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Authors

Ying, Lihua

Chen, Chuansheng

Lin, Chongde

et al.

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The Relationship Between Posttraumatic Stress Symptoms and Suicide Ideation Among Child Survivors Following the Wenchuan Earthquake

LIUHUA YING, PhD, CHUANSHENG CHEN, PhD, CHONGDE LIN, PhD, ELLEN GREENBERGER, PhD, XINCHUN WU, PhD, AND LINA JIANG, PhD

The association between posttraumatic stress disorder (PTSD) symptoms and suicide ideation was examined in a sample of 2,298 child survivors of the Wenchuan earthquake. Results indicated that intrusion, avoidance, hyperarousal symptom clusters, and PTSD total score were significantly associated with suicide ideation. Except for intrusion, other measures of PTSD remained as statistically significant correlates of suicide ideation even after controlling for age, gender, direct exposure, indirect exposure, and depression. Furthermore, results showed that PTSD symptoms had an indirect influence on suicide ideation that was mediated by depression. The findings suggest that avoidance and hyperarousal symptom clusters of PTSD may be two important indicators of suicide ideation among child survivors of the Wenchuan earthquake. Implications of the results for intervention and prevention of suicide behavior are discussed.

The Wenchuan earthquake, with a magnitude of 8.0 on the Richter scale, occurred in central China in 2008. The earthquake led to 69,277 deaths and 374,643 people injured. In addition, 17,923 persons were listed as missing, and about 4.8 million were made homeless. For the survivors of the earthquake, loss of loved ones, exposure to reminders of the earthquake, change of social networks, and the disadvantageous

living conditions subsequent to the earthquake could be expected to bring about adverse psychological consequences. Suicide is an extreme example of such a consequence. Chou et al. (2003) found that victims were 1.46 times more likely than

LIUHUA YING, Department of Psychology, Zhejiang Sci-Tech University, Zhejiang, China, and Institute of Developmental Psychology, Beijing Normal University, Beijing, China; CHUANSHENG CHEN, Department of Psychology and Social Behavior, University of California-Irvine, Irvine, CA, USA; CHONGDE LIN, Institute of Developmental Psychology, Beijing Normal University, Beijing, China; ELLEN GREENBERGER, Department of Psychology and Social Behavior, University of California-Irvine, Irvine, CA, USA; XINCHUN WU, School of Psychology, Beijing Normal University, Beijing, China; LINA JIANG, Hangzhou Dianzi University, Hangzhou, China.

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Address correspondence to Lihua Ying, Department of Psychology, Zhejiang Sci-Tech University, Xiasha Campus, Hangzhou, Zhejiang Province 310018, China; E-mail: ying2269@sina.com and Chongde Lin, Institute of Developmental Psychology, Beijing Normal University, 19 Xijiekouwai Street, Beijing 100875, China; E-mail: linchongde@263.net

nonvictims to commit suicide following the 1999 Taiwan earthquake. Kessler et al. (2008) reported that suicide ideation rose from 2.8% to 6.4% in the 2 years following Hurricane Katrina. Suicide has been theoretically conceived as a continuum from suicide ideation to completed suicide, with suicide ideation as a precursor of attempted and completed suicide (Institute of Medicine, 2002; U.S. Public Health Service, 1999). Thus, to identify risk factors of suicide ideation is critical for the detection and prevention of suicidal behavior among child survivors of the Wenchuan earthquake.

