit (Maddi, Matthews, Kelly, Villarreal, & White, 2012).

Method

Participants

Undergraduate students 18 and older enrolled in a psychology course at Auburn University were invited to complete an online survey related to "a very stressful life event" and were compensated with extra credit. All participants signed an online consent form before participating in the study. Participants younger than 19 were required to have parental permission before participating. Upon completion of the consent form, the participants responded to the online questionnaires. The questionnaires took approximately 90 minutes to complete. The University's Institutional Review Board approved the study protocol in November 2013 and November 2014.

Trauma exposure was assessed through participant responses on the Life Events Checklist-5 (LEC-5) and by reviewing the participants' provided narratives of their index event. First, SPSS (IBM Corp., 2013) syntax was generated to determine preliminary Criterion A status. Participants' index events were coded as meeting *DSM-5* Criterion A if they endorsed their worst event on the LEC-5 as having "happened to me directly" or "witnessed it" and "my life was in danger," "someone else's life was in danger," or it involved "sexual violence." Participants' index events were also coded as *DSM-5* Criterion A if they endorsed having "learned about it happening to a close family member or close friend" and it involved "accident or violence" or "sexual violence" (n = 498). If participants did not endorse any of these response patterns, index events were coded as not meeting *DSM-5* Criterion A (n = 300).

Second, two graduate students verified the *DSM-5* Criterion A status of each narrative generated by the syntax. The raters independently read each narrative, and either agreed (n = 582) or disagreed (n = 139) with the category generated by the syntax based on *DSM-5* guidelines for Criterion A. If the narratives were vague, the raters coded the event to agree with the syntax. If the narrative had information that explicitly contradicted the category generated by

the syntax, the raters coded the event to disagree with the syntax. If no narrative was provided, the raters did not agree or disagree with the syntax, and these cases were not used in the analyses (n = 78).

Third, the raters independently provided a confidence rating of "low" or "high" about their agreement or disagreement with the syntax. If the raters were confident with their decision to agree or disagree with the syntax, they gave a high confidence rating (n = 644). If the raters were not confident with their decision to agree or disagree with the syntax, they gave a low confidence rating (n = 155). Low confidence ratings were given in the event that narratives were extremely vague and more information would be needed in the narrative to absolutely confirm Criterion A status. Events with low confidence ratings were excluded in the analyses to have an extreme groups approach and maximum certainty that all events either met Criterion A or did not meet Criterion A. Fourth, raters independently reviewed narratives for type of event. See Tables 3 and 4 for a breakdown of the most common event types included in the analyses. Disagreements between the raters for syntax agreement, confidence ratings, and event type were resolved through discussion with the raters and an expert in the field of traumatic stress.

Finally, raters independently reviewed narratives for level of exposure. For the cases in which the raters disagreed about exposure level, one rater then verified that these narratives matched the exposure-level response on the LEC-5. The following exposure categories were used: happened to me, witnessed it, and learned about it. In summary, the following categories were created: preliminary Criterion A status generated by the syntax, agreement or disagreement with the syntax generated by the graduate students, type of event based on the narrative, and level of exposure based on the narrative.

The final sample consisted of 644 individuals ages 18 to 54 (*M* = 20.19 years; *SD* = 2.43). All individuals indicated that they had experienced a stressful event. Occurrence of stressful events ranged from currently in progress to 22 years ago (*M* = 4.56 years; *SD* = 4.01). The sample was 79% female (*n* = 509), 87.70% White (*n* = 565), 8.20% African American/Black (*n* = 53), 2.20% Asian (*n* = 14), 3.4% Latino/Hispanic (*n* = 22), 1.10% Other (*n* = 7), and .20% Native Hawaiin/Pacific Islander (*n* = 1).

Measures

See Table 5 for descriptive statistics and number of participants who responded to each measure.

Demographics – A demographics questionnaire was used to assess sex, age, race, ethnicity, income, parent relationship status, relationship status, student status, and work status.

Connor-Davidson Resilience Scale-10 (CD-RISC-10; Campbell-Sills & Stein, 2007; Gucciardi, Jackson, Coulter, & Mallett, 2011) – The CD-RISC-10 is a 10-item self-report measure of trait resilience, or the participants' perceptions of their own ability to cope with stress and adversity. Respondents indicate the extent to which they agree to each item on a five-point scale that ranges from *not true at all* to *true nearly all the time.* Higher scores on the CD-RISC-10 indicate higher levels of trait resilience. The highest possible score is 40. Internal consistency of the CD-RISC-10 is .85, and this abbreviated version correlates highly (*r* =.95) with the original 25-item version of the measure (Campbell-Sills & Stein, 2007). Test-retest reliability has been shown to be .9 (Wang, Shi, Zhang, & Zhang, 2010).

Life Events Checklist (LEC-5; Weathers, et al., 2013) – The LEC is a self-report measure that consists of 17 categories of traumatic stressors (e.g., natural disaster, fire or explosion, transportation accident, serious accident, physical assault, sexual assault, combat exposure, life-

threatening illness or injury). Respondents indicate the degree to which they have experienced each category of traumatic stressor: *happened to me, witnessed it, learned about it, part of my job, not sure, does not apply*. Additionally, respondents identify their worst event. The LEC also includes 14 items where respondents describe the worst event in detail (e.g., resulting injuries, age at time of event) to help clarify Criterion A status. Previous versions of the LEC have been shown to be reliable and valid in a variety of samples (Gray M., Litz, Hsu, & Lombardo, 2004).

Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) – The PTGI is a self-report measure that consists of 21 items of positive change that can be grouped in to the five domains of new possibilities, relating to others, personal strength, spiritual change, and appreciation for life resulting from a highly challenging life crisis. In the current study, participants were asked to respond to the PTGI keeping the event they identified as the worst on the LEC-5 in mind. Respondents choose one of six statements that is true in their life as a result of experiencing a traumatic event (e.g., *I did not experience this change as a result of my crisis, I experienced this change to a very great degree as a result of my crisis.)* The highest possible score is 105. The internal consistency is .90 and test-retest reliability is .71 (Tedeschi & Calhoun, 1996). Higher scores on the PTGI indicate higher levels of posttraumatic growth.

PTSD Checklist for DSM-5 (PCL-5; Weathers, Litz, Keane, Palmieri, Marx, & Schnurr, 2013**)** – The PCL-5 is a 20-item measure of *DSM-5* PTSD symptoms. The PCL instructs respondents to rate how much they have been bothered by PTSD symptoms in the past month, using a five-point scale ranging from *not at all* to *extremely*. The highest possible score is 80. Higher PCL scores indicate greater PTSD symptom severity. PCL scores have strong reliability and validity (for reviews, see McDonald & Calhoun, 2010; Wilkins, Lang, & Norman, 2011).

Grit Scale-12 – (GS-12; Duckworth & Quinn, 2009) – The GS-12 is a 12-item self-report measure of "trait-level perseverance and passion for long-term goals" or grit that contains two factors, perseverance of effort and consistency of interest. Respondents indicate the extent to which they believe they compare to most people in the world on a five-point Likert scale that ranges from *very much like me* to *not like me at all* for each item. Higher scores on the GS-12 indicate higher levels of grit. The highest possible score is 5, and the total score is calculated by adding all of the items and dividing by 12. The internal consistency for the perseverance of effort scale is .70 and consistency of interest scale is .77. The internal consistency for the entire scale is .82. The GS-12 has also demonstrated predictive validity for long-term task completion and performance in a variety of populations (Duckworth & Quinn, 2009).

Work and Social Adjustment Scale (WSAS; Mundt et al., 2002)- The WSAS is a five-item self-report measure of FI. The WSAS instructs respondents to rate the degree of impairment in occupational, home management, leisure, and social functioning using a nine-point scale ranging from *not at all impaired* to *very severely impaired*. The highest possible score is 40. Item stems specify a causal attribution for impairment in each domain (e.g., *Because of my [disorder], my ability to work is impaired*). For the current study, item stems referred to trauma exposure to assess TRFI (i.e., *Because of problems I may have experienced due to the traumatic event…).* The WSAS has demonstrated strong reliability, validity, and responsiveness to treatment across a number of populations (Mataix-Cols et al., 2005; Mundt et al., 2002; Zahra et al., 2014). The WSAS is scored such that higher scores indicate greater TRFI.

Statistical Analyses and Results

Before conducting analyses, skewness and kurtosis of the PTGI were examined to see if data approached normality. Skewness ranged from -0.25 to 1.228 and kurtosis ranged from -1.49

to 0.16; therefore, data were considered to be normal (Curran, West, & Finch, 1996). Because the data were normal, they were modeled as continuous in the MGCFA analyses as normal data with more than four categories on a scale can be accurately modeled as such (Bentler & Chou, 1987). Additionally, the maximum likelihood (ML) estimator was used due to the normality of the data (Brown, 2006). Covariance coverage for the proportion of pairwise present data for the MGCFA of the PTGI ranged from 0.99 to 1.00. Data were missing because participants chose not to respond to certain questions.

To address the first and third aims of examining the fit of the established five-factor model and invariance of the latent means of the factors of the PTGI between the Criterion A and non-Criterion A groups, MGCFA was employed as outlined by Brown (2015) using Mplus version 7.11 (Muthén & Muthén, 1998-2013). The following fit statistics and output were considered to determine if the factor structure provided an adequate fit in both groups (Bentler, 1990; Floyd & Widaman, 1995; Hu & Bentler, 1999; Kline, 2011): χ^2 (reject null that fit is perfect if $p < .05$); root mean square error of approximation (RMSEA; if value is $\leq .06$, fit is acceptable); RMSEA confidence intervals (according to the close-fit and poor-fit hypotheses); comparative fit index (CFI; if value is $\geq .90$ fit is acceptable); Tucker-Lewis index (TLI; if value is $\geq .90$, fit is acceptable); standardized root mean square residual (SRMR; if value is $\leq .08$, fit is acceptable); loadings of the factors on to the latent variables (loadings $\geq .3$ or .4 should be considered); Heywood cases (if Heywood cases exist, the fit is poor).

