Child Ind Res (2017) 10:1121–1134
DOI 10.1007/s12187-016-9441-8

Latent Structure of Posttraumatic Growth and its Temporal Stability Among a Sample of Chinese Children Following an Earthquake

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Accepted: 28 December 2016 / Published online: 11 January 2017

Abstract Since the introduction of the Posttraumatic Growth Inventory (PTGI), the factor structure of PTG has been a hot topic of debate. Nevertheless, no consensus has been achieved to date. Previous researchers have focused mainly on adults, such that the applicability of this measure to traumatized children remains rather unclear. Although several studies have suggested that time since trauma might influence PTG factor structure, no study has examined the stability of the factor structure of PTG over time. Thus, the present study aimed to assess the factor structure of PTG among traumatized children following the Ya'an earthquake, and to specifically examine PTG optimal factor structure over time. Self-report scales were administered to 303 children, 6 months after the earthquake. A five-factor structure of PTG that includes relating to others, new possibilities, personal strength, spiritual changes, and appreciation of life had the best fit indices among all five structural models of PTG examined. The five factor structure of PTG satisfied the factor loading invariance criterion but did not satisfy the item intercept and factor variance invariance criteria. This study extends the extant literature on the five factor structure of PTG from adults to a child sample and confirms that the five factor structure is stable across time, but that PTG scores are indeed moderated by time since trauma. Implications for clinical practice and future research are discussed along with study limitations.

Keywords Children · PTG · Factor structure

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1 Introduction

Perceived benefits following traumatic experiences have attracted growing interest since the 1980s (Osei-Bonsu et al. 2011). Tedeschi and Calhoun (1995) coined the term posttraumatic growth (PTG) to capture these perceived benefits following trauma. PTG has been defined as positive psychological change experienced as a result of experiencing traumatic life events (Calhoun and Tedeschi 1999), and it may occur in terms of self-perception, interpersonal relationships, or life philosophy on both emotional and cognitive levels (Tedeschi and Calhoun 1996). To assess PTG in various traumatized individuals, Tedeschi and Calhoun (1996) developed the Posttraumatic Growth Inventory (PTGI) as an assessment of the five factor model of PTG. The measure consists of 21 items that assess *relating to others, new possibilities, personal strength, spiritual changes, and appreciation of life.* However, the factor structure of the PTG has become a hot and controversial topic in the trauma-related study area (Johnson and Boals 2015; Shakespeare-Finch and Barrington 2012). In the present study, we aimed to examine the latent structure of the PTG among Chinese child survivors of an earthquake.

1.1 Studies of the Latent Structure of the PTG

Many recent studies have sought to examine the applicability of the five factor model of PTG to various traumatized samples (Palmer et al. 2012). Specifically, these studies have supported the applicability of the model among breast cancer survivors (Brunet et al. 2010), deployed veterans (Lee et al. 2010), and members of the general population with various traumatic experiences (Taku et al. 2008). These studies suggest that as different characteristics, the five factors of PTG may reflect different underlying psychological processes and that they are therefore worth distinguishing (Janoff-Bulman 2004; McMillen 2004; Taku et al. 2008). Nevertheless, the five factor model has been confronted with some criticisms (Osei-Bonsu et al. 2011). The spiritual change and appreciation for life factors of the model are comprised of only 2 and 3 items respectively, which may be a source of weakness and instability for these factors (Costello and Osborne 2005).

Leaving these criticisms aside, a number of studies have also found that there are robust interrelationships among the five factors (Cobb et al. 2006; Jaarsma et al. 2006; Taku et al. 2008; Tedeschi and Calhoun 1996), which indicates that a higher-order factor could account for much of the variance among the five components of the model (Chen et al. 2005). One study has identified a single second-order factor, while also considering the five subscales as first-order factors (Cadell et al. 2003). This model could be named the five factor with one higher-order factor model of PTG, and is supported by studies of adult bereaved caregivers (Cadell et al. 2003). However, a recent study found that there were no significance differences between higher order and five factor models of PTG (Taku et al. 2008).

