

Test of the stress sensitization model in adolescents following the pipeline explosion

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Abstract

Purpose: The stress sensitization model states that early traumatic experiences increase vulnerability to the adverse effects of subsequent stressful life events. This study examined the effect of stress sensitization on development of posttraumatic stress disorder (PTSD) symptoms in Chinese adolescents who experienced the pipeline explosion.

Methods: A total of 670 participants completed self-administered questionnaires on demographic characteristics and degree of explosion exposure, the Childhood Trauma Questionnaire (CTQ), and the Posttraumatic Stress Disorder Checklist—Civilian Version (PCL-C). Associations among the variables were explored using MANOVA, and main effects and interactions were analyzed.

Results: Overall MANOVA tests with the PCL-C indicated significant differences for gender ($F = 6.86, p = .000$), emotional abuse ($F = 6.79, p = .000$), and explosion exposure ($F = 22.40, p = .000$). There were significant interactions between emotional abuse and explosion exposure ($F = 3.98, p = .008$) and gender and explosion exposure ($F = 2.93, p = .033$).

Conclusions: Being female, childhood emotional abuse, and a high explosion exposure were associated with high PTSD symptom levels. Childhood emotional abuse moderated the effect of explosion exposure on PTSD symptoms. Thus, stress sensitization influenced the development of PTSD symptoms in Chinese adolescents who experienced the pipeline explosion as predicted by the model.

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1. Introduction

Exposure to overwhelmingly stressful events or severe traumatic experiences can cause a high prevalence of psychiatric disorders [1–3], particularly posttraumatic stress disorder (PTSD) [4–6]. There is growing evidence for wide variation in mental health outcomes following traumatic events, with some individuals showing severe or persistent PTSD symptoms and others showing resilience or only minor psychological distress in the aftermath of trauma exposure. As a result, there is increasing acceptance of the idea that exposure to a disastrous trauma may not always sufficiently explain the development of PTSD. In other words, there may be some associated factors that account for an individual's vulnerability to developing this disorder [7–9]. These factors include pre-trauma factors, such as gender and previous

traumatic experiences, peri-trauma factors, which concern the degree and nature of exposure to the event, and post-trauma factors, such as social support and coping strategies.

Childhood trauma (CT), including physical, emotional, and sexual abuse and neglect, is associated with the development of a range of psychiatric disorders, especially PTSD [10,11]. However, the underlying mechanisms remain inadequately understood. The stress sensitization model has been proposed as a potential mechanism. According to this model, individuals who experience traumatic events in childhood have a lower tolerance for stress in later life and, consequently, may be more likely to develop mental disorders after subsequent stressful events than those who did not experience trauma in childhood. The stress sensitization model can be described as a three-variable relationship in which the PTSD symptoms constitute the dependent variable, recent stressors (e.g., proximate trauma exposure) represent a direct causal variable predicting the PTSD symptoms, and prior stressors (e.g., CT) represent a temporally preceding interaction variable moderating the direct effects of proximate-trauma exposure on PTSD symptoms [12].

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The stress sensitization model has been a prominent influence on research on the role of a range of early-life stressors (e.g., maltreatment, parental divorce or death) on the onset of major depression after proximate stressful life events [13–17]. For example, in a two-year prospective study of 121 young women, Hammen and colleagues found that the risk of adult depression following recent stressful life events is higher among individuals with a history of childhood adversities than among individuals without such a history [13].

Recently, investigators have extended this line of research to include other outcomes, including anxiety disorders [16], the tendency to perpetrate intimate partner violence [18], the risk of alcohol-related behaviors [19,20], and PTSD [21–23]. For instance, in the 1996 Detroit Area Survey of Trauma containing a large representative sample of 2181 individuals in southeast Michigan, Breslau et al. demonstrated that previous exposure to traumatic events is associated with greater vulnerability to PTSD effects after a subsequent trauma [21]. However, since these previous studies have focused exclusively on stressful life events, an alternative explanation of the interactions between CT and subsequent life stressors in predicting mental disorders is that subsequent stressors act as mediators of the association between CT and psychiatric disorders. In other words, CT is associated with mental disorders because they increase the risk for stressful events in later life. Therefore, some researchers have suggested that tests of the stress sensitization model should focus on subsequent stressors that are uncorrelated with prior adversities in order to minimize the possibility of a selection-bias confound based on preexisting risk of trauma exposure [16]. Interestingly, although a number of potentially relevant PTSD factors have been examined in victims who have experienced wars or natural disasters, to the best of our knowledge, investigations of these associated factors in individuals who have experienced technological disasters have not yet been explored. Previous studies have indicated that technological disasters, specifically those that have occurred in peaceful zones, are usually caused by human error and may be significantly different from natural disasters. Consequently, they may exert more severe and long-lasting adverse impacts on mental health than natural disasters [24,25]. More importantly, because adolescence is a period in which there is vulnerability to various potentially stressful challenges and liability to a range of psychological disorders [26], it is a particularly important and informative life stage to investigate the potential predictive factors that are conducive to early, effective interventions.

In November 2013, a pipeline explosion occurred in an eastern coastal city of China, resulting in the death of 62 people and injuries to 136. The estimated cost of the damage was 75 million RMB. A middle school that was close to the explosion site was severely impacted, and some buildings were destroyed; however, there were no fatalities or serious injuries among the staff and students. This pipeline

explosion represents a relatively “equal-opportunity” occurrence because it struck somewhat randomly and independently of any preexisting CT. Thus, there is little imaginable link between CT experienced by the individuals in the explosion and the likelihood of being in the affected middle school at the time the pipeline exploded. Therefore, research on adolescents who experienced the pipeline explosion provides an opportunity to examine the moderation effect of CT on the association between current explosion exposure and development of PTSD with minimal potential of a selection-bias confound based on preexisting risk of trauma exposure.

The current study examined whether Chinese adolescents who had experienced the pipeline explosion developed PTSD symptoms as predicted by the stress sensitization model. Based on the stress sensitization model, we examined interactions between CT and recent explosion exposure to determine whether CT modified the effect of explosion exposure on severity of PTSD symptoms. Specifically, this study addressed two primary questions: (1) What are the relations between gender, CT, degree of explosion exposure, and PTSD symptoms in adolescents? and (2) Does a history of CT modify the relationship between explosion exposure and PTSD symptoms? It was hypothesized that females, high levels of explosion exposure, and CT would be associated with greater PTSD symptoms. In accordance with the stress-sensitization model, we also postulated that the association between explosion exposure and PTSD symptoms would vary as a function of past exposure to CT, and that adolescents with a history of CT and high explosion exposure would show the most severe PTSD symptoms in comparison to adolescents without CT and high explosion exposure and adolescents with or without CT and low explosion exposure.

2. Methods

2.1. Participants

The present study was based on data from a survey conducted four weeks after the pipeline explosion occurred in an eastern coastal city of China. All the seventh and eighth-grade students from the middle school close to the explosion were invited to participate in this study. Finally, 670 adolescents agreed to participate, giving a response rate of 85%. Written consent from the participants and their parents was obtained prior to the survey. The study was approved by the Research Ethics Committee of Shandong University School of Nursing.

2.2. Measures

The participants were asked to complete questionnaires in Chinese under the supervision of five trained assistant researchers. The questionnaire package included two standardized questionnaires as well as two questionnaires

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