

A Follow up Study on the Elderly Survivors' Mental Health Two Years after the Wenchuan Earthquake

Ting Wang, Huiqin Yang, Buxin Han

Abstract—Background: This investigated the mental health of the elderly survivors six months, ten months and two years after the “5.12 Wenchuan” earthquake.

Methods: Two hundred and thirty-two physically healthy older survivors from earthquake-affected Mianyang County were interviewed. The measures included the Revised Impact of Event Scale (IES-R, Chinese version, for PTSD) and a Chinese Mental Health Inventory for the Elderly (MHIE). A repeated measures ANOVA test was used for statistical analysis.

Results: The follow-up group had a statistically significant lower IES-R score and lower MHIE score than the initial group ten months after the earthquake. Two years later, the score of IES-R in follow-up group were still lower than that of non-follow-up group, but no differences were significant on the score of MHIE between groups. Furthermore, a negative relationship was found between scores of IES-R and MHIE.

Conclusion: The earthquake has had a persistent negative impact on older survivors' mental health within the two-year period and that although the PTSD level declined significantly with time, it did not disappear completely.

Keywords—elderly survivors, follow-up, mental health, post-Wenchuan earthquake

I. BACKGROUND

OLDER adults are more vulnerable to natural disasters than adults are, as evidenced in previous studies[1]-[2]. In terms of physical health, decreased sensory awareness, disabled motor functioning, and chronic illnesses make it more difficult for them to escape quickly and to access support in crises. However, a definitive conclusion about the long-term mental health effects of disaster has not been established. On the one hand, older survivors have been considered able to recover from the impact on mental health faster and better than young adults.

Ting Wang was with Graduate University of Chinese Academy of Sciences, Center on Aging Psychology, Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences. Datun Road, A 4th, Chaoyang District, Beijing, China(e-mail: wangting@psych.ac.cn)

Huiqin, Yang was with Consult Center, Southwest University of Science and Technology, Mianyang, Sichuan, China(e-mail: yanghuiqin@swust.edu.cn)

Corresponding author: Buxin, Han was with Center on Aging Psychology, Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences. Datun Road, A4th, Chaoyang District, Beijing, China (phone: (+8610)64879731 e-mail: hanbx@psych.ac.cn)

This study was partially supported by the National Hi-Tech Research and Development Program of China (Grant No. 2008AA022604), Earthquake Relief Project of China Association for Science (Grant No. 113000H369), and the Knowledge Innovation Project of the Institute of Psychology, Chinese Academy of Science (Grant No. 08CX103010)..

Two theories prevailed concerning the resilience of older adults after a natural disaster: maturation hypothesis and inoculation hypothesis [3]. The maturation hypothesis proposed that in the face of disaster, older people focus on more positive emotions than younger adults do, and the inoculation hypothesis claimed that aging adults draw on the accumulated experience of past events to garner the ability to cope with strong emotional responses generated by trauma. On the other hand, certain clinical and laboratory studies have concluded that aging survivors are at greater risk of suffering mental health problems [4]-[7]. There are also two explanations about effects of age — resource and exposure. The resource theory suggests that aging people are not easily to recovery because of lower socioeconomic status of aging and weak functional capacity. The exposure theory suggests that the elderly are not easily aware the disaster signal and are more likely to hurt by the property loss and people death surpass general level [8].

Post-traumatic stress disorder (PTSD) is common in disaster-affected populations and serves as a general indicator to evaluate survivors' mental health status following a disaster. Various scales (e.g., IES, IES-R, PCL-C) have been used to screen PTSD in previous studies. The most frequently reported PTSD symptoms were intrusive, flashbacks, hypersensitive, difficulties sleeping, avoidance, and impaired memory. It is document that older people are more prone to exhibiting PTSD symptoms than younger adults [6], [9]. However, it is argument about relationship between age and PTSD symptoms level. Goenjian et al found older adults scored higher on arousal symptoms and lower on intrusive symptoms than younger adults one and half years after the 1988 earthquake in Armenia [10]. Norris et al. investigated PTSD and age in different nation population after the 1992 Hurricane Andrew in the United States [11]. The results showed age had a curvilinear relation with PTSD among Americans, a linear and negative relation with PTSD among Mexicans, and a linear and positive relation with PTSD among Poles six to twelve months. An investigation on the changing tendency of PTSD symptoms in mainland China, which provide materials in contrast with areas under different culture, is need.

Furthermore, PTSD is usually complicated with depression, anxiety, suicide, and some clinical mental disorder symptoms. Suicide is one of the most common mental health crises in older populations in the world. Qin and Mortensen reported that older adults had the highest suicide rate among all age groups, especially in rural China [12]. Elderly survivors who are unmarried, living alone, or possess low education levels are especially prone to PTSD [7], [13]-[14]. People with these risk factors were more likely to attempt suicide [15]-[16]. It suggests

that aging people with PTSD symptoms are at a greater risk of exhibiting suicidal behaviors. Brandtstadter, Wentura and Greve proposed accommodation and assimilation as ways of responding to stress [17]. Accommodation refers to one's self-regulation of goals or preferences to adapt to the outside world, and assimilation refers to the effort to achieve personal goals by altering the environment. Older people are more likely to choose accommodation rather than assimilation under conditions of traumatic stress. Namely, they are more likely to reformulate their attitudes to adapt themselves rather than their situation. The self-healing process refers to diverse post-trauma responses and psychological resources of earthquake survivors, for example, cognitive efficiency, emotional state, and interpersonal communication. However, in previous studies, indicators of mental health were normally restricted to clinical disorder symptoms such as PTSD, depression, and anxiety.

