

The Effects of Demographic Features on Differences in Sensitivity between PCL-C and SCL-90 Scores in a Follow-up Study in Secondary School Students in the Wenchuan Earthquake Region*

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Abstract

Objective To analyze the sensitivity of effect factors between the PCL-C and the SCL-90, to provide evidence for social psychological crisis screening and post-trauma interventions.

Methods We administered the PCL-C and SCL-90 to screen for PTSD and other psychological problems among students who survived the disaster and continued their school studies. The surveys were carried out 3, 6, 9, and 12 months after the earthquake. A bivariate 2-level logistic model was used to explore the different levels of sensitivity among students. The factors influencing the relationships between PTSD and depression, and between PTSD and anxiety were examined.

Results We analyzed data from 1 677 students, revealing that female students in higher grades were more likely to exhibit symptoms of depression, rather than PTSD, compared with the control group (males in lower grades), and the difference was significant ($P<0.05$). In contrast, ethnic minorities were more likely to exhibit PTSD symptoms compared to the others. In addition, female students were more likely to exhibit symptoms of anxiety than PTSD. Other effects that did not reach statistical significance were suggested to have a similar influence on PTSD, depression, and anxiety.

Conclusion After a natural disaster, specific aspects of depression and anxiety should be examined, avoiding an overemphasis on PTSD in social psychological crisis interventions.

Key words: PTSD; Depression; Anxiety; Bivariate 2-Level Logistic Model; Students; Natural disaster survivors

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INTRODUCTION

Posttraumatic stress disorder (PTSD) is a severe anxiety disorder that can develop after exposure to events resulting in psychological trauma. These events may involve the threat of death, or threats to physical, sexual, and/or psychological integrity, to oneself or to others. PTSD is typically much more enduring (but less

frequent) than other acute stress disorders. Characteristic symptoms of PTSD include re-experiencing trauma in flashbacks, avoidance of stimuli associated with the trauma, and increased arousal. Meanwhile, symptoms related to emotions, thoughts, behaviors, and physiological reactions typically accompany the whole course of the disease^[1-2]. Comorbidity is a common problem in PTSD^[3], and most PTSD cases are accompanied by

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other mental disorders (depression, mania), substance abuse, and anxiety, among other conditions.

A previous study reported that the incidence of PTSD among people affected by trauma was 10%-20%, while the lifetime prevalence was 8%^[4]. Approximately 50% of cases were found to develop a chronic course of the disorder, while one third suffered from PTSD for at least 10 years^[4]. According to the American Psychiatric Association (APA), the prevalence of PTSD in the US has been reported as 1%-14% (8%, average), while the prevalence for females has been reported at 10.45% compared with 5% for males^[5]. A study conducted in Algeria reported that the prevalence of PTSD reached 37.4% in the whole population, and that the suicide risk of PTSD patients was much higher than international norms^[6]. Only a small number of studies have examined young people affected by natural disasters. One study reported that the incidence of PTSD in teenagers after natural disasters ranged from 0-37%^[7]. Approximately one third of these adolescents showed a loss of interest in hobbies, some difficulties in concentration, a tendency to irritability, and depressed by disaster-related thoughts, and about 20% of them suffered from reliving the disaster^[8].

An earthquake of magnitude 8.0 on the Richter scale struck the northwestern margin of Sichuan Province, China, at 2:28 pm on May 12th 2008, with an epicenter at Wenchuan. According to the Chinese Ministry of Civil Affairs, the earthquake caused at least 69 196 deaths, with 374 176 injured and 18 381 missing. Much of the infrastructure of the region (including the water supply, electricity, gas, traffic, and communication facilities) was destroyed. This major catastrophe resulted in a high number of casualties, property loss, and a range of negative psychological impacts on the survivors. To ensure the social stability and guarantee inhabitants' quality of life following disasters, attention must be paid to psychological problems. Therefore, analysis of the trends in psychological state and the effects of social supports, crisis interventions and self-adjustment for survivors could benefit policy-making by providing a scientific basis for understanding post-disaster trauma.

Secondary school students constitute a special case, undergoing a period of physical and mental growth. Students of this age tend to have a strong ability to accept new ideas, and are typically at the stage of forming their own values, but their

psychological endurance and self-adjustment may have limits. Following a disaster such as an earthquake, young people could be expected to exhibit a complex range of psychological problems. Hence, it is important to examine students' mental health and explore the risk factors involved. The current study sought to develop a feasible scientific method for screening out PTSD and other psychological disorders, and to analyze risk factors to provide evidence for social crisis interventions following trauma.

