



# Rumination mediates the relationships of fear and guilt to posttraumatic stress disorder and posttraumatic growth among adolescents after the Ya'an earthquake

Wenchao Wang, Xinchun Wu and Xiaoyu Lan

Beijing Key Laboratory of Applied Experimental Psychology, National Demonstration Center for Experimental Psychology Education (Beijing Normal University), Faculty of Psychology, Beijing Normal University, Beijing, China

## ABSTRACT

**Background:** Although previous research has demonstrated that fear and guilt have an effect on posttraumatic stress disorder (PTSD), it is still unclear how these two emotions affect posttraumatic growth (PTG). Moreover, few studies have examined the mechanisms by which fear and guilt affect PTSD and PTG. Guided by Lee et al.'s theory of PTSD generation mechanisms and Calhoun and Tedeschi's PTG theory, the current study proposes that intrusive rumination (IR) and deliberate rumination (DR) may play a mediating role in the effects of guilt and fear on PTSD and PTG.

**Objective:** This study aimed to simultaneously examine the mediating roles of IR and DR in the relationship between fear, guilt, PTSD, and PTG.

**Method:** This study employed a two-wave longitudinal design. A total of 408 adolescent survivors were assessed using self-report questionnaires after the Ya'an earthquake in China. Measures were obtained for trauma exposure, subjective fear, survivor guilt, IR, and DR at three and a half years after the Ya'an earthquake (Time 1), while PTSD and PTG were assessed at time point four and a half years after the Ya'an earthquake (Time 2).

**Results:** The results showed that both fear and guilt had a direct and positive effect on PTSD and PTG. Fear and guilt were positive predictors of PTSD and negative predictors of PTG through the mediating variable of IR. DR mediated the relationship between guilt and PTG but not PTSD, and also mediated the relationship between IR and PTG.

**Conclusions:** Study findings indicate that fear, guilt, and intrusive rumination may contribute to PTSD symptoms in adolescent trauma survivors. Results also suggest that adolescent survivors can grow emotionally and psychologically following traumatic events, and that directed rumination may contribute to such growth. Interventions that reduce fear, guilt, and intrusive rumination while increasing directed rumination may assist adolescent trauma survivors in recovery and growth.

## La rumiación media las relaciones de miedo y culpa con el trastorno de estrés postraumático y el crecimiento postraumático entre los adolescentes después del terremoto de Ya'an

**Antecedentes:** Aunque investigaciones anteriores han demostrado que el miedo y la culpa tienen un efecto sobre el trastorno de estrés postraumático (TEPT), aún no está claro cómo estas dos emociones afectan el crecimiento postraumático (CPT). Además, pocos estudios han examinado los mecanismos por los cuales el miedo y la culpa afectan el TEPT y el CPT. Guiado por la teoría de Lee et al. de los mecanismos de generación de TEPT y la teoría CPT de Calhoun y Tedeschi, el presente estudio propone que la rumiación intrusiva (IR) y la rumiación deliberada (DR) pueden desempeñar un papel mediador en los efectos de la culpa y el miedo en el TEPT y CPT.

**Objetivo:** Este estudio tuvo como objetivo examinar simultáneamente los roles mediadores de IR y DR en la relación entre miedo, culpa, TEPT y CPT.

**Método:** Este estudio empleó un diseño longitudinal de dos ondas. Un total de 408 adolescentes sobrevivientes fueron evaluados mediante cuestionarios de autoreporte después del terremoto de Ya'an en China. Se obtuvieron medidas para la exposición al trauma, miedo subjetivo, culpa del sobreviviente, IR y RD a los 3.5 años después del terremoto de Ya'an (Tiempo 1), mientras que el TEPT y el CPT se evaluaron en el punto de tiempo 4.5 años después del terremoto de Ya'an (Tiempo 2).

**Resultados:** Los resultados mostraron que tanto el miedo como la culpa tenían un efecto directo y positivo sobre el TEPT y el PTG. El miedo y la culpa fueron predictores positivos de TEPT y predictores negativos de PTG a través de la variable mediadora de IR. DR medió la relación entre culpabilidad y PTG pero no TEPT, y también medió la relación entre IR y CPT.

**Conclusiones:** los hallazgos del estudio indican que el miedo, la culpa y la rumiación intrusiva pueden contribuir a los síntomas de TEPT en los sobrevivientes de traumas en adolescentes. Los resultados también sugieren que los sobrevivientes adolescentes pueden crecer emocional y psicológicamente después de eventos traumáticos, y que la rumiación

## ARTICLE HISTORY

Received 16 July 2019  
Revised 26 November 2019  
Accepted 2 December 2019

## KEYWORDS

Fear; guilt; intrusive rumination; deliberate rumination; posttraumatic stress disorder; posttraumatic growth

## PALABRAS CLAVE

miedo; culpa; rumiación intrusiva; rumiación deliberada; Trastorno de estrés postraumático; Crecimiento postraumático

## 关键词

害怕; 内疚; 侵入性反刍; 主动反刍; PTSD; PTG

## HIGHLIGHTS

- The effects of both fear and guilt on PTSD and PTG was direct and positive, which means that fear and guilt have a double-edged impact on adolescent trauma survivors.
- Fear and guilt are positive predictors of PTSD and negative predictors of PTG through the mediating variable of IR.
- DR mediated the relationship between IR and PTG and between guilt and PTG but not between guilt and PTSD.

dirigida puede contribuir a dicho crecimiento. Las intervenciones que reducen el miedo, la culpa y la rumiación intrusiva al tiempo que aumentan la rumiación dirigida pueden ayudar a los sobrevivientes de traumas adolescentes a recuperarse y crecer.

### 害怕和内疚对青少年创伤后应激障碍和创伤后成长的影响:侵入型反刍和主动反刍的中介作用摘要

**背景:**PTSD和PTG共存于创伤后的青少年群体中,两者可能受到害怕,内疚,侵入性反刍和主动反刍的影响,不过以往并没有研究考察害怕和内疚通过侵入性反刍和主动反刍对PTSD和PTG的影响机制。

**目的:**本研究考察了害怕和内疚对PTSD和PTG的影响,并检验了侵入性反刍和主动反刍在其中的中介作用。

**方法:**在雅安地震后3.5年和4.5年两个时间点,对地震极重灾区芦山县的408名中学生进行问卷调查,通过构建结构方程模型,考察害怕,内疚,侵入性反刍和主动反刍对PTSD和PTG的影响。

**结果:**本研究发现,害怕和内疚都可以同时正向预测PTSD和PTG,侵入性反刍在害怕和内疚对PTSD和PTG的影响间均起到中介作用,主动反刍只在内疚对PTG的影响间起到中介作用,此外,主动反刍还在侵入性反刍对PTG的影响间起中介作用。

**结论:**结果表明,恐惧和内疚对PTSD和PTG都有直接和积极的影响。通过IR的中介变量,恐惧和内疚是PTSD的阳性预测因子和PTG的阴性预测因子。DR介导了内与PTG之间的关系,但没有介导PTSD,也介导了IR与PTG之间的关系。

## 1. Introduction

In 2013, an earthquake measuring 7.0 on the Richter scale occurred in Ya'an City, Sichuan Province, China, which left 217 people dead or missing and 11,470 people injured. Earthquakes are natural events that have the potential to expose survivors to trauma, which can lead to a range of negative psychological consequences, such as posttraumatic stress disorder (PTSD), depression, and anxiety (Fu et al., 2013). PTSD is considered the most common negative outcome of traumatic events (Bal, 2008; Wang et al., 2012). Researchers have found that the incidence of PTSD in adolescents after earthquake was as high as 29.6% (Pan et al., 2015). However, trauma survivors also report positive psychological changes in personal strength, relationships, and appreciation of life. Such changes are defined as posttraumatic growth (PTG; Tedeschi & Calhoun, 1996). PTSD and PTG are regarded as typical manifestations of negative and positive psychological responses, which can coexist in individuals following traumatic experiences (Jin, Xu, & Liu, 2014; Wu, Xu, & Sui, 2016), including earthquakes.