First, the five-factor model and the higher-order model were tested using CFA in each group as part of the first step of MGCFA. Both models provided a mediocre to adequate fit in both groups (see Tables 6 and 7 for fit statistics of both models). Although the lower-order model did not provide a particularly good fit, and it was not necessary to test the higher-order

model (Brown, 2015), a χ^2 difference test was conducted in each group to determine if the higher-order model significantly worsened the fit. Results of the χ^2 difference tests indicated that the higher-order model significantly worsened the fit in both the Criterion A ($\Delta\chi^2 = 31.54$; $df = 5$; $p < .01$) and non-Criterion A ($\Delta\chi^2 = 22.16$; $df = 5$; $p < .01$) groups. Further, the standardized and unstandardized parameter estimates for the five-factor model were examined in both groups (see Tables 8 and 9). The parameter estimates were considered to be acceptable. Therefore, the five-factor model was retained for the remaining steps of the MGCFA.

In the first step of the MGCFA, the MGCFA was run with no cross-group constraints on intercepts and loadings and latent means were fixed at zero across groups to serve as the baseline model for the χ^2 difference test. In the second step, a MGCFA was run with latent means fixed at zero across groups and cross-group equality constraints on the factor loadings while the intercepts were allowed to vary freely across groups. This model was compared to the baseline model in step one using a χ^2 difference test. The results of the χ^2 difference test showed that there were no significant differences between the fit of the models, so it was possible to move to step three.

In the third step of the MGCFA, cross-group equality constraints were placed on the intercepts and factor means were fixed at zero for the Criterion A group. This model was compared to the model in step two using a χ^2 difference test. The results of the χ^2 difference test showed that there were no significant differences between the fit of the models, so it was possible to move to step four to examine the equivalence of the factors' latent means. In the non-Criterion A group which was the group with means not fixed to zero, *p* values indicated that these means were not significantly different from zero. Therefore, the latent means were equivalent across groups. See Table 10 for χ^2 difference tests and fit statistics from MGCFA.

To address the second aim of the present study which was examining whether the five factors of the PTGI represent distinct constructs, the Criterion A and non-Criterion A groups were combined due to the results of step one of the MGCFA that indicated factor loading equivalence. Factor loading equivalence indicates that comparing these groups using the PTGI is possible. First, intercorrelations between the five factors were computed (see Table 11). Second, heterogeneity among the five factors of the PTGI was evaluated with respect to their correlations with the following measures: CD-RISC-10 (items as indicators for one factor of resilience), GS-12 (items as indicators for the consistency of interest and perseverance of effort factors), PCL-5 (seven-factor hybrid model proposed by Armour et al., 2015 with items as indicators for the re-experiencing, avoidance, negative affect, anhedonia, externalizing behavior, anxious arousal, and dysphoric arousal factors), and the WSAS (items as indicators for one factor of TRFI). Covariance coverage ranged from 0.70 to 1.00 for the CD-RISC-10, GS-12, and PTGI analyses, and from 0.98 to 1.00 for the WSAS, PCL and PTGI analyses. Data were missing in these analyses for two reasons. Participants either chose not to respond to certain questions on these measures or measures were not administered to participants because data were combined from two research projects that used different measures.

Next, heterogeneity of correlations were tested using latent variable modeling in Mplus version 7.11 (Muthén & Muthén, 1998-2013). To test model fit, the entire sample was placed in a CFA with each external correlate separately using either robust maximum likelihood (MLR) or ML depending on normality of the data (Brown, 2006). MLR was employed for the PCL (skewness = 0.55 – 2.63; kurtosis = -0.73 – 6.80) and WSAS (skewness = 2.20 – 3.03; kurtosis = 4.04 – 10.84). ML was employed for the CD-RISC-10 (skewness = -0.77 – -0.13; kurtosis = -0.67 - 0.37) and GS-12 (skewness = -0.94 - 0.06; kurtosis = -0.75 - 0.62). Fit statistics indicated

all model fits were acceptable, so omnibus Wald tests were conducted on each external correlate by constraining all correlations between the five factors of the PTGI and the external correlate to be equal. If a Wald test was statistically significant, it indicated that all parameters were not equal. Last, if the omnibus test of heterogeneity was significant, all possible follow-up pairwise comparisons were conducted using Wald tests to identify the source of the heterogeneity. In these Wald tests, two correlation parameters were constrained to equality at a time. If the Wald test was statistically significant, it indicated that these parameters were not equal. To control for the false discovery rate during the omnibus Wald tests and post-hoc pairwise comparisons, the method proposed by Benjamini and Hochberg (1995) was conducted. 35 of the 100 *p*-values remained significant after using this strategy.

Results of the omnibus tests of heterogeneity indicated lack of heterogeneity in the PTGI's factors' correlations with the re-experiencing factor of the PCL-5. Results indicated heterogeneity in the PTGI's factors' correlations with the avoidance, negative affect, anhedonia, externalizing, dysphoric arousal, and anxious arousal factors of the PCL-5, CD-RISC-10, consistency of interest and perseverance of effort factors of the GS-12, and WSAS (see Tables 12 and 13 for correlations, model fit statistics, and Wald Tests). See Table 14 for statistically significant Wald Tests and effect sizes for the pairwise comparisons.

Discussion

The present study was a replication and extension of previous CFAs of the PTGI. First, it aimed to replicate the five-factor model and further evaluate the fit of the higher-order model. Second, it aimed to extend previous findings by examining the construct validity of the five factors of the PTGI with respect to their differential patterns of associations with external

correlates. Third, it aimed to extend previous findings by examining the factorial invariance of the PTGI across Criterion A and non-Criterion A groups.

Consistent with the first hypothesis, the five-factor structure of the PTGI found in previous studies was replicated in the Criterion A and non-Criterion A groups, indicating configural invariance. However, inconsistent with the first hypothesis, the higher-order model significantly worsened model fit in both groups, indicating that the five-factor model should be retained. Like previous studies, fit statistics for the five-factor model in the present study indicated only mediocre to adequate fit, at best and generally indicated somewhat worse fit than previous studies, although samples were comparable (i.e., undergraduate students with a diverse range of events). Nevertheless, model fit was sufficient to justify the exploration of the question of invariance across the Criterion A and non-Criterion A groups.

Accordingly, an MGCFA was conducted to examine the factor loadings, item intercepts, and latent means to further explore the question of invariance across groups. First, the factor loadings were found to be equivalent, demonstrating metric invariance or weak measurement invariance (Dimitrov, 2010). This level of equality indicates that the test has the same meaning and structure for the Criterion A and non-Criterion A groups (Millsap & Olivera-Aguilar), and that it is permissible to compare the groups on their associations with latent factors and external variables (Dimitrov, 2010). Therefore, on this basis the Criterion A and non-Criterion A groups were combined for the heterogeneity of correlations analyses because the measure operates the same way in both groups.

Second, intercepts were equivalent, demonstrating scalar invariance and strong measurement invariance (Dimitrov, 2010). This level of equality indicates that the latent means of the groups can be meaningfully compared (Dimitrov, 2010; Gregorich, 2006; Millsap &

Olivera-Aguilar, 2012), and differences in latent means will be reflected in the observed means (Gregorich, 2006). Specifically, this level of equality indicates that it is permissible to compare Criterion A and non-Criterion A groups on their observed mean scores. Last, and inconsistent with the second hypothesis, latent means were equivalent which indicates that individuals who experience non-Criterion A events experience the same amount of growth on average as individuals who experience Criterion A events. This level of invariance has the most implications for construct validity and is further discussed below.

There are a few possible reasons why the latent means were found to be equivalent. For example, latent means might be equivalent because the construct of PTG has been defined incorrectly. According to the theory of PTG, PTG is multidimensional change that occurs after experiencing a traumatic event and more stressful events cause greater PTG. However, the factor structure, origin of the intercepts, and the latent means for the Criterion A and non-Criterion A groups were not significantly different from each other. These results indicate that PTG might not be different from growth due to normal development. If PTG were a separate construct from growth due to normal development, differences in the factor structure, origin of intercepts, or latent means would be expected. Rather, these results indicate that PTG is better defined as changes in a variety of dimensions that can be due to any type of life stressor.

Further, these results indicate that changes in the five dimensions of PTG are not more extreme for individuals who experience Criterion A events versus individuals who experience non-Criterion A events. This is surprising because the PTG literature states that some individuals who experience a traumatic event are transformed so that they are better off in a variety of domains after experiencing the event. However, it appears that this transformation can happen in individuals who experienced a traumatic event as well as those who experienced a stressful

event. Additionally, the results indicate that the transformation can be just as extreme in individuals who experienced a stressful event.

Alternatively, latent means might have been found to be equivalent because the PTGI does not accurately measure the construct of PTG. The characteristics represented by the five factors of the PTGI might be exhibited by some individuals due to the normal processes of development regardless of experiencing a highly challenging event. For example, individuals become more religious and are more satisfied with life as they age (Mroczek & Spiro, 2005; Stolzenberg, Blair-Loy, & White, 1995). Individuals might be referring to these characteristics when completing the PTGI rather than characteristics that have changed due to experiencing a highly challenging event. Therefore, more longitudinal studies are needed to examine PTGI scores before experiencing a challenging event and after experiencing a challenging event to ensure that these characteristics developed after the event.

