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Curvilinear relationship between disaster exposure and psychological growth:10 years after the Wenchuan earthquake

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ABSTRACT

The extent of disaster exposure is a crucial predictor of both negative and constructive changes influenced by natural disasters. Posttraumatic growth (PTG) is the typical psychological growth that is defined by significant changes for the better in self-view, relationships, and life philosophy as a result of exposure to a traumatic incident. However, findings of previous studies examining the effects of disaster exposure on PTG are inconsistent. The primary aim of this study was to re-examine the nature of the association between the extent of disaster exposure and PTG in a sample of 1,000 adult survivors of the 5.12 Wenchuan earthquake (occurred in 2008) over 10 years ago in China. The results indicated that, after controlling for the effects of demographic factors (i.e., gender, age, residential area site, and marital status) and socioeconomic status (i.e., educational background and annual household income), disaster exposure showed weak linear but strong inverted U-shaped relationships with different PTG domains. In other words, participants who had been exposed to low or high levels of disaster showed low levels of PTG, while those exposed to moderate levels of disaster exhibited high levels of PTG. The result of the study not only enhanced current understanding of the consequences of disaster exposure but also outlined a long-term support system for post-disaster construction activities.

1. Introduction

Exposure to natural disasters has been repeatedly implicated in a range of pathological effects (e.g., anxiety, posttraumatic stress disorder, and insomnia) and behavioral problems (e.g. suicide, violence, and risk-taking) in survivors (Felten-Biermann, 2006; Kun et al., 2009; Nishio et al., 2009; Tsuchiya et al., 2015). China is a natural disaster-prone country, and between 2006 and 2015, the number of people affected by disasters was 1,019,008,563, which was the highest number reported by any country in the world (Sanderson and Sharma, 2016). The 5.12 Wenchuan earthquake (occurred in 2008) was the worst disaster that occurred during this period and led to 69,227 deaths, 374,643 injuries, and 17,923 missing persons (China News Service, 2008). Given the health costs and mental disorders associated with such severe disasters, it is not surprising that researchers have focused primarily on negative psychosocial consequences in survivors. Simultaneously, an increasing number of studies have examined the more positive psychological consequences of disaster exposure including posttraumatic growth (PTG). PTG is the typical psychological growth that is defined by significant changes for the better in self-view, relationships, and life philosophy as a result of exposure to a traumatic incident (Tedeschi and Calhoun, 2004). However, PTG has received considerably less attention, relative to the negative psychopathological outcomes of natural disasters, in previous studies involving the 5.12 Wenchuan earthquake. In addition, previous studies have provided inconsistent results regarding the relationship between disaster exposure and PTG (Linley and Joseph, 2004).

PTG refers to "the experience of positive change that occurs as a result of the struggle with highly changing life crises" (Tedeschi and Calhoun, 2004, p. 1). There are five domains of psychological growth from both theoretical and operational perspectives: improved relationships with others, identification of new possibilities, increased personal strength, positive spiritual change, and increased appreciation of life (Tedeschi and Calhoun, 1996, 2004). PTG occurs in a wide range of people who were facing a wide variety of traumatic circumstances, such as bereavement (Edmonds and Hooker, 1992), HIV infection

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(Schwartzberg, 1993), bone marrow transplantation (Andrykowski and Hunt, 1993), combat (Elder and Clipp, 1989), and so on. Previous studies examining patient care showed that higher levels of PTG contributed to significantly reduced depression (Siegel et al., 2005), attenuated emotional distress (Urcuyo et al., 2005), and increased subjective well-being (Schwarzer et al., 2006). One recent study that included disaster survivors indicated that PTG directly decreased loneliness and indirectly relieved depressive symptoms (Lee et al., 2018). Although PTG research is rare in the context of the 5.12 Wenchuan earthquake, a few important studies have demonstrated that PTG reduced the probability of suicidality in adult survivors affected by mental disorders (Guo et al., 2018) and alleviated immediate academic burnout in school-aged survivors (Ying et al., 2016).

