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Longitudinal linkages between posttraumatic stress disorder and posttraumatic growth in adolescent survivors following the Wenchuan earthquake in China: A three-wave, cross-lagged study

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ABSTRACT

The aim of this study is to examine the longitudinal relationships between posttraumatic stress disorder (PTSD) and posttraumatic growth (PTG) among adolescent survivors of the 2008 Wenchuan earthquake in China. The participants in our study included 245 adolescent survivors who were randomly selected from several primary and secondary schools in the counties of Wenchuan, which are the areas most severely affected by the Wenchuan earthquake. Participants completed the Revised Child PTSD Symptom Scale and the Posttraumatic Growth Inventory (PTGI) at 3.5 years after the earthquake (T1), 4.5 years after the earthquake (T2), and 5.5 years after the earthquake (T3). The results found that PTSD reported in T1 and T2 predicted subsequent PTG reported at T2 and T3 and that PTG did not predict PTSD from T1 to T3. In addition, the cross-sectional correlation between PTSD and PTG weakened from T1 to T3. These results indicate that PTSD and PTG can coexist in individuals after a traumatic experience, and they further suggest that the reduction in PTSD does not indicate the appearance of PTG.

1. Introduction

Earthquakes are one of the most destructive of natural disasters. One such disaster occurred in Wenchuan, China in 2008, causing widespread loss of life and property. Adolescent survivors of this earthquake experienced significant psychological reactions, one of which was posttraumatic stress disorder (PTSD), which is often considered to be the most frequent of pathogenic psychological reactions in the aftermath of the earthquake (Pan et al., 2015; Ying et al., 2013). For example, Wang et al. (2012) found that the prevalence rate for adolescents who are at high risk for PTSD is 28.4%. Similarly, among a sample of 2080 adolescent survivors of the Wenchuan earthquake, the prevalence rate for PTSD was 21.5% (Xu and Song, 2011).

Adolescents who experienced this earthquake have also reported some positive life changes following the disaster (Jin et al., 2014a; Ying et al., 2014). The term "posttraumatic growth" (PTG) was coined by Tedeschi and Calhoun (1995) to describe these positive life changes following traumatic events, though these changes do not indicate the absence of or a reduction in PTSD (Salsman et al., 2009). More importantly, it suggests that PTSD and PTG can coexist in individuals following a traumatic experience (Tedeschi and Calhoun, 1996), and thus, understanding the relationship between PTSD and PTG is an important issue.

Prior studies have examined the relationship between PTSD and PTG among survivors after natural disaster, and found that PTSD is positively related to PTG (Jin et al., 2014a, 2014b; Kun et al., 2009; Xu and Liao, 2011). In their model of PTG, Tedeschi and Calhoun (2004) have suggested that PTG is one of the outcomes that results from an individual's struggle against some degree of psychological distress after life-threatening adversity. The distress may activate the cognitive processes of trauma survivors, which may lead to positive perspectives of self, others and the world and, in turn, result in the realization of PTG (Calhoun and Tedeschi, 2006).

While PTG is one of the outcomes of trauma, it can also be a predictive factor for adaptive behaviors of traumatized people (Hobfoll, 2002; Zoellner and Maercker, 2006) since PTG can negatively predict PTSD among survivors after earthquake (Chen et al., 2014). Possible reason is that PTG can serve as a coping strategy that can relieve the negative results of trauma and reduce the degree of PTSD. Some researchers, however, suggested that growth has been seen to possibly be an independent outcome. In line with this view, some studies have documented no significant relationship with distress (Joseph et al., 1993).

While there has been a proliferation of research on the subject, a meta-analysis conducted by Helgeson et al. (2006) found that the relation of distress to growth remains ill defined, which may be attributed to the cross-sectional design (Dekel et al., 2012),

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which are imperfect with respect to fully understanding the association between PTSD and PTG. Thus, Park and Helgeson (2006) emphasized the need to conduct a longitudinal study regarding the relationship between PTSD and PTG. Furthermore, although a number of longitudinal studies have focused on PTSD or PTG among adolescents following Wenchuan earthquake (An et al., 2013; Fan et al., 2011; Xu and Liao, 2011; Ying et al., 2013; Zhang et al., 2011, 2012), fewer studies examined the relationship between PTSD and PTG. And, the causal relationship between PTSD and PTG was not identified in spite of the examination by Jin's team on PTSD' relation to PTG among the survivors following Wenchuan earthquake. Addressing this gap in knowledge would advance contemporary efforts that aimed at clarifying the relationship between PTSD and PTG among adolescents following disaster.