MATERIALS AND METHODS

Participants

This study examined 1 966 students from three secondary schools, who originally lived in Wenchuan but relocated to Chengdu temporarily to receive regular schooling after the earthquake. We excluded students who were in the graduating classes at junior and senior high schools, considering that students under the additional pressure of entrance exams to the next level of study may suffer more severe psychological problems^[9-11].

Measures

Basic Information This study collected basic information regarding name, age, sex, grade, nationality, dwelling, injury, family members' injury, and loss, and property loss.

PTSD Checklist-civilian Version (PCL-C) The PCL is a standardized self-report rating scale for PTSD comprising 17 items that correspond to the key symptoms of PTSD. Three versions of the PCL exist: 1) The PCL-M is specific to PTSD caused by military-related experiences, 2) The PCL-C is applied generally for any type of traumatic event, and 3) The PCL-S is specific to symptoms in relation to an identified "stressful experience". In the current study, we adopted a version of the PCL-C based on the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV, 1994; compiled by the American Research Center for Post-Traumatic Stress Disorder), to identify PTSD-positive students.

On this scale, scores for each question range from 1 (not at all) to 5 (extremely). A total symptom severity score (range=17-85) can be obtained by summing the scores for each of the 17 items. The PCL-C can be scored in different ways. A diagnosis can be made by: 1) Determining whether an individual meets DSM-IV symptom criteria, i.e., at

least one B item (questions 1-5), three C items (questions 6-12), and at least two D items (questions 13-17). Symptoms rated as “Moderately” or above (responses 3 through 5) are counted as present. 2) Determining whether the total severity score exceeds a given cut-point. 3) Combining the method 1) and 2) to ensure that every individual exhibit sufficient severity and the pattern of symptoms which is required by the DSM for a diagnosis of PTSD^[1,12-14].

This approach for diagnosing PTSD has been shown to have reasonable sensitivity (0.60) and high specificity (0.99)^[15]. In the current study, we set the cut-point for screening positive at 38^[16-18].

The symptom Checklist-90 (SCL-90) The SCL-90 is a 90-item self-report symptom inventory, measuring current psychological symptom status over a time span of “the past 7 days including today.” The SCL-90 is used by clinical psychologists, psychiatrists, and professionals in mental health, medical, and educational settings as well as for research purposes. This instrument is designed to be useful in a number of contexts: 1) initial evaluation of patients at intake as an objective method for symptom assessment, 2) measuring patient progress during and after treatment to monitor change, 3) outcome measurement for treatment programs and providers through aggregated patient information, and 4) clinical trials to help measure changes in symptoms such as depression and anxiety.

The SCL-90 is designed to provide an overview of a patient's symptoms and their intensity at a specific point in time by measuring nine primary symptom dimensions: somatization (SOM), obsessive-compulsive (O-C), interpersonal sensitivity (I-S), depression (DEP), anxiety (ANX), hostility (HOS), phobic anxiety (PHOB), paranoid ideation (PAR), and psychoticism (PSY).

The scores for each question range from 1 (not at all) to 5 (extremely). A total symptom severity score (range=90-450) can be obtained by summing the scores from each of the 90 items. Each of the nine symptom dimensions comprises 6-13 questions, and the scores for each symptom are the means of the total scores of all questions related to the symptom.

In the current study, if the equipartition of one symptom dimension was greater than 2 points, we considered it a positive screening result^[19-20].

Procedure

All of the methods and procedures were approved by the Medical Ethics Committee at our institution. All participants were advised that they

did not have to answer any question that made them uncomfortable, and that they could withdraw from the process at any time without penalty.

Participants attended field investigation sessions once every three months after the trauma occurred. The study began in August 2008, and lasted for one year.

The questionnaire included a chart of basic information, PCL-C and SCL-90. The survey administrator explained the background and cautions (how to answer the sheet correctly) of this research before the survey commenced. All students filled in questionnaires during each session, and all the questionnaires were examined by surveyors before students handed them in.

Data Analysis

In a follow-up analysis, our results were characterized as multilevel repeated trials data. These analyses were limited to data from students who attended four investigation sessions. We took individuals’ repeated measurements as level 1 and measurements among individuals as level 2. Therefore, we analyzed the PCL-C results and each symptom dimension of SCL-90 in a bivariate 2-level logistic model to analyze the sensitivity of effect factors for PTSD and other psychological problems.