Nevertheless, the association between PTSD and PTG has been inconsistent across the existing literature. Some studies found a positive relation between PTSD and PTG (Saccinto, Prati, Pietrantonio, & Perez-Testor, 2013; Wu et al., 2016). Calhoun and Tedeschi's (2006) PTG theory suggest that distress may activate trauma survivors' cognitive processes, which may lead to more positive perspectives of self, others, and the world; thus, an individual with increased PTSD may report increased PTG. However, Engelhard, Lommen, and Sijbrandij (2015) found that higher PTG predicted higher PTSD symptoms, whereas PTSD did not predict PTG in a longitudinal study, which suggests that PTG has no favourable effect on long-term PTSD symptoms. Researchers have also claimed that PTG and PTSD can

be conceptualized as opposite ends of the same continuum, and therefore a negative association between PTSD and PTG can be observed (Chen, Zhou, Zeng, & Wu, 2015; Frazier, Conlon, & Glaser, 2001). Further, Kleim and Ehlers (2009) found a curvilinear association between PTG and PTSD: participants with no or high growth levels reported fewer posttraumatic stress symptoms than those who reported moderate growth. Still others have proposed that the two constructs are not necessarily related and can coexist as two independent entities (Sleijpen, Haagen, Mooren, & Kleber, 2016; Zoellner & Maercker, 2006).

These inconsistent findings have disturbed the understanding of the relationship of PTSD and PTG. To elucidate their relationship and constructs, Dekel, Mandl, and Solomon (2011) suggested that it is necessary to examine predictive factors simultaneously and to compare their determining factors (e.g. García, Cova, Rincón, & Vázquez, 2015). The aim of the present study reflects this suggestion: to examine simultaneously and compare possible factors and predictive mechanisms of PTSD and PTG among adolescent survivors of the Ya'an earthquake.

Among the many variables that may influence PTSD and PTG, emotion-related factors have been a concern of many researchers; fear and guilt are two common emotional responses found in PTSD (Beck et al., 2011; Okulate & Jones, 2006; Zhou, Wu, Fu, & An, 2015). According to the theory of PTSD generation mechanism, proposed by Lee, Scragg, and Turner (2001), PTSD mainly arises from three emotions: fear, guilt, and shame. For survivors of a natural disaster, fear and guilt are more common (Carmassi et al., 2017).

In addition to emotion-related factors, the cognitive response triggered by trauma is an important reason for the emergence of PTSD and PTG. On the one hand, according to the cognitive model of PTSD (Ehlers &

Clark, 2000), the nature of the predominant emotions (e.g. guilt, fear, anger, shame, and sadness) experienced by trauma survivors is an invaluable clue to cognitive themes. Feelings of fear and guilt can lead survivors to engage in maladaptive cognitive processing styles (e.g. rumination) as a way to deal with traumatic events, which can result in PTSD. On the other hand, a traumatic event can challenge people's stable cognitive systems involving their understanding of the world, according to Calhoun and Tedeschi's (2006) model of PTG. To build a posttraumatic understanding of the world, survivors can re-examine their belief systems and re-frame traumatic events. In this process, conscious or unconscious reflection on traumatic events plays an important role.

### 1.1. Fear affects PTSD and PTG

According to the anxiety buffer disruption assumption (Pyszczynski & Kesebir, 2011), fear of traumatic events can lead to the emergence of PTSD. The theory indicates that an individual's fear of suffering from trauma will increase that individual's ability to cognitively extract traumatic events, which may lead to intrusive thinking about traumatic events, accompanied by a tendency to avoid situations that might lead them to recall traumatic events. In addition, some researchers have found that fear may limit individuals' exploration and processing of traumatic experiences, thus preventing them from integrating traumatic memories that aggravate their PTSD (Farnsworth & Sewell, 2011; Forbes et al., 2008). Empirical studies of adolescents after the earthquake have also found that traumatic fear can lead to higher levels of PTSD (Ying et al., 2014; Zhou et al., 2015).

Fear predicts not just PTSD but also PTG. However, studies of the relationship between fear and PTG have produced inconsistent results. Some have argued that fear can limit an individual's cognitive abilities and make it more difficult for survivors to redirect their attention from the negative outcomes and effects of traumatic events (Farnsworth & Sewell, 2011). This fixation may impede their ability to identify the benefits and positive changes brought about by their traumatic experience, and reduce their ability to deal with trauma, thereby reducing PTG. However, according to Calhoun and Tedeschi (2006), fear indicates that a person's view of the world has been challenged, and this may elicit repetitive thinking about traumatic cues, during which process they can identify positive changes following the trauma, and thereby experience growth. Studies have also shown that trauma urges adolescent survivors to lose their sense of control in the world, producing posttraumatic fear, which can both increase their mental stress and create opportunities for meaning making

(Foa, Riggs, Massie, & Yarczower, 1995; Ying et al., 2014; Zhou, Wu, Li, & Zhen, 2018).

### 1.2. Guilt affects PTSD and PTG

Guilt is also a common emotional response in trauma survivors (Beck et al., 2011; Okulate & Jones, 2006). Tilghman-Osborne, Cole, and Felton (2010) argue that when individuals feel that their (real or hypothetical) behaviour has adverse consequences and violates their own moral standards, they will feel guilty. Guilt is one type of moral emotion characterized by negative self-evaluation (Tangney & Dearing, 2002). Individuals who have experienced traumatic events but survived often suffer from survivor guilt (Niederland, 1968). Natural disasters, such as earthquakes, can lead to serious loss of life and property, and when others are injured or killed, survivors naturally seek to attribute these events to a cause; guilt arises when survivors attribute part of the cause of death or property damage to themselves (Carmassi et al., 2017).

Guilt is a compound, self-conscious emotion and contains negative emotional components such as remorse, anxiety, and pain (Hoffman, 1984). However, guilt is also a moral emotion, and although it is often an unpleasant experience, it can have a prosocial role in society, causing individuals to care about others beyond themselves (de Hooge, Nelissen, Breugelmans, & Zeelenberg, 2011). It is evident that guilt following a trauma may play both positive and negative roles. On the one hand, this negative emotion can stimulate the individual's PTSD symptoms. Previous research has found that guilt is not conducive to individual integration of broken core beliefs (Kubany & Manke, 1995); moreover, guilt can lead to more self-punishment and stress for individuals (Burney & Irwin, 2000; Shapiro & Stewart, 2011). A meta-analysis (Pugh, Taylor, & Berry, 2015) of the relationship between guilt and PTSD found that they are strongly related, and that guilt may predict the occurrence of PTSD. Experimental studies have also confirmed that the arousal of guilt can predict symptoms of PTSD (Bub & Lommen, 2017). On the other hand, as a self-conscious emotion, guilt can facilitate psychological adaptation (Tangney & Tracy, 2012), which promotes the adoption of positive coping strategies and the emergence of more altruistic behaviour. This, in turn, makes the individual more sympathetic to others, enhances their appreciation of life, and helps them achieve PTG (Tangney, Stuewig, & Mashek, 2007). Hijazi, Keith, and O'Brien (2015) and Dekel, Mamon, Solomon, Lanman, & Dishy (2016) have found, for example, that guilt can be a significant positive predictor of the PTG of trauma survivors.