Given the beneficial outcomes of PTG mentioned above, previous studies involving 5.12 Wenchuan earthquake survivors examined effective antecedent predictors of PTG such as personality (An et al., 2017; Jia et al., 2015), rumination (Wu et al., 2015; Zhou and Wu, 2016), and social support (Jia et al., 2017, 2015). The role of disaster exposure, although indispensable in PTG research, has been largely ignored in the context of the 5.12 Wenchuan earthquake, and only a few studies have considered it. With respect to adult survivors, Jin et al. (2014) found that disaster exposure was positively related to PTG 1 year after the disaster. In contrast, another study conducted 8 years after the disaster showed that disaster exposure was not associated with PTG (Guo et al., 2017). Of the five domains of PTG, only one, new possibilities, was negatively associated with disaster exposure (Guo et al., 2017), which is inconsistent with the findings of the earlier study (Jin et al., 2014). Interestingly, one longitudinal study involving adolescent survivors showed a similar pattern to that for adults, in that disaster exposure was positively related to PTG 1 year after the disaster but lost its significance after 2.5 years (Ying et al., 2014). The existing literature has yet to establish a reasonable explanation for this differentiation in the relationship between disaster exposure and PTG. Derived from social cognitive theory (Bandura, 1989), links between disaster exposure and posttraumatic recovery were mediated by survivors' perceived coping self-efficacy in recovery (Benight and Bandura, 2004). For a relatively short period after the disaster, survivors who had experienced higher levels of disaster exposure were more likely to ask for and receive social support from rescue workers and local government, relative to those who experienced lower levels of exposure, and this resulted in greater psychological benefits. In contrast, the role of coping self-efficacy varied with the development of post-disaster rebuilding activities over a relatively long period. In this dynamic and ongoing scenario, links between disaster exposure and PTG could weaken with a decline in the perceived unpredictability and uncontrollability of the disaster, which is strongly related to short-term coping self-efficacy. Therefore, the primary aim of this study was to explore the relationship between long-term PTG and disaster exposure in the context of the 5.12 Wenchuan earthquake. The first hypothesis was as follows:

H1: Disaster exposure will not be linearly associated with PTG in adult survivors 10 years after the 5.12 Wenchuan earthquake.

In addition, empirical research has not examined potential nonlinear relationships between disaster exposure and long-term PTG in natural disaster survivors. According to social cognitive theory, survivors' long-term coping self-efficacy could vary according to the extent of disaster exposure. Long-term coping self-efficacy could be stable in survivors with little or moderate disaster exposure, as they obtain gradient post-disaster arrangement. In contrast, greater exposure could exhaust survivors' recovery beliefs and result in lower levels of PTG, and there could be a curvilinear long-term association. Previous empirical studies examining long-term PTG have demonstrated a curvilinear association between the extent of traumatic exposure and PTG in various participant groups such as Vietnam veterans (Fontana and Rosenheck, 1998), young people exposed to terror incidents (Laufer and Solomon, 2006), and cancer patients (Lechner et al., 2003). Given the complex situation surrounding post-disaster rebuilding following the 5.12 Wenchuan earthquake, this study assumed a second hypothesis, as follows:

H2: Disaster exposure will be curvilinearly associated with PTG in adult survivors 10 years after the 5.12 Wenchuan earthquake.

2. Methods

2.1. Sampling procedure

The participants in this cross-sectional study were recruited from six counties in Sichuan in May 2018, on the 10th anniversary of the 5.12 Wenchuan earthquake, and included a sample of 1000 adult survivors. A detailed description of the sampling method has been published elsewhere (He et al., 2018). In brief, in the first stage, the survey team selected 26 communities, based on the degree of damage caused by the earthquake and residents' living arrangements thereafter. In the second stage of the sampling procedure, 30–50 individuals were selected from each settlement according to local population size. The inclusion criteria were as follows: Adult age, residence in the local county before the earthquake, and no migration to other areas more than 1 year after the earthquake.

2.2. Measures

2.2.1. PTG

PTG was assessed using the Posttraumatic Growth Inventory (PTGI; Tedeschi and Calhoun, 1996). This instrument consists of 21 items with six response alternatives ranging from 1 (no change) to 6 (a high degree of change) and assesses changes in five PTG domains: relating to others, new possibilities, personal strength, appreciation of life, and spiritual change. This inventory has demonstrated good reliability in diverse languages and has been validated in many countries (Laufer and Solomon, 2006; Taku et al., 2018; Tedeschi and Calhoun, 1996). In the current study, the PTGI was translated into Chinese and back-translated into English by two bilingual researchers. A pilot study was conducted, and one item was revised (from "I have a stronger religious faith" to "I have a stronger faith"), as most Chinese people hold traditional Chinese values (e.g., Confucianism, Taoism, or the Yin-Yang system) rather than a specific religious belief (Chen, 2001). In the current study, Cronbach's αs for the PTGI subscales ranged from 0.553 to 0.843, and that for the overall scale was 0.928. The PTGI overall score and five subscores were calculated as means of related items.