Additionally, an alternative three factor model has been derived via Principal Component Analysis (Powell et al. 2003). Here, the factors include *changes in self/positive life attitudes, philosophy of life, and relating to others*. Principal Component Analysis is justified when there are no specific models to provide an initial basis for theory. However, to overcome the limitations of Powell et al.'s (2003) analysis, Linley et al. (2007) used

confirmatory factor analysis (CFA) to assess Powell et al.'s (2003) model, finding the model to be adequate. This model has also received support among various samples, such as refugees and displaced people (Powell et al. 2003), Latina immigrants, adult survivors of flash flood disaster (Mordeno et al. 2015a, b), and in members of the general population with varied trauma experiences (Joseph et al. 2005).

As was the case for the five factor model, robust interrelationships are found between the three PTG factors (Mordeno et al. 2015a, b; Weiss and Berger 2006), with Taku et al. (2008) suggesting that a higher-order factor might be extracted from the existing three factors. However, they found that fit indices for such a model showed no significant improvements compared to a three factor model (Taku et al. 2008).

When three and five factor models are compared, some studies indicate that the three factors model shows better fit indices (Mordeno et al. 2015a, b), whereas one study found the opposite (Taku et al. 2008). The question of which model is superior therefore remains open. Nevertheless, there is a consensus that PTG factors identified to date have high internal consistency, and thus Osei-Bonsu et al. (2011) proposed a one factor model of PTG, although such a model has yet to be supported in more traumatized samples. Further evaluation of such models is clearly needed (Morris et al. 2005).

1.2 The Present Study

Despite the promising results of studies to date, some limitations still remain to be addressed. First, the factor structure of PTG can vary depending on particular characteristics of a sample or specific types of traumatic experiences (Hooper et al. 2009; Lee et al. 2010). Thus, it cannot be assumed that a measure validated largely with samples of survivors of one type of traumatic event is a valid measure for use with other survivor samples. The present study focused on earthquake survivors, and sought to examine the latent structure of PTG following an earthquake.

Second, few confirmatory factor studies to date have focused on the latent structure of PTG among children, although many studies have focused on PTG in child samples (Cryder et al. 2006; McElheran et al. 2012; Yoshida et al. 2016), finding that such growth does occurs in children following trauma (Cryder et al. 2006). Cognitive capabilities may represent critical components of the PTG process (Calhoun and Tedeschi 2006). Compared to adults, however, children do not have enough cognitive development (Tedeschi and Calhoun 2004). Variability in youngsters' cognitive capabilities may influence their encoding and appraisal of, and attributions about, trauma (Hasan and Power 2004), as well as repertoire of coping strategies, ability to marshal resources and cope effectively, and capacity to attend to and report their internal experiences and emotional states (Cryder et al. 2006; Kilmer 2006; Kilmer and Gil-Rivas 2010), which could in turn influence the extent to which children realize PTG. Understanding the latent structure of PTG in children may be helpful in elucidating the nature of PTG in this population, and may aid in post-disaster child mental health care (Yoshida et al. 2016).

Although previous studies did not focus systematically on the latent structure of child PTG, there are nevertheless some important implications of this work. For example, Salter and Stallard (2004) found that child PTG most strongly reflects a change in philosophy of life, as well as a new appreciation for life and a desire to seize new opportunities. Other studies indicate that child PTG may involve five domains,

including new possibilities, relating to others, personal strength, appreciation of life, and spiritual change (Cryder et al. 2006; Kilmer et al. 2009). Despite such progress, the latent structure of child PTG and other child-specific characteristics of the experience remain to be clarified.

A further limitation is that no data are available with regards to the stability of the factor structure of PTG over time. Time since trauma is indeed an important factor that affects psychological outcomes following traumatic events (Meyerson et al. 2011; Steel et al. 2002). More specifically, Helgeson et al. (2006) suggested that time since trauma is a critically important factor in the development of positive outcomes following trauma. Children have limited life experiences and their cognitive schemas are still in the process of being built, and as such are not yet fully developed (Harvey et al. 2006), which may limit a child's recognition of both losses and gains. As time elapses since a trauma, a child's cognitive capability gradually matures, which is necessary if one is to find meaning or otherwise identify benefits following trauma (Milam et al. 2004), such that more PTG is realized. Thus, the passage of time since trauma may be an important predictor of PTG (McElheran et al. 2012).