Further, latent means might have been found to be equivalent because PTG might not necessarily need to be precipitated by a Criterion A event. Some research indicates that higher levels of distress and rumination or experiencing events that are more central to one's identity lead to higher levels of PTG (Boals, Steward, & Schuettler, 2010; Boals & Schuettler, 2011). Therefore, future research should examine PTG using a MGCFA that compares individuals who experienced high versus low PTSD symptoms or high versus low event centrality status to see if latent means remain equivalent across these groups. This analysis might provide evidence that the construct of PTG is separate from the growth due to normal processes of development.

Similarly, it is possible that latent means were found to be equivalent because, in the present sample, the non-Criterion A group experienced events that certainly qualify as significant stressors (e.g., cancer). Thus, the difference in stressor severity level between the Criterion A and

non-Criterion A groups might not be extreme. Nonetheless, in the present study stressors were classified according to *DSM-5* Criterion A, which sets a fairly high threshold for classifying medical conditions as traumatic stressors. According to the *DSM-5* explication of Criterion A, "a life-threatening illness or debilitating medical condition is not necessarily considered a traumatic event. Medical incidents that qualify as traumatic events involve sudden, catastrophic events (e.g., waking during surgery, anaphylactic shock)" (p. 274) Therefore, future studies should consider specific event types when examining invariance to determine if certain types of events are associated with differences in the factor structure, intercepts, or factor means.

Due to the theoretical justification for the five-factor model (Tedeschi & Calhoun, 1996), the second aim of the current study was to provide support for using five factors rather than a total score by examining the heterogeneity of correlations of the five factors of the PTGI with external correlates. Consistent with hypotheses five through seven, all external correlates were positively associated with the five factors of the PTGI. However, the third hypothesis was partially supported by the heterogeneity of correlations analyses, as there was some evidence of subscale differentiation. For example, there were many instances where the relating to others factor was differentiated from the personal strength and new possibilities factors. Similarly, the spiritual change factor was differentiated from the new possibilities and personal strength factors and the new possibilities factor was differentiated from the appreciation of life factor. However, there was less support for differentiation between the personal strength factor and the appreciation of life and new possibilities factors. Finally, there was one instance of differentiation between the relating to others factor and the appreciation of life factor. Therefore, these results indicate that the chosen external correlates provided some evidence that the PTGI factors are measuring different constructs.

It is difficult to provide a theoretical rationale for most instances of differentiation, but there are a few instances for which a plausible theoretical justification can be offered. For example, personal strength had the strongest association with resilience when compared to the four other factors. Therefore, it follows that this construct has high convergent validity with resilience, a construct concerning the ability to withstand hardship, as personal strength is a construct concerning self-assurance and the "ability to handle almost anything" (Tedeschi & Calhoun, 2004). However, this correlation was only found to be significantly different from the relating to others and new possibilities factors, meaning that the appreciation of life and spiritual change factors also overlap with the construct of resilience. Because there are other instances of external correlates that provided evidence for differentiation between the personal strength factor and the appreciation of life and spiritual change factors (i.e., avoidance, negative affect, externalizing, anxious arousal, perseverance of effort), the fact that resilience did not differentiate these factors is not concerning.

Additionally, these analyses showed insignificant correlations between resilience and the spiritual change and relating to others factors, and small correlations between resilience and the appreciation of life, new possibilities, and relating to others factors indicating that these constructs are not highly associated. Therefore, in line with previous literature, these results provide support that PTG is distinct from resilience and that resilient individuals would be less likely obtain PTG after experiencing a stressful or traumatic event (Joseph, 2011).

Additionally, personal strength had the strongest association with the perseverance of effort factor of the GS-12 and was significantly different from the spiritual change and new possibilities factors. Similarly, it follows that this construct has high convergent validity with perseverance of effort, a construct concerning long-term dedication, as personal strength is a

construct concerning the ability to persist in the face of adversity. However, the perseverance of effort factor failed to differentiate personal strength from the appreciation of life and relating to others factors, meaning that these factors might be measuring overlapping constructs. Because there are other instances of external correlates that provided evidence for differentiation between the personal strength factor and the appreciation of life and relating to others factors (i.e., avoidance, externalizing, anxious arousal), the fact that the perseverance of effort factor did not differentiate these factors is not concerning.

More theoretical support for subscale differentiation comes from the consistency of interests factor of the GS-12. This factor had the weakest correlation with the new possibilities factor and was significantly different from the appreciation of life factor. The construct of consistency of interests is concerned with long-term dedication to the same goals and activities, whereas the construct of new possibilities is concerned with the "possibility of taking a new and different path in life" (Tedeschi & Calhoun, 2004). Therefore, it follows that the appreciation of life factor is more highly associated with consistency of interests than new possibilities as one who maintains long-term interest in the same goals and activities would be unlikely to see new avenues of interest and opportunity as appealing.

Examples of external correlates where no clear theoretical justification emerged, but were able to differentiate subscales include the avoidance, negative affect, anhedonia, externalizing behaviors, dysphoric arousal, and anxious arousal factors of the PCL-5, and the WSAS. Interestingly these external correlates were able to differentiate three to six out of ten possible factor comparisons. For example, the externalizing factor of the PCL-5 was the best external correlate at differentiating the factors of the PTGI. The personal strength and new possibilities factors had stronger associations with the externalizing factor whereas the appreciation of life,

spiritual change, and relating to others factors had weaker associations with the externalizing factor. However, there appears to be little conceptual justification for this pattern. Additionally, until now it has been unclear which aspects of PTG drive the association between PTSD and PTG. These analyses indicated that personal strength and new possibilities are likely responsible for this association as these factors have stronger correlations with the PCL-5 factors.

The heterogeneity of correlations analyses also provided evidence that not all of the five factors are well differentiated. The external correlates were not able to differentiate any of the five factors from all of the other factors, and none of the external correlates were able to show that the spiritual change factor was significantly different from the appreciation of life or relating to others factors. However, as mentioned previously, one study that used a measure of religious/spiritual importance showed medium and small effect sizes, respectively, for these associations (Schultz, Tallman, & Atmaier, 2010). Further, when differentiation was shown, all but one of the effect sizes were small. These results indicate that although correlations were significantly different from each other, the degree of the difference was small. In sum, there was some evidence that the five factors were differentiated with respect to their pattern of associations with external correlates. These results suggest that the factors represent at least somewhat distinct latent variables. However, effect sizes were small and most differences were not clearly explicable in the context of the theory of PTG.

Notably, this is the first study to conduct an invariance analysis of the PTGI using *DSM-5* Criterion A and non-Criterion A groups. Additionally, this is the first study to systematically evaluate the heterogeneity of correlations of the five factors with a select number of relevant external correlates. However, the current study has several limitations that should be considered when interpreting results. First, the conclusions of the study are based on cross-sectional data.

Therefore, it is unclear whether the characteristics of PTG were present in the sample before experiencing a Criterion A or non-Criterion A event or if they developed these characteristics after experiencing the event. Further, PTG is a process, and processes should not be examined using one-time point. Longitudinal studies are needed that address this limitation by administering the PTGI before and after exposure to a traumatic or stressful event to further examine the factor structure and the heterogeneity of correlations of the five factors with external correlates.

Second, some participants did not provide sufficiently detailed stressor narratives. The goal of the current study was to create the cleanest groups possible to ensure that events that unequivocally met Criterion A were being compared to events that unequivocally did not meet Criterion A. Therefore, individuals who did not provide narratives or provided vague narratives had to be excluded. However, the narrative coding system in the present study was more rigorous than previous studies that compared Criterion A to non-Criterion A events. Whereas other researchers who used *DSM-IV* (American Psychiatric Association, 2000) criteria and were concerned with PTG relied solely on the narrative (e.g., Morris, Shakespeare-Finch, Rieck, and Newberry, 2005) or an informal questionnaire about the traumatic event when coding for Criterion A events (e.g., Shakespeare-Finch & Barrington, 2012), LEC-5 responses and narratives were considered in tandem in the present study. Further, two graduate student coders reviewed narratives, so any mistakes or disagreements were thoroughly discussed and resolved.

Third, although almost all individuals in the study responded to the PTGI, PCL, and WSAS, there were missing data on the GS-12 and CD-RISC-10. However, Full Information Maximum Likelihood (FIML), a sophisticated missing data technique, was employed to handle

the missing data. Further, covariance coverage for the external correlates ranged from 0.70 to 1.00, and this range is considered adequate when using FIML (Enders, 2010).

Fourth, the current study was limited in the amount of available external correlates which could have contributed to the lack of differentiation found between the spiritual change factor and the appreciation of life and relating to others factors. Future research should include more external correlates directly relevant to each factor of the PTGI to provide more evidence for subscale differentiation. Examples would include a measure of religiosity or a measure of perceived social support. However, as mentioned previously, past studies have used external correlates that directly relate to specific PTGI factors, so these constructs were not used in the current study. Additionally, the aim of the present study was not to provide evidence for convergent and discriminant validity. Rather, the primary aim was to provide evidence for subscale differentiation which was adequately addressed using a select number of relevant external correlates. Further, 100 pair-wise comparisons were conducted in the heterogeneity of analyses using the Benjamini and Hochberg (1995) technique for controlling for the false discovery rate. Adding more analyses would likely affect the results such that less pair-wise comparisons would emerge as significant.