### 1.3. The mediating role of rumination

Although fear and guilt may both predict PTSD and PTG, the predictive mechanisms remain unclear. According to Lee et al.'s (2001) theory of PTSD generation mechanisms and to previous research, we propose that rumination may mediate the effects of fear and guilt on PTSD and PTG (Bub & Lommen, 2017; Dekel et al. 2016; Zhou et al., 2015; Zhou et al., 2018). Rumination is a cognitive process consisting of repeated attempts to analyse one's problems and feelings of distress, but with no accompanying action to make positive changes (McEvoy, Watson, Watkins, & Nathan, 2013). Rumination can be divided into two types: Intrusive rumination (IR) and deliberate rumination (DR). The former is the uncontrollable recall of trauma-related cues, while the latter refers to taking the initiative to think about and re-examine trauma events (Cann et al., 2011).

Fear increases the chances of finding trauma clues in the cognitive world, and this in turn results in intrusive thoughts about traumatic experiences, which means that fear may promote IR (Zhou et al., 2015). In addition, fear may create constant psychological stress for survivors, and to relieve this stress survivors may try to think positively about post-traumatic cues. Thus, fear may also improve survivors' DR (Joseph & Linley, 2008).

Guilt may also trigger IR and DR for trauma survivors – a high level of guilt often represents their failure to develop a stable self-schema or core belief after trauma, while the challenges of core beliefs lead to corresponding psychological stress and force survivors to engage in cognitive activities, such as balancing the belief system through IR and DR (Zhou et al., 2015). Guilt also has psychological adaptation functions (Tangney et al., 2007); guilty survivors tend to proactively think about how they will perform in future trauma and try to avoid perceived misconduct. Thus, guilt may promote DR.

Given that fear and guilt may trigger both IR and DR, how might these two kinds of rumination affect PTSD and PTG? The appearance of IR implies that an individual is cognitively focused on the negative aspects of traumatic events, which increases their negative evaluation of those events (Ehlers & Clark, 2008) and maintains and enhances their existing negative cognition (Nolen-Hoeksema, 1991). This induces anxiety, tension, and helplessness, which eventually leads to PTSD and the reduction of PTG (Egan, Hattaway, & Kane, 2014; Hasking, Boyes, Finlay-Jones, McEvoy, & Rees, 2019). However, compared with IR, DR has evidenced different effects on PTSD and PTG (Zhou & Wu, 2016; Zhou et al., 2015). DR helps individuals think positively about traumatic events and pay attention to the positive aspects of traumatic events, which helps

them actively construct their understanding of the post-traumatic world and attribute meaning to the trauma; this promotes PTG and reduces PTSD (Zhou & Wu, 2016; Zhou et al., 2015).

The separate effects of IR and DR on posttraumatic psychological responses have been investigated; however, some studies have found a positive relationship between IR and DR. Calhoun and Tedeschi (2006) PTG model, for example, suggests that IR can provide survivors with traumatic cues and opportunities for further DR. This may be because IR increases an individual's negative emotional and cognitive burden (Ciesla & Roberts, 2007). To alleviate these negative feelings, individuals must take the initiative to process trauma-related cues. Therefore, when both IR and DR are activated by guilt, IR can also positively predict DR. IR arguably plays a 'two-sided' role in posttraumatic psychological reactions, and may be a predictor of PTSD and PTG (Calhoun & Tedeschi, 2006; Cann et al., 2011; Wu, Zhou, Wu, & An, 2015; Zhou, Wu, An, & Chen, 2014).

### 1.4. The present study

While it is theoretically plausible that IR and DR can mediate the relationship of fear and guilt with PTSD/PTG. However, to our knowledge, no empirical study has simultaneously examined the mediating roles of IR and DR in the relationship between fear, guilt, PTSD, and PTG. The purpose of this study was to investigate how adolescents' fear and guilt after the Ya'an earthquake predicted PTSD and PTG by including IR and DR as mediating variables. We generated three hypotheses: (a) Fear and guilt predicts both PTSD and PTG; (b) IR and DR mediate the relationship between fear, guilt, and PTSD/PTG; and (c) DR plays multiple mediating roles in the path from fear and guilt to PTSD and PTG via IR.

Adolescence is a time of peak levels of self-conscious emotions (Somerville et al., 2013) that are associated with social-cognitive, physical, and interpersonal transformations. Adolescents are more vulnerable to the impact of natural disasters, such as earthquakes, because of insufficient experience and strategies for dealing with trauma (Margolin, Ramos, & Guran, 2010). Additionally, adolescence is a period of rapid cognitive development; trauma, then, is particularly likely to induce more event-related cognitive processing, such as rumination, in adolescents, which in turn may influence eventual psychosomatic reactions (Tedeschi & Calhoun, 2004). Therefore, the current study investigated the effects of fear and guilt on PTSD and PTG in adolescent survivors of the Ya'an earthquake, and analysed the mediators of IR and DR, to provide evidence-based guidance for psychological interventions among adolescent trauma survivors.

## 2. Methods

### 2.1. Participants and procedures

The participants were from two middle schools in the areas that were worst-hit by the earthquake. Three-and-a-half years after the quake (Time 1; T1), participants completed the trauma exposure questionnaire, subjective fear questionnaire, and survivor guilt questionnaire. One year later (Time 2; T2), participants completed the event-related rumination inventory, the PTSD checklist for the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), and the post-traumatic growth inventory (PTGI). All participants were instructed to fill in the questionnaires with specific reference to their earthquake experience; this was to ensure that the emotional (fear and guilt), cognitive (IR and DR), and posttraumatic psychological reactions (PTSD and PTG) they reported were directly related to the earthquake rather than to other traumatic events.

At T1, participants comprised 545 students (307 females) between the ages of 11 and 18 ( $M = 14.16$  years,  $SD = 1.77$ ). At T2, 408 adolescents (234 females) from the T1 sample were retained. The participant retention rate was 74.9%. Analysis of the potential impact of participant attrition showed that there were no significant differences in all study variables. In total, 408 students who participated in two surveys were selected as participants for the current study. All the participants were from the worst-hit area – Lushan County, which is the epicentre of the Ya'an earthquake. They were all threatened with death during the earthquake, and some of the participants were injured. Thus, all participants met criteria A in the DSM-5 (American Psychiatric Association, 2013).

The study protocol was approved by the research ethics committee of Beijing Normal University. All participants signed a written informed consent.

## 2.2. Measures

### 2.2.1. Trauma exposure questionnaire

The trauma exposure questionnaire (Wu, Zhang, Lin, & Zang, 2013) is an 18-item self-report measure, used to rate the trauma exposure experienced in the earthquake. One of the examples is that 'The earthquake injured relatives and friends.' According to previous research among Chinese adolescents, this scale exhibited a good internal consistency (Wu et al., 2013; Ying et al., 2014). Each of the items is rated on a 3-point scale where 3 represents 'saw it myself,' 2 represents 'heard about it from others,' and 1 represents 'did not experience any situations above.' A sum score was used to represent trauma exposure in this study, with higher values indicating higher trauma exposure. Because this study was conducted with earthquake survivors, the PTSD and PTG of the

participants may have been affected by the level of earthquake trauma exposure. Thus, the level of earthquake trauma exposure was used as the control variable. Cronbach's alpha was 0.82 in the current sample.

### 2.2.2. Subjective fear questionnaire

The subjective fear questionnaire (Wu et al., 2013) is an 8-item self-report measure that assesses fear or worry about the death of parents, friends, teachers or others. One of the examples is 'I fear that my parents will die in the earthquake.' According to previous research among Chinese adolescents, this scale exhibited a good internal consistency (Zhou et al., 2018). All of the items are scored dichotomously, with 'Yes = 1' and 'No = 0.' All the items were summarized to signify fear, with higher scores indicating higher subjective fear. Cronbach's alpha was 0.86 in the current sample.