2.2.2. Disaster exposure

As in previous studies (Kun et al., 2009; Zhang and Ho, 2011), disaster exposure was assessed in two stages: the first stage used a two-point scale (yes = 1 and no = 0) to determine whether participants had experienced the following 15 events: being buried, being injured, being disabled, family died, family injured, family disabled, kinsfolk died, kinsfolk injured, kinsfolk disabled, acquaintance died, acquaintance injured, acquaintance disabled, witness to others' burial, witness to others' death, and witness to others' injury. The second stage involved a one-term measurement of the extent of participants' loss of housing and property during the disaster (0 = mild, 1 = moderate, 2 = serious). The theoretical maximum score for earthquake exposure was 17, with higher scores demonstrating a greater level of exposure. We regarded this variable as a continuous variable to enable inspection of the relationships between disaster exposure and PTG and its five domains.

2.2.3. Control variables

We included demographic characteristics and socioeconomic status as control variables. Data regarding gender, age, residential area, marital status, educational background, and annual household income were collected.

2.3. Ethical approval and informed consent

The study was approved by the ethics committee at the Department of Sociology and Social Work, Sun Yat-sen University. Before the survey, all participants received written information about the study and signed a consent form if they volunteered to participate in the study. In addition, all data were coded to preserve participants' anonymity.

2.4. Statistical analysis

Descriptive statistics, means, standard deviations, and ranges were calculated for the variables and presented. The relationships between disaster exposure and the PTG domains were demonstrated via a locally weighted scatterplot smoother (LOWESS) estimator, which allowed the fitting of nonparametric smoothing curves to scatterplots without prior assumption of curve shapes (Cleveland, 1979). Further, we estimated the quadratic fit of the relationship between disaster exposure and PTG. Based on the results of LOWESS and quadratic fit, both linear and quadratic regression models were estimated via the Tobit regression model, as the dependent variables had definite boundaries (i.e., a range from 1 to 6; McDonald and Moffitt, 1980). We plotted detailed associations between disaster exposure and long-term PTG, to estimate whether the effects of disaster exposure on long-term PTG were positive or negative.

3. Results

3.1. Descriptive statistics

Details of the descriptive statistics are listed in Table 1. The mean scores for the overall PTGI and five PTG domains revealed that the participants exhibited a moderate level of PTG (range from 3.028 to 3.130). The actual observed values for disaster exposure ranged from 1 to 12, with a mean score of 3.610 (SD = 1.641). Of the 1000 participants, men accounted for 43.5%, and participants' mean age was 45.618 (SD = 11.628) years. Most participants lived in rural locations (55.7%) and were married (82.7%). The minority of participants had been educated to associate college level or above (25.3%), and the proportion of participants who earned high annual household incomes (90,000 RMB and above) was low (22.1%).

Table 1
Descriptive statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max
Dependent variables					
PTGI score	1000	3.109	0.809	1	5.143
Relating to others	1000	3.125	0.910	1	5.429
New possibilities	1000	3.119	0.880	1	5.8
Personal strength	1000	3.120	0.946	1	5.5
Spiritual change	1000	3.130	1.047	1	6
Appreciation of life	1000	3.028	0.936	1	5.333
Independent variables					
Disaster exposure	1000	3.610	1.641	1	12
Demographic and socioeconomic variables					
Male	1000	0.435	0.496	0	1
Age	1000	45.618	11.628	28	74
Rural site	1000	0.557	0.497	0	1
Married	1000	0.827	0.378	0	1
Educational background (0 = primary school and below)					
Junior high school	1000	0.313	0.464	0	1
Senior high school	1000	0.277	0.448	0	1
Associate college and above	1000	0.253	0.435	0	1
Annual household income (0 = less than 40,000 RMB)					
40,000–59,999 RMB	1000	0.286	0.452	0	1
60,000–89,999 RMB	1000	0.255	0.436	0	1
90,000 RMB and above	1000	0.221	0.415	0	1