Posttraumatic stress disorder (PTSD) is a commonly noted psychological reaction in the aftermath of an earthquake, which is characterized by persistent intrusive memories about the traumatic event, avoidance of stimuli associated with the trauma, and symptoms of hyperarousal (American Psychiatric Association [APA], 2000). Numerous studies have documented that prevalence rates of PTSD in child and adolescent survivors of earthquakes range widely, from 4.5% to 95% (Bulut, Bulut, & Tayli, 2005; Eksi & Braun, 2009; Giannopoulou et al., 2006; Goenjian et al., 1995; Hsu, Chong, Yang, & Yen, 2002; Roussos et al., 2005; Ying, Wu, & Lin, 2012; Zang, Zhang, & Wu, 2009). The disparity of PTSD rates across studies can be attributed to differences in the severity of earthquakes, the timing of psychiatric assessment, and the diversity of the research methodologies employed (Salcioglu & Basoglu, 2008; Ying, Wu, Lin, & Chen, 2013). For example, the rate of PTSD among children exposed to the 1999 Athens earthquake was lower than that found in the 1988 Armenian earthquake, perhaps because of their differences in magnitude (5.9 and 6.8 on the Richter scale, respectively) and/or the extent of the destruction (Giannopoulou et al., 2006).

Although previous studies have found mental disorders (e.g., affective disorder, personality disorder, and major depressive disorder) to be significantly associated with suicidality, the association between PTSD

symptoms and suicide ideation or behavior still remains unclear. One perspective is that it is not PTSD per se, but the co-occurrence of PTSD with other psychiatric disorders, especially depression, that leads to suicidality. For example, Bryan and Corso (2011) failed to find an association between PTSD and suicide ideation after controlling for depression in a sample of active duty military personnel ($M = 31.07 \pm 9.25$ years). The other perspective is that PTSD is independently associated with increased risk for suicide ideation or behavior, as has been found in patients with PTSD exposed to combat trauma (Fontana & Rosenheck, 1995; Skopp, Luxton, Bush, & Sirotnin, 2011) and physical/sexual abuse (Thompson et al., 1999; Ullman & Brecklin, 2002), as well as in non-clinical samples in community settings (Sareen, Cox, Goodwin, & Asmundson, 2005). For example, Mazza (2000) found that after controlling for depression and gender, PTSD symptomatology was significantly related to suicide ideation and marginally to suicide attempt in 106 adolescents ($M = 15.63 \pm 1.16$ years) in an urban high school. Another study showed that lifetime PTSD was associated with suicide ideation even after controlling for depression and other variables (e.g., age, family drug problems) in a sample of adolescents (12–17 years; Waldrop, Hanson, Kilpatrick, Naugle, & Saunders, 2007).

In addition to overall PTSD, researchers have examined the relationships between PTSD symptom clusters and suicidality and found them to be complex. Bell and Nye (2007) found that reexperiencing symptoms was uniquely and positively predictive of suicide ideation among 50 male Vietnam combat veterans with PTSD ($M = 57.7 \pm 3.8$ years), but avoidance and hyperarousal symptom clusters were not. Guerra and Calhoun (2011) found that only the “numbing cluster” (a five-item subcluster of the avoidance symptom cluster) of PTSD symptoms was significantly related to suicide ideation independent of the effects of depression among PTSD-diagnosed U.S. military veterans ($M = 38.3 \pm 10.2$ years). Similarly,

Lemaire and Graham (2011) revealed that the avoidance symptom cluster was associated with more risk than the reexperiencing or hyperarousal symptom clusters for current suicide ideation in returning Iraq and Afghanistan war veterans ($M = 29.4 \pm 8.4$ years). Additionally, Ben-Ya'acov and Amir (2007) found that in a community sample of adult men aged 25 to 45 years who had been exposed to traumatic life events, avoidance may serve as a buffer against suicide risk, while high levels of arousal may increase suicide risk. Finally, Tarrier and Gregg (2004) reported that suicidality was significantly correlated with intrusion and hyperarousal symptoms but not with avoidance symptoms in a sample of adult patients with chronic PTSD ($M = 37.4 \pm 13.3$ years). In a multivariate analysis with life impairment and depression as independent variables, however, neither of the above PTSD symptom clusters was uniquely associated with suicidality.