Fifth, all included measures were self-report. Therefore, known limitations of this method should be considered. However, a portion of the present study was focused on examining the factor structure of a self-report measure, so using a self-report measure was justified for the MGCFA. Sixth, the sample is likely to have above average levels of religiosity compared to the United States as a whole (Gallup, 2014). Therefore, the range of responses for the spiritual change factor could be restricted which might have impacted the findings that this factor was not significantly different from the relating to others and appreciation of life factors. Last, the

MGCFA and heterogeneity of correlations analyses were conducted even though fit statistics were not good (Brown, 2015). Therefore, these results should be interpreted with caution.

In sum, when the results of the heterogeneity of correlations analyses are considered in tandem with the results of the MGCFA, it appears as if there is adequate evidence to use the five-factor model of the PTGI rather than the total score. However, most studies concerned with PTG use the PTGI total score. This might lead to inaccurate measurement as the present study found the higher-order factor of PTG to worsen model fit. Further, some factors contribute more to the correlations with external correlates than others. With the present external correlates, it appears as if the personal strength and new possibilities factors are driving many of these associations. Therefore, it might be important to examine each factor independently when researching PTG because this information would be lost if total score were used. Clinically speaking, using the five factors to create a profile of PTG for clients might be more useful than the total score so that more specific feedback could be provided regarding areas of growth (Zoellner & Maercker, 2006). Additionally, the results of the present study indicate that the PTGI can be used in a trauma-exposed, non-trauma-exposed, or mixed sample. Although the finding that latent means were equivalent is inconsistent with the theory of PTG, statistically speaking, the measure is operating the same way for both groups.

References

Affleck, G., & Tennen, H. (1996). Construing benefits from adversity: Adaptational significance and dispositional underpinnings. *Journal of Personality*, *64*, 899–922. http://dx.doi.org/10.1111/j.1467-6494.1996.tb00948.x

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author. http://dx.doi.org/10.1176/appi.books.9780890423349

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing. http://dx.doi.org/10.1176/appi.books.9780890425596

Anderson, W. P., & Lopez-Baez, S. I. (2008). Measuring growth with the Posttraumatic Growth Inventory. *Measurement and Evaluation in Counseling and Development, 56*, 215-227. http://dx.doi.org/10.1002/j.2161-007x.2011.tb01032.x

Armour, C., Tsai, J., Durham, T. A., Charak, R., Biehn, T. L., Elhai, J. D., & Pietrzak, R. H. (2015). Dimensional structure of DSM-5 posttraumatic stress symptoms: Support for a hybrid Anhedonia and Externalizing Behaviors model. *Journal of Psychiatric Research, 61*, 106-113. http://dx.doi.org/10.1016/j.jpsychires.2014.10.012

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. J*ournal of Royal Statistical Society, 57*, 289–300.

Bensimon, M. (2012). Elaboration on the association between trauma, PTSD, and posttraumatic growth: The role of trait resilience. *Personality and Individual Differences, 52*, 782-787. http://dx.doi.org/10.1016/j.paid.2012.01.011

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*, 238–246. http://dx.doi.org/10.1037/0033-2909.107.2.238

Bentler, P. M., & Chou, C.-P. (1987). Practical issues in structural modeling. *Sociological Methods and Research*, *16*, 78-117. http://dx.doi.org/10.1177/0049124187016001004

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., & Keane, T. M. (1995). The development of a clinician-administered PTSD scale. *Journal of Traumatic Stress, 8*, 75-90. http://dx.doi: 10.1002/jts.2490080106

Blix, I., Hansen, M. B., Birkeland, M. S., Nissen, A., & Heir, T. (2013). Posttraumatic growth, posttraumatic stress and psychological adjustment in the aftermath of the 2011 Oslo bombing attack. *Health and Quality of Life Outcomes, 11*, 160-166. http://dx.doi.org/10.1186/1477-7525-11-160

Boals, A., & Schuettler, D. (2009). PTSD symptoms in response to traumatic and non-traumatic events: the role of respondent perception and A2 criterion. *Journal of Anxiety Disorders, 23*, 458-462. http://dx.doi.org/10.1016/j.janxdis.2008.09.003

Boals, A., Steward, J. M., & Schuettler, D. (2010). Advancing our understanding of posttraumatic growth by considering event centrality. *Journal of Loss and Trauma, 15*, 518-533. http://dx.doi.org/10.1080/15325024.2010.519271

Brown, T. A. (2006). *Confirmatory Factor Analysis for Applied Research.* New York: The Guilford Press.

Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research.* New York: The Guilford Press.

Brunet, J., McDonough, M. H., Hadd, V., Crocker, P. R., & Sabiston, C. M. (2010). The Posttraumatic Growth Inventory: An examination of the factor structure and invariance

among breast cancer survivors. *Psycho-Oncology, 19*, 830-838. http://dx.doi.org/10.1002/pon.1640

Cadell, S., Regehr, C., & Hemsworth, D. (2003). Factors contributing to posttraumatic growth: A proposed structural equation model. *American Journal of Orthopsychiatry, 73*, 279-287. http://dx.doi.org/10.1037/0002-9432.73.3.279

Calhoun, L. G., Cann, A., Tedeschi, R. G., & McMillan, J. (2000). A correlational test of the relationship between posttraumatic growth, religion, and cognitive processing. *Journal of Traumatic Stress, 13*, 521-527. http://dx.doi.org/10.1023/a:1007745627077

Calhoun, L. G., Tedeschi, R. G., Cann, A., & Hanks, E. A. (2010). Positive outcomes following bereavement: Paths to posttraumatic growth. *Psychologica Belgica, 50*, 125-143. http://dx.doi.org/10.5334/pb-50-1-2-125

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the Connor-Davidson Resilience Scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress, 20*, 1019-1028. http://dx.doi.org/10.1002/jts.20271

Carver, C. S. (1998). Resilience and thriving: Issues, models, and linkages. *Journal of Social Issues, 54*, 245-266. http://dx.doi.org/10.1111/j.1540-4560.1998.tb01217.x

Cobb, A. R., Tedeschi, R. G., & Calhoun, L. G. (2006). Correlates of posttraumatic growth in survivors of intimate partner violence. *Journal of Traumatic Stress, 19*, 895-903. http://dx.doi.org/10.1002/jts.20171

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd Edition). Hillsdale, NJ: Erlbaum.

Cordova, M. J., Cunningham, L. L., Carlson, C. R., & Andrykowski, M. A. (2001). Posttraumatic growth following breast cancer: A controlled comparison study. *Health Psychology, 20*, 176-185. http://dx.doi.org/10.1037//0278-6133.20.3.176

Cordova, M. J., Giese-Davis, J., Golant, M., Kronenwetter, C., Chang, V., & Spiegel, D. (2007). Breast cancer as trauma: Posttraumatic stress and posttraumatic growth. *Journal of Clinical Psychology in Medical Settings, 14*, 308-319. http://dx.doi.org/10.1007/s10880-007-9083-6

Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods, 1*, 16-29. http://dx.doi.org/10.1037//1082-989x.1.1.16

Currier, J. M., Holland, J. M., & Neimeyer, R. A. (2012). Prolonged grief symptoms and growth in the first two years of bereavement: Evidence of a curvilinear relationship. *Traumatology, 18*, 65-71. http://dx.doi.org/10.1177/1534765612438948

Davis, C. G., Nolen-Hoeksema, S., & Larson, J. (1998). Making sense of loss and benefiting from the experience: Two construals of meaning. *Journal of Personality and Social Psychology, 75*, 561-574. http://dx.doi.org/10.1037//0022-3514.75.2.561

Dekel, S., Ein-Dor, T., & Solomon, Z. (2012). Posttraumatic growth and posttraumatic distress: A longitudinal study. *Psychological Trauma: Theory, Research, Practice, and Policy, 4*, 94-101. http://dx.doi.org/10.1037/a0021865

Dimitrov, D. M. (2010). Testing for factorial invariance in the context of construct validation. *Measurement and Evaluation in Counseling and Development, 43*, 121-149. http://dx.doi.org/10.1177/0748175610373459

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*, 1087-1101. http://dx.doi.org/10.1037/0022-3514.92.6.1087

Enders, C. K. (2010). *Applied Missing Data Analysis.* New York: The Guilford Press.

Filipp, S. H. (1999). A three-stage model of coping with loss and trauma. In A. Maercker, M. Schutzwohl, & Z. Solomon, *Posttraumatic stress disorder: A lifespan developmental perspective* (pp. 43-78). Seattle: Hogrefe and Huber.