3.2. Relationships between disaster exposure and PTG

As seen in Fig. 1, the solid lines indicate the LOWESS fit, and the dotted line represents the fit of the quadratic regression to the data. All LOWESS results demonstrated evidence of statistically significant curvilinear relationships between disaster exposure and scores for the PTGI and five PTG domains (Fig. 1). As shown in Table 2, the results suggested that the linear relationship between PTGI score and disaster exposure was nonsignificant ($\beta = 0.02$, $p > 0.10$). Regarding the five PTG domains, relating to others ($\beta = 0.03$, $p < 0.10$) and appreciation of life ($\beta = 0.05$, $p < 0.05$) showed weak linear associations with disaster exposure. However, when the quadratic disaster exposure item was included in the estimations (Table 3), scores for the PTGI and all five PTG domains exhibited strong curvilinear associations with disaster exposure. Fig. 2 shows that participants with moderate disaster exposure were more likely to have higher long-term PTG relative to other participants. The pattern of relationships between disaster exposure and PTG and its five domains was displayed as an inverted U shape within 95% confidence intervals. These results were robust when we checked the curvilinear relationship between disaster exposure and PTGI score across different age groups (see Table A in Appendixes). In addition, after we controlled Post-traumatic Stress Disorder (PTSD) symptom and checked the curvilinear relationship between disaster exposure and PTGI score across PTSD and non-PTSD groups, results were still consistent (see Table B in Appendixes). Thus, these results supported H2 and partially supported H1.

3.3. Other predictors of PTG

In addition to demonstrating the weak linear association between disaster exposure and PTG, Table 2 provides an overall picture of the main effects of the regression estimates. Men were more likely to exhibit higher PTG levels relative to those observed in women (βs ranged from 0.13 to 0.17, $ps < 0.05$). Age was significantly correlated with PTG level, in that younger participants reported higher levels of PTG ($\beta s = 0.01$, $ps < 0.10$). Participants from rural areas were more likely to have higher PTGI scores relative to those from urban areas ($\beta = 0.12$, $p < 0.05$). Relative to those from urban areas, participants from rural areas exhibited higher scores for all PTG domains other than relating to others (βs ranged from 0.13 to 0.16, $ps < 0.10$). In addition, married participants reported lower levels of appreciation of life ($\beta = -0.19$, $p < 0.05$). Further, we observed a strong gradient for education, as higher educational levels were related to higher PTGI and PTG domain scores. Annual household income was weakly correlated with PTG, and the coefficients for the dummy variable (60,000 –89,999 RMB in Model 1, Model 3, and Model 4) were significantly negative (βs ranged from −0.19 to −0.13, $ps < 0.10$).

4. Discussion

To the best of our knowledge, this was the first study to demonstrate a curvilinear relationship between the extent of disaster exposure and long-term PTG. In particular, even after controlling for the effects of demographic characteristics and socioeconomic status, adult survivors with moderate levels of disaster exposure exhibited the highest scores in the PTGI and five PTG domains. Survivors with higher or lower levels of disaster exposure tended to report lower PTG levels.

A previous study indicated that levels of threat and trauma exposure were associated with PTG (Lechner et al., 2003). Survivors' coping self-efficacy was therefore strongly correlated with disaster exposure within a short period after the earthquake (Benight and Bandura, 2004). In the current study, both short- and long-term coping self-efficacy in those with low and moderate levels of exposure followed these patterns. However, in those with high levels of exposure, short-term coping self-efficacy could not be maintained over time, as their psychosocial expectations outstripped the actual long-term benefits of post-disaster