### 2.2.3. Survivor guilt questionnaire

Survivor guilt was assessed by Interpersonal Guilt Questionnaire designed by O' Connor, Berry, Weiss, Bush, and Sampson (1997), which is a 67-items scale, designed to measure five subcategories of guilt: survivor guilt (22 items), omnipotent guilt (14 items), separation guilt (15 items), and self-hate (16 items). In the current study, we only used the subcategories of survivor guilt (e.g. 'It makes me very uncomfortable to receive better treatment than the people I am with'). The Chinese version of the survivor guilt questionnaire was first translated and used by Wang, Wu, and Tian (2018) and showed adequate construct and criterion validity. This part comprises 22 items scored on a 5-point Likert scale, ranging from *completely disagree* (1) to *completely agree* (5). All the items were summarized to represent guilt, with higher scores indicating higher survivor guilt. The Cronbach's alpha coefficient for the questionnaire was 0.82.

### 2.2.4. Event-related rumination inventory

IR and DR were assessed by the twenty-item Event-Related Rumination Inventory (Cann et al., 2011), which was validated in the Chinese context before and showing adequate concurrent and construct validity (Zhou, Wu, An, Wang, & Tian, 2017). The inventory was used to measure IR (e.g. 'Thoughts, memories, or images of the event came to mind even when I did not want them.') and DR (e.g. 'I forced myself to deal with my feelings about the event.') that appeared over the prior two weeks. The inventory's instructions explained to participants that 'the event' referred only to the Ya'an earthquake and not to other traumatic events. The items were rated on a 6-point scale that ranged from *not at all* (0) to *always* (5). All the items, separated by two

dimensions, were summarized to represent IR and DR, with higher values indicating higher event-related rumination. In the present study, the Cronbach's alpha were 0.93 and 0.89 for IR and DR, respectively.

### 2.2.5. PTSD checklist for DSM-5

The PTSD checklist for DSM-5 was designed by Weathers (2013) and is a popular tool to assess post-traumatic stress symptoms. According to previous research among Chinese adolescent survivors, this checklist exhibited a good internal consistency (Chen et al., 2015; Zhou & Wu, 2016). The checklist consists of 20 items, and four subscales: intrusions, negative cognition and emotion alteration, avoidance, and hyperarousal. In the present study, all of the items were modified to ensure that the answers would refer only to the Ya'an earthquake, which the participants had recently experienced (e.g. 'Feeling upset when you think or hear about this earthquake'). Items are scored on a 4-point Likert scale from '0 = not at all/only once' to '3 = almost every week.' A sum score was used to represent PTSD, with higher values indicating higher PTSD symptoms. The Cronbach's alpha of this scale was 0.91 in the present study.

### 2.2.6. Posttraumatic Growth Inventory (PTGI)

PTG was assessed by the Chinese version of Posttraumatic Growth Inventory (Zhou et al., 2014), which was the revised version based on the Posttraumatic Growth Inventory (Tedeschi & Calhoun, 1996). The Chinese version of PTGI has previously been found to have good validity and reliability among Chinese adolescents after an earthquake (e.g. Wu et al., 2015; Zhou et al., 2014). One of the examples is that 'I have found a new way for my life.' The PTGI is a 22-item self-report instrument, with each item rated on a 6-point Likert scale ranging from '1 = not at all' to '6 = extremely.' Participants were told that the growth they felt should be in reference only to the Ya'an earthquake. A sum score was used to represent PTG. Higher total scores indicate more positive changes (such as appreciation of life and enhanced personal strength) after the Ya'an earthquake. In the present study, the Cronbach's alpha reliability coefficient for the scale was 0.93.

## 2.3. Data analysis

Statistical analyses were conducted using Mplus 7.0 software. Missing data were handled with full-information maximum likelihood estimates (FIML) in structural models. The following four indices were used to evaluate the goodness of fit of the model: Chi-square values, the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). The general cut-offs for accepting a model are equal to or greater than 0.90 for the CFI and TLI, and less than 0.08 for the RMSEA (Wen, Chang, Hau, & Liu, 2004).

In the structural equation model, scores of each dimension of the scale were taken as the observable variable. PTSD and PTG were the latent variables extracted from multiple dimensions. Fear, guilt, IR, and DR were measured by a single dimension and were therefore substituted into the model in the form of observable variables.

## 3. Results

### 3.1. Descriptive statistics and correlations among measures

Table 1 shows that traumatic exposures were positively correlated with IR and PTSD. Fear was positively associated with guilt, IR, DR, PTSD, and PTG. Guilt was positively associated with IR, DR, PTSD, and PTG. IR was positively associated with DR and PTSD. DR was positively associated with PTSD and PTG. However, no significant correlation was observed between PTSD and PTG.

### 3.2. Structural equation model analyses

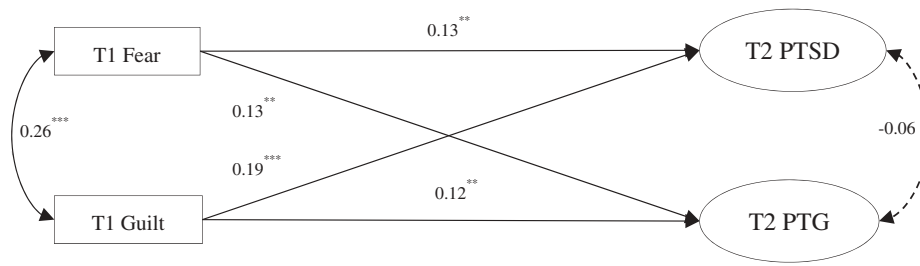
To analyse our data, we first constructed a measurement model that consisted of two latent factors (PTSD and PTG) and seven observed variables. Model fit was acceptable:  $\chi^2/df = 2.17$ , CFI = 0.995, TLI = 0.990, RMSEA (90% CI) = 0.041 (0.016–0.064). All factor loadings for the indicators of the latent variables were significant ( $p < .001$ ).

Second, we built a direct-effects model, which demonstrated that fear and guilt had direct effects on PTSD and PTG (Figure 1). Model fit was acceptable:  $\chi^2/df = 1.47$ , CFI = 0.998, TLI = 0.996,

**Table 1.** Descriptive statistics and correlations for key variables.

	<i>M</i> ± <i>SD</i>	1	2	3	4	5	6	7
1. T1 Traumatic Exposure	20.59 ± 3.39	1						
2. T1 Fear	5.60 ± 2.42	0.07	1					
3. T1 Guilt	66.36 ± 9.32	0.04	0.26***	1				
4. T1 IR	6.41 ± 5.75	0.18***	0.22***	0.30***	1			
5. T1 DR	9.61 ± 6.24	0.05	0.19***	0.27***	0.48***	1		
6. T2 PTSD	11.64 ± 9.08	0.21***	0.19***	0.29***	0.43***	0.16**	1	
7. T2 PTG	58.08 ± 23.33	0.01	0.15**	0.14***	0.03	0.28***	0.06	1

Note: IR = Intrusive Rumination, DR = Deliberate Rumination, PTSD = Posttraumatic stress disorder, PTG = Posttraumatic growth. \*\*\* $p < .001$ , \*\* $p < .01$ .



**Figure 1.** Direct effect model.

Note: All path coefficients were standardized coefficients. PTSD = Posttraumatic stress disorder, PTG = Posttraumatic growth. \*\*\* $p < .001$ , \*\* $p < .01$ .

RMSEA (90% CI) = 0.013(0.000–0.039). The effect of fear and guilt on both PTSD and PTG was significant and positive. Moreover, the relationship between fear and guilt was significant and positive, but the relationship between PTSD and PTG was not significant.