These findings from previous studies provided us with several theoretical explanations of the association between PTSD symptoms and suicidality among individuals who had experienced different types of trauma (i.e., combat trauma, physical/sexual abuse) or had different mental health histories (i.e., psychiatric patients, and community samples). However, several issues still need further examination. First, previous studies of the association between PTSD and suicide ideation or behavior have seldom involved survivors of natural disasters, especially child survivors (Panagioti, Gooding, & Tarrier, 2009). To our knowledge, only two studies have explored this issue among survivors of natural disasters. In a study of four communities exposed to Hurricane Mitch in Nicaragua, researchers found that individuals with a PTSD diagnosis reported significantly higher levels of suicide ideation (37.9%) than those without a PTSD diagnosis (9.0%; Caldera, Palma, Penayo, & Kullgren, 2001). In a study of adolescents who had experienced the threat of mudslides caused by Typhoon Morakot in Taiwan, Tang et al. (2010) found that PTSD had both direct and

indirect (via major depressive disorder) effects on an increased suicide risk.

Second, previous studies have mostly relied on the categorical model of psychiatric disorders and focused on individuals who met the criteria for PTSD. Relatively little attention has been paid to individuals with subthreshold PTSD symptoms (Dell'Osso et al., 2011), which occur at much higher rates than full-blown PTSD (Breslau, Lucia, & Davis, 2004; Lai, Chang, Connor, Lee, & Davidson, 2004; Marshall et al., 2001). Moreover, previous studies found that individuals with subsyndromal PTSD (i.e., individuals showing PTSD symptoms but not meeting the full criteria for PTSD) showed social or family impairment, comorbidity, and suicide ideation that were comparable to those observed in individuals with a full PTSD diagnosis (Breslau et al., 2004; Grubaugh et al., 2005; Marshall et al., 2001; Stein, Walker, Hazen, & Forde, 1997). Thus, it is clinically important to examine the whole spectrum of PTSD symptoms and suicide ideation, regardless of diagnostic status. Finally, a prior study on cross-national variation in youth (aged 13–15 years) suicide ideation showed that the prevalence of suicide ideation varied widely across countries and regions, ranging from a low of 0.7% in Myanmar to a high of 31.1% in Zambia (Page, Saumweber, Hall, Crookston, & West, 2013). Thus, we need to examine the association between PTSD symptoms and suicide ideation outside of Western culture.

Based on the limited evidence of an association between PTSD symptoms and suicide ideation among children and adolescents (Mazza, 2000; Tang et al., 2010; Waldrop et al., 2007), we hypothesized that (1) PTSD total score as well as three symptom clusters (i.e., intrusion, avoidance, and hyperarousal) would be positively associated with suicide ideation, even after controlling for age, gender, depression, and earthquake-related experiences (i.e., direct and indirect exposure) and that (2) depression would mediate the association between PTSD symptoms and suicide ideation.

METHOD

Participants and Procedure

Data in this study were collected as part of a large-scale study on psychological adjustment among child and adolescent survivors following the Wenchuan earthquake (Ying et al., 2013). In the study, 3,088 child and adolescent survivors were randomly selected from 20 primary and secondary schools in the counties of Wenchuan and Maoxian, the two areas most severely affected by the earthquake. Data were collected in May 2009, 1 year after the Wenchuan earthquake. This project was approved by the local education authorities (i.e., county departments of education), school principals, classroom teachers, and the Research Ethics Committee of Beijing Normal University. In China, research projects that are approved by local education authorities such as county departments of education and the school administrators and that are deemed to provide a service to the students do not require parental consent. The current project fits that category, and thus, written informed consent from parents was not obtained. Students were provided with a description of the research and were informed that participation was voluntary and that they had a right to decline to participate in the study. Informed consent was obtained from each subject. Under the supervision of trained individuals with a master's degree in psychology, participants took about an hour to complete the confidential questionnaires (ID-coded and matched with a name) in their classroom. Given that this study was initiated partly to help children cope with the aftermath of the earthquake, no incentives were offered to the students for their participation other than possible counseling if needed. Participants who were identified as having PTSD, suicide ideation, or other serious symptoms were provided psychological/counseling services.