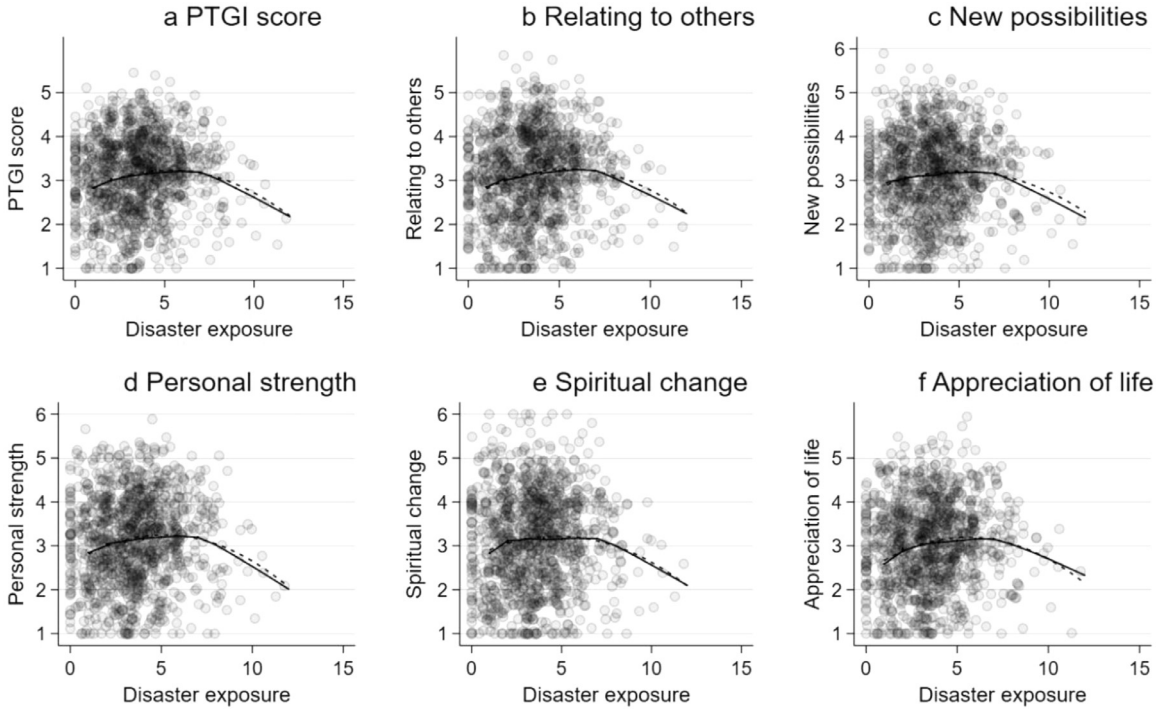

Fig. 1. LOWESS curves demonstrating the relationship between disaster exposure and PTG.

Table 2
Main effects of disaster exposure on PTG.

VARIABLES	Model 1 PTGI score	Model 2 Relating to others	Model 3 New possibilities	Model 4 Personal strength	Model 5 Spiritual change	Model 6 Appreciation of life
Independent variables						
Disaster exposure	0.02	0.03+	0.01	0.02	0.01	0.05*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Demographic and socioeconomic variables						
Male	0.15**	0.13*	0.16**	0.16*	0.17*	0.15*
	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)
Age	0.01**	0.01***	0.01**	0.01+	0.01*	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rural site	0.12*	0.08	0.13*	0.14*	0.16*	0.13+
	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)	(0.07)
Married	−0.07	−0.04	−0.04	−0.05	−0.08	−0.19*
	(0.07)	(0.08)	(0.07)	(0.08)	(0.09)	(0.08)
Educational background (0 = primary school and below)						
Junior high school	0.28**	0.26**	0.29**	0.32**	0.25*	0.31**
	(0.09)	(0.10)	(0.10)	(0.10)	(0.12)	(0.10)
Senior high school	0.51***	0.59***	0.52***	0.46***	0.42**	0.47***
	(0.10)	(0.12)	(0.11)	(0.12)	(0.14)	(0.12)
Associate college and above	0.51***	0.52***	0.57***	0.45**	0.50**	0.48***
	(0.12)	(0.14)	(0.13)	(0.14)	(0.16)	(0.14)
Annual household income (0 = less than 40,000 RMB)						
40,000–59,999 RMB	0.00	−0.03	−0.03	0.03	0.04	0.07
	(0.07)	(0.08)	(0.08)	(0.09)	(0.10)	(0.09)
60,000–89,999 RMB	−0.13+	−0.15	−0.19*	−0.18+	−0.01	−0.04
	(0.08)	(0.09)	(0.09)	(0.10)	(0.11)	(0.10)
90,000 RMB and above	0.03	0.02	−0.02	−0.01	0.10	0.14
	(0.09)	(0.10)	(0.10)	(0.11)	(0.12)	(0.11)
Constant	2.16***	2.01***	2.19***	2.33***	2.16***	2.10***
	(0.22)	(0.26)	(0.25)	(0.27)	(0.31)	(0.26)
Observations	1000	1000	1000	1000	1000	1000
df	11	11	11	11	11	11
chi2	51.78	47.96	45.16	38.46	24.32	48.70
Log likelihood	−1183	−1310	−1274	−1355	−1490	−1344
PR2	0.0214	0.0180	0.0174	0.0140	0.00809	0.0178

Standard errors in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$.