Floyd, F. J., & Widaman, K. F. (1995). Factory analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment, 7*, 286-299. http://dx.doi.org/10.1037/1040-3590.7.3.286

Gallup. (2014). *Alabama Scorecard*. Retrieved 2014, from Gallup: http://www.gallup.com/poll/174560/alabama-scorecard.aspx

Gray, M. J., Litz, B. T., Hsu, J. L., & Lombardo, T. W. (2004). Psychometric properties of the Life Events Checklist. *Assessment, 11*, 330-341. http://dx.doi.org/10.1177/1073191104269954

Gregorich, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Medical Care, 44,* S78–S94. http://dx.doi.org/10.1097/01.mlr.0000245454.12228.8f

Grubaugh, A. L., & Resick, P. A. (2007). Posttraumatic growth in treatment-seeking female assault victims. *Psychiatric Quarterly, 78*, 145-155. http://dx.doi.org/10.1007/s11126-006-9034-7

Gucciardi, D. F., Jackson, B., Coulter, T. J., & Mallet, C. J. (2011). The Connor-Davidson Resilience Scale (CD-RISC): Dimensionality and age-related measurement invariance with Australian cricketers. *Psychology of Sports and Exercise, 12*, 423-433. http://dx.doi.org/10.1016/j.psychsport.2011.02.005

Helgeson, V. S., Reynolds, K. A., & Tomich, P. L. (2006). A meta-analytic review of benefit finding and growth. *Journal of Counseling and Clinical Psychology, 74*, 797-816. http://dx.doi.org/10.1037/0022-006x.74.5.797

Hooper, L. M., Marotta, S. A., & Depuy, V. (2009). A confirmatory factor analytic study of the Posttraumatic Growth Inventory among a sample of racially diverse college students. *Journal of Mental Health, 18*, 335-343. http://dx.doi.org/10.1080/09638230802522502

Horowitz, M. J., Wilner, N., & Alvarez, W. (1979). Impact of Event Scale: A measure of subjective distress. *Psychosomatic Medicine, 41*, 209-218. http://dx.doi.org/10.1097/00006842-197905000-00004

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1-55. http://dx.doi.org/10.1080/10705519909540118

IBM Corp. Released 2013. IBM SPSS Statistics for Macintosh, Version 22.0. Armonk, NY: IBM Corp.

Jaarsma, T. A., Pool, G., Sanderman, R., & Ranchor, A. V. (2006). Psychometric properties of the Dutch version of the Postraumatic Growth Inventory among cancer patients. *Psycho-Oncology, 15*, 911-920. http://dx.doi.org/10.1002/pon.1026

Joseph, S. (2011). *What doesn't kill us.* New York: Basic Books.

Joseph, S., Linley, P. A., & Harris, G. J. (2004). Understanding positive change following trauma and adversity: Structural clarification. *Journal of Loss and Trauma: International Perspectives on Stress & Coping, 10*, 83-96. http://dx.doi.org/10.1080/15325020490890741

Kaler, M. E., Erbes, R. C., Tedeschi, R. G., Arbisi, P. A., & Polusny, M. A. (2011). Factor structure and concurrent validity of the Posttraumatic Growth Inventory-Short form among veterans from the Iraq War. *Journal of Traumatic Stress, 24*, 200-207. http://dx.doi.org/10.1002/jts.20623

Kangas, M. (2013). DSM-5 trauma and stress-related disorders: Implications for screening for cancer-related stress. *Frontiers in Psychiatry, 4*, 1-3. http://dx.doi.org/10.3389/fpsyt.2013.00122

Kastenmuller, A., Greitemeyer, T., Epp, D., Frey, D., & Fischer, P. (2012). Posttraumatic growth: Why do people grow from their trauma? *Anxiety, Stress & Coping: An International Journal, 25*, 477-489. http://dx.doi.org/10.1080/10615806.2011.571770

Kline, R. B. (2011). *Principles and practice of structural equation modeling, 3rd edition.* New York: The Guilford Press.

Lee, J. A., Luxton, D. D., Reger, G. M., & Gahm, G. A. (2010). Confirmatory factor analysis of the Posttraumatic Growth Inventory with a sample of soldiers previously deployed in support of the Iraq and Afghanistan wars. *Journal of Clinical Psychology, 66*, 813-819. http://dx.doi.org/10.1002/jclp.20692

Lelorain, S., Bonnaud-Antignac, A., & Florin, A. (2010). Long term posttraumatic growth after breast cancer: Prevalence, predictors and relationships with psychological health. *Journal*

of Clinical Psychology in Medical Settings, 17, 14-22. http://dx.doi.org/10.1007/s10880-009-9183-6

Linley, P. A., & Joseph, S. (2004). Positive change following trauma and adversity: A review. *Journal of Traumatic Stress, 17*, 90-112. http://dx.doi.org/10.1023/b:jots.0000014671.27856.7e

Linley, P. A., Andrews, L., & Joseph, S. (2007). Confirmatory factor analysis of the Posttraumatic Growth Inventory. *Journal of Loss and Trauma, 12*, 321-332. http://dx.doi.org/10.1080/15325020601162823

Liu, P., Wang, L., Cao, C., Wang, R., Zhang, J., Zhang, B.,… Elhai, D. (2014). The underlying dimensions of DSM-5 posttraumatic stress disorder symptoms in an epidemiological sample of Chinese earthquake survivors. *Journal of Anxiety Disorders, 28,* 345-351. http://dx.doi.org/10.1016/j.janxdis.2014.03.008

Lowe, S. R., Manove, E. E., & Rhodes, J. E. (2013). Posttraumatic stress and posttraumatic Growth among low-income mothers who survived hurricane Katrina. *Journal of Consulting and Clinical Psychology, 81*, 1-13. http://dx.doi.org/10.1037/a0033252

Maddi, S. R., Matthews, M. D., Kelly, D. R., Villarreal, B., & White, M. (2012). The role of hardiness and grit in predicting performance and retention of USMA cadets. *Military Psychology, 24*, 19-28. http://dx.doi.org/10.1080/08995605.2012.639672

Mataix-Cols, D., Cowley, A. J., Hankins, M., Schneider, A., Bachofen, M., Kenwright, M., ... Marks, I. M. (2005). Reliability and validity of the Work and Social Adjustment Scale in phobic disorders. *Comprehensive Psychiatry, 46*, 223-228. http://dx.doi.org/10.1016/j.comppsych.2004.08.007

McDonald, S. D., & Calhoun, P. S. (2010). The diagnostic accuracy of the PTSD Checklist: A critical review. *Clinical Psychology Review, 30*, 976-987. http://dx.doi.org/10.1016/j.cpr.2010.06.012

McCrae, R. R., & Costa, P. T. (1986). Personality, coping, and coping effectiveness in an adult sample. *Journal of Personality, 54*, 385-404. http://dx.doi.org/10.1111/j.1467-6494.1986.tb00401.x

Millsap, R. E., & Olivera-Aguilar, M. (2012). Investigating measurement invariance using confirmatory factor analysis. In R. H. Hoyle (Ed.), Handbook of structural equation modeling (pp. 380– 392). New York, NY: Guilford Press.

Morrill, E. F., Brewer, N. T., O'Neill, S. C., Lillie, S. E., Dees, E. C., Carey, L. A., & Rimer, B. K. (2008). The interaction of post-traumatic growth and post-traumatic stress symptoms in predicting depressive symptoms and quality of life. *Psycho-Oncology, 17*, 948-953. http://dx.doi.org/10.1002/pon.1313

Morris, B. A., Shakespeare-Finch, J., Rieck, M., & Newberry, J. (2005). Multidimensional nature of posttraumatic growth in an Australian population. *Journal of Traumatic Stress, 18*, 575-585. http://dx.doi.org/10.1002/jts.20067

Mroczek, D. K., & Spiro, A. (2005). Change in life satisfaction during adulthood: Findings from the Veterans Affairs normative aging study. *Journal of Personality and Social Psychology, 88*, 189-202. http://dx.doi.org/10.1037/0022-3514.88.1.189

Mundt, J. C., Marks, I. M., Shear, M. K., & Greist, J. M. (2002). The Work and Social Adjustment Scale: A simple measure of impairment in functioning. *The British Journal of Psychiatry, 180*, 461-464. http://dx.doi.org/10.1192/bjp.180.5.461

Muthén, L.K. and Muthén, B.O. (1998-2013). Mplus user's guide (7th ed.). Los Angeles, CA: Muthén & Muthén.

Nenova, M., DuHamel, K., Zemon, V., Rini, C., & Redd, W. H. (2013). Posttraumatic growth, social support, and social constraint in hematopoietic stem cell transplant survivors. *Pscyho-Oncology, 22*, 195-202. http://dx.doi.org/10.1002/pon.2073

Nishi, D., Matsuoka, Y., & Kim, Y. (2010). Posttraumatic growth, posttraumatic stress disorder and resilience of motor vehicle accident survivors. *BioPsychoSocial Medicine, 4*, 1-6. http://dx.doi.org/10.1186/1751-0759-4-7

O'Leary, V. E., & Ickovics, J. R. (1995). Resilience and thriving in response to challenge: An opportunity for a paradigm shift in women's health. *Women's Health: Research on Gender, Behavior, and Policy, 1*, 121-142.

O'Leary, V. E., Alday, C.S., & Ickovics, J. R. (1998). Models of life change in posttraumatic growth. In R.G. Tedeschi, C. L. Park, & L. G. Calhoun (Eds.), *Posttraumatic growth: Positive changes in the aftermath of crisis* (pp. 127-151). Mahwah, NJ: Erlbaum.