From the initial targeted classrooms, 3,052 students (53.5% female, age range of 8–19 years) participated in the study, yield-

ing a response rate of 98.83%. This high rate was mainly due to the fact that this study was supported by the school authorities and teachers and was carried out during school time in the classroom. Participants completed a battery of questionnaires including the Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996; Zang, 2010), the Primary and Secondary Control Scale (PSCS; Chang, Chua, & Toh, 1997; Xin, Zhao, & Guo, 2008), the Social Support Questionnaire (Li, Zou, & Zhao, 2003), and the Connor and Davidson's Resilience Scale (CD-RISC; Connor & Davidson, 2003), among others. Due to the overall length of the study and the varying appropriateness of measures for different age groups, not all measures were administered to all students. Of most relevance to this study, for example, 754 secondary school students were administered a social support questionnaire but not the CDC's Youth Risk Behavior Surveillance System (YRBSS, Brener et al., 2004), which included a measure of suicide ideation. Thus, the current study analyzed the data from 2,298 child and adolescent survivors who completed all four main measures: the Child PTSD Symptom Scale (CPSS; Foa, Johnson, Feeny, & Treadwell, 2001), the Center for Epidemiologic Studies Depression Scale for Children (CES-DC; Fendrich, Weissman, & Warner, 1990; Weissman, Orvaschel, & Padian, 1980), the Earthquake Experience Scale (Chen, Lin, Tseng, & Wu, 2002), and a single-item measure of suicide ideation from the CDC's YRBSS (Brener et al., 2004). Of the 2,298 participants, 1,164 (50.7%) were female and 1,127 (49.3%) were male. The mean age of the participants was 12.7 years ($SD = 2.14$), with a range from 8 to 19 years. To evaluate whether there were systematic biases in the 754 participants who were not included in this study, they were compared with students from equivalent grade levels included in the current study ($n = 799$). Results showed that except for gender, $\chi^2(1, N = 1553) = 6.82$, there were no significant differences in age, $t(1551) = 1.33$, and mean scores on the main study

variables including PTSD, $t(1551) = 1.14$, and depression, $t(1551) = 0.43$).

Measures

Posttraumatic Stress Disorder. Post-traumatic stress symptom level was assessed with the Chinese version (Zang, 2009; Zhang et al., 2009) of the CPSS (Foa et al., 2001). This 17-item self-report measure was designed to assess the severity of DSM-IV-defined PTSD symptoms in relation to the most distressing event. Children reported the presence and frequency of symptoms during the past 2 weeks on a 4-point Likert-type scale, ranging from 0 (*not at all/only at one time*) to 3 (*many times a week or almost always*). The items were modified so that they were answered in reference to the Wenchuan earthquake the participants had recently experienced (e.g., “feeling upset when you think or hear about this earthquake”). Total possible CPSS scores range from 0 to 51; subscale scores range from 0 to 15 for reexperiencing, 0–21 for avoidance, and 0–15 for arousal, with higher scores indicating greater severity of PTSD symptoms. The Chinese version of the CPSS was first translated and used by Zang et al. (2009) in a study of children exposed to the Wenchuan earthquake. It has demonstrated acceptable validity and reliability (Zang, 2009; Zhang et al., 2009). In this study, the Cronbach’s α of the total scale was .85. Cronbach’s α s of the three subscales were lower but acceptable (i.e., .73 for intrusion, .66 for avoidance, and .69 for hyperarousal), and they were similar to those of a recent study that examined the psychometric properties of this scale for use with female adolescent sexual assault survivors [i.e., Cronbach’s α s = .74 (intrusion), .71 (avoidance), and .58 (hyperarousal); Gillihan, Aderka, Conklin, Capaldi, & Foa, 2013].