In addition, the factor structure of PTG could also be influenced by time since trauma. For example, breast cancer survivors report positive changes in their lives relatively shortly after being diagnosed, with such changes reflecting the five aspects of PTG. Over time, increases in PTG were seen in terms of a sense of personal strength, the realization of new possibilities, and new appreciation of life and relationships with others (Cordova et al. 2001; Manne et al. 2004). Alternatively, Mordeno et al. (2015b) suggested that since instability and chaos characterize the situation immediately after a natural disaster, survivors will likely choose vague ways to achieve growth (3-factor model) rather than more specific patterns (5-factor model) used when the post-trauma situation becomes more stable. Nevertheless, it remains unclear exactly how the factor structure of child PTG might change with time elapsed since a trauma.

We used a confirmatory factor analysis alternative model approach to address the aforementioned limitations, such that the first aim of this study was to assess five theoretically and empirically based models of PTG in a sample of Chinese adolescents who experienced the Ya'an earthquake. The competing models included a 1 factor model, a 3 factor model, a 5 factor model (see Table 1 for this three model structure mapping), a 3 factors with 1 higher-order factor model, and a 5 factors with 1 higher-order factor model. The second aim of this study was to examine the temporal stability of the optimal factor structure of PTG, and we hypothesized that children would experience more PTG as time elapsed since the trauma.

2 Method

2.1 Participants and Procedures

We focused on Lushan county in Sichuan province, which was most affected by the Ya'an earthquake. We first contacted the local education authority and informed them of the aims and methods of investigation, and indicated that we could provide psychological services if required. With the approval of the local education authority and schools, we chose one primary school in Lushan county and randomly selected several

Table 1 Item mappings for three alternative PTGI factor models

PTGI items		1 factor	3 factor model	5 factor model
1.	My priorities about what is important in life	PTG	Philosophy	Life
2.	I'm more likely to try to change things which need changing	PTG	Philosophy	Possibilities
3.	An appreciation for the value of my own life	PTG	Philosophy	Life
4.	A feeling of self reliance	PTG	Change	Strength
5.	A better understanding of spiritual matters	PTG	Change	Spirit
6.	Knowing that I can count on people in times of trouble	PTG	Philosophy	Relate
7.	A sense of closeness with others	PTG	Relate	Relate
8.	Knowing that I can handle difficulties	PTG	Change	Strength
9.	A willingness to express my emotions	PTG	Change	Relate
10.	Being able to accept the way things work out	PTG	Change	Strength
11.	Appreciating each day	PTG	Philosophy	Life
12.	Having compassion for others	PTG	Philosophy	Relate
13.	I'm able to do better things with my life	PTG	Change	Possibilities
14.	New opportunities are available which wouldn't have been otherwise	PTG	Change	Possibilities
15.	Putting effort into my relationships	PTG	Philosophy	Relate
16.	I have strong religious faith	PTG	Relate	Spirit
17.	I discovered that I'm stronger than I thought I was	PTG	Change	Strength
18.	I learned a great deal about how wonderful people are	PTG	Relate	Relate
19.	I developed new interests	PTG	Philosophy	Possibilities
20.	I accept needing others	PTG	Relate	Relate
21.	I established a new path for my life	PTG	Change	Possibilities

PTG = Posttraumatic Growth, Change = Changes in Self/Positive Life Attitudes, Philosophy = Philosophy of Life, Relate = Relating to Others, Possibilities = New Possibilities, Strength = Personal Strength, Spirit = Spiritual Change, Life = Appreciation for Life, 3-factor model by Powell et al. (2003); 5-factor model by Tedeschi and Calhoun (1996)

classes in the school, in which all of the students attending school on the date of measurement were recruited to participate. Three hundred and three child survivors were selected. The mean age of the children at the time of the first measurement wave was 9.91 (SD = 0.78) years, and age range was from 8.0 to 11.0 years. Of the 303 participants, 151 (49.8%) were female and 152 (50.2%) were male. All of the participants experienced this earthquake, and 7.3% of the participants were trapped and 15.5% were injured in the earthquake. The houses of 50.5% of participants were severely damaged or totally destroyed in the earthquake.

This study was approved by the Research Ethics Committee of Beijing Normal University and was conducted with the consent of the principals of the participating schools. There were no exclusion criteria. Compensation was not provided. The purpose of the study and the voluntary nature of the students' participation were highlighted before the survey, and written informed consent was obtained from school principals and classroom teachers. In China, research projects that are approved by local education authorities and school administrators, and that are deemed to provide a service to the students, do not require parental consent. Assessments were conducted at

different time points under the supervision of trained individuals with Master's degrees in psychology. The participants were initially asked to provide demographic information that included gender and age. They were then asked to complete the remaining measures assessing posttraumatic reactions. After the questionnaire packets were completed, the participants were told that school psychologists or teachers were available to provide psychological/counseling services if needed.