In mainland China, longitudinal data on the mental health of older population after a disaster is still very limited although numerous studies established out abroad. Existing studies involved almost no mental health assessment prior to the disaster and the follow-up period was limited to one year. Our previous article described the mental health status of older survivors four months pre-earthquake and six months post-earthquake in Mianyang area, which showed that older survivors' mental health status was adversely affected by the earthquake [18]. This paper is one part of our longitudinal study in the earthquake-affected areas, intended to follow up on and analyze the change tendency of elderly survivors' mental health over a longer period.

In addition to exploring the change of mental health status over time, some interview surveys were conducted before and after the disaster and some were designed as long-term follow up studies. Most studies on disaster have indicated that the incidence of PTSD decreased most rapidly in the first year after trauma, more gradually in the second year, and stabilized into a chronic condition after two years. However, a few studies have also found that PTSD morbidity exhibited a transient increase during the first year [9], [19]-[24]. A small number of aging adults were involved in previous studies. With the exception of intrusion memory and unfocused attention symptoms' level in PTSD patients, few longitudinal studies on cognitive efficiency in aging survivors have been conducted. With respect to emotional responses, it is well known that people under stress often have negative feelings like fear, anger, helplessness, and hopelessness or depression, anxiety, and emotional numbness. An important feature of previous studies involved assessing differences of emotional regulation strategies between young and older adults. However, there have not been many studies focused on the status of positive emotional responses after trauma.

From a large body of research on aging and mental health, performance in coping with stress was related to individuals' social status, salary, physical health, and accumulated experience. Participants in this paper came from a non-clinical community-based sample of Wenchuan earthquake survivors aged 55 and over. All the participants were born before 1953, and all had experienced the political upheaval of the Cultural Revolution from 1966 to 1976 and the three-year harvest

disaster from 1959 to 1961. According to the inoculation hypothesis, their accumulated knowledge, tested coping style, and improved psychological maturation in the past may make elderly individuals more resilient in the face of crisis.

To our knowledge, this is the first study to investigate the mental health of aging adults more than one year after a natural disaster in mainland China. Our aim is to investigate how the mental health status of aging survivors changes over time and to evaluate mental health in a more multi-faceted manner than looking exclusively at PTSD.

II. METHODS

A. Participants

Initial data collected from shelter communities whose residents were from Mianyang city. It lies in the northwest of city — High-tech industries development zone — surrounding by several villages, removed in June, 2010. We conducted three sets of survey six months (November 2008), ten months (March and April 2009), and two years (June and August 2010) after the earthquake. Two hundred and thirty-two older survivors took part in the first survey six months after the disaster, which was set as T0. The other two surveys were set as T1 and T2. We defined two analytic samples for this study in order to test the time effect. The first includes subjects who participated at T0 and T1; the second consists of subjects who participated at T0, T1, and T2. In sample one (2009, T1), we followed up with 232 older survivors four months after T0. In sample two (2010, T2), among the 232 subjects in T1, 120 survivors were involved in the follow-up survey. The response rate for T2 was 51.7%. The participants lost to follow up either refused to continue or lost contact after relocating.

In this paper, we selected age 55 as the lowest age of inclusion on account of the retirement age for women, which is five years earlier than for men in China. The age of the study sample ranged between 55 to 97 years and the average age in the two samples was 68.16 ± 9.26 and 68.38 ± 9.30 . All participants have no collective trauma experience according to their self-report. Their demographic characteristics, including age, gender, educational background, marriage, and nationality, are shown in Table I. There is no significant difference regarding gender, age, and nationality across the follow up and non-follow up groups at $p = .05$, but there were differences across groups in marriage, educational background, and profession. All the participants were able to communicate with interviewers fluently and were not hindered by conditions such as stroke and dementia.

B. Questionnaires

1. Social-demographic information. Socio-demographic qualities, including gender, age, marital status, educational background, psychiatric diseases history and daily self-care ability were addressed by the scale.
2. Earthquake experiences. Feelings of personal safety, property damage, loss of family member, and physical injury from the

earthquake were assessed. The questions included the following: "Do you have feelings of fear, helplessness, and terror?" "Were you trapped somewhere after the earthquake?" "Do you have an injury worse than a bruise?" "Did you see houses get destroyed?" "Have your relatives or friends been wounded?" "Have any relatives or friends died?" "Have you witnessed death or dying?" "Have you seen or touched corpses?" The participants gave binary responses in "yes" or "no" form.