Osei-Bonsu, P. E., Weaver, T. L., Eisen, S. V., & Vander Wal, J. S. (2012). Posttraumatic Growth Inventory: Factor structure in the context of DSM-IV traumatic events. *International Scholarly Research Network, 2012*, 1-9. http://dx.doi.org/10.5402/2012/937582

Park, C. L., & Folkman, S. (1997). Meaning in the context of stress and coping. *Review of General Psychology, 1*, 115-144. http://dx.doi.org/10.1037//1089-2680.1.2.115

Park, C. L., Cohen, L. H., & Murch, R. L. (1996). Assessment and prediction of stress-related growth. *Journal of Personality, 64*, 71-105. http://dx.doi.org/10.1111/j.1467-6494.1996.tb00815.x

Palmer, G. A., Graca, J. J., & Occhietti, K. E. (2012). Confirmatory factor analysis of the Posttraumatic Growth Inventory in a veteran sample with posttraumatic stress disorder. *Journal of Loss and Trauma, 17*, 545-556. http://dx.doi.org/10.1080/15325024.2012.678779

Paul, M. S., Berger, R., Berlow, N., Rovner-Ferguson, H., Figlerski, L., Gardner, S., Malave, A. F. (2010). Posttraumatic growth and social support in individuals with infertility. *Human Reproduction, 25*, 133-141. http://dx.doi.org/10.1093/humrep/dep367

Powell, S., Rosner, R., Butollo, W., Tedeschi, R. G., & Calhoun, L. G. (2003). Posttraumatic growth after war: A study with former refugees an displaced people in Saravejo. *Journal of Clinical Psychology, 59*, 71-83. http://dx.doi.org/10.1002/jclp.10117

Prati, G., & Pietrantoni, L. (2013). Italian adaption and confirmatory factor analysis of the full and short form of the Posttraumatic Growth Inventory. *Journal of Loss and Trauma: International Perspectives on Stress & Coping, 19*, 12-22. http://dx.doi.org/10.1080/15325024.2012.734203

Prati, G., & Pietrantoni, L. (2009). Optimism, social support, and coping strategies as factors contributing to posttraumatic growth: A meta-analysis. *Journal of Loss and Trauma, 14*, 364-388. http://dx.doi.org/10.1080/15325020902724271

Roe-Berning, S. (2013). *The measure of Posttraumatic Growth: An evaluation of the factor structure of the Posttraumatic Growth Inventory in a South African sample* (Unpublished doctoral dissertation). University of Witwatersrand, Johannesburg.

Schaefer, J. A., & Moos, R. H. (1992). Life crises and personal growth. In B. N. Carpenter, *Personal coping: Theory, research, and application* (pp. 149-170). Westport: Praeger.

Schuettler, D., & Boals, A. (2011). The path to posttraumatic growth versus posttraumatic stress disorder: Contributions of event centrality and coping. *Journal of Loss and Trauma, 16*, 180-194. http://dx.doi.org/10.1080/15325024.2010.519273

Schultz, J. M., Tallman, B. A., & Altmaier, E. M. (2010). Pathways to posttraumatic growth: The contributions of forgiveness and importance of religion and spirituality. *Psychology of Religion and Spirituality, 2*, 104-114. http://dx.doi.org/10.1037/a0018454

Schmidt, S. D. (2013). Posttraumatic growth reported by emerging adults: A multigroup analysis of the roles of attachment, support, coping, and life satisfaction" (Unplubished doctoral dissertation). University of Connecticut, Connecticut.

Scott, W. J. (1990). PTSD in DSM-III: A case in the politics of diagnosis and disease. *Social Problems, 37*, 294-311. http://dx.doi.org/10.1525/sp.1990.37.3.03a00020

Shakespeare-Finch, J., & Barrington, A. J. (2012). Behavioral changes add validity to the construct of posttraumatic growth. *Journal of Traumatic Stress, 25*, 433-439. http://dx.doi.org/10.1002/jts.21730

Sheikh, A. I., & Marotta, S. A. (2005). A cross-validation study of the Posttraumatic Growth Inventory. *Measurement and Evaluation in Counseling and Development, 38*, 66-77.

Slavin-Spenny, O. M., Cohen, J. L., Oberleitner, L. M., & Lumley, M. A. (2011). The effects of different methods of emotional disclosure: Differentiation posttraumatic growth from stress symptoms. *Journal of Clinical Psychology, 67*, 993-1007. http://dx.doi.org/10.1002/jclp.20750

Smith, S. K., Samsa, G., Ganz, P. A., & Zimmerman, S. (2013). Is there a relationship between posttraumatic stress and growth after a lymphoma diagnosis? *Psycho-Oncology, 23*, 1-7. http://dx.doi.org/10.1002/pon.3419

Stolzenberg, R. M., Blair-Loy, M., & White, L. J. (1995). Religous participation in early adulthood: Age and family life cycle effects on church membership. *American Sociological Review, 60*, 84-103. http://dx.doi.org/10.2307/2096347

Taku, K., Calhoun, L. G., Tedeschi, R. G., Gil-Rivas, V., Kilmer, R. P., & Cann, A. (2007). Examining posttraumatic growth among Japanese university students. *Anxiety, Stress, & Coping, 20*, 353-367. http://dx.doi.org/10.1080/10615800701295007

Taku, K., Cann, A., Calhoun, L. G., & Tedeschi, R. G. (2008). The factor structure of the Posttraumatic Growth Inventory: A comparison of five models using confirmatory factor analysis. *Journal of Traumatic Stress, 21*, 158-164. http://dx.doi.org/10.1002/jts.20305

Taylor, S. E. (1983). Adjustment to threatening events: A theory of cognitive adaptation. *American Psychologist, 38*, 1161-1173. http://dx.doi.org/10.1037//0003-066x.38.11.1161

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*, 1-18. http://dx.doi.org/10.1207/s15327965pli1501_01

Tedeschi, R. G., & Calhoun, L. G. (1996). The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress, 9*, 455-471. http://dx.doi.org/10.1002/jts.2490090305

Tomich, P. L., & Helgeson, V. S. (2012). Posttraumatic growth following cancer: Links to quality of life. *Journal of Traumatic Stress, 25*, 657-573. http://dx.doi.org/10.1002/jts.21738

Tsai, J., El-Gabalawy, R., Sledge, W. H., Southwick, S. M., & Pietrzak, R. H. (2015). Post-traumatic growth among veterans in the USA: Results from the National Health and Resilience in Veterans Study. *Psychological Medicine, 45*, 165-179. http://dx.doi.org/10.1017/s0033291714001202

Wagner, B., Knavelsrud, C., & Maercker, A. (2007). Post-traumatic growth and optimism as outcomes of an internet-based intervention for complicated grief. *Cognitive Behaviour Therapy, 36*, 156-161. http://dx.doi.org/10.1080/16506070701339713

Wang, L., Shi, Z., Zhang, Y., & Zhang, Z. (2010). Psychometric properties of the Connor-Davison Resilience Scale in Chinese earthquake victims. *Psychiatry and Clinical Neurosciences, 64*, 499-504. http://dx.doi.org/10.1111/j.1440-1819.2010.02130.x

Weathers, F. W., Blake, D. D., Schnurr, P. P., Kaloupek, D. G., Marx, B. P., & Keane, T. M. (2013). *The Life Events Checklist for DSM-5 (LEC-5)*. Retrieved from The National Center for PTSD: www.ptsd.va.gov

Weathers, F. W., Huska, J. A., & Keane, T. M. (1991). The PTSD Checklist-Civilian Version (PCL-C), Available from F. W. Weathers, National Center for PTSD, Boston Veterans Affairs Medical Center, 150 S. Huntington Avenue, Boston, MA 02130.

Weathers, F.W., Litz, B.T., Keane, T.M., Palmieri, P.A., Marx, B.P., & Schnurr, P.P. (2013). *The PTSD Checklist for DSM-5 (PCL-5)*. Scale available from the National Center for PTSD at www.ptsd.va.gov.

Weathers, F. W., Marx, B. P., Friedman, M. J., & Schnurr, P. P. (2014). Posttraumatic stress disorder in DSM-5: New criteria, new measures, and implications for assessment. *Psychological Injury and Law, 7*, 93-107. http://dx.doi.org/10.1007/s12207-014-9191-1

Weiss, D. S., & Marmar, C. R. (1996). The Impact of Event Scale - Revised. In J. Wilson & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399-411). New York: Guilford.

Weiss, T. (2004). Correlates of posttraumatic growth in husbands of breast cancer survivors. *Psycho-Oncology, 13*, 260-268. http://dx.doi.org/10.1002/pon.735

Weiss, T., & Berger, R. (2006). Reliability and validity of a Spanish version of the Posttraumatic Growth Inventory. *Research on Social Work Practice, 16*, 191-199. http://dx.doi.org/10.1177/1049731505281374

Wilkins, K. C., Lang, A. J., & Norman, S. B. (2011). Synthesis of the psychometric properties of the PTSD checklist (PCL) military, civilian, and specific versions. *Depression and Anxiety, 28*, 596-606. http://dx.doi.org/10.1002/da.20837

Yalom, I. D., & Lieberman, M. A. (1991). Bereavement and heightened existensial awareness. *Psychiatry, 54*, 334-345.