All 303 participants completed the first assessment 6 months after the earthquake (T1). Another assessment occurred 18 months after the earthquake (T2), with 286 (94.4%) of the original 303 participants completing the survey. The dropout rate was due to some students not attending school or being transferred to other schools. To investigate the potential impact of attrition, we tested for differences in gender, age, and PTG in the first assessment between the longitudinal sample and the participants who did not follow up. Attrition analysis results indicated that there were no significant differences in gender (χ^2 (1) = 0.06, $p = 0.814$), age (χ^2 (3) = 6.91, $p = 0.075$), or PTG (t (301) = 0.74, $p = 0.458$).

2.2 Measures

Post-Traumatic Growth Inventory (PTGI) Posttraumatic growth was measured using the Post-Traumatic Growth Inventory (PTGI). The original Post-Traumatic Growth Inventory was developed by Tedeschi and Calhoun (1996) and consists of the following five subscales: Personal strength, new possibilities, relating to others, appreciation of life, and spiritual change. Each of the 21 items is scored on a 6-point scale that ranges from 0 (*no change*) to 5 (*very great degree of change*). The PTGI has good internal consistency and good construct, convergent, and discriminate validities (Tedeschi and Calhoun 1996). To use the PTGI to investigate Chinese children and adolescents following an earthquake, we first translated the items into Chinese and then invited two psychology doctorate degree holders from the University of Hong Kong and University of British Columbia in Canada to translate the Chinese PTGI back into English. The back-translation suggested that the Chinese items retained the original English meanings. Next, considering applicability for Chinese children after the earthquake, we carried out a review based on the translated PTGI items, and we then reworded some items according to these interview results, to ensure that all the children could understand all item meanings. In this study, the internal reliability of the modified inventory was good at T1 and T2 ($\alpha = 0.88$ for T1, 0.93 for T2).

2.3 Data Analysis Strategies

SPSS18.0 and Mplus 6.0 (Muthén and Muthén 2010) were used to conduct descriptive statistical analyses and to evaluate the best-fitting factor model, respectively. Missing data were handled with full-information maximum likelihood estimates (FIML) in structural models. Compared to conventional methods of dealing with missing data (e.g., listwise and pairwise deletion), the results produced by the FIML method are less biased and more reliable. CFA was used to evaluate five alternative models, as described above. For all of the models estimated, no correlated errors or cross-loadings were specified, but factors were allowed to correlate. We used chi-square values, the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean

square error of approximation (RMSEA), and the standardized root mean residual (SRMR) to evaluate model fit. The general cutoffs for accepting a model are equal to or greater than 0.90 for the CFI and TLI, and less than 0.08 for the SRMR and RMSEA (Wen et al. 2004). Chi-square difference and CFI difference tests were conducted to compare models, wherein a significant difference in chi-square at the 0.05 level indicated that the two nested models were significantly different (Satorra and Bentler 2001), and a difference in CFI of 0.01 provides strong support for the model with the higher CFI value (Cheung and Rensvold 2002).

To examine the temporal stability of the optimal PTG factor structure, the study utilized established procedures for invariance testing in hierarchical order (Meredith 1993). Three levels of comparison to determine the degree of measurement invariance of PTG were used: (a) configural invariance, wherein all model parameters were allowed to vary freely between groups, (b) metric or weak factorial invariance, in which factor loadings across groups were constrained to be equal, and (c) scalar or strong factorial invariance, in which observed variable intercepts were constrained to be equal. Models with more conservative restrictions were compared to the model from the prior step.

3 Results

The global mean PTG scores at T1 and T2 were 64.45 (SD = 18.56; range: 0–105) and 58.26 (SD = 21.95; range: 0–105), respectively. Additionally, a cutoff score of 57 is suggested to indicate probable PTG after an earthquake (Xu and Liao 2011), and thus the prevalence of PTG in this study was 59.1% ($n = 179$) at T1, and 52.8% ($n = 151$) at T2. Global mean PTG scores were higher at T1 than T2 ($t(587) = 3.45$, $p < 0.01$, and PTG was more prevalent at T1 than T2 (χ^2 (1) = 7.26, $p < 0.01$).