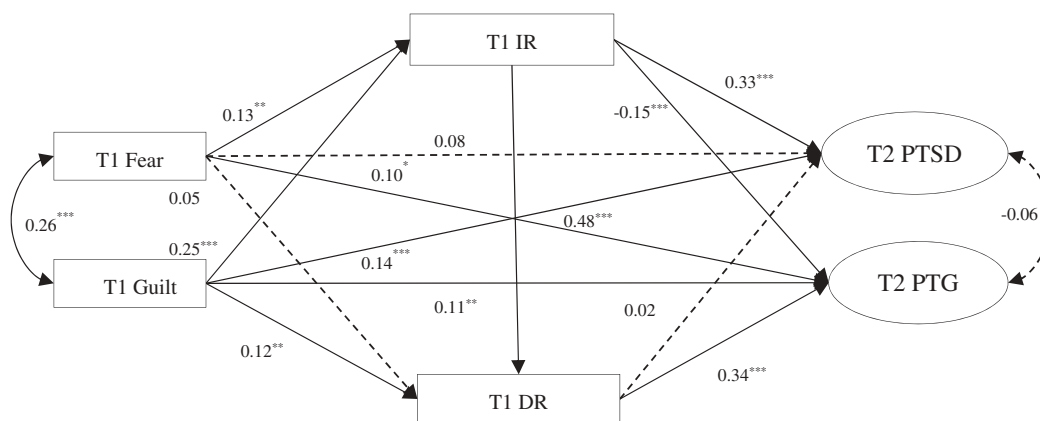
Next, after controlling for traumatic exposure, we added IR and DR as mediating variables into the direct-effects model. We built two structural equation models: in Model 1, IR and DR predicted PTSD and PTG, respectively; in Model 2, which was based on Model 1, a path from IR to DR was added, establishing a multiple indirect effects model. We tested the two models separately and found that the fitting index of Model 2 [ $\chi^2/df = 4.57$ , CFI = 0.983, TLI = 0.957, RMSEA (90% CI) = 0.070 (0.063–0.078)] was significantly better than that of Model 1 [ $\chi^2/df = 5.98$ , CFI = 0.923, TLI = 0.881, RMSEA (90% CI) = 0.111(0.096–0.125)]. Compared with the direct effects model, the model fit indices of Model 1 and Model 2 dropped. This is mainly because degree of freedom increases, with the mediating variables adding inside the models (Bentler & Bonett, 1980; Wen & Liang, 2015). Notwithstanding the decrease of goodness-of-fit, the model fit indices of Model 2 were still

acceptable. Further, the difference between the two models was significant ( $\Delta\chi^2 = 32.57$ ,  $p < 0.001$ ), which indicated that Model 2 was more compatible with the data in this study. Figure 2 shows the path coefficients of the Model 2.

Finally, the bias-corrected bootstrap test was conducted to further evaluate the significance and CIs of the IR and DR mediating effects; 5000 bootstrap samples were created from the original data set using random samples with replacement. If the 95% confidence interval for the estimate of indirect path coefficient does not include 0, it could be concluded that the indirect path coefficient is significant. Table 2 illustrates these results, which indicate that both fear and guilt had an indirect effect on PTSD and PTG through IR. Guilt had an indirect effect on PTG through DR. Additionally, both fear and guilt affected PTSD and PTG through DR, following IR.

#### 4. Discussion

The current study examined the mediating roles of IR and DR in the effects of fear and guilt on PTSD and PTG. The results show that the effect of both fear and guilt on PTSD and PTG was direct and positive. Fear and guilt are positive predictors of PTSD and



**Figure 2.** Multiple indirect effects model.

Note: All path coefficients were standardized coefficients. IR = Intrusive Rumination, DR = Deliberate Rumination, PTSD = Posttraumatic stress disorder, PTG = Posttraumatic growth. \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$ .

**Table 2.** Bias-corrected bootstrap text on mediating effects.

Indirect paths	$\beta$	<i>B</i>	Standardized 95% CI	
			Low	High
Fear-IR-PTSD	0.043*	0.041	0.022	0.064
Fear-IR-PTG	-0.020*	-0.102	-0.037	-0.003
Fear-DR-PTSD	0.001	0.003	-0.009	0.013
Fear-DR-PTG	0.017	0.090	-0.002	0.036
Fear-IR-DR-PTSD	0.001	0.003	-0.009	0.013
Fear-IR-DR-PTG	0.023*	0.078	0.006	0.040
Guilt-IR-PTSD	0.083**	0.002	0.051	0.115
Guilt-IR-PTG	-0.038*	-0.047	-0.063	-0.013
Guilt-DR-PTSD	0.002	0.002	-0.008	0.014
Guilt-DR-PTG	0.041*	0.040	0.021	0.061
Guilt-IR-DR-PTSD	0.002	0.000	-0.008	0.014
Guilt-IR-DR-PTG	0.041*	0.035	0.021	0.061

Note: All path coefficients were standardized coefficients. IR = Intrusive Rumination, DR = Deliberate Rumination, PTSD = Posttraumatic stress disorder, PTG = Posttraumatic growth. \*\* $p < .01$ , \* $p < .05$ .

negative predictors of PTG through the mediating variable of IR. DR mediated the relationship between IR and PTG, and between guilt and PTG; but DR did not mediate the relationship between guilt and PTSD.

Our findings indicate that fear and guilt have direct positive effects on both PTSD and PTG, which is consistent with previous studies (Pyszczynski & Kesebir, 2011; Wang et al., 2018; Zhou et al., 2018). Fear and guilt are two typical negative emotions, which can create negative psychological feelings for an individual, hinder their recovery from a traumatic experience, and thus aggravate their PTSD (Farnsworth & Sewell, 2011; Forbes et al., 2008). The effect size of guilt on PTSD is greater than that of fear. At 4.5 years after the earthquake, survivors had lower levels of fear but their guilt was still at moderate levels. Thus, guilt likely has a greater impact on PTSD.

Fear and guilt, however, can also play a significant positive predictive role for PTG, which is also consistent with previous studies (Dekel et al., 2016; Zhou et al., 2018). The positive predictive effect of fear on PTG indicates that psychological pressure induced by fear helps individuals adopt positive ways to cope with trauma and to achieve positive psychological changes (Ying et al., 2014; Zhou et al., 2018). Guilt, as a moral emotion, can promote prosocial behaviour in individuals and help them get more social support (Carni, Petrocchi, Del Miglio, Mancini, & Couyoumdjian, 2013; Tangney & Tracy, 2012). Moreover, survivors with high guilt levels are more likely to feel kindness from others and experience more positive emotions such as gratitude, all of which are conducive to the development of PTG (Wang et al., 2018).

In addition, the current study found that fear can indirectly predict PTSD through IR. Fear increases the extraction of trauma-related cues, which can easily lead to IR of traumatic events. IR is negative cognition of traumatic events, which is a common negative coping style after individual trauma exposure (Baschnagel, Gudmundsdottir, Hawk, & Beck,

2009; Michael, Halligan, Clark, & Ehlers, 2007). The positive predictive effect of IR on PTSD is consistent with many previous studies (Janoff-Bulman, 2010; Zhou et al., 2015), which have suggested that IR makes it difficult for individuals to change their negative appraisals of traumatic events, which in turn results in PTSD (Zhou & Wu, 2016). Fear also negatively predicted PTG via IR. A possible explanation for these findings is that survivors with high IR tend to focus on the negative aspects of trauma, making it difficult for them to find positive life meanings in their trauma (Schmaling, Dimidjian, Katon, & Sullivan, 2002; Wu et al., 2015).

Unlike fear, guilt positively predicts both IR and DR; this in turn indirectly affects PTSD and PTG. Guilt can positively predict PTSD and negatively predict PTG by promoting IR. Adolescent survivors with high guilt levels may not have established new core beliefs following their traumatic event, and thus believe that they are responsible for some of the catastrophic consequences of the earthquake. This suggests that they are still obsessed with traumatic events and are more prone to IR, which supports the guilt-based PTSD model (Lee et al., 2001).

