

Health-related quality of life among survivors in minority area 2 years after Jiuzhaigou earthquake

A cross-sectional study

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Abstract

To investigate the health-related quality of life (HRQoL) and related factors, the symptoms of posttraumatic stress disorder (PTSD) among earthquake survivors in minority area 2 years after Jiuzhaigou earthquake.

Two years after the Jiuzhaigou earthquake, a cross-sectional survey was conducted by a multi-stage sampling approach. HRQoL was measured by the short form 12 (SF-12), PTSD was measured by the PTSD Check List-Civilian Version (PCL-C), and social support was measured by the Multidimensional Scale of Perceived Social Support. Descriptive statistics, *t*-tests, ANOVA and multiple linear regression analysis were used for data analysis.

Of the 561 participants, the mean scores on the physical component summary (PCS) and mental component summary (MCS) were 46.36 ± 12.79 and 55.03 ± 8.73 , and 5.73% reported the symptoms of PTSD. Lower PCS and MCS after an earthquake were associated with elderly age, physical illness, and low level of social support ($P < .05$). Meanwhile, PTSD was significantly associated with MCS.

These findings showed that physical disease and psychological symptoms can adversely affect the HRQoL of survivors. Moreover, providing higher social support to survivors should be considered as a way to improve the HRQoL outcomes of survivors.

Abbreviations: HRQoL = Health-related Quality of Life, MCS = Mental Component Summary, PCS = Physical Component Summary, PTSD = Posttraumatic Stress Disorder, SF-12 = short form 12.

Keywords: ethnic minority, mental health, physical health, posttraumatic stress disorder, social support

1. Introduction

Earthquake was one of the most common and devastating natural disasters.^[1–3] Difference from many other natural disasters, earthquakes usually unpredictable, and its impact

can be very widespread and severe. It caused significant loss of life, multiple injuries and extensive damage to property and infrastructure.^[4]

On August 8, 2017, an earthquake measuring 7.0 on the Richter scale struck Zhangzha Town, Jiuzhaigou County, Aba Prefecture, northern Sichuan Province of China. This disaster resulted in at least 176 492 people affected, 525 injured and 25 killed, the total property damages cost about 114.46 million.

Earthquakes could result in survivors suffering from long-term physical and psychological burdens.^[5,6] Previous researches have shown that even after a long period, natural disasters can still undermine survivors' health-related quality of life (HRQoL), including physical and psychological domains.^[7–9] Furthermore, earthquakes could trigger mental problems range from sleep disorder to serious mental health disease, especially posttraumatic stress disorder (PTSD).^[10–12] Prior studies had shown that the prevalence of PTSD was 4.4% to 40.1% after earthquake.^[13–15] Meanwhile, several researches suggested that people with PTSD symptoms usually accompanied by physical and emotional issues, which might further impair their HRQoL.^[16,17]

Although the literature on the health status of earthquake survivors is increasing, few studies reported the impact of earthquakes on the HRQoL and mental health of survivors living in the mountainous and minority areas (areas where people of ethnic minorities predominantly live together). Jiuzhaigou located in mountainous areas and is an ethnic minority region, where many residents of Jiuzhaigou are ethnic minorities (especially Tibetan), and they usually have unique spiritual culture and religious beliefs. In addition, access to higher quality healthcare is hard for local people. The most important thing is