In a bivariate 2-level logistic model, we took PCL-C and SCL-90 scores as two responses, then calculated two logistic equations with effect factors as independent variables. After comparing factors’ coefficients between two equations, we summarized the differences in sensitivity of each factor to PTSD, depression and anxiety. The equations are shown below:

$$\begin{aligned} Y_{1j} &\sim \text{Binominal}(n_{1j}, \pi_{1j}) \\ Y_{2j} &\sim \text{Binominal}(n_{2j}, \pi_{2j}) \\ \text{Logit}(\pi_{1j}) &= \ln[p_1/(1-p_1)] = \beta_0\chi_{0ij} + \beta_2\chi_{2ij} + \beta_4\chi_{4ij} + \beta_6\chi_{6ij} + \beta_8\chi_{8ij} + \beta_{10}\chi_{10ij} + \beta_{12}\chi_{12ij} + \beta_{14}\chi_{14ij} + \beta_{16}\chi_{16ij} + \beta_{18}\chi_{18ij} \\ \text{Logit}(\pi_{2j}) &= \ln[p_2/(1-p_2)] = \beta_1\chi_{1ij} + \beta_3\chi_{3ij} + \beta_5\chi_{5ij} + \beta_7\chi_{7ij} + \beta_9\chi_{9ij} + \beta_{11}\chi_{11ij} + \beta_{13}\chi_{13ij} + \beta_{15}\chi_{15ij} + \beta_{17}\chi_{17ij} + \beta_{19}\chi_{19ij} \\ \text{cov} \begin{bmatrix} \text{resp}_{1j} \mid \pi_{1j} \\ \text{resp}_{2j} \mid \pi_{2j} \end{bmatrix} &= \begin{bmatrix} g(\pi_{1j}) \\ p[g(\pi_{1j})g(\pi_{2j})]^{0.5} g(\pi_{2j}) \end{bmatrix} \\ g(\pi) &= \pi(1-\pi)/n \\ i: &\text{level 1 (i repeated measurements); } j: \text{level 2 (j individuals);} \\ \chi_{0i}: &\text{constant; } \chi_{nij}: \text{effect factors; } \beta_n: \text{coefficient;} \\ \text{cov}: &\text{covariance; resp}_{1j}: \text{response 1; resp}_{2j}: \text{response 2;} \\ Y_{1j}: &\text{individual J's response 1's result; } Y_{2j}: \text{individual J's response 2's screening result;} \end{aligned}$$

p_1 : the probability for response 1's positive result;
 p_2 : the probability for response 1's positive result.

Multilevel analysis was applied because the data hierarchy in our research meant that individual data were not independent at one level. In this case, we took individual's repeated measurements as level 1 and differences between individuals as level 2. We then calculated all of the coefficients, which reflected different levels of sensitivity to responses, and was unique for each effect factor in this model.

The results of our multi-level model were found to be valid after excluding individual variation and repeated measurement variation, revealing the effect of one covariant on different response variables and the differences between them.

We chose MlwiN 2.02 to analyze our data. P-values less than 0.05 were considered statistically significant.

RESULTS

Descriptive Data

From August 2008 to May 2009, we conducted whole follow-up surveys. We examined 1 804, 1780, 1 727, and 1 742 students respectively for each survey, and the total numbers of usable questionnaires for each survey were 1 790, 1 744, 1 688, and 1 697. Overall, 1 677 students who took part in all the investigations, and their questionnaire responses were used as the final data for analysis.

Population

Students' ages ranged from 11 to 19 years. There were 764 males and 913 females, and most of the students belonged to ethnic minority groups (88.7%). A small number of students were physically injured in the earthquake (3.9%), and 78.7% of them suffered family property loss. A small number (2.1%) of the students lost family members in the disaster (Table 1).

PCL-C and SCL-90 Screening

Of the 1 677 students, 613, 515, 416, and 373 students were screened as PTSD positive with the PCL-C, at 3, 6, 9, and 12 months after the earthquake, respectively (positive rates of 36.5%, 30.7%, 24.8%, and 22.2%).

Table 2 shows the screening results for nine symptom dimensions of SCL-90. Before statistical testing, a trend was apparent in the data shown in Table 2, suggesting that psychological problems improved over time.

Table 1. Participant Demographic Information

Demographics		Frequency	Percent Age(%)
Gender	Male	764	45.6
	Female	913	54.4
Grade	Junior High School	716	42.7
	Senior High School	961	57.3
Ethnic	Minority Nationality	1 487	88.7
	Han Ethnic Group	190	11.3
Injury	No	1 611	96.1
	Yes	66	3.9
Death or Missing in Lineal Consanguinity	No	1 642	97.9
	Yes	35	2.1
Death or Missing in Non-lineal Consanguinity	No	1 396	83.2
	Yes	281	16.8
Property Loss	No	355	21.2
	Yes	1 322	78.8