3. The Impact of Event Scale-Revised (IES-R). PTSD symptoms were assessed using the Impact of Event Scale-Revised, which is a self-report scale designed to measure PTSD symptoms and is widely used in China [25]-[28]. The scale includes twenty-two items, with six items for intrusive symptoms, eight items for arousal symptoms, and eight items for avoidance symptoms. The participants completed the questionnaire from "completely unfit" to "completely fit" according to a five-point Likert scale. The Cronbach α coefficients for the overall score in this sample were .94-.95 in administrations and .83-.90 for the subscales.
4. Mental Health Inventory for the Elderly (MHIE). Mental health status was measured by the Mental Health Inventory for the Elderly, developed by the Aging Psychology Center, Institute of Psychology, Chinese Academy of Sciences [29]. MHIE scores represent an individual's mental health status within the last month. The theoretical proposition of the questionnaire is "mental health as a harmony and stable state of mind such that inner psychological processes can be well-adapted with the external environment." It includes 65 items distributed over five subscales, including cognitive efficient, emotional states, self-perception, interpersonal communication, and adaptive ability, with ten, 15, 11, ten, and 19 items in each subscale respectively. The questionnaire developed from a survey of 5149 older adults sampled from 29 cities in mainland China. The Cronbach α coefficient is .95 for the overall score and .75-.95 for five subscales. The test-retest reliability of the scale is .92 and for the subscales, .71-.93. The confirmatory factor analysis revealed $\chi^2/df = 22.90$, NFI = .95, NNFI = .95, IFI = .95, CFI = .95, RMSEA = .07. In addition, the mental health score was correlated significantly with subjective happiness, depression, and other relevant variables. People completed the questionnaire according to real-life perceptions from "completely unfit" to "completely fit" in a four point Likert scale. The Cronbach α reliability coefficient for the overall scale is .93-.95 and for the subscales is .75-.88 in the current study.

C. Procedure and Statistical Analysis

Students from Southwest University of Science and Technology, speaking the local dialect, helped researchers interview the participants by face-to-face. We did the T0 and T1 investigations in shelters and the T2 we met participants at their home for shelter houses moved. All participants and their family members were informed the purpose, risks, benefits, confidentiality, and voluntary participation of the interview, as well as the right to withdraw anytime during the study if they felt uncomfortable. Participants were permitted to finish the

questionnaire by themselves or have volunteers read items aloud to them then made corresponding choice. Each interview lasted about 40-50 minutes. Results were computed off-line with SPSS 15.0. Group differences in social-demographic information and exposure effect of the earthquake, respectively, were tested among follow-up and non-follow-up groups using a Chi-square test. The exposure level, which showed significant difference between groups, was set as the covariate for statistical analysis. Differences in mental health status were evaluated using repeated measured ANVOA. The two post-disaster assessments were included in the test of within-subjects effects.

III. RESULTS

A. Earthquake Experience

According to the self-report of 232 participants, the percentage of elderly individuals who were able to adequately care for themselves before and after the earthquake decreased from 75.9% to 66.8% ($\chi^2 = 5.01$, $p = .08$), while those depending on care by others increased from 4.3% to 7.8%. About the earthquake exposure, there are no differences between the follow group and non-follow group of experiences such as being trapped, being seriously hurt, witnessing the destruction of houses, or feelings of fear, helplessness, and terror. Differences were found with regard to the number of lost ($\chi^2 = 5.01$, $p = .04$) or wounded ($\chi^2 = 9.51$, $p = .00$) relatives or friends, witnessing the death of relatives or friends ($\chi^2 = 4.29$, $p = .04$), and seeing or touching corpses ($\chi^2 = 7.81$, $p = .01$), at $p = .05$. The participants who not followed on in T1 experienced much more exposure to traumatic events in the earthquake.

B. Results of First Follow-up Study

At 10 months after the earthquake, the follow-up group had a statistically significant lower mean PTSD score than the initial group (Table II). The difference remained statistically significant across intrusion and arousal symptoms after nearly one year, though not for avoidance symptoms.

A significant decline on mental health status measured by MHIE was found in the first round, in which the follow-up survivor group reported poorer mental health. The total scores on mental health ($F(1,231) = 2.46$, $p < .05$) differed significantly. For the cognitive efficiency subscale, there was no difference between the level of the two post-earthquake surveys ($F(1,231) = 0.00$, $p > .05$). The self-perception subscale scores declined at the 10th month ($F(1,231) = 9.17$, $p < .01$) as did scores for interpersonal communication ($F(1,231) = 5.18$, $p < .05$). Score differences between groups on emotional state also reached statistical significance ($F(1,231) = 7.20$, $p < .01$). There was no significant difference ($F(1,231) = 3.08$, $p = .08$) in the adaptability between groups. Participants reported fewer problems with intrusive and arousal symptoms but no change with respect to avoidance symptoms ($F_{intrusive}(1,231) = 5.86$, $p < .05$; $F_{arousal}(1,231) = 7.44$, $p < .01$; $F_{avoidance}(1,231) = 1.32$, $p > .05$).

C. Results of Second Follow-up

This follow-up group had a statistically significant lower mean PTSD score than the initial group in the second circle (Table II). The same pattern of change was observed in the subscale scores, though the mental health scores of MHIE showed no significant decline with the extension of time.

D. Correlation Between PTSD and Mental Health

At ten months and two years after the earthquake, the results showed that scores of PTSD negatively and significantly correlated with that of mental health at $p < .01$ (Table III).

IV. DISCUSSIONS

A. PTSD Symptoms Decreased in Two Years

We assessed the level of posttraumatic symptoms among older survivors after the earthquake. At each round, subjects from follow-up groups experienced less intrusion memory and arousal symptoms than they reported in their initial assessment. However, there was no significant reduction of avoidance symptoms in two years. This is consistent with the results of a study on children's PTSD after Wenchuan earthquake [30]. It reported a decline in intrusion and arousal symptoms but no difference in avoidance symptoms among children and adolescents in the two periods (one month and seven months) of time following the Wenchuan earthquake. Norris, Perilla, Riad, Kaniasty and Lavizzo reported a prevalence of intrusion and avoidance symptoms in adult survivors with an average age of (48.5 ± 17.0) [31]. These symptoms decreased 5.0% and 9.5%, respectively, although arousal prevalence increased 6.2% in the two years after a hurricane. The above results revealed that psychological performance after natural disasters and trauma or population type did not exhibit a stable relationship. Different people respond differently to different forms of disaster. Kato, Asukai, Miyake, Minakawa and Nishiyama attributed the reduction of PTSD symptoms among older subjects (defined as being at least 60 years old of age) to such factors as decreased psychological stress, extensive social networks, and previous disaster experiences [32]. Further studies need to clarify the mechanisms affecting elderly population's response to disaster.