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The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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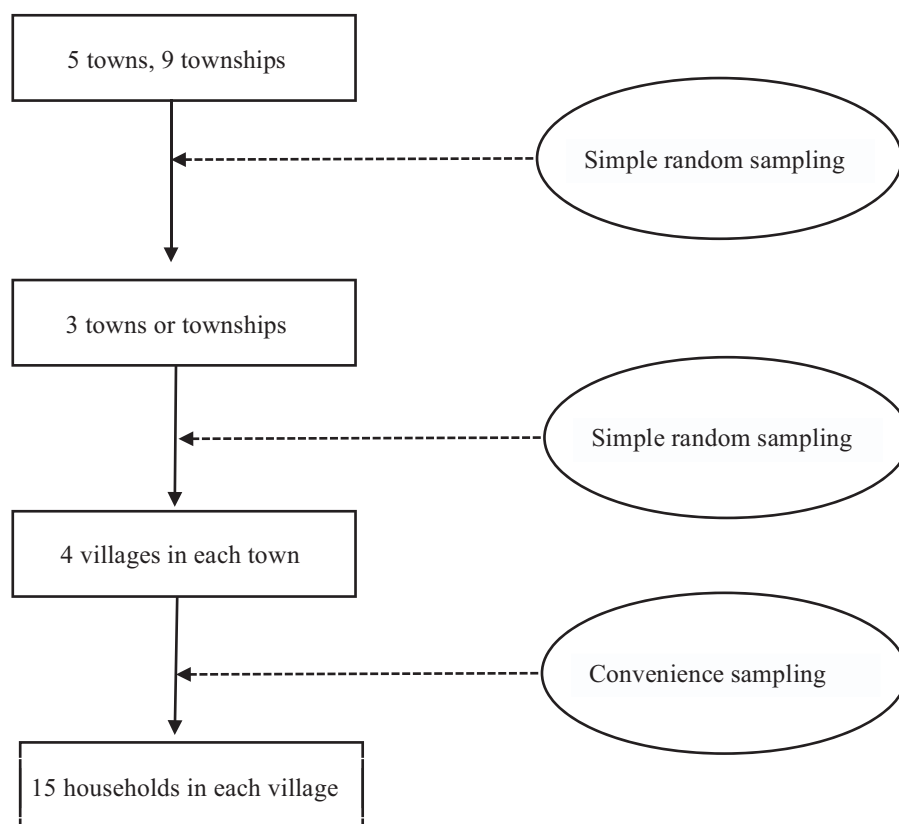


Figure 1. Flow chart of sampling stages. The arrows represent the direction of the flow chart.

that the main source of income for Jiuzhaigou residents is tourism, but the famous Jiuzhaigou scenic spot was closed due to the earthquake. Therefore, local residents lost their main sources of income during the past 2 years since the incidence of earthquake. To reveal the health status of the special population and potential risk factors for health, this study was designed to investigate HRQoL and associated factors for HRQoL, the symptoms of PTSD among survivors in the minority area 2 years after the Jiuzhaigou earthquake.

2. Materials and methods

2.1. Ethics and consent

This study protocol was approved by the Institutional Review Board (IRB) of West China Hospital in Sichuan University. Since most of the residents in the areas were illiterate, written consent may not be feasible. Therefore, the IRB approved to obtain the verbal consent of the respondents.

2.2. Study design and participants

A cross-sectional survey was performed in September 2019, 2 years after the Jiuzhaigou earthquake. All data were collected through face-to-face interviews by trained investigators. All the participants are the permanent residents, lived at epicenter of the earthquake, had experienced the earthquake on August 8, 2017, as well as the age of 7 or above when the investigation conducted (In order to facilitate the analysis, the age of the participants was

divided into 4 groups according to the quartiles of their age). A multi-stage sampling approach was adopted (Fig. 1). As the earthquake area located in the alpine and gorge region, the villages and the population distribution are relatively scattered, it was very difficult to take a random sample in the final stage. Consulted with a local healthcare provider, we selected survivors based on households with convenient sampling method to ensure the representativeness of the sample.

2.3. Measurements

The collected demographic information included gender, age, ethnicity, educational level and household annual income. Current physical health concerned chronic diseases prevalence, two-week prevalence, annual hospitalization rate. Earthquake-related experiences consisted of “buried due to earthquake”, “family property loss”, “family member injured”, “lost family member”, etc.

The PTSD symptoms were measured by the PTSD Check List-Civilian Version (PCL-C), a 17-item self-report symptom scale that corresponds to DSM-IV criteria.^[18] The Chinese version of the PTSD Check List-Civilian Version has been shown to have sound reliability and validity.^[19] Each item uses the 5-point Likert scale to reflect the severity of symptoms, ranging from 1 (not at all) to 5 (extremely severe). The total score ranges from 17 to 85, and an adult with a score of 38 or higher was identified as having PTSD symptoms.^[20,21] The internal consistency (Cronbach’s Alpha coefficient) of the PTSD Check List-Civilian Version in our study was 0.96.

The short form 12 (SF-12), a widely used shorter form with 12 questions all selected from SF-36, was used to measure the HRQoL. The SF-12 measures 8 domains: general health perceptions, physical functioning, role limitations due to physical problems, role limitations due to emotional problems, bodily pain, mental health, vitality, and social functioning.^[22] The 8 domains can finally be calculated to 2 summary scores: Physical Component Summary (PCS) and Mental Component Summary (MCS) by the US norm, and higher PCS and MCS scores reflects better HRQoL.^[23] Previous research indicated that the standard SF-12 was valid and equivalent for the Chinese.^[24] The internal consistency (Cronbach's Alpha coefficient) of the SF-12 in our study was 0.85.