Table 2. Screening Results for the Nine Symptom Dimensions of the SCL-90

Symptom Dimension		1 Time	2 Time	3 Time	4 Time
SOM	Positive	304	284	261	283
	Negative	1373	1393	1416	1394
O-C	Positive	847	767	613	579
	Negative	830	910	1064	1098
I-S	Positive	782	683	574	540
	Negative	895	994	1103	1137
DEP	Positive	695	573	476	459
	Negative	982	1104	1201	1218
ANX	Positive	649	535	432	413
	Negative	1028	1142	1245	1264
HOS	Positive	682	669	523	555
	Negative	995	1008	1154	1122
PHOB	Positive	597	518	436	451
	Negative	1080	1159	1241	1226
PAR	Positive	609	545	445	454
	Negative	1068	1132	1232	1223
PSY	Positive	477	435	392	361
	Negative	1200	1242	1285	1316

Note. Somatization=SOM, Obsessive-Compulsive=O-C, Interpersonal Sensitivity=I-S, Depression=DEP, Anxiety=ANX, Hostility=HOS, Phobic Anxiety=PHOB, Paranoid Ideation=PAR), and Psychoticism=PSY.

Bivariate 2-level Logistic Model Results

The variable assignments are shown in Table 3.

The results revealed that over the course of study, there was a trend that students’ psychological problems steadily improved, indicated by the negative correlation between time and both PCL-C and SCL-90 scores ($P<0.05$). In addition, we found significant differences between PTSD and SCL-90 symptoms.

Some of the effect factors we calculated in the model, indicated different levels of sensitivity between PTSD and depression, and PTSD and Anxiety. Table 4 indicates that gender, school grade and ethnicity exhibited different degrees of

correlation with PTSD and depression. Only gender exhibited different sensitivity between PTSD and anxiety. Females and students in higher grades were more likely to show depression symptoms than PTSD, and students were much more likely to exhibit PTSD symptoms if they were not of Han ethnicity. Between PTSD and anxiety, females tended to exhibit anxiety symptoms rather than PTSD. All the results above were significant. Thus, being female appeared to constitute an important risk factor for depression and anxiety, but not PTSD. If factors did not reach statistical significance, this indicated that they had the same effect between PTSD and depression, and PTSD and anxiety.

All other results are shown in Table 4.

Table 3. Variable Assignments in Bivariate 2-level Logistic Model

Variables		Assignment* & Definition		
Time	0 First time	1 Second time	2 Third time	3 Fourth time
Gender	0 Male	1 Female		
Grade	0 Junior High grade 1	1 Junior High grade 2	2 Senior High grade 1	3 Senior High grade 2
Ethnic	0 Han ethnic	1 Minority ethnic		
Injury	0 No	1 Yes		
Hospitalized	0 No	1 Yes		
Death or missing in lineal consanguinity	0 No	1 Yes		
Death or missing in on-lineal consanguinity	0 No	1 Yes		
Property loss	0 No	1 Yes		

Note. *0 meant reference level in bivariate 2-level logistic model.

Table 4. Bivariate 2-level Logistic Model Coefficient (SD) between PTSD and Depression, and PTSD and Anxiety

Variables*	PTSD(Sd**)	DEP (Sd**)	Wald χ^2	P	PTSD(Sd)	ANX(Sd)	Wald χ^2	P
Intercept	-1.501(0.356)	-0.885(0.366)	3.764	>0.05	-1.501(0.355)	-1.215(0.368)	0.780	>0.05
Time	-0.245(0.025)	-0.225(0.024)	0.681	>0.05	-0.246(0.025)	-0.238(0.025)	0.141	>0.05
Gender	0.335(0.056)	0.542(0.054)	17.936	<0.05	0.335(0.056)	0.595(0.056)	26.949	<0.05
Grade	0.023(0.024)	0.071(0.023)	5.195	<0.05	0.024(0.024)	0.036(0.024)	0.290	>0.05
Ethnic	0.112(0.037)	0.045(0.036)	4.341	<0.05	0.111(0.037)	0.083(0.037)	0.735	>0.05
Injury	0.617(0.135)	0.597(0.134)	0.029	>0.05	0.616(0.135)	0.585(0.135)	0.069	>0.05
Hospitalized	0.119(0.320)	-0.350(0.334)	2.663	>0.05	0.120(0.319)	-0.179(0.334)	1.048	>0.05
Death or Missing in Lineal consanguinity	-0.033(0.191)	-0.069(0.188)	0.080	>0.05	-0.017(0.191)	0.051(0.188)	0.162	>0.05
Death or Missing in On-lineal Consanguinity	0.201(0.073)	0.148(0.071)	0.705	>0.05	0.201(0.073)	0.229(0.072)	0.193	>0.05
Property Loss	0.638(0.075)	0.681(0.071)	0.099	>0.05	0.640(0.076)	0.601(0.074)	0.354	>0.05

Note. *:Variables were χ_{nij} (effect factors) in a bivariate 2-level logistic model. **:Coefficient (Sd) were β_n in bivariate 2-level logistic model.