Given this background, we would examine the reciprocal relationship between PTSD and PTG in adolescent survivors following the Wenchuan earthquake. The aims of the study are to assess whether PTSD predicts PTG, to determine whether PTG can predict PTSD, and to examine whether PTSD and PTG can predict each other over time.

2. Methods

2.1. Participants and procedures

In the present study, 245 adolescent survivors were randomly selected from several primary and secondary schools in the county of Wenchuan, the area most severely affected by the Wenchuan earthquake. None of adolescents in the study exhibited psychiatric conditions prior to the earthquake. The mean age of the adolescents at the time of the first measuring wave was 14.18 (S.D.=1.39) years and the range was 12.0–19.0 years. Of the 245 participants, 124 (50.6%) were female and 121 (49.4%) were male. With respect to ethnicity, 57 (24.2%) belonged to the Han ethnic group, 70 (28.7%) belonged to the Tibetan ethnic group, 115 (46.9%) belonged to the local Qiang ethnic group, and 3 (1.2%) belonged to other minor ethnic categories. All the participants have experienced this earthquake, and witnessed the collapse of houses. Their homes were damaged, but they have no bereavement experiences in this earthquake.

This project was approved by the Research Ethics Committee of Beijing Normal University, the local education authorities (i.e., County Departments of Education) and the principals of the participating schools. Written informed consents were obtained from school principals, classroom teachers, and each subject. Each participant was given the right to withdraw from the survey at any time. No compensation was provided to the students for their participation in the study; however, counseling was made available.

Of the 245 participants, all of them completed the first assessment 3.5 years after the earthquake (T1). At the second assessment, which was 4.5 years after the earthquake (T2), 209 (85.3%) of the original 245 participants completed the survey. At the third assessment, which was 5.5 years after the earthquake (T3), 159 (64.9%) of the original participants completed the survey. During the follow-up surveys, all adolescents were free of medications and none was abusing drugs. Attrition analysis results indicate that there were no significant differences in gender [$\chi^2(1)=1.16$, $p>0.05$], age [$\chi^2(7)=10.76$, $p>0.05$], ethnicity [$\chi^2(3)=2.60$, $p>0.05$], PTSD [$t(243)=-1.86$, $p>0.05$] or PTG [$t(243)=0.08$, $p>0.05$].

2.2. Measures

2.2.1. The Child PTSD Symptom Scale (CPSS)

PTSD was assessed using a modified version of the CPSS (Zhou et al., 2014c). The original CPSS was developed by Foa et al. (2001) and consists of the following three subscales: intrusion symptoms, avoidance symptoms, and hyper-arousal symptoms. The revised CPSS was formed according to the present situation of the adolescents following Wenchuan earthquake. Firstly, all the items of original CPSS were translated into Chinese, and an exploratory survey was carried out. Then, we interviewed these adolescents who completed the Chinese version of CPSS. After completing the procedures above, we made some revisions on the language on the basis of adolescents' answers, and formed the modified CPSS. The respondents rated the frequency of symptoms during the previous two weeks using a 4-point-Likert scale ranging from 0 (not at all/only once) to 3 (almost always). Subscale scores ranged from 0 to 15 for intrusion symptoms, 0 to 21 for avoidance symptoms, and 0 to 15 for hyper-arousal symptoms. In the current sample, the scale exhibited good internal consistency (alpha coefficient for global PTSD was 0.86 at T1, 0.89 at T2, and 0.87 at T3) and good fit indices in confirmative factor analysis (χ^2/d.f.=2.11, CFI=0.92, TLI=0.90, RMSEA=0.054, SRMR=0.054).