Social support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS), which has been previously used in Chinese population. The MSPSS has 12 items and measures 3 type of support: family support, friends support and other support. Each item score ranges from 1 to 7, a higher total score indicates a higher level of social support.^[25,26] If the total score ranges from 12 to 36 was considered as the low level of social support, ranges from 37 to 60 was considered as the middle level of social support, ranges from 61 to 84 was considered as the high level of social support.^[27] The internal consistency (Cronbach's Alpha coefficient) of the Perceived Social Support Scale in our study was 0.96.

Several methods had been adopted to address potential sources of bias and ensure the quality of research. First, we organized an interdisciplinary team to develop a questionnaire that is representative, objective and easy to understand. Second, all the interviewers received systematical training and a pilot study was conducted before the formal investigation. We also used a multistage sampling method to control selection bias and multivariate analyses to minimize the impacts of confounders, and the form of double-entry to ensure the accuracy of the data.

2.4. Sample size

The sample size was calculated on the basis of an assumed PTSD prevalence of 16.5% in the Taiwan 9.21 earthquake.^[28] a value of 0.05 for α (significance level), 0.2 P for δ (allowable error). The initially estimated sample size was 486. However, we increased the primary sample size by 10% to avoid the potential non-response situations. There for our minimum sample size was 535. The primary sampling units were households, presumed each household had average 3 people, we had to selected at least 178 households.

2.5. Statistical analysis

All data were analyzed with the Statistical Package for the Social Sciences (SPSS) Version 22.0 (SPSS Inc., Chicago). Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated at first. Subsequently, the differences in continuous variables were evaluated by t -tests (for two-group comparisons) or analyses of variance (ANOVAs; for multi-group comparisons), if the data were normally distributed. Otherwise, nonparametric methods (Wilcoxon rank sum tests or Kruskal-Wallis H tests) were used. Furthermore, a multiple linear regression analysis was implemented to explore the associated factors of PCS and MCS scores, respectively. A $P < .05$ was considered statistically significant. Missing data were addressed by the methods of series mean and exclude cases pairwise.

3. Results

In order to ensure the quality of the research, we had conducted a pilot study before the formal investigation. A total of 33 questionnaires were distributed during the pilot survey, and finally 30 questionnaires were collected, the responding rate was 90.91%. The analysis results of pilot study indicate that the Cronbach's alpha value of the SF-12 scale was 0.87 and the split-half Spearman-Brown Coefficient was 0.77, which shows the good internal consistency of items in our study. Meanwhile, we had also adjusted the sequence of some items in the questionnaire and made some modifications for the answers to make the investigation questionnaire more logical and clearer.

3.1. Social-demographic characteristics and earthquake-related experiences

The demographic characteristics and earthquake-related experiences of participants are shown in Table 1. Of the 561 participants, 261 (46.5%) were male, 413 (73.6%) were ethnic minorities; the mean age of all participants at the time of survey was 49.75 ± 18.58 years. The majority of the subjects (59.5%) received primary or lower level of education, and 58.7% of the respondents had a household annual income of less than 20,000 Yuan. Because some respondents failed to answer the earthquake-related experience, we excluded 35 subjects with missing data in this section when analyzing the earthquake-related experience. Of the 526 participants, 485 (92.2%) reported that their families had property loss due to earthquake; 476 (90.5%) reported that no family members injured; and 495 (94.5%) reported that no family members died as the result of the earthquake. Furthermore, 516 (98.8%) participants were not buried because of the earthquake.

The mean scores of PCS and MCS of all participants were 46.36 and 55.03 respectively. Male respondents reported higher scores than female in the PCS ($P < .001$). The PCS score of subjects aged ≤ 35 was significantly higher than those aged ≥ 65 (54.66 vs 34.82, $P < .001$); and subjects with Bachelor degree or above were significantly higher than those with primary education or illiteracy (54.89 vs 48.11, $P < .001$). As to earthquake-related experiences, we found that participants who had family members injured reported higher scores in PCS ($P = .004$), and who had family members died of earthquake reported higher scores in PCS ($P < .001$). There was no significant difference in MCS scores among different groups (Table 1).