B. Indicators of Mental Health Turned Worse or Kept Stable in Two Years

According to our previous study, the mental health of the elderly declined before and after the earthquake. At the 10-month mark, the mental health of the 232-person group decreased. However, the total score did not fare better or worse after two years of follow-up. It may be attributable to the effect of earthquake exposure, which was higher among the non follow-up population. Secondly, unmarried marital status and fewer educational qualifications in the non follow-up group, are classic predictors of lower mental health after a disaster [33].

The negative correlation between scores of IES-R and MHIE also indicated that aging survivors two years after the Wenchuan earthquake did not present a mental health improvement rate as PTSD symptoms declined.

The underlying mechanisms are discussed as follows:

1. Cognitive efficiency. Cognitive efficiency specifically refers to memory and attention in the MHIE scale. According to our past study in Mianyang, the level of cognitive efficiency declined in survivors age 60–74 six months after the earthquake [18], consistent with the hypothesis that continual stress produced by negative life events has a negative impact of cognitive efficiency [34]. In our previous study in Beichuan County, the epicenter of the earthquake, we found that the participants' cognitive efficiency level declined at both 4 months and 10 months after the earthquake compared with pre-earthquake data [35]. The Mianyang follow-up study did not show any change in cognitive efficiency after two years, which suggest that traumatic exposure has a different impact on individual cognitive efficiency. Another consideration regards the discrepancy between time of onset and the interview. Deeg, Huizink, Comijs and Smid found cognitive efficiency of the elderly showed a temporary improvement six weeks following the disaster in the area nearest to the site of the disaster that in turn decline in the next period [36]. However, that study did not show any change in other areas. The author attributed this phenomenon to individuals' increased anxiety or arousal level in the period immediately following a disaster, due to the increased strain on cognitive resources to cope with fear, nightmares, and so on. Furthermore, there exists no definitive cut-off point with respect to previous studies, so a clear description about the patterns of cognitive change over time requires further investigation.
2. Emotional state. This subscale consists of items concerning positive emotion (e.g., happiness, feeling energetic, relaxation, feeling pleased) and negative emotion (e.g., displeasure, unhappiness, or anxiety). Yet, Shemesh et al. found that elderly survivors (55 years above) scored higher on emotional distress than subjects without extermination camp experiences did after the Second World War [37]. Ben-Zur and Zimmerman also found that the extermination camp survivors (age range: 78–83 years) rated higher than the comparison group on negative affect 60 years later [38]. As early as in 1980th, western researchers found negative emotional effect persisted in aging survivors more than one year [39]. In our study, the elderly stated they experienced less positive emotion but reported no changes with respect to negative emotion during two rounds of self-reporting. Namely, ongoing exposure would affect not only negative emotion but also positive emotion in an aging population. Studies have suggested that age-related emotional reactions may correlate with the social support, cultural, and historical context of the disaster-stricken [40].
3. Interpersonal communication. Information from others can help aging population reduce stress. This subscale detects the frequency of older adults' interactions with others. Wang, H. H. et al. reported that survivors of a coal mining disaster had significantly higher prevalence rates of interpersonal symptoms, measured by SCL-90, at 3 months and 6 months

after the disaster [41]. However, Lin et al. reported better social relationships for older survivors 12 months after an earthquake [22]. Our results were similar to those of Wang, H. H. The participants told us that they would rather stay at home, isolated from others, than participate in social activities. We consider that if they received much social support from public, older survivors would tend to utilize more avoidance strategies to deal with stress. They did not take full advantage of interpersonal supports after the earthquake. There were two reasons for this. First, older survivors reported having fewer friends after the trauma than before. Some lost lives in the earthquake; some others lived outside the city after the earthquake. Second, psychological stress and adverse emotional response reduced the motivation to engage in interpersonal activities.

4. Self-perception. This subscale relates to the degree to which survivors evaluated and accepted themselves after the earthquake. Scores of self-perception decline in the 10-month follow-up group. Bodvarsdottir & Elklit reported a correlation between self-worth and the development of PTSD symptoms but did not establish the principle cause [42]. We found that some older adults expressed anxiety over burdening family members because of weak physical health after the disaster. Moreover, individuals who lost relatives, especially children, in the disaster often attribute the death to their own powerless to protect them, producing guilt and remorse. Individual traits may play an important role in the subjects' self-ratings.
5. Adaptation ability. This subscale refers to the coping behavior and resilience of aging adults. If older survivors had previous experience with natural disaster and other potentially relevant lifetime events, they would demonstrate better adaptation and greater resilience in the face of subsequent nature disasters [2]. Aging adults were considered to have better resilience than other age groups because of their rebuild perception of traumatic events protect them from strong emotional responses [43]. Weak adaptation ability could cause psychological problems or struggles in daily life. Our results revealed that the adaptation of aging adults reduced after the disaster and did not recover after two years [18]. Older participants in Mianyang may, who were in lower exposure, received less social support than aging survivors at the earthquake epicenter did. According to the "Psychological Typhoon Effect" reported by Li, et al [44], the more people suffer economic and physical damage, the stronger is the resilience demonstrated by young adults. Does the phenomenon still exist in aging population? The current results showed no interaction between age group and adaptation ability loss. A test of adaptation or resilience between age groups will have to be conducted in future studies.