Furthermore, this study found that guilt indirectly predicts PTG by DR. Previous studies have found that rethinking traumatic events may help survivors achieve more positive changes (Wu et al., 2015; Zhang, Xu, & Yuan, 2018; Zhou & Wu, 2016). However, DR positively predicted only PTG, not PTSD. This result shows that although actively reflecting about traumatic events can help individuals grow, ruminating about traumatic events means re-exposure to the trauma, which means that the survivors are not recovering from the traumatic event but are still struggling with traumatic memories (Taku, Calhoun, Cann, & Tedeschi, 2008). Therefore, DR does not relieve negative symptoms.

Another important finding of this study is that guilt can positively predict PTG through the chain mediation of IR and DR. The positive prediction effect of IR on DR is consistent with previous studies (Cann, Calhoun, Tedeschi, & Solomon, 2010; Nightingale, Sher, & Hansen, 2010; Taku et al., 2008). According to the PTG integrated model theory of Calhoun and Tedeschi (2006), IR may appear before DR and provide clues about DR for survivors, thus promoting DR. It can be seen from Table 1 that there is no significant correlation between IR and PTG. The reason is that DR plays a suppressor role in the relationship between IR and PTG (Pandey & Elliott, 2010). The use of structural equation models (SEMs) helps us discover the complex relationship between IR and PTG. It also suggests that IR, like fear and guilt, can have a 'double-edged' effect after trauma.



It is worth mentioning that this study did not find a significant association between PTSD and PTG in correlation analysis and model analysis, which was consistent with previous studies (Wang et al., 2018; Zhou et al., 2015). A potential explanation might be attributed to the difference of measuring instrument on PTSD and PTG, and participants as well as their traumatic experiences. More importantly, posttraumatic stress symptoms in adolescents were low four and a half years after the earthquake, which makes it difficult for the adolescent survivors to activate their feelings of stress and thus to achieve growth (Meyerson, Grant, Carter, & Kilmer, 2011).

Several limitations of the current study should be acknowledged. First, all data were collected via self-report, which may be susceptible to response bias. Some scholars believe that PTG as measured by the PTGI does not measure actual growth from pre- to post-trauma (Frazier et al., 2009; Zoellner & Maercker, 2006). Future studies should use more evaluation methods such as assessing individuals' PTG through changes in prosocial behaviour before and after trauma. Second, this study was conducted 3.5 and 4.5 years after the Ya'an earthquake; as time since the earthquake increases, PTSD and PTG levels will decrease, and the influencing factors of PTSD and PTG may be different in different time periods (Liang, Cheng, Zhou, & Liu, 2019). Future research should verify whether the results of the current study hold true at different times after the earthquake. Third, the present study was a two-wave longitudinal design in which independent variables and mediating variables were examined at the same time; this can affect the interpretation of the results. Previous studies, for example, have suggested that IR can also trigger individual fear (McCullough, Orsulak, Brandon, & Akers, 2007). Future research should use a three-wave longitudinal design to better test the mediating effect. Finally, the current study only controlled for exposure to the earthquake and did not control for other potentially influencing factors such as gender, age, and negative life events. Therefore, more covariates should be controlled in future studies to reduce interference with the results.

Despite these limitations, this study involves several strengths. First, this study used longitudinal analysis to reveal the relationship between fear, guilt, PTSD, and PTG. Second, this study included fear and guilt in one model for comparative analysis, and found similarities and differences between the two emotions in the psychological responses after the trauma. Specifically, guilt but not fear, can predict PTG by the mediation of DR. This result indicates that fear may lead individuals to escape rather than actively recall traumatic events, but guilt may facilitate actively thinking about the meaning of trauma, which is the main difference observed in this study between the mechanisms of fear and guilt in PTSD and PTG. Finally, this study simultaneously

examined the mechanisms of PTSD and PTG, which are typical positive and negative psychological responses, respectively, after trauma. The results from this study highlight the complex effects of fear and guilt on posttraumatic psychological responses. This study indicates that some of the factors, such as fear, guilt, and IR, may play both positive and negative roles after traumatic events, which suggests that psychotherapists should pay closer attention to the emotions of adolescent trauma survivors and aim to guide their emotions in a positive direction.

This study also highlights important implications for adolescent survivors of the Ya'an earthquake from an intervention and health-enhancement perspective. The assessment for the adaptation of adolescents with traumatic experiences should incorporate both positive and negative indices of adjustment. Some of the factors, such as fear, guilt, and IR, may play both positive and negative roles after traumatic events, which suggests that psychotherapists should pay closer attention to the emotions of adolescent trauma survivors and aim to guide their emotions in a positive direction. For example, when an adolescent experiences survivor guilt, psychologist should guide him or her to actively think about the positive changes that the traumatic event may have brought to him or her, which is to guide the adolescent to engage in more DR, thus promoting PTG. In addition, it is also important to avoid the IR that is impacted by fear and guilt. However, if the IR occurs in adolescents, appropriate guidance may also lead to DR, thus making IR play a positive role.

In summary, study findings indicate that fear, guilt, and intrusive rumination may contribute to PTSD symptoms in adolescent trauma survivors. Results also suggest that adolescent survivors can grow emotionally and psychologically following traumatic events, and that directed rumination may contribute to such growth. Interventions that reduce fear, guilt, and intrusive rumination while increasing directed rumination may assist adolescent trauma survivors in recovery and growth.

### Disclosure statement

No potential conflict of interest was reported by the authors.

### Funding

This work was supported by the Major Project of Beijing Social Science Fund, China [grant number 15ZDA11].