3.2. Physical disease, social support and PTSD

Symptoms of PTSD were reported as 5.73% of all the participants, and those who had symptoms of PTSD had lower MCS score (44.66 vs 54.90, $P < .001$). In addition, the subjects with chronic diseases ($P < .001$), illness within 2 weeks ($P = .04$), hospitalization within 1 year ($P = .01$) and lower levels of social support ($P = .02$) had lower MCS scores; the participants with chronic diseases, illness within 2 weeks, hospitalization within one year and lower levels of social support had lower PCS scores (All $P < .001$) (Table 2).

3.3. Multivariable analyses for PCS and MCS

Multiple linear regression analysis (Enter) was performed to examine HRQoL related factors. The results (Tables 3 and 4) revealed that gender, chronic disease, two-week prevalence,

Table 1**Demographic characteristics and health-related quality of life among survivors of the Jiuzhaigou earthquake, China (N=561).**

Variables	N (%)	PCS			MCS		
		Mean	t/F value	P	Mean	t/F value	P
Gender			3.51	<.001		1.39	.16
Male	261 (46.5)	48.35			55.57		
Female	300 (53.5)	44.62			54.55		
Age group			93.52	<.001		1.97	.12
≤35	133 (23.7)	54.66			56.34		
36–50	161 (28.7)	50.37			54.22		
51–64	126 (22.5)	45.38			54.19		
≥65	141 (25.1)	34.82			55.46		
Ethnicity			−0.41	.68		1.78	.07
Han	148 (26.4)	45.99			56.02		
Ethnic minorities	413 (73.6)	46.49			54.67		
Educational level			37.44	<.001		0.99	.41
illiteracy	202 (36.1)	38.98			54.45		
Primary school	131 (23.4)	48.11			55.80		
Junior high school	119 (21.3)	50.22			54.30		
High school	54 (9.6)	52.90			56.28		
Bachelor degree or above	54 (9.6)	54.89			55.46		
Household annual income (CNY)			0.61	.61		1.95	.12
<5000	158 (28.2)	46.27			55.54		
5000–20000	171 (30.5)	45.61			54.84		
20000–50000	114 (20.3)	46.26			53.50		
>50000	118 (21.0)	47.65			56.08		
Loss of property			1.03	.31		0.18	.86
Yes	485 (92.2)	46.01			54.84		
No	41 (7.8)	48.11			55.09		
Buried due to earthquake			−0.38	.70		−1.51	.13
Yes	6 (1.2)	48.22			60.24		
No	516 (98.8)	46.21			54.90		
Family member injured			−2.99	.004		1.05	.30
Yes	50 (9.5)	49.83			53.40		
No	476 (90.5)	45.79			55.02		
Family member died			−3.80	<.001		1.09	.27
Yes	29 (5.5)	51.19			53.15		
No	495 (94.5)	45.88			54.96		

MCS = Mental Component Summary, PCS = Physical Component Summary.

Table 2**Descriptive statistics of physical disease, social support and posttraumatic stress disorder symptoms among participants (N=561).**

Variables	N (%)	PCS			MCS		
		Mean	t/F value	P	Mean	t/F value	P
Chronic diseases			13.90	<.001		4.37	<.001
No	318 (56.7)	52.26			56.49		
Yes	243 (43.3)	38.64			53.11		
Two-week prevalence			9.66	<.001		2.05	.04
No	365 (65.1)	50.17			55.63		
Yes	196 (34.9)	39.27			53.91		
Annual hospitalization			4.49	<.001		2.82	.01
No	490 (88.0)	47.34			55.55		
Yes	67 (12.0)	38.86			51.41		
Social support			12.72	<.001		3.76	.02
Lower	33 (6.9)	37.00			52.08		
Middle	125 (26.2)	44.01			53.22		
Higher	320 (66.9)	47.64			55.26		
PTSD symptoms			0.66	.51		4.27	<.001
Positive	26 (5.7)	43.92			44.66		
Negative	428 (94.3)	45.66			54.90		

MCS = Mental Component Summary, PCS = Physical Component Summary, PTSD = Posttraumatic Stress Disorder.

