

The Role of Perceived Severity of Disaster, Rumination, and Trait Resilience in the Relationship Between Rainstorm-related Experiences and PTSD Amongst Chinese Adolescents Following Rainstorm Disasters



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ABSTRACT

This study examined the mediating role of perceived severity of trauma and rumination in the relationship between traumatic experiences and PTSD, and assessed the moderated role of resilience in this mediating process. Nine hundred and fifty-one adolescents were selected to complete a self-report questionnaire involving rainstorm-related experiences, perceived severity of trauma, rumination, resilience, and PTSD. The results found that rainstorm-related experiences had a positive effect on PTSD by perceived severity of disaster, or by rumination via perceived severity of disaster. Resilience buffered the relationship between rainstorm-related experiences and PTSD, but did not buffer the relation of rainstorm-related experiences to perceived severity of disaster and rumination. These findings indicated that rainstorm-related experiences may have an indirect effect on PTSD via cognitive activities, and these indirect paths were not buffered by resilience. A buffering effect only occurred in the direct paths from rainstorm-related experiences to PTSD.

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INTRODUCTION

It has been documented that posttraumatic stress disorder (PTSD) is a common negative outcome amongst individuals following traumatic experiences. Studies have found that the prevalence of PTSD in a traumatized population following natural disasters ranges from 5% to 60% (Galea, Nandi, & Vlahov, 2005). In China, these rates have been found to range from 6.5%–82.6% (Cao, Wang, Cao, & Zhang, 2015). Of particular importance is the finding that adolescents may report more severe PTSD symptoms than adults because of their susceptibility to trauma (Eth, 2008). For example, Ying et al. (2015)'s study on adolescents following the Wenchuan earthquake found that 8.4% of individual's showed signs of PTSD. A study on adolescents who experienced a flood in southwestern Poland found that 18% of the participants met full diagnostic criteria for PTSD (Bokszczanin, 2007). Agustini, Asniar, and Matsuo (2011)

Cernvall et al., 2016; Delahanty, Raimonde, Spoonster, & Cullado, 2003; Zhou & Wu, 2016). Therefore, the aim of this study was to assess the role of perceived severity of disasters and levels of rumination in relationship between traumatic experiences and PTSD, and to elucidate the underlying cognitive processes of the occurrence of PTSD amongst adolescents after a rainstorm disaster.

The perceived severity of disasters involves the appraisal and associated cognitions regarding the severity of the disaster outcomes (e.g., evaluating the economic and health consequences following a natural disaster). The cognitive theory of stress and coping suggests that an individual's cognitive appraisal and coping process plays an important role in the resulting psychological outcomes (Lazarus & Folkman, 1984). Based on this theory, the experience of a traumatic event can activate an individual's appraisal system, wherein people are primarily focused on the potential harm associated with a traumatic experience. When individual who has recently suffered a trauma evaluates and perceives the traumatic experience as being threatening, they may show more fear or worry than an individual who does not. This can lead to a conditioned fear of trauma-related cues (Jovanovic et al., 2009), wherein traumatic events may easily intrude into peoples' cognitive worlds (Fani et al., 2012) and elicit PTSD symptoms, particularly those related to re-experiencing the event(s). Thus, studies have reported that having a greater perceived severity of an experienced trauma was associated with more symptomatology associated with PTSD (Besser, Neria, & Haynes, 2009; Girelli, Resick, Marhoefer-Dvorak, & Hutter, 1986; Kemp, Rawlings, & Green, 1991; Lee, Ahn, Jeong, Chae, & Choi, 2014; Solomon, Mikulincer, & Hobfoll, 1987). Taken together, it may be that the perceived severity of trauma may mediate the relationship between traumatic experiences and PTSD.

Another important predictive factor of PTSD is rumination, which refers to a mode of responding to distress that involves repetitively and passively focusing on symptoms of distress and on the possible causes and consequences of these symptoms (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Janoff-Bulman (2010) claimed that the shattered world assumption, led by trauma severity, caused substantial internal disequilibrium before and after a trauma and, in turn, could cause a traumatized individual to immerse him/herself into the traumatic events and ruminate on them. Furthermore, rumination on traumatic events causes individuals to focus on the negative outcomes of traumatic events and, in turn, increases negative emotions (Blackburn & Owens, 2016), which may ultimately lead to PTSD (Borders, Rothman, & McAndrew, 2015; Chuen Yee Lo, Lau, Cheung, & Allen, 2012). Thus, it was proposed that traumatic experiences may be indirectly associated with PTSD via rumination.