Table 3
Effects of disaster exposure and its quadratic term on PTG.

VARIABLES	Model 1 PTGI score	Model 2 Relating to others	Model 3 New possibilities	Model 4 Personal strength	Model 5 Spiritual change	Model 6 Appreciation of life
Disaster exposure	0.22***	0.23***	0.17**	0.24***	0.20**	0.26***
	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)
Disaster exposure quadratic term	−0.02***	−0.02***	−0.02**	−0.03***	−0.02**	−0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Demographic and socioeconomic variables						
Male	0.15**	0.13*	0.16**	0.16**	0.18*	0.16**
	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)
Age	0.01**	0.01***	0.01**	0.01+	0.01*	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rural site	0.12*	0.08	0.13*	0.14*	0.16*	0.13+
	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)	(0.07)
Married	−0.08	−0.05	−0.05	−0.06	−0.09	−0.21**
	(0.07)	(0.08)	(0.07)	(0.08)	(0.09)	(0.08)
Educational background (0 = primary school and below)						
Junior high school	0.26**	0.24*	0.27**	0.29**	0.23+	0.28**
	(0.09)	(0.10)	(0.10)	(0.10)	(0.12)	(0.10)
Senior high school	0.48***	0.57***	0.50***	0.43***	0.39**	0.45***
	(0.10)	(0.12)	(0.11)	(0.12)	(0.14)	(0.12)
Associate college and above	0.48***	0.50***	0.55***	0.42**	0.47**	0.45**
	(0.12)	(0.13)	(0.13)	(0.14)	(0.16)	(0.14)
Annual household income (0 = less than 40,000 RMB)						
40,000–59,999 RMB	0.00	−0.03	−0.03	0.03	0.04	0.07
	(0.07)	(0.08)	(0.08)	(0.09)	(0.10)	(0.09)
60,000–89,999 RMB	−0.15+	−0.16+	−0.20*	−0.20*	−0.02	−0.06
	(0.08)	(0.09)	(0.09)	(0.10)	(0.11)	(0.09)
90,000 RMB and above	0.00	−0.01	−0.04	−0.03	0.07	0.11
	(0.09)	(0.10)	(0.10)	(0.11)	(0.12)	(0.11)
Constant	1.86***	1.71***	1.93***	1.99***	1.87***	1.77***
	(0.23)	(0.27)	(0.26)	(0.28)	(0.32)	(0.28)
Observations	1000	1000	1000	1000	1000	1000
df	12	12	12	12	12	12
chi2	68.21	61.01	54.89	53.49	32.54	63.42
Log likelihood	−1175	−1303	−1270	−1347	−1486	−1337
PR2	0.0282	0.0229	0.0212	0.0195	0.0108	0.0232

Standard errors in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$.