2.2.2. Posttraumatic Growth Inventory (PTGI)

Posttraumatic growth is measured using a modified version of the PTGI (Zhou et al., 2014b). The original PTGI 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 using a 6-point scale ranging from 0 (no change) to 5 (very great degree of change). The PTGI has good internal consistency, as well as construct, convergent and discriminate validity (Tedeschi and Calhoun, 1996). The revised PTGI includes three subscales and 22 items: perceived changes in self, a changed sense of relationship with others, and a changed philosophy of life. The modified scale exhibits good reliability and construct validity for the sample of adolescent survivors of the Wenchuan earthquake. In this study, the internal reliability for the modified inventory is good with an alpha coefficient for global PTG of 0.89 at T1, 0.90 at T2 and 0.91 at T3. Furthermore, the fit indices in the confirmative factor analysis are acceptable (χ^2/d.f.=2.60, CFI=0.90, TLI=0.88, RMSEA=0.065, SRMR=0.049).

2.3. Data analysis

Descriptive analyses are conducted to measure the degree of PTSD symptoms and PTG. Pearson correlations are calculated to examine the associations between PTSD and PTG, both cross-sectionally and longitudinally.

The statistical analyses are conducted using Mplus 6.0 software (Muthén and Muthén, 2010). Missing data are handled by using full-information maximum likelihood estimates (FIML) in structural models. To evaluate model fit, we use chi-square values, comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean residual (SRMR). A non-significant chi-square indicates a good model-data fit. The general cutoffs for accepting a model are equal to or greater than 0.90 for CFI and TLI, and equal to or less than 0.08 for the RMSEA and SRMR (Wen et al., 2004).

Regarding that structural equation model (SEM) has a strong advantage to more accurately represent constructs through the use of multiple measures, which can decrease the limitations associated with measurement errors and incomplete representation of constructs (Weston et al., 2008), we then build structural equation models (SEM) to examine the relation of PTSD to PTG. SEM models have two basic elements: a measurement part (measurement model) and a structural part (structural model). Although both the measurement and the structural parts can be evaluated simultaneously in SEM, Anderson and Gerbing (1988) recommend that the fit of the measurement model be evaluated prior to proceeding with an evaluation of the full model (measurement and structural models together). Thus, we first assess the measurement model and then assess the structural model.

To assess the bidirectional relationships between PTSD symptoms and PTG, the SEM approach is implemented in a cross-lagged model. The following four SEM models are tested and compared: (a) a stability model without any cross-lagged structural paths (M1); (b) a model with cross-lagged structural paths from prior PTSD symptoms to later PTG (M2); (c) a model with cross-lagged structural paths from prior PTG to later PTSD symptoms (M3); and (d) a model with both cross-lagged structural paths representing reciprocal effects (M4). Satorra-Bentler-scaled chi-square difference tests were used to compare nested models (Satorra and Bentler, 2001). A significant chi-square value indicates a difference in model fit between two compared models, and suggested that the model of lower chi-square value fit the data better than that of higher chi-square value.

The effect of PTSD symptoms on PTG is supported if M2 accounts better for the data than M1. The effect of PTG on PTSD symptoms is supported if M3 accounts better for the data than M1. Finally, if M4 is the best-fitting model of the four, then the bidirectional relationships between PTSD symptoms and PTG (i.e., the hypothesized bidirectional effects) are likely to be reciprocal.

3. Results

3.1. Descriptive statistics and correlations among measures

Table 1 presents the means, standard deviations, and correlations of the main measures. The means of PTSD and PTG at Times 1, 2, and 3 are 14.42 (S.D.=8.42), 14.02 (S.D.=8.28), and 13.19 (S.D.=7.40); and 62.05 (S.D.=20.94), 56.27 (S.D.=20.90), and 60.35 (S.D.=19.92), respectively. Next, *Pearson* correlations between the major variables are calculated, and it is determined that there are significant correlations between PTSD at T1 and PTG at T1, T2 and T3. PTSD at T2 is significantly related to PTG at T2 and T3 but not at T1, and PTSD at T3 is related to PTG at T1 and T3 but not at T2.