C. Dissociation of MHIE Indicators and PTSD Two Years after the Earthquake

The current study found that PTSD symptoms decreased while indicators of mental health measured by MHIE declined

or remained stable within two years after the earthquake. This dissociation implied the existence of a different mental and behavioral development over time after the earthquake. This recalls the dissociation between emotion and behavior among Chi-Chi earthquake survivors in Yu-Chi, Taiwan [45]. In that study, the occurrence of PTSD and symptoms of depression decreased but the rates of suicide and alcohol addiction increased within 3 years after the Chi-Chi earthquake. The different methodologies and target populations of the two studies limit the number of conclusions that can be drawn from their commonalities, but both imply that more attention should be paid to mental health indicators, rather than merely the psychiatric symptoms of PTSD. Furthermore, the number in the study may be too small compare with the community affected by the earthquake for a PTSD follow up study. However, we think it is enough to reflect the dissociation between PTSD and mental health indicators measured by MHIE as distribution of the sample population is more concentrated.

In summary, this study provided further support for the assertion that the mental health of aging adults is comparatively poor, despite the resiliency of that group, perhaps as a result of having experienced nature disasters in the early life. It could not provide a full support to the inoculation and mature hypothesis. However, it is consistent with exposure and resource explanations that the elderly are voluntary to be long-time affected by nature disaster. Reduction in close relationship, adaptation to new environments, and social services were all reflections of lack of resources. Our results mimicked other studies with respect to PTSD change over time. In future research, it would be interesting to compare post-disaster mental health between different age groups.

This study has several strengths: (1) we explored the impact of disaster in greater depth by conducting follow-up interviews with the same participants two years after the earthquake; (2) the multi-dimensional mental health indicators cover a broader range of information than single mental disorder symptom. The assessment of mental health status may shift clinical focus from clinical symptoms of mental disorder to aspects individuals' daily mental functioning.

There is a sample selection bias. Our sample was restricted to one geographic area, and the elderly individuals interviewed for the initial survey were not randomly selected from the entire population, but from evacuees who remained in the shelter during the daytime. Therefore, the results may be biased toward an overestimation of the severity of symptoms. The follow-up sample size is also limited, as we lost contact with those who left the temporary shelter, while those who remained may have been prone to a greater mental health decline by the second round of interview.

We screened the participants' health condition according to their self-reporting. A clinical diagnosis should be used as a control variable to ensure accurate results. Our subsequent studies will involve a clinical psychologist to help screen subjects. Any mechanisms reflected psychological recovery process would be detected by researchers.

V. CONCLUSIONS

Our study investigated the change of mental health levels in an aging population in response to earthquake two years after its occurrence. We found:

(1) The PTSD total score decreased after two years, which means that the PTSD level declined over time but did not completely disappear.

(2) The mental health status measured by MHIE did not show any change after two years. It may imply that a weak educational background and unmarried status older survivors correlate with poor post-disaster mental health, according to the socio-demographics characteristics of the non-follow up population.

(3) There is a negative relationship between PTSD and MHIE indicators during the follow-up investigation, indicating a more complicated concept of mental health.

TABLE I
SOCIO-DEMOGRAPHIC VARIABLES IN THE FOLLOW-UP GROUP

| variable | T0 | T1 | T2 | | χ^2 | P |
|---|------------|------------|-------------------------|-----------------------------|----------|------|
| | Number (%) | Number (%) | Follow-up Number (%) | Non-follow-up Number (%) | | |
| Gender | | | | | 1.02 | 0.31 |
| Male | 106(45.7) | 106(45.7) | 51(42.5) | 55(49.1) | | |
| Female | 126(54.3) | 126(54.3) | 69(57.5) | 57(50.9) | | |
| Missing | - | - | - | - | | |
| Age | | | | | 3.13 | 0.21 |
| 55-59 | 63(27.2) | 63(27.2) | 38(31.7) | 25(22.3) | | |
| 60-69 | 97(41.8) | 97(41.8) | 51(42.5) | 46(41.1) | | |
| ≥ 70 | 69(29.7) | 69(29.7) | 31(25.8) | 38(33.9) | | |
| Missing | 3(1.3) | 3(1.3) | - | 3(2.7) | | |
| Marital status^c | | | | | 9.65 | 0.00 |
| Married | 161(69.4) | 161(69.4) | 93 (77.5) | 64(57.1) | | |
| Single/divorced/Separated/ widowed | 62(26.7) | 62(26.7) | 27(22.5) | 39(34.8) | | |
| Missing | 9(3.9) | 9(3.9) | - | 9(8.0) | | |
| Educational background^d | | | | | 15.94 | 0.00 |
| Primary or below | 113(48.7) | 113(48.7) | 48(40.0) | 65(58.0) | | |
| Junior/Senior high | 88(37.9) | 88(37.9) | 49(40.8) | 39(34.8) | | |
| Tertiary or above | 23(9.9) | 23(9.9) | 20(16.7) | 3(2.7) | | |
| Missing | 8(3.5) | 8(3.5) | 3(2.5) | 5(4.5) | | |
| Career | | | | | 12.02 | 0.00 |
| Farmer | 62(26.7) | 62(26.7) | 21(17.5) | 41(36.7) | | |
| Others | 166(71.6) | 166(71.6) | 99(82.5) | 67(59.8) | | |
| Missing | 4(1.7) | 4(1.7) | - | 4(3.5) | | |
| In total | 232 | 232 | 120 | 112 | | |