Table 3**Multiple linear regression analysis of factors associated with physical component summary.**

Factors (reference)	B	β	t value	P	95% CI	
					Lower	Upper
Age (≥ 65)						
≤ 35	8.80	0.28	4.62	<	5.06	12.54
36–50	8.45	0.30	6.00	<.001	5.68	11.22
51–64	7.11	0.24	5.34	<.001	4.49	9.72
Gender (Male)	–2.82	–0.11	–3.13	.002	–4.59	–1.05
Ethnicity (Minority)	–1.38	–0.05	–1.39	.16	–3.33	0.57
Household income (CNY) (>50000)						
<5000	–0.69	–0.02	–0.54	.59	–3.22	1.83
5000–20000	0.42	0.02	0.34	.74	–2.06	2.91
20000–50000	–0.45	–0.02	–0.34	.74	–3.06	2.16
Education (Bachelor degree or above)						
Illiteracy	–3.65	–0.14	–1.76	.08	–7.72	0.43
Primary school	–1.23	–0.04	–0.59	.55	–5.32	2.86
Junior high school	–1.50	–0.05	–0.76	.45	–5.34	2.35
High school	–1.65	–0.04	–0.82	.42	–5.62	2.32
Chronic disease (No)	–6.87	–0.27	–6.54	<.001	–8.94	–4.81
Two-week prevalence (No)	–6.56	–0.25	–6.89	<.001	–8.43	–4.69
Annual hospitalization (No)	–4.05	–0.10	–3.03	.003	–6.67	–1.42
Social support (High)						
Low	–7.31	–0.14	–4.10	<.001	–10.81	–3.81
Middle	–0.74	–0.03	–0.70	.48	–2.80	1.33
Buried due to earthquake (No)	2.27	0.02	0.48	.63	–7.04	11.58
Family member injured (No)	1.56	0.04	1.02	.31	–1.46	4.58
Family member died (No)	4.05	0.07	1.96	.05	–0.01	8.10
(Constant)	51.20		20.54	<.001	46.30	56.10

β = Standardized Coefficients, B = Unstandardized Coefficients, CI = confidence interval.

annual hospitalization and social support were negatively correlated with, and age was positively correlated with participants' PCS scores (adjusted $R^2=0.488$). Age, chronic

disease, annual hospitalization, positive PTSD symptom and social support were negatively correlated with participants' MCS scores. (Adjusted $R^2=0.128$).

Table 4**Multiple linear regression analysis of factors associated with mental component summary.**

Factors (reference)	B	β	t value	P	95% CI	
					Lower	Upper
Age (≥ 65)						
≤ 35	–3.53	–0.16	–2.53	.01	–6.26	–0.79
36–50	–3.62	–0.19	–3.09	.00	–5.93	–1.32
51–64	–1.63	–0.08	–1.43	.14	–3.87	0.62
Gender (Male)	–0.64	–0.04	–0.79	.43	–2.22	0.95
Ethnicity (Minority)	–1.56	–0.08	–1.75	.08	–3.32	0.19
Household income (CNY) (>50000)						
<5000	–0.76	–0.04	–0.63	.53	–3.13	1.61
5000–20000	–0.67	–0.03	–0.57	.57	–2.96	1.62
20000–50000	–1.34	–0.06	–1.07	.28	–3.80	1.11
Chronic diseases (No)	–3.31	–0.18	–3.45	.001	–5.19	–1.43
Two-week prevalence (No)	0.43	0.02	0.50	.62	–1.27	2.13
Annual hospitalization (No)	–3.65	–0.14	–3.03	.003	–6.02	–1.28
Social support (High)						
Low	–2.28	–0.07	–1.43	.15	–5.41	0.85
Middle	–2.22	–0.11	–2.31	.02	–4.11	–0.33
PTSD ^d symptoms (No)	–9.20	–0.24	–5.17	<.001	–12.70	–5.70
Buried due to earthquake (No)	7.31	0.08	1.72	.09	–1.05	15.67
Family member injured (No)	–1.26	–0.04	–0.89	.38	–4.07	1.54
Family member died (No)	1.68	0.04	0.85	.40	–2.22	5.57
(Constant)	61.87		39.89	<.001	58.83	64.92

B = Unstandardized Coefficients, β = Standardized Coefficients, CI = confidence interval, PTSD = Posttraumatic Stress Disorder.

4. Discussion

This population-based survey demonstrated the prevalence of symptoms of PTSD, physical disease, and health-related quality of life, including physical and mental health, of survivors in minority area 2 years after the Jiuzhaigou earthquake. We found that survivors in minority area had inferior physical health status but relatively better mental health status than Chinese general population and survivors in non-minority area.^[24,29]

In our study, the prevalence of chronic disease and two-week morbidity rate among survivors in minority area 2 years after earthquake was 43.32% and 34.94% respectively, higher than the rate in non-ethnic areas.^[13,30] Meanwhile, the PCS score in our research was not only significantly lower than the Chinese general population, but also lower than the PCS score in other non-ethnic areas.^[29] One possible reason was that Jiuzhaigou located in rural areas, because of the shortage of medical resources, with the catastrophe, residents more likely to be attacked by acute and chronic disease. Besides, majority of respondents are Tibetans in our survey. Their lifestyle, such as diet, are quite different from the Han nationality. Due to the particularity of the geographical environment in Tibetan areas, residents' traditional eating habits are mainly high-protein, high-fat and high-energy, the intake of vegetables and fruits is relatively low, unbalanced dietary habits may lead to worse physical health of survivors.