Goodness of fit indices for PTG models at T1 and T2 are presented in Table 2. As can be seen in Table 2, the 1 factor model, 3 factor model, and 3 factors with 1 higher-order factor model provide a poor fit to the data at both T1 and T2. These results indicate that these three models should be rejected. We found that the 5 factor and 5 factors with 1 higher-order factor models were acceptable, having good fit indices at T1 and T2. To identify the optimal model at T1 and T2, we then carried out a model comparison by testing the χ^2 difference between the two acceptable models, at T1 and T2. At T1, the fit indices were not significantly different across the two models ($\Delta\chi^2 = 7.14$, $p > 0.05$), which indicates that proposing an additional higher-order factor adds little to positing five separate but intercorrelated factors. Thus, we selected the 5 factor model of PTG as the optimal model. At T2, the fit indices for the 5 factor model were significantly superior to those for the 5 factors with 1 higher-order factor model ($\Delta\chi^2 = 12.74$, $p < 0.05$). We therefore also selected the 5 factor model of PTG as the optimal one at T2.

Standardized factor loadings and factor correlations for the five factor model at T1 and T2 are displayed in Table 3. All of the factor loadings were positive, salient, and significant at the two time points, ranging from 0.45 to 0.73 for T1 and 0.56 to 0.82 for T2. There were significant moderate relationships between *relating to others, new possibilities, personal strength, and appreciation of life* at both times, but the relationships between *spiritual change* and the other four factors were weaker at both times, with a non-significant relationship between *spiritual change* and *appreciation of life* six months after the earthquake. These results indicated that the five factor model of PTG

Table 2 Model goodness of fit indices at T1 and T2

Factor model	χ^2	*df*	CFI	TLI	RMSEA	90% CI	SRMR	BIC
Time 1 ($n = 303$)								
1 factor	365.46***	189	0.894	0.882	0.056	0.047–0.064	0.052	22829.21
3 factor	417.36***	186	0.861	0.843	0.064	0.056–0.072	0.086	22898.26
5 factor	***301.36*****	***179***	***0.926***	***0.914***	***0.047***	***0.038–0.057***	***0.045***	***22822.26***
3 factors with 1 higher-order factor	417.36***	186	0.861	0.843	0.064	0.056–0.072	0.086	22898.26
5 factors with 1 higher-order factor	308.50***	184	0.925	0.914	0.047	0.038–0.056	0.046	22800.82
Time 2 ($n = 286$)								
1 factor	477.50***	189	0.885	0.872	0.073	0.065–0.081	0.054	20904.59
3 factor	590.52***	186	0.839	0.818	0.087	0.089–0.095	0.120	21034.58
5 factor	***348.43*****	***179***	***0.933***	***0.921***	***0.058***	***0.048–0.066***	***0.043***	***20832.08***
3 factors with 1 higher-order factor	590.52***	186	0.839	0.818	0.087	0.079–0.095	0.120	21034.58
5 factors with 1 higher-order factor	361.17***	184	0.929	0.920	0.058	0.049–0.067	0.045	20816.54

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

had good discriminant validity at both times, but that its convergent validity is relatively poor.

Table 4 shows temporal stability results for PTG, with the results indicating that the hypothesized five factor model fit well across the two groups. When comparing the subsequent models with additional constraints to the configural invariance model, the $\chi 2$ values were no significantly different across configural invariance and metric invariance models, which indicates that the latent structure of PTG is stable across T1 and T2. In terms of item intercepts (scalar invariance), results revealed that there was a significant difference in item intercepts and factor variances between T1 and T2, indicating that time since trauma does moderate PTG. Looking further at specific item intercepts, it can be observed that children have on average higher PTG scores at 6 months after the earthquake.

4 Discussion

To our knowledge, this is the first study to examine the latent factor structure of PTG and its temporal stability using a child sample following natural disaster. The five factor structural model of PTG had better fit indices than other models tested at 6 and 18 months after the Ya'an earthquake. This extends the results of previous studies on adults (Brunet et al. 2010; Lee et al. 2010; Taku et al. 2008) to children, and suggests that the five factor model of PTG is applicable among children. Furthermore, time since trauma moderated child PTG.