TABLE II
COMPARISON OF MENTAL HEALTH STATUS ^a AND PTSD ^b SYMPTOMS
BETWEEN GROUPS OVER TIME

| Variable factors | N=232 | | | N=120 | | | F |
|--|-------------------|-------------------|------------|-------------------|-------------------|-------------------|-------|
| | T0 Mean (SD) | T1 Mean (SD) | F | T0 Mean (SD) | T1 Mean (SD) | T2 Mean (SD) | |
| PTSD symptoms ^a | | | | | | | |
| Intrusive | 7.19 (4.76) | 6.26 (3.98) | 5.86* | 6.87 (4.74) | 5.73 (3.82) | 5.92 (3.45) | 3.35* |
| Arousal | 8.55 (6.80) | 7.06 (5.65) | 7.44* | 8.28 (6.86) | 6.08 (4.84) | 5.93 (4.70) | 7.99* |
| Avoidance | 8.27 (5.67) | 7.73 (5.00) | 1.32 | 8.24 (5.89) | 6.96 (5.11) | 7.37 (4.83) | 2.19 |
| Total score | 24.01 (16.20) | 21.05 (13.50) | 5.15* | 23.39 (16.49) | 18.77 (12.61) | 19.23 (12.12) | 4.98* |
| Mental health status ^b | | | | | | | |
| Cognitive function | 26.38 (4.79) | 26.45 (4.74) | 0.00 | 26.68 (4.90) | 26.68 (4.58) | 27.03 (5.08) | 0.26 |
| Emotion experiences | 44.90 (7.76) | 43.22 (7.51) | 7.20* * | 45.41 (7.16) | 44.02 (7.08) | 45.35 (6.93) | 1.94 |
| Self-perception | 35.76 (4.64) | 34.52 (4.71) | 9.17* * | 36.13 (4.29) | 35.05 (4.54) | 35.14 (4.45) | 2.91 |
| Interpersonal communication | 30.30 (5.15) | 29.25 (5.34) | 5.18* | 30.80 (4.82) | 29.98 (5.09) | 30.00 (5.44) | 1.38 |
| Adapt ability | 56.66 (9.18) | 55.27 (8.57) | 3.08 | 57.10 (8.71) | 56.08 (8.05) | 55.98 (8.86) | 0.94 |
| Total score | 194.00 (26.07) | 188.70 (25.96) | 2.46* | 196.12 (24.42) | 191.82 (23.94) | 193.50 (25.66) | 1.36 |

Note. PTSD=posttraumatic stress disorder.

^aPTSD symptoms were measured by the Impact of Event Scale-Revised.

^bMental health status were measured by Mental Health Inventory for the Elderly.

* p <0.05. ** p <0.01. *** p <0.001.

TABLE III
CORRELATION EFFICIENCY BETWEEN PTSD AND MENTAL HEALTH STATUS
MEASURED BY MHIE

| | Group 1 (n = 232) | | Group 2 (n = 120) | | |
|------------------|-------------------|--------|-------------------|--------|--------|
| | IES 08 | IES 09 | IES 08 | IES 09 | IES 10 |
| Mental health 08 | -.411* | | -.398* | | |
| Mental health 09 | | -.544* | | -.473* | |
| Mental health 10 | | | | | -.493* |