Depression. Children’s depressive symptoms were measured using the Chinese version (Li, Chung, & Ho, 2010; Wang, 1993) of the CES-DC (Fendrich et al., 1990; Weissman et al., 1980). The CES-DC is a 20-item self-report measure for the assess-

ment of emotional, cognitive, and behavior-related symptoms of depression. For each item, participants are instructed to assess the frequency of their reactions during the past week on a 4-point scale (0 = *not at all*, 1 = *a little*, 2 = *some*, 3 = *a lot*). Total possible scores range from 0 to 60, with higher CES-DC scores indicating increasing levels of depressive symptoms. The CES-DC has demonstrated good psychometric properties (Barkmann, Erhart, & Schulte-Markwort, 2008). The CES-DC was translated into Chinese in the early 1990s and was validated among various Chinese populations (Li et al., 2010; Wang, 1993). The Cronbach’s α of the scale in this study was .82.

Suicide Ideation. Following previous studies (An, Ahn, & Bhang, 2010; Baca-Garcia et al., 2011; Swahn & Bossarte, 2007), we assessed suicide ideation using one item from the national YRBSS of the Centers for Disease Control and Prevention (Brener et al., 2004). The Chinese version of YRBSS has been validated and has shown good validity and reliability (Zhang et al., 2001). The single item used in this study was “During the past half year, have you ever seriously thought about killing yourself?” Participants responded to the item on a 3-point scale (0 = *no*, 1 = *sometimes*, 2 = *frequently*). In this study, this item was recoded as a dichotomized variable (0 = *no*, 1 = *yes*) because very few subjects (2.6%) selected the third response option (“frequently”) on the 3-point scale.

Severity of Exposure to the Earthquake. The severity of exposure to the earthquake was assessed in terms of *direct exposure* (1 item, “Was the participant trapped or injured in the earthquake?” no or yes) and *indirect exposure* (22 items, i.e., a checklist of whether the participant witnessed or heard about a parent, other relative, teacher, classmate, friend, or another person he/she knew who was trapped, injured, or died during the earthquake). The items were modified from scales used in prior studies of natural disasters (Chen et al., 2002).

RESULTS

Descriptive Statistics and Intercorrelations Among Main Variables

Based on the *DSM-IV* (APA, 2000), subjects were identified as having probable PTSD according to the following criteria: (1) one or more items of an intrusion subscale scored 2 or 3; (2) three or more items of the avoidance subscale scored 2 or 3; (3) two or more items of the hyperarousal subscale scored 2 or 3. According to these criteria, the prevalence rates of probable intrusion, avoidance, hyperarousal, and PTSD were 52.0% ($n = 1196$), 13.4% ($n = 309$), 28.3% ($n = 651$), and 8.4% ($n = 192$), respectively. Weissman et al. (1980), the developers of the CES-DC, stipulated a cutoff score of 15 as being indicative of depression in children and adolescents. According to this criterion, the prevalence rate for probable depression was 39.5% ($n = 908$). In addition, the prevalence rates of suicide ideation were 14.4% ($n = 332$) for the total sample, 16.1% ($n = 187$) for females, and 12.9% ($n = 145$) for males; 39.6% ($n = 76$) for participants with probable PTSD ($n = 192$) and 12.2%

($n = 256$) for participants without probable PTSD ($n = 2,106$).

As shown in Table 1, suicide ideation was significantly correlated with depression and PTSD (the three PTSD subscales and the whole scale). Depression was significantly correlated with the PTSD scores. In addition, both age and gender were significantly correlated with suicide ideation as well as with PTSD and depression. Both direct and indirect exposure also had significant correlations with PTSD and depression.