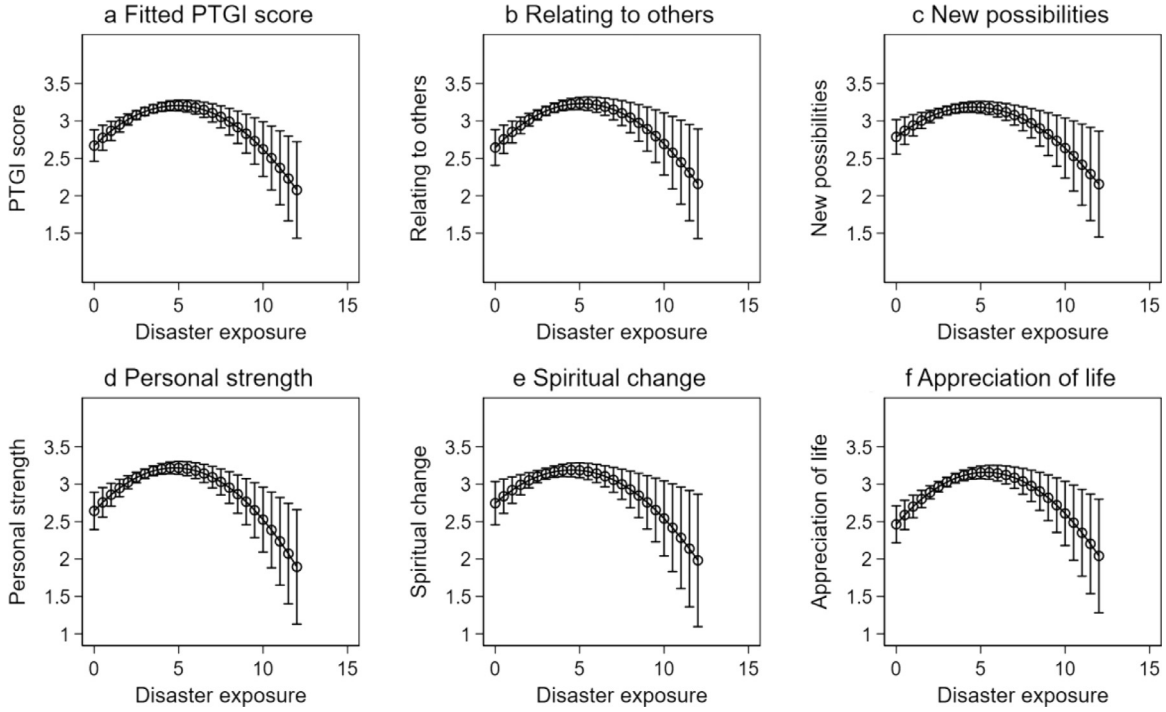

Fig. 2. Patterns of associations between disaster exposure and PTG.

rebuilding activities. Consequently, long-term PTG and the five PTG domains were compressed.

From the perspective of post-disaster rebuilding, these results highlighted the need for a long-term support system in post-disaster construction activities. Short-term psychological interventions were necessary but inadequate in promoting prolonged growth in those with high levels of disaster exposure. Support from neighborhoods and local communities would provide long-term physical and psychological benefits for survivors (Flores et al., 2014; Ziersch et al., 2005). Therefore, future social work involving disaster victims should embed pre- and post-disaster community-based interventions into the overall socioecological system.

Although it was not a primary aim of the study, we examined the roles of demographic characteristics and socioeconomic status in PTG. The results showed that men exhibited higher levels of long-term PTG, relative to those observed in women, which is consistent with the results of the survey conducted 8 years after the disaster (Guo et al., 2017) but contradicted the findings of that conducted 1 year after the disaster (Jin et al., 2014). One possible explanation for these findings is that women were more likely to develop short-term PTG, relative to men, as a previous meta-analysis suggested that women were likely to utilize emotion-focused coping strategies for a short period in post-disaster rebuilding activities (Vishnevsky et al., 2010). In contrast, with respect to long-term psychological benefits, Guo et al. (2017) reported that men played a critical role in Chinese families, and male survivors were expected to accept responsibility for the recovery of both their families and local societies. Therefore, they were likely to experience high levels of long-term PTG. The positive education gradient effects were consistent with the results of previous studies (Guo et al., 2017; Jin et al., 2014), which indicated that long-term PTG could be reinforced in survivors with higher educational levels, and long-term coping self-efficacy could be attenuated over time in those with low educational levels.

The study was subject to several limitations, which should be noted. For example, the cross-sectional design limited the inference of causation regarding long-term PTG. Future studies should include a panel design to collect longitudinal data. In addition, although we surveyed people from six counties to provide disaster area diversity, participants were not recruited via random sampling, which could have reduced the generalizability of the findings. Moreover, specific variables related to long-term psychological outcomes of natural disasters, such as general trust and media exposure (He et al., 2018), were not explored in the study. Further, the role of gender in the development of long-term PTG remains unclear, and future studies should examine potential factors (e.g., long-term coping self-efficacy, rumination, and social support) via reasonable methodological designs. Results in this study were mostly relate to natural disaster and that future studies should examine PTG in the aftermath of exposure to other kinds of disasters such as terror attacks, outbreaks of infectious diseases, and chronic disease scenarios.

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Conflicts of interests

The authors have no conflicts of interest to declare.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.02.032.

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