Specifically, we found that 1 factor, 3 factor, and 3 factor with 1 higher-order factor models of PTG had poor fit indices at both times after the Ya'an earthquake, and that

Table 3 Standardized factor loadings and factor correlations for 5 factor model of PTGI

PTGI items	Life	Strength	Relate	Possibilities	Spirit
My priorities about what is important in life	0.47 (0.78)				
An appreciation for the value of my own life	0.57 (0.76)				
Appreciating each day	0.60 (0.66)				
A feeling of self-reliance		0.61 (0.66)			
Knowing that I can handle difficulties		0.64 (0.72)			
Being able to accept the way things work out		0.48 (0.62)			
I discovered that I'm stronger than I thought I was		0.58 (0.67)			
Knowing that I can count on people in times of trouble			0.46 (0.58)		
A sense of closeness with others			0.63 (0.64)		
A willingness to express my emotions			0.46 (0.56)		
Having compassion for others			0.66 (0.62)		
Putting effort into my relationships			0.57 (0.60)		
I learned a great deal about how wonderful people are			0.68 (0.74)		
I accept needing others			0.63 (0.69)		
I'm more likely to try to change things which need changing				0.56 (0.62)	
I'm able to do better things with my life				0.61 (0.70)	
New opportunities are available which wouldn't have been otherwise				0.46 (0.64)	
I developed new interests				0.45 (0.64)	
I established a new path for my life				0.64 (0.70)	
A better understanding of spiritual matters					0.54 (0.66)
I have strong religious faith					0.73 (0.82)
PTGI factors	Correlation among factors				
Life	–	(0.70**)	(0.70**)	(0.68**)	(0.17**)
Strength	0.49**	–	(0.77**)	(0.72**)	(0.28**)
Relate	0.58**	0.67**	–	(0.80**)	(0.32**)
Possibilities	0.55**	0.60**	0.74**	–	(0.30**)
Spirit	0.03	0.16**	0.21**	0.20**	–

Relate = Relating to Others, Possibilities = New Possibilities, Strength = Personal Strength, Spirit = Spiritual Change, Life = Appreciation for Life; the numbers outside the brackets are factor loadings/correlation coefficients at T1, and the numbers within brackets are the factor loadings/correlation coefficients at T2; $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

their fit indices were inferior to those of a 5 factor model of PTG. These results are inconsistent with previous studies that have supported 1 factor (Osei-Bonsu et al. 2011) and 3 factor models of PTG (Mordeno et al. 2015a, b; Powell et al. 2003). This non-replication could be attributed to sample characteristics. Previous studies have suggested that victims of flash floods and refugee-respondents might experience overwhelming instability that provoked them to employ broader cognitive strategies to regulate their distress, instead of the more specific ways espoused in the 5-factor model (Mordeno et al. 2015b; Powell et al. 2003). Children sampled 6 and 18 months after the Ya'an earthquake have received substantial assistance from the government and other groups, having more resources available and are thus able to utilize more specific

Table 4 Invariance test results for the 5-factor model between T1 and T2

Model	χ^2	*df*	CFI	TLI	RMSEA	90% CI	SRMR
Configural invariance	649.80	358	0.93	0.92	0.053	0.046–0.059	0.044
Metric invariance	662.68	374	0.93	0.92	0.051	0.045–0.058	0.048
Scalar factorial invariance	710.07	390	0.92	0.92	0.053	0.047–0.059	0.050
Factor variances invariance	774.47	410	0.91	0.91	0.055	0.049–0.061	0.082
Model comparison	$\Delta\chi^2$ (*p*)	Δ *df*					
Configural vs Metric	12.88 ($p > 0.05$)	16					
Metric vs Scalar	47.39 ($p < 0.001$)	16					
Scalar vs Factor	64.40 ($p < 0.001$)	20					

Configural = Configural invariance model, Metric = Metric invariance model, Scalar = Scalar factorial invariance model, Factor = Factor variances invariance model

approaches to deal with the distressing event. Thus, the 5-factor model might be more relevant and a better representation of their experiences.