PTSD Symptoms and Suicide Ideation

We conducted four multiple logistic regression analyses to examine whether the risk of suicide ideation was significantly correlated with PTSD total score and the three symptom clusters noted above, after controlling for age, gender, direct exposure, indirect exposure, and depression. Specifically, in each regression analysis, after entering all the preceding variables, the second-step variables were entered one at a time to assess each measure of PTSD's association with suicide ideation. The odds ratio for each factor after controlling for

TABLE 1
Descriptive Statistics and Intercorrelations Among Main Variables

	1	2	3	4	5	6	7	8	9	10
1. Age	—									
2. Gender	.02	—								
3. Direct exposure	.08**	-.02	—							
4. Indirect exposure	.17**	.01	.31**	—						
5. Depression	.24**	.12**	.11**	.17**	—					
6. PTSD intrusion	.05*	.12**	.14**	.20**	.56**	—				
7. PTSD avoidance	.17**	.06**	.11**	.18**	.65**	.57**	—			
8. PTSD hyperarousal	.21**	.09**	.09**	.16**	.69**	.57**	.64**	—		
9. PTSD total score	.17**	.10**	.13**	.21**	.74**	.83**	.87**	.86**	—	
10. Suicide ideation	.13**	.05*	.04*	.10**	.31**	.20**	.29**	.27**	.30**	—
Mean	12.73	—	0.27	5.92	18.78	4.53	5.07	4.56	14.17	—
SD	2.12	—	0.44	7.58	8.50	2.83	3.19	2.81	7.54	—

Note. PTSD = posttraumatic stress disorder.
* $p < .05$; ** $p < .01$.

TABLE 2

Hierarchical Logistical Regression for Suicide Ideation as a Function of Age, Gender, Direct Exposure, Indirect Exposure, Depression, and PTSD Symptoms

Step	Variables	<i>B</i>	<i>SE</i>	Wald	OR	95% CI
1	Age	.07	.03	5.68	1.07*	1.01–1.13
	Gender ^a	.00	.13	0.00	1.00	0.78–1.29
	Direct exposure	.08	.15	0.29	0.92	0.69–1.23
	Indirect exposure	.02	.01	4.32	1.02*	1.00–1.03
	Depression	.11	.01	166.15	1.11***	1.09–1.13
2 ^b	PTSD intrusion	.04	.03	2.06	1.04	0.99–1.09
	PTSD avoidance	.10	.03	14.51	1.10***	1.05–1.16
	PTSD hyperarousal	.13	.03	18.37	1.13**	1.07–1.20
	PTSD total score	.05	.01	16.19	1.05***	1.03–1.07

Note. Wald = Wald statistic; OR = odds ratio; CI = confidence interval; PTSD = posttraumatic stress disorder.

^aGender variable was coded as 0 = female and 1 = male.

^bThe second-step variables were entered one at a time to assess each measure of PTSD's association with suicide ideation after controlling for age, gender, direct exposure, indirect exposure, and depression.

* $p < .05$; ** $p < .01$; *** $p < .001$.

age, gender, direct exposure, indirect exposure, and depression are shown in Table 2. Results indicated that the avoidance symptom cluster ($B = .10$, $SE = .02$, $Wald = 14.51$, $OR = 1.10$ 95% CI 1.05–1.16), the hyperarousal symptom cluster ($B = .13$, $SE = .03$, $Wald = 18.37$, $OR = 1.13$, 95% CI 1.07–1.20), and the overall PTSD score ($B = .05$, $SE = .01$, $Wald = 16.19$, $OR = 1.05$, 95% CI 1.03–1.07) were significantly associated with suicide ideation, after controlling for age, gender, direct exposure, indirect exposure, and depression. However, intrusion did not make a unique contribution to suicide ideation after controlling for these variables ($B = .04$, $SE = .03$, $Wald = 2.06$, $OR = 1.04$, 95% CI 0.99–1.09). Additionally, it should be noted that age ($B = .07$, $SE = .03$, $Wald = 5.68$, $OR = 1.07$, 95% CI 1.01–1.13), indirect exposure ($B = .02$, $SE = .01$, $Wald = 4.32$, $OR = 1.02$, 95% CI 1.00–1.03), and depression ($B = .11$, $SE = .01$, $Wald = 166.15$, $OR = 1.11$ 95% CI 1.09–1.13) also made significant contributions to explaining suicide ideation.