Although traumatic experiences may lead to more PTSD symptoms via the activation of one's perceptions of trauma severity or rumination, the complimentary role of the perceived severity of a disaster and rumination has seldom been examined. In fact, Lazarus and Folkman (1984) suggested that the appraisal of traumatic experiences might be associated with cognitive coping. That is, the perceived severity of trauma may be related to rumination because rumination can be considered as a way of coping following a traumatic event (Baschnagel, Gudmundsdottir, Hawk, & Beck, 2009). Specifically, when traumatized people perceive a trauma as being of a higher severity, they also tend to perceive more psychological stress which, in turn, undermines their emotional ability to self-regulate, or the capacity to engage in self-control over one's behavior (Baumeister, Gailliot, DeWall, & Oaten, 2006). This may lead traumatized individuals to focus their attention on negative thoughts and feelings, which can lead to the formation of negative self-schemas based on their traumatic experiences, and increase the likelihood of rumination (Michl, McLaughlin, Shepherd, & Nolen-Hoeksema, 2013; Scher, Ingram, & Segal, 2005). Taken collectively, it is likely that

traumatic experiences may also have indirect effects on PTSD based on an individual's perceived severity of the trauma via rumination.

Nevertheless, it has been noted when examining the predictive factors of PTSD, individual characteristics and traits should not be ignored (Bonanno, 2004). The diathesis-stress model emphasizes that exposure to traumatic events interacts with individual characteristics and traits to produce trauma-related outcomes (McKeever & Huff, 2003), wherein trait resilience may be an important individual characteristic (Besser & Priel, 2010; Wagnild, 2009). Furthermore, studies have indicated that resilience may buffer the role of traumatic experiences in PTSD (Fincham, Altes, Stein, & Seedat, 2009; Lee et al., 2014), but it is still unclear as to whether resilience buffers the underlying cognitive processes of PTSD following a traumatic event. Therefore, this study further assessed the potential moderating role of resilience in paths from traumatic experiences to PTSD.

Trait resilience refers to a positive personality trait that enables individuals to recover from adversity and to adapt, thrive and mature in the face of difficult or challenging circumstances (Friborg, Hjemdal, Rosenvinge, & Martinussen, 2003; Liu, Wang, Zhou, & Li, 2014). Resilient

but the predictive utility of such relationships has not yet been evaluated in adolescent survivors of natural disasters. Moreover, the complimentary role of perceived severity of disasters and rumination in the relationship between traumatic experiences and PTSD has seldom been examined, which further limits our understanding of the underlying processes of PTSD. More importantly, although the potential moderating role of resilience in the relationship between traumatic experiences and PTSD had been identified (Ying, Wu, Lin, & Jiang, 2014

it had a good internal reliability in the current study (Cronbach's alpha = 0.89). This questionnaire showed good reliability and validity in ado-

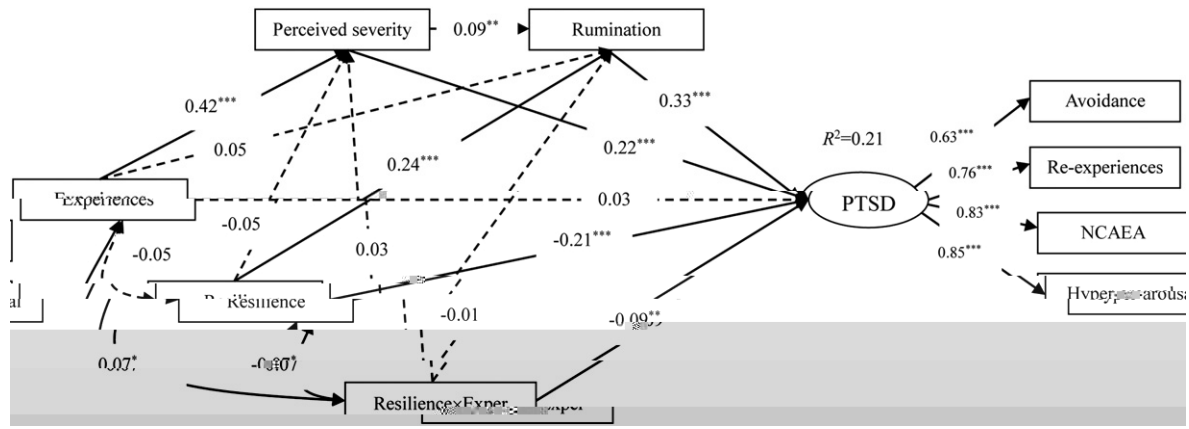


Fig. 2. Moderated serial multiple mediation model. Experiences and Exper represent rainstorm-related experiences, perceived severity represents perceived severity of disaster, NCAEA represents negative cognition and emotion alteration of PTSD; ***, Path is significant at the 0.001 level (2-tailed); **, Path is significant at the 0.01 level (2-tailed); *, Path is significant at the 0.05 level (2-tailed).