Zahra, D., Qureshi, A., Henley, W., Taylor, R., Quinn, C., Pooler, J., ... Byng, R. (2014). The work and social adjustment scale: Reliability, sensitivity and value. *International Journal of Psychiatry in Clinical Practice, 18*, 131-138. http://dx.doi.org/10.3109/13651501.2014.894072

Zhang, W., Yan, T.-t., Du, Y.-s., & Liu, X.-h. (2013). Relationship between coping, rumination and posttraumatic growth in mothers of children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 7*, 1204-1210. http://dx.doi.org/10.1016/j.rasd.2013.07.008

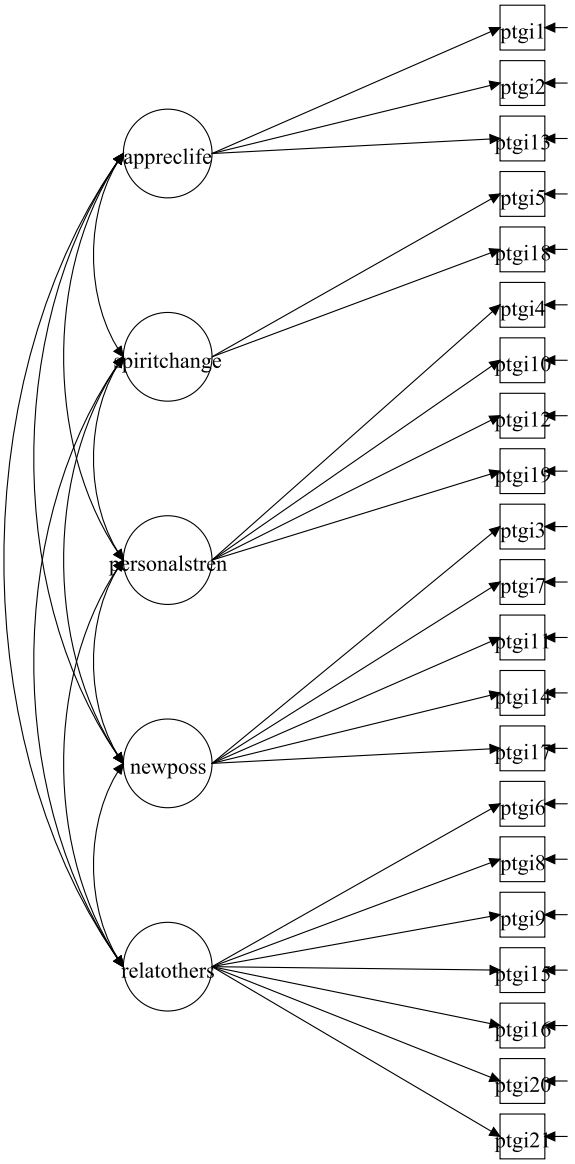
Zoellner, T., & Maercker, A. (2006). Posttraumatic growth in clinical psychology — A critical review and introduction of a two component model. *Clinical Psychology Review, 26*, 626-653. http://dx.doi.org/10.1016/j.cpr.2006.01.008

Zoellner, T., Rabe, S., Karl, A., & Maercker, A. (2008). Posttraumatic growth in accident survivors: Openness and optimism as predictors of its constructive or illusory sides. *Journal of Clincal Psychology, 64*, 245-263. http://dx.doi.org/10.1002/jclp.20441

Appendix

Figure 1

Five-Factor Model of the Posttraumatic Growth Inventory



Note. Appreclife = appreciation of life; Spiritchange = spiritual change; Personalstren = personal strength; Newposs = new possibilities; Relatothers = relating to others.

Table 1
Summary of Goodness-of-Fit Indices for Previous CFA Studies of the Five-Factor Model

Study, Year	χ^2	*df*	CFI	TLI	SRMR	RMSEA	90% CI for RMSEA	
							LL	UL
Linley, Andrews, & Joseph, 2007	585.57*	179	0.92	-	-	0.08	0.07	0.09
Prati & Peitrantoni, 2013	1073.21*	179	0.95	-	-	0.06	0.06	0.07
Taku, Cann, Calhoun, & Tedeschi, 2008	962.53*	179	0.98	0.97	0.05	0.07	0.07	0.07
Lee, Luxton, Reger, & Gahm, 2010	5165.89*	179	0.97	-	0.06	0.09	0.09	0.09
Palmer, Graca, & Occhietti, 2012	362.66*	179	0.91	-	-	0.07	0.06	0.08
Brunet, McDonough, Hadd, Crocker, & Sabiston, 2010	927.01*	179	0.97	-	0.05	0.10	-	-

Note. PTGI = Posttraumatic Growth Inventory; CFA = confirmatory factor analysis; χ^2 = chi-square fit statistic; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval; LL = lower limit; UL = upper limit.
*$p < .05$.

Table 2

Summary of Goodness-of-Fit Indices for Previous CFA Studies of the Higher-Order Model

Study, Year	χ^2	*df*	CFI	TLI	SRMR	RMSEA	90% CI for RMSEA	
							LL	UL
Linley, Andrews, & Joseph, 2007	608.51*	184	0.91	-	-	0.08	0.07	0.09
Prati & Peitrantoni, 2013	1139.53*	184	0.94	-	-	0.07	0.06	0.07
Taku, Cann, Calhoun, & Tedeschi, 2008	1045.70*	184	0.97	0.97	0.05	0.07	0.07	0.08
Lee, Luxton, Reger, & Gahm, 2010	5337.91*	184	0.97	-	0.06	0.09	0.09	0.09
Palmer, Graca, & Occhietti, 2012	373.28*	184	0.90	-	-	0.07	0.06	0.08

Note. PTGI = Posttraumatic Growth Inventory; CFA = confirmatory factor analysis; χ^2 = chi-square fit statistic; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval; LL = lower limit; UL = upper limit.

*$p < .05$.

Table 3

Top 10 Criterion A Group Event Types

Event	Total % (*n*)
Transportation Accident	31.5 (126)
Sexual Assault	13.0 (52)
Suicide	12.5 (50)
Natural Disaster	11.8 (47)
Serious Accident	5.0 (20)
Physical Assault	4.3 (17)
Sudden Violent Death	2.8 (11)
Fire or Explosion	2.5 (10)
Exposure to Toxic Substance	2.3 (9)
Life-threatening Illness or Injury	2.3 (9)

Table 4

Top 10 Non-Criterion A Group Event Types

Event	Total % (*n*)
Cancer	22.6 (55)
Divorce	11.5 (28)
Death of a grandparent	10.3 (25)
Life-threatening Illness or Injury	7.8 (19)
Natural Disaster	5.8 (14)
Heart Problems	4.5 (11)
Other	4.5 (11)
Expected Death	4.1 (10)
Serious Accident	3.7 (9)
Family Relationship Problems	3.3 (8)

Table 5

Descriptive Statistics of the PTGI, PCL-5, CD-RISC-10, GS-12, and WSAS

Measure	*n*	*M* (*SD*)	α	Range	Median
PTGI	599	40.85 (27.05)	0.96	105	37
PCL-5	621	14.92 (14.95)	0.94	73	10
CD-RISC-10	444	26.59 (7.52)	0.91	40	26
GS-12	442	3.37 (.58)	0.81	3.75	3.33
WSAS	638	3.56 (5.78)	0.86	34	0

Note. PTGI = Posttraumatic Growth Inventory; PCL-5 = Posttraumatic Stress Disorder Checklist – 5; CD-RISC-10 = Connor-Davidson – Resilience Scale-10; GS-12 = Grit Scale-12; WSAS = Work and Social Adjustment Scale; *n* = sample size; *M (SD)* = sample mean and standard deviation; α = internal consistency.

Table 6

Goodness-of-Fit Indices for the CFA of the Five-Factor Model in Both Groups

							90% CI for RMSEA	
Group	χ^2	*df*	CFI	TLI	SRMR	RMSEA	LL	UL
Crit A	795.038[a]*	179	0.892	0.873	0.051	0.093	0.087	0.100
Non A	559.053[b]*	179	0.896	0.878	0.053	0.094	0.085	0.103

Note. PTGI = Posttraumatic Growth Inventory; CFA = confirmatory factor analysis; Posttraumatic Growth Inventory; χ^2 = conventional chi-square fit statistic (under maximum-likelihood estimation); CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval; LL = lower limit; UL = upper limit; Crit A = Criterion A; Non A = non-Criterion A.

[a]$n = 400$. [b]$n = 244$.

*$p < .001$.

Table 7

Goodness-of-Fit Indices for the Higher-Order Model in Both Groups

							90% CI for RMSEA	
Group	χ^2	*df*	CFI	TLI	SRMR	RMSEA	LL	UL
Crit A	826.579[a]*	184	0.887	0.872	0.053	0.094	0.088	0.101
Non A	581.210[b]*	184	0.891	0.876	0.056	0.095	0.086	0.103

Note: PTGI = Posttraumatic Growth Inventory; χ^2 = conventional chi-square fit statistic (under maximum-likelihood estimation); CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval; LL = lower limit; UL = upper limit; Crit A = Criterion A; Non A = non-Criterion A.

[a]$n = 400$. [b]$n = 244$.

*$p < .001$.

Table 8

STDYX and Unstandardized Parameter Estimates in the Criterion A Group

	Estimate/*SE* (*p*-value)	STDYX
Factor Loadings		
AL BY		
Item 1	1.00/0.00[a]	0.67
Item 2	1.18/.09 ($p < .01$)	0.77
Item 13	1.33/.10 ($p < .01$)	0.86
SC BY		
Item 5	1.00/0.00[a]	0.95
Item 18	.90/.05 ($p < .01$)	0.85
PS BY		
Item 4	1.00/0.00[a]	0.64
Item 10	1.27/0.10 ($p < .01$)	0.81
Item 12	1.18/0.09 ($p < .01$)	0.78
Item 19	1.33/0.10 ($p < .01$)	0.78
NP BY		
Item 3	1.00/0.00[a]	0.66
Item 7	1.33/0.10 ($p < .01$)	0.76
Item 11	1.42/0.10 ($p < .01$)	0.87
Item 14	1.05/0.09 ($p < .01$)	0.65
Item 17	1.38/0.10 ($p < .01$)	0.78
RO BY		
Item 6	1.00/0.00[a]	0.70
Item 8	0.94/0.07 ($p < .01$)	0.74
Item 9	0.84/.06 ($p < .01$)	0.73
Item 15	1.09/0.08 ($p < .01$)	0.77
Item 16	1.14/0.08 ($p < .01$)	0.79
Item 20	1.18/0.08 ($p < .01$)	0.80
Item 21	1.13/0.08 ($p < .01$)	0.81
Factor intercorrelations		
AL WITH		
SC	1.50/0.17 ($p < .01$)	0.71
PS	1.14/0.14 ($p < .01$)	0.87
NP	0.94/0.12 ($p < .01$)	0.79
RO	1.23/0.14 ($p < .01$)	0.83
SC WITH		
PS	1.23/0.15 ($p < .01$)	0.61
NP	1.25/0.14 ($p < .01$)	0.68
RO	1.61/0.17 ($p < .01$)	0.70
PS WITH		
NP	0.98/0.12 ($p < .01$)	0.87
RO	1.14/0.13 ($p < .01$)	0.81
NP WITH		
RO	1.045/0.12 ($p < .01$)	0.81

Note. PTGI = Posttraumatic Growth Inventory; STDYX = standardized solution outputted by Mplus; AL= appreciation of life; SC = spiritual change; PS = personal strength; NP = new possibilities; RO = relating to others.