Nevertheless, we also found that the fit indices for a 5 factor with 1 higher-order factor model of PTG were good at both times of assessment. These indices did not differ between the models, which is inconsistent with the study of Cadell et al. (2003). This result might be attributed to inter-factor correlations. It seems likely that there would be a higher order factor, given such correlations (Taku et al. 2008). In this study, however, poor convergent validity was found, and the factor correlations were not uniform: There was a non-significant relationship between *spiritual changes* and *appreciation of life* at 6 months after the earthquake. Thus, while a higher order factor could be extracted, the fit indices might not be superior to that of the 5 factor model.

We found clear evidence of factor loading invariance between 6 and 18 months after the earthquake. This result suggests that for child survivors, the 5 factor model of PTG has applicability across time. However, the non-invariance of item intercepts and factor variances indicated that time since trauma does moderate PTG. Specifically, PTG scores were greater at 6 months than that at 18 months after the earthquake. This indicates that the level of PTG might in fact decrease over time, which is inconsistent with our hypothesis and McElheran et al. (2012) study, but is consistent with other studies of children and adolescents (Barakat et al. 2006; Phipps et al. 2007). This finding also indicates that the participants may experience a general process of healing in response to the earthquake, and that such psychological healing represents an exponential growth mode such that the healing process is more rapid earlier on and then slows down over time. Specifically, traumatized children and adolescents tend to engage initially in negative cognition regarding the traumatic event, which can lead them to experience more psychological distress (Lindstrom et al. 2013). However, such distress could motivate children to re-think the trauma in more positive ways (Butler et al. 2005; Nelson 2011), and in turn realize more PTG. However, with the alleviation of distress, the motivation to grow further might also abate. Additionally, compared to adults, children and adolescents may require more assistance in constructing meaning from trauma due to

developmental constraints (Kilmer and Gil-Rivas 2010). Adult support and scaffolding of growth may dissipate over time, limiting the "staying power" or temporal stability of PTG in youth relative to adults (Meyerson et al. 2011). In addition to adults' support, close peer relationships also allow for an understanding of survivorship and overcoming challenges, and encourage a regained sense of control over physical and psychological well-being by sharing of traumatic experiences (Morris et al. 2011; Sabiston et al. 2007). This makes it possible for close peer relationships to facilitate PTG, especially in the short run after the trauma, as traumatized people during this period are more inclined to enter into alliances with each other in order to cope with the traumatic event. In contrast, as time goes by, such connections may gradually loosen because individuals are so saturated with stories of or feelings about the trauma that they may attempt to escape from too much peer interaction (Kaniasty and Norris 2004; Norris et al. 2005).

Several design and measurement limitations must be acknowledged. First, due to the aim of our study and the characteristics of participants, our sample may be somewhat selective. Secondly, the study was conducted with a sample of children survivors after the Ya'an earthquake in China, and generalizations to people with other traumatic experiences must be made with caution. Moreover, this study did not assess relevant constructs (e.g., cognitive processing, clinical symptoms) to determine differential relationships between PTG and other constructs. Establishing relationships with other constructs will help clarify the nature and criterion function of PTG dimensions (Mordeno et al. 2015a).

Notwithstanding these limitations, the present study is of importance first and foremost because, to the best of our knowledge, it is one of the first to examine the factor structure of PTG and its temporal stability among children survivors of a natural disaster, which expands recent research on the latent structure of PTG among adults. In addition, while previous researchers have argued that variability in youngsters' cognitive capabilities might influence their cognition regarding trauma (Hasan and Power 2004), this study found that this variability in cognitive capability did not change children's perceived content of PTG, relating to others, new possibilities, personal strength, spiritual changes, and appreciation of life. That is, our finding extends Tedeschi and Calhoun's (1996) five-factor structure of PTG to a child sample, and further indicates that traumatic survivors, including children, may experience positive interpersonal relationships, find new possibilities and personal strength, realize positive spiritual changes, and grow to appreciate life after trauma. Other limitations identified in previous research were also addressed, including our examination of the stability of PTG structure across time. Research on PTG should focus attention on the five factors and factor levels at different time periods.

From a clinical perspective, the present results suggest that school educators or psychologists should focus on the improvement of relating to others, new possibilities, personal strength, spiritual changes, and appreciation of life after trauma. Additionally, interventions to potentiate PTG should be based on the characteristics of PTG at different time points since the trauma.

Acknowledgements This study was supported by the Major Project of Beijing Social Science Fund, China (grant number: 15ZDA11). We sincerely appreciate the students and teachers who voluntarily devoted time and interest to our research.

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