SRMR = 0.009]. Wherein, rainstorm-related experiences positively and significantly predicted PTSD ($\beta = 0.15, < 0.001$). Next, employing a moderated serial multiple mediation analysis (see Fig. 2), we found that this model fit the data better [$\chi^2/df = 4.30, CFI = 0.97, TLI = 0.95, RMSEA (90\%CI) = 0.059 (0.045-0.073), SRMR = 0.020$]. The results of path analyses found that rainstorm-related experiences only had a significant positive prediction on the perceived severity of the disaster, but had a non-significant relation to the other variables. The perceived severity of the disaster positively predicted rumination and PTSD, and rumination positively predicted PTSD. Resilience positively predicted rumination and negatively PTSD, but demonstrated a non-significant relation with perceived severity of the disaster. The interaction term between rainstorm-related experiences and resilience negatively predicted PTSD, whereas it had a non-significant association with resilience and perceived severity of the disaster. Overall, 21% of the variance in PTSD could be explained by this model. These results indicated that rainstorm-related experiences might have a positive effect on PTSD based on one's perceived severity of the disaster, or by rumination via one's perceived severity of the disaster. In addition, resilience moderated the relationship between rainstorm-related experiences and PTSD, but did not moderate the relation of rainstorm-related experiences to perceived severity of the disaster and rumination.

We conducted bias-corrected bootstrap tests with a 95% confidence interval (Gootzeit & Markon, 2011) to evaluate the significance levels of the indirect effects of rainstorm-related experiences and resilience on PTSD, and the direct effects of the interaction term between rainstorm-related experiences and resilience on perceived severity of the disaster, rumination, and PTSD, in Fig. 2. Five thousand bootstrap samples were created from the original data set using random samples with replacement. The model in Fig. 2 was then constructed 5000 times with these samples, to yield 5000 estimations of each indirect path coefficient. If the 95% confidence interval of an indirect path

coefficient does not include 0, it is suggested that the indirect path is indeed significant.

Table 2 shows the bias-corrected bootstrap test results. The 95% confidence intervals for the direct paths from the interaction term between rainstorm-related experiences and resilience to perceived severity of disaster and rumination included 0, and from rainstorm-related experiences to PTSD also included 0, whereas from resilience and the interaction term between rainstorm-related experiences and resilience to PTSD did not include 0. The 95% confidence interval for the indirect paths from rainstorm-related experiences to PTSD via perceived severity of disaster, from rainstorm-related experiences to PTSD through perceived severity of disaster via rumination, and from resilience to PTSD via rumination did not include 0. Conversely, the 95% confidence intervals for the other indirect path coefficients did include 0. These results further supported the paths in Fig. 2.

Similarly, we used a simple slope test to further examine whether the moderating effect of resilience on the relationship between rainstorm-related experiences and PTSD was significant or not. We graphed the relation between rainstorm-related experiences and PTSD for participants whose levels of resilience were 1 SD above or below the mean (see Fig. 3). For participants 1 SD above the mean of resilience, increased rainstorm-related experiences were not significantly associated with change in PTSD symptoms ($\beta = 0.12, = 1.32, = 0.187$). In contrast, for participants 1 SD below the mean, increased rainstorm-related experiences were associated with a significant increase in PTSD symptoms ($\beta = 0.45, = 4.70, < 0.001$).

DISCUSSION

To our knowledge, this is first study to examine the combined role of rainstorm-related experiences, perceived severity of disasters, rumination, and resilience in PTSD amongst adolescents following a rainstorm

Table 1
Means, standard deviations, and correlations amongst main variables.