We then examined whether depression mediated the relationship between PTSD symptoms and suicide ideation, fol-

lowing the guidelines for mediation analysis provided by Baron and Kenny (1986). Results showed that the PTSD total score was significantly related to suicide ideation ($B = .11$, $SE = .01$, $p < .001$) and depression ($B = .69$, $SE = .25$, $p < .001$), and depression was significantly related to suicide ideation ($B = .08$, $SE = .01$, $p < .001$). The relationship between PTSD total score and suicide ideation remained significant ($B = .05$, $SE = .01$, $p < .001$) when depression was entered into the model, but the Sobel test (for binary outcome variables, MacKinnon & Dwyer, 1993; Sobel, 1982) also showed a significant mediation effect (Sobel $z = 6.76$, $p < .05$). In other words, depression partially mediated the relationship between PTSD total score and suicide ideation.

DISCUSSION

To our knowledge, this is the first study that examined the association between PTSD symptoms and suicide ideation among child and adolescent earthquake survivors. Consistent with previous results from adult and child PTSD patients exposed to

combat trauma (Fontana & Rosenheck, 1995; Skopp et al., 2011) or physical/sexual abuse (Thompson et al., 1999; Ullman & Brecklin, 2002), as well as results based on community samples (Sareen et al., 2005), our results indicated that total PTSD symptoms were associated with an increased risk of suicide ideation among child and adolescent earthquake survivors, even after adjusting for age, gender, direct exposure, indirect exposure, and depression. Furthermore, consistent with a study by Tang et al. (2010), our findings showed that PTSD symptoms had an indirect influence on suicide ideation that was mediated by depression.

With respect to specific PTSD symptom clusters, our analyses indicated that the avoidance symptom cluster was positively associated with suicide ideation, after controlling for age, gender, direct exposure, indirect exposure, and depression (for a similar finding, see Guerra & Calhoun, 2011). One possible explanation for the association between the avoidance symptom cluster and suicide ideation is that those child survivors who scored higher on avoidance symptoms (i.e., expending more efforts to avoid thoughts, feelings, or conversations associated with the trauma) might have a more generalized avoidant coping style, as shown in previous studies (Amir, Kaplan, Efroni, & Kotler, 1999; Pineles et al., 2011; Schnider, Elhai, & Gray, 2007). An avoidant coping style has been found in a recent study to be linked to suicide ideation (Pietrzak, Russo, Ling, & Southwick, 2011). It should be noted, however, that an earlier study (Ben-Ya'acov & Amir, 2007) found that avoidance symptoms were negatively correlated with suicide risk in a community sample of men (aged 25–45 years) with no known psychopathology. The authors suggested that those individuals who scored higher on the cluster of avoidance symptoms fared better because they might have avoided developing a suicide-related schema. A possible explanation for the inconsistent findings may lie in the different roles that avoidance coping seems to play for children and adults. Previous research has shown that, as individ-

uals age, avoidance coping becomes more adaptive (Cukrowicz, Ekblad, Cheavens, Rosenthal, & Lynch, 2008; Mather & Carstensen, 2003). Future research is needed to directly compare developmental differences in the associations between avoidance coping and suicide ideation.

Consistent with the recent studies with adults (Ben-Ya'acov & Amir, 2007; Surris, Lin-Malcolm, & North, 2011), our results showed that the hyperarousal symptom cluster was significantly associated with suicide ideation, even after controlling for age, gender, direct exposure, indirect exposure, and depression. As suggested by other researchers (Litz, Orsillo, Kaloupek, & Weathers, 2000; Menning, Renz, Seifert, & Maercker, 2008), hyperarousal symptoms (e.g., sleeping difficulty, hypervigilance, and irritability) may lead to the depletion of the emotional and cognitive resources necessary for maintaining a positive mood state by redirecting attention to threat and anxiety cues, which in turn may increase the potential risk of developing suicide ideation (Simon et al., 2007). The finding of the current study suggests that hyperarousal symptoms are especially important in children's susceptibility to suicide ideation after a natural disaster.