DISCUSSION

An important step in identifying community needs is establishing the prevalence of psychiatric disorders^[21]. In the current study, prevalence of PTSD at 3, 6, 9, and 12 months after the earthquake were 36.5%, 30.7%, 24.8%, and 22.2%, higher than the prevalence reported in a number of previous studies^[22-24]. It is possible that the different reliability and validity of the scales used in earlier studies might have caused differences between the current findings and previous reports. However, we propose that the Wenchuan Earthquake is likely to have been the major cause of the high prevalence we observed. Generally, the intensity and extent of the trauma were positively correlated with its psychological impact on, supporting the notion that the disaster was the main reason for the high prevalence of PTSD.

One previous study reported that PTSD had severe comorbidity with depression, mania, anxiety and substance abuse^[3]. Another study indicated that, in a general model, the level of depression served as a significant mediator between 1) dissociation and trauma-related and 2) PTSD symptomatology^[25]. Our results indicated that females exhibited a tendency toward depression and anxiety symptoms, in accord with previous studies^[26-27], but that they tended not to exhibit PTSD symptoms. At the same time, being female was a risk factor for PTSD, depression and anxiety, compared to males.

In general, compared with teenage males, psychiatrists and social workers tend to focus interventions to young females, who are considered to be more open to discussion about their thoughts, including fears, anxieties, re-experience of the trauma, etc.^[28], and more likely to wish to express their feelings to relieve stress. This may explain the tendency of females to depression and anxiety rather than PTSD in the current study. Below we propose a possible model for the processes underlying this finding.

Following trauma, victims typically manifest psychological problems as symptoms of acute stress disorder (ASD) within 4 weeks, and some begin to exhibit PTSD symptoms in 3 months. Only a small proportion of victims exhibit delayed PTSD if PTSD symptoms show at 6 months after the trauma^[29]. During the first few months, several types of psychological aid were available to earthquake victims, especially students. As a result of this help and the particular psychological characteristics of

females, females tended to recover better from ASD, reducing the chances of developing PTSD. As such, they were more likely to show other chronic mental problems rather than PTSD.

In our study, students in higher grades were more sensitive to depression than PTSD, but the results revealed no difference between grades in the level of sensitivity to PTSD and anxiety. In accord with Fan and Sun's study of student survivors of an earthquake^[30], we found that students in higher grades were more likely to exhibit PTSD, depression and anxiety symptoms. We hypothesize that students in higher grades exhibited more symptoms of depression because they were more mature relative to younger students. Although their mature cognitive abilities and endurance may have helped them cope with the trauma in the acute stage (i.e. the 'cushion effect'), these abilities may have also led to a deeper realization of the destructive power of the earthquake and an understanding of the damage it caused. Thus, older students' mature cognition may have enhanced their experience of fears, horrors and other negative emotions compared to younger students, resulting in a tendency to develop more severe psychological problems, such as PTSD, depression and anxiety.

This earthquake occurred in a region in which ethnic minorities typically live in close communities. The ethnic minorities in this region include Tibetan, Qiang and Hui Muslim, among others. We hypothesize that the sensitivity to PTSD (but not depression) exhibited by people belonging to ethnic minority groups may have been related to their religion. It's said that there is psychological defense mechanism in their settlements^[31]. In addition, members of these minority groups typically believe in samsara (literally meaning "continuous flow", is the cycle of birth, life, death, rebirth or reincarnation within Buddhism, Hinduism, Bön, Jainism, Sikhism, and other Indian religions)^[32-33], which may have helped them deal with emotions related to loss in the earthquake, and help them avoid chronic mental problems such as depression and anxiety. These minority communities have their own languages, and a large proportion of their populations have difficulty understanding Mandarin. However, it is likely that many volunteers offering psychological assistance only understand Mandarin. A lack of efficient mutual communication may have meant that students received little help during the acute stages of trauma. This may have led to a situation in which students were unable to cope with the experience of

earthquake at first, resulting in ASD, which later developed into PTSD, as indicated in our results.

Although many psychological workers may have already determined the target diseases and the characteristics of their interventions, we believe our findings could help to lay a foundation for the screening of PTSD, anxiety and depression, providing a way of choosing sensitive screening scales to avoid false positives and false negatives in their results.

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