This study revealed that the prevalence of PTSD of minority survivors was 5.73%. Previous research represented that the prevalence of PTSD was 52.7% 3 months after the Jiuzhaigou earthquake,^[31] and 46.3% 1 year after the earthquake.^[32] This indicated that the symptom of PTSD might alleviate as time goes by. It is worth noting that, in our investigation, the MCS score of HRQoL of survivors was higher than the Chinese general population and other non-ethnic survivors,^[24,29] meanwhile, the PTSD prevalence was lower than that in non-ethnic areas.^[33] This might be interpreted by the fact that Jiuzhaigou belongs to ethnic minority areas, and its residents are mainly ethnic minorities, especially Tibetans. In China, almost each minority has its own religious beliefs. For example, the Tibetans believe in Tibetan Buddhism, they believe that people can continue to live in another world after death. Such religious beliefs may help survivors relieve stress and improving mental health.^[34] Furthermore, ethnic minorities have rich social activities and usually live in groups in the form of families, this may enable survivors to gain better social support and lighten the mood.

In the health-related quality of life subscale, we found several potential associated factors, including age, gender, chronic disease, two-week prevalence, annual hospitalization, social support and PTSD symptoms. Consistent with previous studies,^[15] for elderly subjects, they had lower PCS score but higher MCS score. This may be illustrated by the fact that younger survivors do have better physical health, but their coping style and emotional stability had not fully developed. As a result, older survivors were likely to handled mental problem better than younger survivors after the earthquake.^[35,36] Meanwhile, the results showed that females tend to had poorer physical health than males, consisting with Hu et al research.^[37] Further, survivors with physical illnesses scored lower on both PCS and MCS domains, indicating that physical diseases have a general impact on both physical and mental dimensions. The study also found that social support and PTSD were significantly related to HRQoL. Survivors with higher level of social support had better HRQoL, both in terms of physical health

and psychological well-being. And PTSD symptom was remarkably associated with a lower MCS score. One possible reason was that, after the earthquake, material and psychological support from family or friends may lead to more positive psychological and physical adaptation.^[38]

Several potential limitations of our study need to be noticed. First, the research design of the study was a cross-sectional research rather than a prospective research, as well as there was no baseline data of the participants. As a result, we were no longer able to exhibit the dynamic changes of mental health and quality of life among survivors directly. Despite the fact that, some prior research had presented some useful information, providing good comparisons for our research.^[31,32] Furthermore, in this study, the survey area is an ethnic area, and the respondents are predominantly ethnic minorities, but some unique characteristics of ethnic minority respondents have not been collected.

Despite these limitations, there were some strengths in our research. A key strength of the present study is that, to our knowledge, it is the first to explored the health-related quality of life and mental health of people who have experienced earthquake in minority area. Besides, this is a population-based survey using multi-stage sampling method, which made the conclusions more representative.

Our research found an interesting conclusion, which was the MCS score of HRQoL of survivors was relatively higher than the Chinese general population and other non-ethnic earthquake survivors. One possible reason was that the most of Jiuzhaigou residents were minority and they had unique spiritual culture and religious beliefs. However, probably because the sample size of this study is not large enough, and some unique characteristics of participants were not collected, the differences in HRQoL among different ethnic groups had not been found. Thus, further research should expand the sample size, and information about residents' cultural beliefs and lifestyle should be taken into account.

5. Conclusions

The results of this investigation show that, two years after Jiuzhaigou earthquake, survivors in minority area had inferior physical health status but relatively better mental health status than Chinese general population and survivors in non-minority area. These findings indicate that in the long term, the physical health problems of the victims in minority areas are more prominent, and the situation of chronic disease is serious. Therefore, the government should focus on improving the health service level of primary health institutions, widely carry out publicity and education that is conducive to physical and mental health, and strengthen the tertiary prevention of chronic disease to improve the overall health of residents in earthquake-stricken areas. At the same time, more social support should be provided to survivors.

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