	M ± SD	1	2	3	4	5	6
1. Sex	-	1.00					
2. Age	14.78 ± 1.70	0.04	1.00				
3. Rainstorm-related experiences	0.62 ± 0.61	0.14 ^a	0.05	1.00			
4. Perceived severity	2.73 ± 0.73	0.07 ^b	0.15 ^a	0.43 ^a	1.00		
5. Rumination	2.37 ± 0.85	-0.01	0.04	0.07 ^b	0.09 ^a	1.00	
6. Resilience	2.34 ± 0.67	-0.01	-0.11 ^a	-0.05	-0.07 ^b	0.23 ^a	1.00
7. PTSD	0.86 ± 0.52	-0.02	-0.04	0.15 ^a	0.25 ^a	0.28 ^a	-0.13 ^a

: Perceived severity = perceived severity of disaster.
^a Correlation is significant at the 0.01 level (2-tailed).
^b Correlation is significant at the 0.05 level (2-tailed).

Table 2
Bias-corrected bootstrap test.

Paths	Standardized β ()	Standardized 95% CI	
		Low	High
Direct paths			
Experiences - PTSD	0.03(0.04)	-0.03	0.09
Resilience - PTSD	-0.21 (0.04) ^a	-0.28	-0.15
Interaction term - PTSD	-0.09(0.05) ^b	-0.16	-0.01
Interaction term - perceived severity	0.03(0.04)	-0.03	0.08
Interaction term - rumination	-0.01(0.03)	-0.07	0.04
Indirect paths			
Experiences - perceived severity - PTSD	0.09(0.02) ^a	0.07	0.12
Experiences - rumination - PTSD	0.02(0.01)	-0.01	0.04
Experiences - perceived severity - rumination - PTSD	0.01(0.006) ^b	0.003	0.02
Resilience - perceived severity - PTSD	-0.01(0.01)	-0.02	0.002
Resilience - rumination - PTSD	0.08(0.02) ^a	0.06	0.10
Resilience - perceived severity - rumination - PTSD	-0.001(0.04)	-0.003	0.001

: Experiences = Rainstorm-related experiences, perceived severity = perceived severity of disaster, Interaction term = Interaction term between rainstorm-related experiences and resilience.

^a Path is significant at the 0.05 level (2-tailed).

^b Path is significant at the 0.05 level (2-tailed).

disaster. By using moderated serial multiple mediation analysis, the findings indicated that perceived severity of disasters and rumination fully mediated the relation of rainstorm-related experiences to PTSD, and resilience moderated the direct association between rainstorm-related experiences and PTSD.

Specifically, the findings suggest that there is a direct effect of rainstorm-related experiences on PTSD before inserting the mediators (i.e., perceived severity of disasters and rumination). Our findings support the shattered world assumption (Janoff-Bulman, 2010), and are also consistent with the findings of previous studies that have found that traumatic experiences have a direct and positive effect on PTSD (Bokszczanin, 2007; Chen et al., 2015; Dixon, Shochet, & Shakespeare-Finch, 2015). Furthermore, after inserting perceived severity of disasters and rumination into the relationship between rainstorm-related experiences and PTSD, the prior significant, direct association between them disappeared, which suggested that a complete mediational role in the relation of rainstorm-related experiences and PTSD. More importantly, this finding further supported our studies on PTSD amongst adolescents after the Ya'an earthquake (Wu et al.,

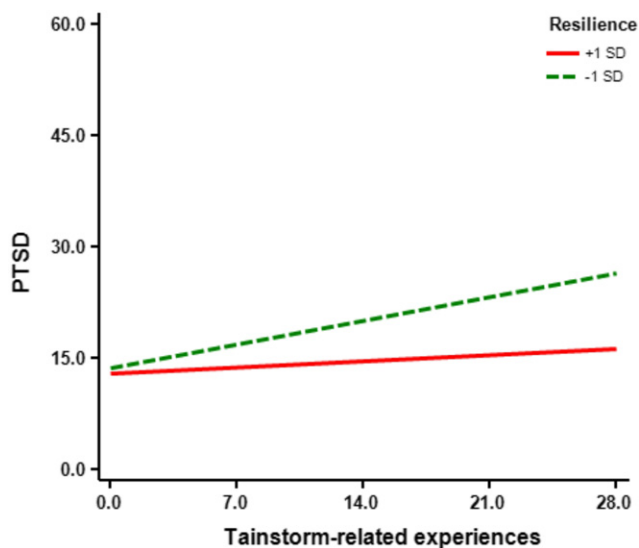


Fig. 3. Relationship between rainstorm-related experiences and PTSD at different levels of resilience.