Note. *** p <0.001

REFERENCES

- [1] Chan, E., "The untold stories of the Sichuan earthquake," *Lancet*, vol. 372, no. 9636, pp. 359, 2008.
- [2] Cherry, K., Allen, P., & Galea, S., "Older adults and nature disasters," *Crisis and Disaster Counseling: Lessons Learned from Hurricane Katrina and Other Disasters*, vol.115, 2009.
- [3] Knight, B., Gatz, M., Heller, K., & Bengtson, V., "Age and emotional response to the Northridge earthquake: a longitudinal analysis," *Psychology and Aging*, vol. 15, no. 4, pp. 627-634, 2000.
- [4] Chung, M., "Post-traumatic stress disorder in older people," *Aging Health*, vol. 3, no. 6, pp. 743-749, 2007.
- [5] Norris, F. H., Kaniasty, K., Conrad, M. L., Inman, G. L., & Murphy, A. D., "Placing age differences in cultural context: A comparison of the effects of age on PTSD after disasters in the United States, Mexico, and Poland," *Journal of Clinical Geropsychology*, vol. 8, no. 3, pp. 153-173, 2002.
- [6] Ticehurst, S., Webster, R., Carr, V., & Lewin, T., "The psychosocial impact of an earthquake on the elderly," *International Journal of Geriatric Psychiatry*, vol. 11, no.11, pp. 943-951, 1996.
- [7] van Zelst, W., de Beurs, E., Beekman, A., Deeg, D., & van Dyck, R., "Prevalence and risk factors of posttraumatic stress disorder in older adults," *Psychother Psychosom*, vol. 72, no. 6, pp. 333-342, 2003.
- [8] Thompson, M., Norris, F., & Hanacek, B., "Age differences in the psychological consequences of Hurricane Hugo," *Psychology and Aging*, vol. 8, pp. 606-606, 1993.
- [9] Carr, V., Lewin, T., Webster, R., & Kenardy, J., "A synthesis of the findings from the quake impact study: a two-year investigation of the psychosocial sequelae of the 1989 Newcastle earthquake," *Social Psychiatry and Psychiatric Epidemiology*, vol. 32, no. 3, pp. 123-136, 1997.
- [10] Goenjian, A. K., Najarian, L. M., Pynoos, R. S., Steinberg, A. M., Manoukian, G., Tavosian, A., Fairbanks, L. A., "Posttraumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia," *American Journal of Psychiatry*, vol. 151, no. 6, pp. 895, 1994.
- [11] Norris, F., Friedman, M., & Watson, P., "60,000 disaster victims speak: Part II," *Summary and implications of the disaster mental health research. Psychiatry: Interpersonal & Biological Processes*, vol. 65, no. 3, pp. 240-260, 2002.
- [12] Qin, P., & Mortensen, P., "Specific characteristics of suicide in China," *Acta Psychiatrica Scandinavica*, vol.103, no. 2, pp. 117-121, 2008.
- [13] Kohn, R., Levav, I., Garcia, I., Machuca, M., & Tamashiro, R., "Prevalence, risk factors and aging vulnerability for psychopathology following a nature disaster in a developing country," *International Journal of Geriatric Psychiatry*, vol. 20, no. 9, pp. 835-841, 2005.
- [14] Kuwabara, H., Shioiri, T., Toyabe, S., Kawamura, T., Koizumi, M., Ito-Sawamura, M., ... Someya, T., "Factors impacting on psychological distress and recovery after the 2004 Niigata-Chuetsu earthquake, Japan: Community-based study," *Psychiatry and Clinical Neurosciences*, vol. 62, no. 5, pp. 503-507, 2008.
- [15] Panagioti, M., Gooding, P., & Tarrier, N., "Post-traumatic stress disorder and suicidal behavior: A narrative review," *Clinical Psychology Review*, vol. 29, no. 6, pp. 471-482, 2009.
- [16] Wiktorsson, S., Runeson, B., Skoog, I., stling, S., & Waern, M., "Attempted Suicide in the elderly: characteristics of suicide attempters 70 years and older and a general population comparison group," *American Journal of Geriatric Psych*, vol. 18, no. 1, pp. 57-67, 2010.
- [17] Brandtstadter, J., Wentura, D., & Greve, W., "Adaptive resources of the aging self: Outlines of an emergent perspective," *Planning and Control Processes Across the Life Span*, vol. 16, no. 2, pp. 323-349, 1993.
- [18] Wang T., Yang H.Q., Li, J., & Han, B.X., "汶川地震前后绵阳灾区老年人心理健康状况[Mental health status changes of Mianyang elderly victims before and after 5•12 wenchuan earthquake]," *Chinese Journal of Gerontology*, vol. 29, no. 9, pp. 1134-1137, 2009.
- [19] Galea, S., "The long-term health consequences of disasters and mass traumas," *Canadian Medical Association Journal*, vol. 176, no. 9, pp. 1293, 2007.
- [20] Goenjian, A., Walling, D., Steinberg, A., Roussos, A., Goenjian, H., & Pynoos, R., "Depression and PTSD symptoms among bereaved adolescents 6 1/2 years after the 1988 Spitak earthquake," *Journal of Affective Disorders*, vol. 112, no. 1-3, pp. 81-84, 2009.
- [21] Kim, S., Plumb, R., Gredig, Q., Rankin, L., & Taylor, B., "Medium-term post-Katrina health sequelae among New Orleans residents: predictors of poor mental and physical health," *Journal of Clinical Nursing*, vol. 17, no. 17, pp. 2335-2342, 2008.
- [22] Lin, M., Huang, W., Huang, C., Hwang, H., Tsai, L., & Chiu, Y., "The impact of the Chi-Chi earthquake on quality of life among elderly survivors in Taiwan—A before and after study," *Quality of Life Research*, vol. 11, no. 4, pp. 379-388, 2002.
- [23] Seplaki, C., Goldman, N., Weinstein, M., & Lin, Y., "Before and after the 1999 Chi-Chi earthquake: traumatic events and depressive symptoms in an older population," *Social Science & Medicine*, vol. 62, no.12, pp. 3121-3132, 2006.
- [24] Wang, X.D., Gao, L., Shinfuku, N., Zhang, H.B., Zhao, C.Z., & Shen, Y.C., "Longitudinal study of earthquake-related PTSD in a randomly selected community sample in north China," *American Journal of Psychiatry*, vol. 157, no. 8, pp. 1260-1266, 2000.
- [25] Smith, P., Perrin, S., Dyregrov, A., & Yule, W., "Principal components analysis of the impact of event scale with children in war," *Personality and Individual Differences*, vol. 34, no. 2, pp. 315-322, 2003.
- [26] Wu, K., & Chan, K., "The development of the Chinese version of Impact of Event Scale—Revised (CIES-R)," *Social Psychiatry and Psychiatric Epidemiology*, vol. 38, no. 2, pp. 94-98, 2003.
- [27] Guo, S.R., Xin, Z.R., & Geng, L.N., "Reliability and validity of Chinese version of the impact of event scale-revised," *Chinese Journal of Clinical Psychology*, vol. 15, no. 1, pp. 15-17, 2007.
- [28] Huang, Y. P., Zhang, Y. L., Xiang, H., & Zhou, Y. F., "The Chinese version of the impact of event scale-reviewed: reliability and validity," *Chinese Mental Health Journal*, vol. 20, no. 1, pp. 28-31, 2006.
- [29] Li, J., Wu, Z.Y., & Han, B.X., "老年心理健康量表的编制[Development of mental health inventory for the Elderly]," *Chinese Mental Health Journal*, vol. 23, no. 9, pp. 656-660, 2009.
- [30] Zhang, N., Zhang, Y. Q., Wu, K. K., Zhu, Z. H., & Dyregrov, A., "Factor structure of the children's revised impact of event scale among children and adolescent who survived the 2008 Sichuan earthquake in China," *Scandinavian Journal of Psychology*, vol.52, no. 3, pp. 236-241, 2011.
- [31] Norris, F., Perilla, J., Riad, J., Kaniasty, K., & Lavizzo, E., "Stability and change in stress, resources, and psychological distress following nature disaster: findings from Hurricane Andrew," *Anxiety, Stress & Coping*, vol. 12, no. 4, pp. 363-396, 1999. Retrieved from <http://dspace.udel.edu:8080/dspace/handle/19716/667>.
- [32] Kato, H., Asukai, N., Miyake, Y., Minakawa, K., & Nishiyama, A., "Post-traumatic symptoms among younger and elderly evacuees in the early stages following the 1995 Hanshin-Awaji earthquake in Japan," *Acta Psychiatrica Scandinavica*, vol. 93, no. 6, pp. 477-481, 1996.
- [33] Bonanno, G. A., Galea, S., Bucchiarelli, A., & Vlahov, D., "What predicts psychological resilience after disaster? The role of demographics, resources, and life stress," *Journal of Consulting and Clinical Psychology*, vol. 75, no. 5, pp. 671-682, 2007.
- [34] Danckwerts, A., & Leatham, J., "Questioning the link between PTSD and cognitive dysfunction," *Neuropsychology Review*, vol. 13, no. 4, pp. 221-235, 2003.
- [35] Wang, H. H., Zhang, Z. J., Tan, Q. R., Yin, H., Chen, Y. C., Wang, H. N.,..., Tang, L. H., "Psychopathological, biological, and neuroimaging characterization of posttraumatic stress disorder in survivors of a severe coalmining disaster in China," *Journal of Psychiatric Research*, vol. 44, no. 6, pp. 385-392, 2010.
- [36] Deeg, D., Huizink, A., Comijs, H., & Smid, T., "Disaster and associated changes in physical and mental health in older residents," *The European Journal of Public Health*, vol. 15, no. 2, pp. 170, 2005.
- [37] Shemesh, A., Kohn, R., Radomislensky, I., Brodsky, J., & Levav, I., "Emotional distress and other health-related dimensions among elderly survivors of the Shoa Living in the community," *The Israel Journal of Psychiatry Related Science*, vol. 45, no. 4, pp. 230-238, 2008.
- [38] Ben-Zur, H., & Zimmerman, M., "Aging holocaust survivors' well-being and adjustment: Associations with ambivalence over emotional expression," *Psychology and Aging*, 20(4), 710-713, 2005.
- [39] Bolin, R., & Klenow, D. J., "Older people in disaster: a comparison of black and white victims," *The International Journal of Aging and Human Development*, vol. 26, no. 1, pp. 29-43, 1998.
- [40] Bleich, A., Gelkopf, M., Melamed, Y., & Solomon, Z., "Emotional impact of exposure to terrorism among young-old and old-old Israeli citizens," *American Journal of Geriatric Psychology*, vol. 13, no. 8, pp. 705, 2005.