### ORCID

Xiaoyu Lan  <http://orcid.org/0000-0003-3166-9869>

## References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Bal, A. (2008). Post-traumatic stress disorder in Turkish child and adolescent survivors three years after the Marmara earthquake. *Child and Adolescent Mental Health, 13*(3), 134–139.
- Baschnagel, J. S., Gudmundsdottir, B., Hawk, L. W., Jr, & Beck, J. G. (2009). Post-trauma symptoms following indirect exposure to the September 11th terrorist attacks: The predictive role of dispositional coping. *Journal of Anxiety Disorders, 23*(7), 915–922.
- Beck, J. G., McNiff, J., Clapp, J. D., Olsen, S. A., Avery, M. L., & Hagewood, J. H. (2011). Exploring negative emotion in women experiencing intimate partner violence: Shame, guilt and PTSD. *Behavior Therapy, 42*(4), 740–750.
- Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588–606.
- Bub, K., & Lommen, M. J. (2017). The role of guilt in posttraumatic stress disorder. *European Journal of Psychotraumatology, 8*(1), 1407202.
- Burney, J., & Irwin, H. J. (2000). Shame and guilt in women with eating-disorder symptomatology. *Journal of Clinical Psychology, 56*(1), 51–61.
- Calhoun, L. G., & Tedeschi, R. G. (2006). The foundations of posttraumatic growth: An expanded framework. In L. G. Calhoun & R. G. Tedeschi (Eds.), *Handbook of posttraumatic growth* (pp. 1–23). Mahwah: Lawrence Erlbaum Associates.
- Cann, A., Calhoun, L. G., Tedeschi, R. G., & Solomon, D. T. (2010). Posttraumatic growth and depreciation as independent experiences and predictors of well-being. *Journal of Loss and Trauma, 15*, 151–166.
- Cann, A., Calhoun, L. G., Tedeschi, R. G., Triplett, K. N., Vishnevsky, T., & Lindstrom, C. M. (2011). Assessing posttraumatic cognitive processes: The event related rumination inventory. *Anxiety, Stress Coping, 24*, 137–156.
- Carmassi, C., Bertelloni, C. A., Gesi, C., Conversano, C., Stratta, P., Massimetti, G., ... Dell'Osso, L. (2017). New DSM-5 PTSD guilt and shame symptoms among Italian earthquake survivors: Impact on maladaptive behaviors. *Psychiatry Research, 251*, 142–147.
- Carni, S., Petrocchi, N., Del Miglio, C., Mancini, F., & Couyoumdjian, A. (2013). Intrapsychic and interpersonal guilt: A critical review of the recent literature. *Cognitive Processing, 14*(4), 333–346.
- Chen, J., Zhou, X., Zeng, M., & Wu, X. (2015). Post-traumatic stress symptoms and post-traumatic growth: Evidence from a longitudinal study following an earthquake disaster. *PloS One, 10*(6), e0127241.
- Ciesla, J. A., & Roberts, J. E. (2007). Rumination, negative cognition, and their interactive effects on depressed mood. *Emotion, 7*(3), 555–565.
- de Hooge, I. E., Nelissen, R., Breugelmans, S. M., & Zeelenberg, M. (2011). What is moral about guilt? Acting “prosocially” at the disadvantage of others. *Journal of Personality and Social Psychology, 100*(3), 462–473.
- Dekel, S., Mamon, D., Solomon, Z., Lanman, O., & Dishy, G. (2016). Can guilt lead to psychological growth following trauma exposure? *Psychiatry Research, 236*, 196–198.
- Dekel, S., Mandl, C., & Solomon, Z. (2011). Shared and unique predictors of post-traumatic growth and distress. *Journal of Clinical Psychology, 67*, 241–252.
- Egan, S. J., Hattaway, M., & Kane, R. T. (2014). The relationship between perfectionism and rumination in posttraumatic stress disorder. *Behavioural and Cognitive Psychotherapy, 42*(2), 211–223.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy, 38*(4), 319–345.
- Ehlers, A., & Clark, D. M. (2008). Posttraumatic stress disorder: The development of effective psychological treatments. *Nordic Journal of Psychiatry, 62*, 11–18.
- Engelhard, I. M., Lommen, M. J. J., & Sijbrandij, M. (2015). Changing for better or worse? posttraumatic growth reported by soldiers deployed to Iraq. *Clinical Psychological Science, 3*(5), 789–796.
- Farnsworth, J. K., & Sewell, K. W. (2011). Fear of emotion as a moderator between PTSD and firefighter social interactions. *Journal of Traumatic Stress, 24*, 444–450.
- Foa, E. B., Riggs, D. S., Massie, E. D., & Yarczower, M. (1995). The impact of fear activation and anger on the efficacy of exposure treatment for posttraumatic stress disorder. *Behavior Therapy, 26*(3), 487–499.
- Forbes, D., Parslow, R., Creamer, M., Allen, N., McHugh, T., & Hopwood, M. (2008). Mechanisms of anger and treatment outcome in combat veterans with posttraumatic stress disorder. *Journal of Traumatic Stress, 21*, 142–149.
- Frazier, P., Conlon, A., & Glaser, T. (2001). Positive and negative life changes following sexual assault. *Journal of Consulting and Clinical Psychology, 69*, 1048–1055.
- Frazier, P., Tennen, H., Gavian, M., Park, C., Tomich, P., & Tashiro, T. (2009). Does self-reported posttraumatic growth reflect genuine positive change? *Psychological Science, 20*(7), 912–919.
- Fu, Y., Chen, Y., Wang, J., Tang, X., He, J., Jiao, M., ... Li, J. (2013). Analysis of prevalence of PTSD and its influencing factors among college students after the Wenchuan earthquake. *Child and Adolescent Psychiatry and Mental Health, 7*, 1–6.
- García, F. E., Cova, F., Rincón, P., & Vázquez, C. (2015). Trauma or growth after a natural disaster? The mediating role of rumination processes. *European Journal of Psychotraumatology, 6*, 26557.
- Hasking, P., Boyes, M. E., Finlay-Jones, A., McEvoy, P. M., & Rees, C. S. (2019). Common pathways to NSSI and suicide ideation: The roles of rumination and self-compassion. *Archives of Suicide Research, 23*(2), 247–260.
- Hijazi, A. M., Keith, J. A., & O'Brien, C. (2015). Predictors of posttraumatic growth in a multiwar sample of US combat veterans. Peace and conflict. *Journal of Peace Psychology, 21*(3), 395–408.
- Hoffman, M. L. (1984). Interaction of affect and cognition in empathy. In C. E. Izard, J. Kagan, & R. B. Zajonc (Eds.), *Emotions, cognition and behavior* (pp. 103–131). Cambridge: Cambridge University Press.
- Janoff-Bulman, R. (2010). *Shattered assumptions*. New York: Simon and Schuster.
- Jin, Y., Xu, J., & Liu, D. (2014). The relationship between posttraumatic stress disorder and post traumatic growth: Gender differences in PTG and PTSD subgroups. *Social Psychiatry and Psychiatric Epidemiology, 49*, 1903–1910.
- Joseph, S., & Linley, P. A. (2008). Positive psychological perspectives on posttraumatic stress: An integrative psychosocial framework (pp. 3–20). In S. Joseph & P. A. Linley (Eds.), *Trauma, recovery, and growth*. New Jersey: Wiley.
- Kleim, B., & Ehlers, A. (2009). Evidence for a curvilinear relationship between posttraumatic growth and post

