



# Latent growth curves and predictors of depressive symptoms among Chinese adolescent earthquake survivors<sup>☆</sup>



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## ABSTRACT

The objective of this longitudinal study was to identify growth curves and related predictors of depressive symptoms among Chinese adolescent earthquake survivors. A total of 1573 adolescent survivors of the 8-magnitude Wenchuan earthquake were assessed through the Depression Self-Rating Scale for Children (cutoff for probable clinical depression: 15), Social Support Rate Scale, Adolescent Self-Rating Life Events Checklist, and a self-designed questionnaire covering earthquake exposure and demographic information at 6-, 12-, 18-, 24- and 30-months after the earthquake. Data were analyzed using growth mixture modeling (GMM) and multinomial logistic regression. The prevalence rates of depressive symptoms were 27.6%, 40.6%, 30.9%, 37.5% and 29.8% at 6-, 12-, 18-, 24- and 30-months, respectively. GMM analysis showed four patterns of growth curves for depressive symptoms: chronic depression (25.6% of the sample), recovery (1.7%), delayed depression (4.3%), and resilience (68.4%). Female gender was related with decreased probability of resilience. Direct witness of tragic scenes during the earthquake was related with higher risk for chronic depression. More negative life events and fewer social support were also common predictors of not developing the resilience pattern. The need of providing appropriate individualized interventions for high-risk adolescent earthquake survivors is indicated.

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## 1. Introduction

Earthquake is one of the most common natural disasters that are usually unpredictable, uncontrollable, and may cause great loss of life and property. Although it has been extensively evidenced that psychiatric disorders are prevalent in earthquake survivors, especially in children and adolescents (Davidson & McFarlane, 2006; Furr, Comer, Edmunds, & Kendall, 2010), previous research has also indicated that there are highly variable psychopathological reactive responses among earthquake survivors (Bonanno, Brewin, Kaniasty, & La Greca, 2010; Norris et al., 2002), and that the occurrence possibility of depression following earthquake among different populations varies in a wide range (Ekşi et al., 2007; Goenjian et al., 2011; Qu et al., 2012; Sharan, Chaudhary, Kavathekar, & Saxena, 1996). Yet, up till now, limited research has used growth mixture modeling or similar statistical techniques to explore the possible patterns of time-course depression trajectories among earthquake survivors. There are longitudinal studies that demonstrated the existence of heterogeneous time-course trajectories of psychiatric symptoms (including depressive symptoms) following traumatic experiences such as breast cancer (Deshields, Tibbs, Fan, & Taylor, 2006), severe acute respiratory

syndrome (Bonanno et al., 2008), severe physical injury (deRoos-Cassini, Mancini, Rusch, & Bonanno, 2010), and exposure to war (Bonanno, Mancini et al., 2012). In general, these studies observed four patterns of growth trajectories for post-traumatic psychiatric symptoms: 1) chronic dysfunction (i.e., prolonged severe symptoms); 2) recovery (i.e., initial moderate to severe symptoms followed by a gradual relief); 3) delayed dysfunction (i.e., postponed outbreak of severe symptoms); and 4) resilience (i.e., stable minimal or no symptoms). However, it remains relatively unclear about the heterogeneity in the long-term course of depressive symptoms following earthquake. Our prior study collected four waves of data from a large sample of Chinese adolescents exposed to the 2008 Wenchuan earthquake, subsequently at 6-, 12-, 18- and 24-months after the disaster, and reported the time-varying changes of depressive symptoms of the whole sample, without examining individual variation in developmental trajectories of depressive symptoms (Ye, Fan, Li, & Han, 2014). Thus, the primary purpose of the present study was to include data from further follow-up and identify the latent growth curves of post-earthquake depression in Chinese adolescent earthquake survivors.

Several predictive factors for the occurrence of depression following earthquake have been widely documented, such as gender, age, injury severity, social support, exposure to earthquake, and post-earthquake life adversity (Armenian et al., 2002; Ekşi et al., 2007; Goenjian et al., 2011; Sharan et al., 1996). One drawback existing in previous studies is that they mostly used the cross-sectional design, thus making it difficult to understand whether the predictive validities of these factors

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would be different for different people at different time points after earthquake. Only a few studies have longitudinally investigated the time-varying relationships between these predictors and post-earthquake depression. For example, Ye et al. (2014) reported that whereas loss/injury of family members and direct witness of tragic scenes during the earthquake could account for higher risk of adolescents' depression from 6 to 18 months following the earthquake, they could not predict adolescents' depression from 18 to 24 months following the earthquake. However, there is a dearth of research regarding the association of these predictors to the cluster membership of depression growth trajectories, i.e. whether and how these predictors are differently related to different clusters of depression growth trajectories. Accordingly, the present study also intended to contribute to the literature by addressing this issue.

Specific objectives of the present study were: 1) to examine the prevalence of depressive symptoms in adolescent survivors of the 8-magnitude Wenchuan earthquake, which occurred on May 12, 2008, 2) to identify clusters of adolescents showing distinct growth curves of depressive symptoms, through using growth mixture modeling, and 3) to explore significant predictors for the cluster membership.

## 2. Method

### 2.1. Participants and procedure

A total of 2463 students in the 7th–10th grades from two high schools in Dujiangyan City (which is 21 km away from the epicenter and one of the ten most affected areas by the earthquake) completed a package of questionnaires 6-months after the Wenchuan earthquake. The questionnaires assessed demographic characteristics, earthquake exposure, depressive symptoms, post-earthquake negative life events, and social support. Among them, only 7th and 10th graders, totally 1573 target students, were voluntarily recruited for the current study so that participants could be followed for at least 2 years before their graduation. Participants came from a variety of socio-economic backgrounds and thus could be considered representative of high school student population in the area.