[a] Parameter was fixed at 1.0.

Table 9

STDYX and Unstandardized Parameter Estimates for the Five-Factor Model of the PTGI in the Non-criterion A Group

	Estimate/*SE* (*p*-value)	STDYX
Factor Loadings		
AL BY		
Item 1	1.00/0.00[a]	0.72
Item 2	1.17/0.11 ($p < .01$)	0.76
Item 13	1.25/0.11 ($p < .01$)	0.82
SC BY		
Item 5	1.00/0.00[a]	0.93
Item 18	0.92/0.06 ($p < .01$)	0.82
PS BY		
Item 4	1.00/0.00[a]	0.72
Item 10	1.09/0.09 ($p < .01$)	0.81
Item 12	1.01/0.09 ($p < .01$)	0.78
Item 19	1.18/0.09 ($p < .01$)	0.86
NP BY		
Item 3	1.00/0.00[a]	0.77
Item 7	1.11/0.08 ($p < .01$)	0.80
Item 11	1.21/0.09 ($p < .01$)	0.83
Item 14	0.90/0.09 ($p < .01$)	0.68
Item 17	1.13/0.09 ($p < .01$)	0.81
RO BY		
Item 6	1.00/0.00[a]	0.71
Item 8	1.07/0.09 ($p < .01$)	0.79
Item 9	0.98/0.09 ($p < .01$)	0.76
Item 15	1.09/0.10 ($p < .01$)	0.78
Item 16	1.05/0.10 ($p < .01$)	0.76
Item 20	1.07/0.09 ($p < .01$)	0.76
Item 21	1.08/0.09 ($p < .01$)	0.80
Factor intercorrelations		
AL WITH		
SC	1.54/0.21 ($p < .01$)	0.74
PS	1.26/0.19 ($p < .01$)	0.79
NP	1.22/0.17 ($p < .01$)	0.81
RO	1.24/0.18 ($p < .01$)	0.82
SC WITH		
PS	1.61/0.22 ($p < .01$)	0.71
NP	1.44/0.20 ($p < .01$)	0.81
RO	1.58/0.21 ($p < .01$)	0.73
PS WITH		
NP	1.52/0.20 ($p < .01$)	0.93
RO	1.42/0.20 ($p < .01$)	0.86
NP WITH		
RO	1.27/0.17 ($p < .01$)	0.81

Note. PTGI = Posttraumatic Growth Inventory; STDYX = standardized solution outputted by Mplus; AL= appreciation of life; SC = spiritual change; PS = personal strength; NP = new possibilities; RO = relating to others.

[a] Parameter was fixed at 1.0.

Table 10

χ^2 Difference Tests and Goodness-of-Fit Indices for Five-Factor Models within MGCFA

Model	χ^2	*df*	Model Comparison	$\Delta\chi^2$	Δdf	CFI	TLI	SRMR	RMSEA
1	1354.091*	358				0.894	0.875	0.052	0.094
2	1371.679*	374	2-1	17.588	16	0.893	0.880	0.054	0.092
3	1391.605*	390	3-2	19.926	16	0.893	0.885	0.054	0.090

Note. χ^2 = conventional chi-square fit statistic (under maximum-likelihood estimation); PTGI = Posttraumatic Growth Inventory; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation.

*$p < .001$.

Table 11

STDYX Inter-correlations of the Five Factors in Criterion A and Non-Criterion A Group

PTGI Factor	SC	PS	NP	RO
AL	.71*	.84*	.80*	.82*
SC		.65*	.68*	.71*
PS			.89*	.83*
NP				.82*

Note. PTGI = Posttraumatic Growth Inventory; STDYX = standardized solution outputted by Mplus; AL= appreciation of life; SC = spiritual change; PS = personal strength; NP = new possibilities; RO = relating to others.

*$p < .01$.

Table 12

Correlations and Wald Ws of the PCL-5, CD-RISC-10, GS-12, and WSAS with the PTGI

	Correlation with criterion					
Measure	AL	SC	PS	NP	RO	Wald W
CD-RISC - 10	.171*	.093	.246*	.148*	.098	13.190❖
PCL-5						
REX	.303*	.150*	.319*	.354*	.211*	7.457
AVD	.218*	.141*	.322*	.289*	.145*	14.579❖
NAF	.153*	.028	.234*	.261*	.061	16.973❖
ANH	.120*	.051	.216*	.285*	.058	26.034❖
EXT	.098	-.045	.208*	.257*	.043	24.179❖
DYS	.186*	.085	.248*	.338*	.117*	19.692❖
AXA	.173*	.024	.221*	.244*	.067	17.687❖
WSAS	.135*	.041	.198*	.316*	.076*	20.645❖
GS-12						
CON	.189*	.134*	.118*	.055*	.088*	11.192❖
PER	.200*	.049	.250*	.162*	.144*	10.717❖

Note. PCL-5 = Posttraumatic Stress Disorder Checklist – 5; CD-RISC-10 = Connor-Davidson – Resilience Scale-10; GS-12 = Grit Scale-12; WSAS = Work and Social Adjustment Scale; PTGI = Posttraumatic Growth Inventory; AL= appreciation of life; SC = spiritual change; PS = personal strength; NP = new possibilities; RO = relating to others; REX = re-experiencing; AVD = avoidance, NAF = negative affect; ANH = anhedonia, EXT = externalizing; DYS = dysphoric arousal; AXA = anxious arousal; CON = consistency of interests; PER = perseverance of effort. *$p < .05$. ❖Significant after the Benjamini and Hochberg (1995) technique for controlling for the false discovery rate.

Table 13

Goodness-of-Fit Indices for the CFA of the Five-Factor Model and Included Measures

							90% CI for RMSEA	
Group	χ^2	*df*	CFI	TLI	SRMR	RMSEA	LL	UL
CD-RISC-10	1671.965*	419	0.895	0.884	0.050	0.068	0.065	0.072
PCL-5	1816.226*	713	0.914	0.901	0.051	0.049	0.046	0.052
WSAS	1135.570*	284	0.887	0.871	0.055	0.069	0.064	0.073
GS-12	1648.1498	474	0.896	0.884	0.053	0.062	0.059	0.066

Note. PTGI = Posttraumatic Growth Inventory; CD-RISC-10 = Connor-Davidson – Resilience Scale-10; GS-12 = Grit Scale-12; WSAS = Work and Social Adjustment Scale; χ^2 = chi-square fit statistic; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval; LL = lower limit; UL = upper limit.

*$p < .001$.

Table 14

Wald Tests and Cohen's q Effect Sizes for Statistically Significant Pairwise Comparisons

Measure	Stat	Pairwise comparison							
		RO with PS	RO with NP	SC with NP	AL with NP	SC with PS	AL with PS	RO with AL	PS with NP
CD-RISC-10	W	11.41							8.60
	q	0.15*							0.10*
PCL-5									
AVD	W	13.71	7.75				5.60		
	q	0.19*	0.15*				0.11*		
NAF	W	12.69	13.17	9.08		8.45			
	q	0.18*	0.21*	0.24*		0.21*			
ANH	W	11.00	23.16	9.50	11.72				
	q	0.15*	0.20*	0.19*	0.15*				
EXT	W	10.14	16.21	17.56	11.68	12.52	6.19		
	q	0.17*	0.22*	0.31**	0.17*	0.26*	0.11*		
DYS	W	7.88	18.02	8.48	8.37				
	q	0.14*	0.23*	0.27*	0.16*				
AXA	W	12.20	10.27	8.57		8.30		5.41	
	q	0.17*	0.18*	0.22*		0.21*		0.11*	
WSAS	W	5.66	19.35	11.15	11.31				
	q	0.13*	0.25*	0.29*	0.19*				
GS-12									
CON	W				8.91				
	q				0.14*				
PER	W					6.78			6.80
	q					0.21*			0.09

Note. PTGI = Posttraumatic Growth Inventory; CD-RISC-10 = Connor-Davidson – Resilience Scale-10; GS-12 = Grit Scale-12; WSAS = Work and Social Adjustment Scale; CFI = comparative fit index; AL= appreciation of life; SC = spiritual change; PS = personal strength; NP = new possibilities; RO = relating to others; AVD = avoidance, NAF = negative affect; ANH = anhedonia, EXT = externalizing; DYS = dysphoric arousal; AXA = anxious arousal; CON = consistency of interests; PER = perseverance of effort.

All Wald Ws were statistically significant after using Benjamini and Hochberg's (1995) procedure to control for the false discovery rate.

*Small effect size as indicated by Cohen's *q* (1988). **Medium effect size as indicated by Cohen's *q* (1988).