- trauma depression and PTSD in assault survivors. *Journal of Trauma Stress*, 22(1), 45–52.
- Kubany, E. S., & Manke, F. P. (1995). Cognitive therapy for trauma-related guilt: Conceptual bases and treatment outlines. *Cognitive and Behavioral Practice*, 2(1), 27–61.
- Lee, D. A., Scragg, P., & Turner, S. (2001). The role of shame and guilt in traumatic events: A clinical model of shame-based and guilt-based PTSD. The role of shame and guilt in traumatic events: A clinical model of shame-based and guilt-based PTSD. *British Journal of Medical Psychology*, 74(4), 451–466.
- Liang, Y., Cheng, J., Zhou, Y., & Liu, Z. (2019). Trajectories of posttraumatic stress disorders among children after the Wenchuan earthquake: A four-year longitudinal study. *European Journal of Psychotraumatology*, 10(1), 1586266.
- Margolin, G., Ramos, M. C., & Guran, E. L. (2010). Earthquakes and children: the role of psychologists with families and communities. *Professional Psychology: Research and Practice*, 41(1), 1–9. doi:10.1037/a0018103
- McCullough, M. E., Orsulak, P., Brandon, A., & Akers, L. (2007). Rumination, fear, and cortisol: An in vivo study of interpersonal transgressions. *Health Psychology*, 26(1), 126–132.
- McEvoy, P. M., Watson, H., Watkins, E. R., & Nathan, P. (2013). The relationship between worry, rumination, and comorbidity: Evidence for repetitive negative thinking as a transdiagnostic construct. *Journal of Affective Disorders*, 151(1), 313–320.
- Meyerson, D. A., Grant, K. E., Carter, J. S., & Kilmer, R. P. (2011). Posttraumatic growth among children and adolescents: A systematic review. *Clinical Psychology Review*, 31, 949–964.
- Michael, T., Halligan, S. L., Clark, D. M., & Ehlers, A. (2007). Rumination in posttraumatic stress disorder. *Depression and Anxiety*, 24(5), 307–317.
- Niederland, W. G. (1968). Clinical observations on the “survivor syndrome”. *International Journal of Psycho-Analysis*, 49, 313–315.
- Nightingale, V. R., Sher, T. G., & Hansen, N. B. (2010). The impact of receiving an HIV diagnosis and cognitive processing on psychological distress and posttraumatic growth. *Journal of Traumatic Stress*, 23, 452–460.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100(4), 569–582.
- O’ Connor, L. E., Berry, J. W., Weiss, J., Bush, M., & Sampson, H. (1997). Interpersonal guilt: The development of a new measure. *Journal of Clinical Psychology*, 53(1), 73–89.
- Okulate, G. T., & Jones, O. B. E. (2006). Post-traumatic stress disorder, survivor guilt and substance use—a study of hospitalised Nigerian army veterans. *South African Medical Journal*, 96(2), 144–146.
- Pan, X., Liu, W. Z., Deng, G. H., Liu, T. S., Yan, J., Tang, Y. X., & Xu, M. (2015). Symptoms of posttraumatic stress disorder, depression, and anxiety among junior high school students in worst-hit areas 3 years after the Wenchuan earthquake in China. *Asia Pacific Journal of Public Health*, 27(2), 1985–1994.
- Pandey, S., & Elliott, W. (2010). Suppressor variables in social work research: Ways to identify in multiple regression models. *Journal of the Society for Social Work and Research*, 1(1), 28–40.
- Pugh, L. R., Taylor, P. J., & Berry, K. (2015). The role of guilt in the development of post-traumatic stress disorder: A systematic review. *Journal of Affective Disorders*, 182, 138–150.
- Pyszczynski, T., & Kesebir, P. (2011). Anxiety buffer disruption theory: A terror management account of posttraumatic stress disorder. *Anxiety, Stress & Coping*, 24, 3–26.
- Saccinto, E., Prati, G., Pietrantonio, L., & Perez-Testor, C. (2013). Posttraumatic stress symptoms and posttraumatic growth among Italian survivors of emergency situations. *Journal of Loss and Trauma*, 18(3), 210–226.
- Schmaling, K. B., Dimidjian, S., Katon, W., & Sullivan, M. (2002). Response styles among patients with minor depression and dysthymia in primary care. *Journal of Abnormal Psychology*, 111(2), 350–356.
- Sleijpen, M., Haagen, J., Mooren, T., & Kleber, R. J. (2016). Growing from experience: An exploratory study of posttraumatic growth in adolescent refugees. *European Journal of Psychotraumatology*, 7, 286–298.
- Somerville, L. H., Jones, R. M., Ruberry, E. J., Dyke, J. P., Glover, G., & Casey, B. J. (2013). The medial prefrontal cortex and the emergence of self-conscious emotion in adolescence. *Psychological Science*, 24(8), 1554–1562. doi:10.1177/0956797613475633
- Stewart, S. E., & Shapiro, L. (2011). Pathological guilt: A persistent yet overlooked treatment factor in obsessive-compulsive disorder. *Annals of Clinical Psychiatry*, 23(1), 63–70.
- Taku, K., Calhoun, L. G., Cann, A., & Tedeschi, R. G. (2008). The role of rumination in the coexistence of distress and posttraumatic growth among bereaved Japanese university students. *Death Studies*, 32, 428–444.
- Tangney, J. P., & Tracy, J. L. (2012). Self-conscious emotions. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 446–478). New York: Guilford Press.
- Tangney, J. P., & Dearing, R. L. (2002). *Shame and guilt-emotions and social behavior*. New York, NY: Guilford Press.
- Tangney, J. P., Stuewig, J., & Mashek, D. J. (2007). Moral emotions and moral behavior. *Annual Review of Psychology*, 58, 345–372.
- Tedeschi, R. G., & Calhoun, L. G. (1996). The posttraumatic growth inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress*, 9, 455–471.
- Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: conceptual foundations and empirical evidence”. *Psychological Inquiry*, 15(1), 1–18. doi:10.1207/s15327965pli1501\_01
- Tilghman-Osborne, C., Cole, D. A., & Felton, J. W. (2010). Definition and measurement of guilt: Implications for clinical research and practice. *Clinical Psychology Review*, 30(5), 536–546.
- Wang, W., Fu, W., Wu, J., Ma, X., Sun, X., Huang, Y., ... Yoshikawa, T. (2012). Prevalence of PTSD and depression among junior middle school students in a rural town far from the epicenter of the Wenchuan earthquake in China. *PLoS One*, 7, e41665.
- Wang, W., Wu, X., & Tian, Y. (2018). Mediating roles of gratitude and social support in the relation between survivor guilt and posttraumatic stress disorder, posttraumatic growth among adolescents after the Ya’an Earthquake. *Frontiers in Psychology*, 9, 2131.
- Weathers, F. W. (2013). The PTSD checklist for DSM-5 (PCL-5): Development and initial psychometric analysis. Paper presented at the 29th annual meeting of the International Society for Traumatic Stress Studies, Philadelphia, PA.

- Wen, H., & Liang, Y. (2015). The essence of testing structural equation models using popular fit indexes [Chinese]. *Journal of Psychological Science*, 38(4), 987–994.
- Wen, Z. L., Chang, L., Hau, K. T., & Liu, H. Y. (2004). Testing and application of the mediating effects [Chinese]. *Acta Psychologica Sinica*, 36, 614–620.
- Wu, X., Zhang, Y., Lin, C., & Zang, W. (2013). The effect of disaster exposure on PTSD of primary and secondary students: Mediating and moderating effects [Chinese]. *Psychological Development and Education*, 29, 641–648.
- Wu, X., Zhou, X., Wu, Y., & An, Y. (2015). The role of rumination in posttraumatic stress disorder and posttraumatic growth among adolescents after the Wenchuan earthquake. *Frontiers in Psychology*, 6, 1335.
- Wu, Z., Xu, J., & Sui, Y. (2016). Posttraumatic stress disorder and posttraumatic growth coexistence and the risk factors in Wenchuan earthquake survivors. *Psychiatry Research*, 237, 49–54.
- Ying, L., Lin, C., Wu, X., Chen, C., Greenberger, E., & An, Y. (2014). Trauma severity and control beliefs as predictors of posttraumatic growth among adolescent survivors of the Wenchuan earthquake. *Psychological Trauma: Theory, Research, Practice, and Policy*, 6, 192–198.
- Zhang, Y., Xu, W., & Yuan, G. (2018). The relationship between posttraumatic cognitive change, posttraumatic stress disorder, and posttraumatic growth among Chinese adolescents after the Yancheng tornado: the mediating effect of rumination. *Frontiers in Psychology*, 9, 474.
- Zhou, X., & Wu, X. (2016). The relationship between rumination, posttraumatic stress disorder, and posttraumatic growth among Chinese adolescents after earthquake: A longitudinal study. *Journal of Affective Disorders*, 193, 242–248.
- Zhou, X., Wu, X., An, Y., & Chen, J. (2014). The roles of rumination and social support in the associations between core belief challenge and posttraumatic growth among adolescent survivors after the Wenchuan earthquake [Chinese]. *Acta Psychologica Sinica*, 46(10), 1509–1520.
- Zhou, X., Wu, X., An, Y., Wang, W., & Tian, Y. (2017). The applicability of events related rumination inventory among adolescents following earthquake [Chinese]. *Chinese Journal of Clinical Psychology*, 25(6), 1001–1006.
- Zhou, X., Wu, X., Fu, F., & An, Y. (2015). Core belief challenge and rumination as predictors of PTSD and PTG among adolescent survivors of the Wenchuan earthquake. *Psychological Trauma Theory Research Practice and Policy*, 7(4), 391–397.
- Zhou, X., Wu, X., Li, X., & Zhen, R. (2018). The role of posttraumatic fear and social support in the relationship between trauma severity and posttraumatic growth among adolescent survivors of the Ya'an earthquake. *International Journal of Psychology*, 53(2), 150–156.
- Zhou, X., Wu, X., Yuan, X., Chen, J., & Chen, Q. (2015). The role of core beliefs challenge, subjective fear and intrusive rumination in associations between the severity of traumatic expose and posttraumatic stress disorder in adolescent survivors after Ya'an earthquake [Chinese]. *Acta Psychologica Sinica*, 47, 455–465.
- Zhou, X., Wu, X., & Zhen, R. (2018). Patterns of posttraumatic stress disorder and posttraumatic growth among adolescents after the Wenchuan earthquake in China: A latent profile analysis. *Journal of Traumatic Stress*, 31(1), 57–63.
- Zoellner, T., & Maercker, A. (2006). Posttraumatic growth in clinical psychology—A critical review and introduction of a two-component model. *Clinical Psychology Review*, 26(5), 626–653.