- [41] Wang, H., Zhang, Z., Tan, Q., Yin, H., Chen, Y., Wang, H., et al. Psychopathological, biological, and neuroimaging characterization of posttraumatic stress disorder in survivors of a severe coalmining disaster in China. *Journal of Psychiatric Research*, 44(6), 385-392, 2010
- [42] Bodvarsdottir, I., & Elklit, A. "Psychological reactions in Icelandic earthquake survivors," *Scandinavian Journal of Psychology*, vol. 45, no. 1, pp. 3-13, 2004.
- [43] Cherry, K., Silva, J., & Galea, S. "Nature disasters and the oldest-old: a psychological perspective on coping and health in late life." *Lifespan Perspectives on Nature Disasters: Coping with Katrina, Rita, and Other Storms*, pp. 171-193, 2009.
- [44] Li, S., Rao, L., Bai, X., Zheng, R., Ren, X., Li, J., ..., Zhang, K. "Progression of the "Psychological Typhoon Eye" and variations since the Wenchuan Earthquake," *PloSone*, vol. 5, no. 3, pp. e9727, 2010
- [45] Chou, F. H. C., Wu, H.C. H. I., Chou, P., Su, C. Y., Tsai, K. Y. I., Chao, S. S., ..., Ou-Yang, W.E.N.C. "Epidemiologic psychiatric studies on post-disaster impact among Chi-Chi earthquake survivors in Yu-Chi, Taiwan. *Psychiatry and Clinical Neurosciences*," vol. 61, no. 4, pp. 370-378, 2007.