2015; Zhou et al., 2015), and indicated that trauma-related experiences provide a potential predictor for PTSD. Additionally, a more important predictor or process of PTSD may be the perceived severity of disasters and the rumination following rainstorm-related experiences.

Here, we found that rainstorm-related experiences might have a one-step, indirect effect on PTSD via one's perceived severity of the disasters, which is consistent with previous studies (Besser et al., 2009; Lee, Joo, & Choi, 2013; Lee et al., 2014; Pedrelli, Feldman, Vorono, Fava, & Petersen, 2008) and Lazarus and Folkman' (1984) theory. That is, a stressor typically triggers a stress reaction if the stressor is perceived as a threat or if an individual feels incapable of meeting the perceived demands of a given situation (Lazarus & Folkman, 1984). Based on this theory, we believe that the rainstorm-related experiences may have elicited the adolescent participants' negative perceptions of the disaster or that they perceived the disasters as being particularly severe because it was uncontrollable (Zhou et al., 2015). The adolescents may have been more likely to perceive the rainstorm as being more threatening, and thus they felt unsafe. This loss could lead to a heightened sensitivity to threat—even minor threat, and in turn may have triggered a sequence of physical, emotional, and cognitive emergency responses - a state termed chronic hyperarousal (Van der Kolk, Greenberg, Orr, & Pitman, 1988), which can cause individuals to fail to modulate their emotions and hence lead to PTSD (Bloom & Farragher, 2010). Moreover, a greater perceived severity of the natural disaster may have also added to the adolescents' fear and worry, thus eliciting more intrusive symptoms (Fani et al., 2012) and ultimately resulting in PTSD.

Additionally, we also found a significant multiple indirect path to PTSD from rainstorm-related experiences to perceived severity of disasters via rumination, which was consistent with our hypothesis and supported Janoff-Bulman's (2010) theory. Our results found that a higher degree of exposure to traumatic experiences led to a greater perceived severity of the disasters. Calhoun and Tedeschi (2006) suggested that for individuals who view a disaster as being more aversive, their belief system about the world as being a safe place and their sense of self-efficacy may be shattered, leading to the individuals' cognitive disequilibrium. To relieve this disequilibrium, individual need to repeatedly think about or ruminate over the traumatic events (Janoff-Bulman, 2010). Furthermore, as rumination involves repeatedly replaying the course of an experience in one's mind, focusing on how unpleasant it was (Hu, Koucky, Brown, Bruce, & Sheline, 2015), this behavior can present traumatic cues to a traumatized individual's cognitions and, thereby, increase their intrusive symptoms, ultimately leading to PTSD. In addition, rumination may impede changes in negative appraisals of traumatic events (Ehlers, Mayou, & Bryant, 1998), this may lead traumatized individuals to focus on the negative effects of the traumatic experiences, and thus may increase the symptoms PTSD.

Nevertheless, we did not find a one-step, indirect effect of rainstorm-related experiences on PTSD via rumination. One possible explanation might be attributed to the non-significant, direct relation between rainstorm-related experiences and rumination, which was not consistent with previous studies (Borders et al., 2015; Chuen Yee Lo et al., 2012), but supported the findings from Zhou et al.' (2015) studies on adolescents. Here, previous studies considered rumination following a trauma as being a negative coping strategy that traumatized individual frequently use (Baschnagel et al., 2009). However, for adolescents with rainstorm-related experiences in this study, family and social groups may have been able to provide more support, which may have helped them to use more positive strategies to cope with the traumatic event. Thus, they may have been less likely to ruminate as their main coping strategy, which may explain why we found the non-significant and direct relationship between rainstorm-related experiences and rumination.

This study also found that resilience had a directly negative effect on PTSD, which was consistent with previous studies (Bonanno, 2005; Connor & Davidson, 2003; Dai et al., 2014; Lee et al., 2014). It may be that resilience enables individuals to bounce back from adversity, and

to adapt, thrive and mature in the face of adverse circumstances (Friborg et al., 2003; Liu, Wang, Zhou, & Li, 2014), and thus can protect traumatized people from PTSD (Ying et al., 2014). Nevertheless, an unexpected but interesting finding was the significantly positive association between resilience and rumination. This was inconsistent with previous studies (Calhoun & Tedeschi, 2006; Thanoi, Phanchaoenworakul, Thompson, Panitrat, & Nityasuddhi, 2010; Tugade & Fredrickson, 2004). A potential explanation may be that adolescents have immature cognitive and emotional capabilities., Although resilience can lead to more optimistic thinking (

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