All 1573 target students participated in the initial survey 6-months after the earthquake (T<sub>1</sub>; November 10–17, 2008) and were successfully followed up in 12-months (T<sub>2</sub>; May 18–22, 2009), 18-months (T<sub>3</sub>; November 23–27, 2009), 24-months (T<sub>4</sub>; May 17–21, 2010) and 30-months (T<sub>5</sub>; November 22–26, 2010). However, not all of them provided complete data on the measure of depressive symptoms at each wave of survey. Specifically, 1565 participants (99.5%) provided it at T<sub>1</sub>, 1429 (90.8%) at T<sub>2</sub>, 1287 (81.8%) at T<sub>3</sub>, 1312 (83.4%) at T<sub>4</sub>, and 1035 (65.8%) at T<sub>5</sub>. Only those (N = 1501) who provided complete data on the measure of depressive symptoms in at least 2 waves were included in the analyses for the current study. Table 1 presents demographics and earthquake exposure of the sample.

Ethics approval was granted by the Human Research Ethics Committee of the corresponding author's institution. Signed informed consent from both participants and their parents was obtained before each participant commenced the study. Participants were informed that they could withdraw from the study at any time.

### 2.2. Measures

Demographic information such as gender, age, number of siblings, grade, and location of residence was obtained at T<sub>1</sub>.

Depressive symptoms were measured by the Depression Self-Rating Scale for Children (DSRSC, Chinese-language version) (Su, Wang, Zhu, Luo, & Yang, 2003). Participants rated on a 3-point scale to report the frequency of 18 symptoms (0 = 'never' to 2 = 'mostly'). Su et al. (2003) established a norm for 8- to 16-year-old Chinese children from 14 cities in China and reported an average score of depressive symptoms of 9.77 (SD = 4.83). As it has been recommended for Chinese children, a

**Table 1**  
Demographics and earthquake exposure of participants (N = 1501).

Variable	n (%) or mean (SD)
Age at initial survey	15.0 (1.3)
Gender	
Female	826 (55.0)
Male	675 (45.0)
Grade	
7th grade	215 (14.3)
10th grade	1286 (85.7)
No. of children in the family	
1	1243 (82.8)
≥2	258 (17.2)
Residence location (n = 1459) <sup>a</sup>	
Urban	992 (68.0)
Rural	467 (32.0)
Family member injury or killed/missing (n = 1471) <sup>a</sup>	
No	1093 (74.3)
Injured	186 (12.6)
Killed/missing	192 (13.1)
House damage (n = 1467) <sup>a</sup>	
Minor/no	456 (31.1)
Moderate	381 (26.0)
Severe	630 (42.9)
Property loss other than house damage (n = 1475) <sup>a</sup>	
Minor/no	636 (43.1)
Moderate	516 (35.0)
Severe	323 (21.9)
Direct witness of tragic scenes (n = 1418) <sup>a</sup>	
No	570 (40.2)
Yes	848 (59.8)

<sup>a</sup> Number of participants differed from N = 1501 due to missing data.

cutoff score of 15 was considered for the presence of significant depressive symptoms (Su et al., 2003). In this study, Cronbach's alphas were 0.80, 0.81, 0.82, 0.84 and 0.84 at T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively.

Intensity of exposure to the earthquake was assessed at T<sub>1</sub> using four items: death, injury and/or missing of family members, house damage, property loss, and direct witness of tragic scenes. The first item included five choices: 1 = death of a family member, 2 = missing of a family member, 3 = severe injury of a family member, 4 = moderate injury of a family member, and 5 = none of the above. The other three items were rated on a 5-point scale, with 1 representing the highest level of exposure and 5 representing the lowest.

Post-earthquake negative life events were recorded at T<sub>1</sub> and T<sub>4</sub> for a time period of last six months, using the Adolescent Self-Rating Life Events Checklist (Chinese-language version) (Liu et al., 1997), which comprises 26 items and assesses life events including: interpersonal conflicts, academic pressure, family conflicts, punishment by guardians or teachers, humiliation, monetary loss, health problems, and death or illness of family members. A 5-point scale was used to rate the severity of negative life events (1 = 'never happened' to 5 = 'happened with very strong impact'), with a higher total score indicating greater severity. In this study, Cronbach's alphas were 0.88 and 0.91 at T<sub>1</sub> and T<sub>4</sub>, respectively.

Post-earthquake social support was measured by the Social Support Rate Scale (Xiao, 1994) at T<sub>1</sub> and T<sub>4</sub> for a time period of last six months. It includes 10 items clustering into 3 dimensions of objective support, subjective support, and utilization of social support. In this study, we adjusted the semantic expression of some items to suit the sample characteristics. For example, we changed "perceived support from the spouse" into "perceived support from companions". In this study, Cronbach's alphas were 0.76 and 0.80 at T<sub>1</sub> and T<sub>4</sub>, respectively.

### 2.3. Statistical analysis

As noted above, we include in the analyses only the participants (N = 1501) who provided complete data on DSRSCS in at least 2 waves. Among them, 872 (58.1%) provided complete data on DSRSC across all five waves and 629 (41.9%) had missing data on DSRSC in at

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