Finally, the results indicated that although intrusion symptoms were associated with suicide ideation at the bivariate level, they were not a statistically significant predictor after controlling for other variables (i.e., age, gender, direct exposure, indirect exposure, and depression). This finding is consistent with a study by Bryan and Anestis (2011), who also found that the relationship between PTSD intrusion symptoms and two components of the desire for suicide (i.e., perceived burdensomeness and thwarted belongingness) could be explained by individuals' general state of mental health (e.g., hopelessness, depressed mood, or sleep loss). Therefore, compared with depressive symptoms, intrusion symptoms may not be a strong risk factor for suicide ideation among child and adolescent earthquake survivors.

This study has several limitations. First, to attain a large sample, we assessed PTSD and depressive symptoms by self-report questionnaire, rather than by clinical interview. Contrasted with interview-based measures for diagnosis, self-report measures may have overestimated or underestimated the prevalence rates of these disorders (Turner, Bowie, Dunn, Shappo, & Yule, 2003). Second, in the current study, because very few children of this age would show other aspects of suicidality such as suicide attempts, we were unable to examine the association between PTSD symptoms and suicidal behavior. In the future, a targeted sampling technique (not a community sample) is needed to generate enough subjects to understand suicidal plans or attempts among children. Third, suicide ideation was assessed using only one question from the YRBSS. Additionally, we recoded the one-item scale as a dichotomized variable because very few subjects (2.6%) selected the third response option (“frequently”) on the 3-point scale. Although many recent studies (An et al., 2010; Baca-Garcia et al., 2011; Nelson et al., 2011; Swahn & Bossarte, 2007) used one item to measure suicide ideation, multi-item scales may yield data that are more reliable and valid and have a better distribution for data analysis. Fourth, the reliability indices of the subscales of PTSD were moderate in magnitude, so caution is needed when interpreting our results and comparing them with those from studies that have measures with more reliable subscales. Finally, we collected the data of the current study 1 year after the Wenchuan earthquake. Thus, it is not clear whether psychological interventions some children received might have affected the current findings.

The results of the current study have implications for clinical service for child and adolescent survivors of an earthquake. The results suggest that clinical or school psychologists should assess PTSD symptoms (especially avoidance and hyperarousal symptoms clusters) as part of an overall evaluation of children’s vulnerability and resilience for suicide ideation, which could lead to suicidal behavior. Clinically, our results suggest that the therapies used to reduce PTSD symptoms might also be used to alleviate the risk of suicide ideation. Indeed, a new, integrated treatment combining behavioral activation and therapeutic exposure has been shown to be an effective treatment of PTSD symptoms as well as overlapping symptoms of PTSD and depression (Gros et al., 2012). Additionally, school-based interventions can be successfully utilized to help children and adolescents following a traumatic event (Foa, Keane, Friedman, & Cohen, 2008; Frueh, Grubaugh, Elhai, & Ford, 2012; Jaycox, Stein, & Amaya-Jackson, 2009; Jaycox et al., 2010; Rolfsnes & Idsoe, 2011; Wu, Lin, Zang, & Fu, 2010). For example, Stein et al. (2003) showed that a cognitive behavior group intervention can significantly decrease symptoms of PTSD in students who are exposed to violence and can be effectively delivered on school campuses by trained school-based mental health clinicians. Tol et al. (2008) also found that a school-based psychosocial intervention was effective to some extent (e.g., a moderate reduction in PTSD symptoms among girls) in a low-income, high crime rate context. Timely interventions need to be put in place to protect children who have experienced natural disasters (and other trauma) from the negative outcomes that they often entail.

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