

Health-Related Quality of Life of Chinese Earthquake Survivors: A Case Study of Five Hard-Hit Disaster Counties in Sichuan

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Abstract As one of the most destructive natural disasters, earthquakes affect the health of survivors. The devastating earthquakes that hit Sichuan, China have aroused the concern of domestic and international scholars. The health-related quality of life (HRQOL) of survivors also requires substantial research. Studies on impact factors, such as gender, age, monthly income, and education, have become controversial. The subjects in this study are the people of five hard-hit disaster counties in Sichuan Province, namely, Wenchuan, Qingchuan, Mianzhu, Lushan, and Dujiangyan. A preliminary survey was conducted in May and June 2013 in areas badly hit by the earthquake in Sichuan, China. A total of 2000 questionnaires were distributed, and 1672 of which were received, yielding a recovery rate of 83.6 %. To further complement and corroborate the conclusions, a follow-up survey was conducted in October and November 2013, where 1526 effective questionnaires were received. The analysis in this paper is mainly based on the first survey, and the collected data from the follow-up survey were used to perform a supplementary analysis. By analyzing data from five hard-hit areas in Sichuan and by establishing models, we drew the following conclusions: The results of analysis of variance and Tukey's honestly significant difference tests revealed the following results. First, the results of two investigations indicate the HRQOL of earthquake survivors is relatively poor, especially in terms of general health (GH), mental health (MH), social functioning (SF), etc. However, results of the second survey indicate that the scores of all domains (except GH) have increased significantly, with the SF having the most significant increase. Second, the

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HRQOL scores of men are higher than those of women. Individuals with higher education or monthly income have higher HRQOL scores than those with lower education or income. Moreover, younger survivors have higher HRQOL scores than older survivors. Third, a positive correlation exists among the HRQOL domains of all survivors. Among all domains, the PF, RP, GH, MH, and VT of survivors have a very strong correlation. In addition, SF, BP, MH, and VT have a strong correlation. Other variables have a relatively weak correlation.

Keywords Earthquake survivor · Health-related quality of life · SF-36 · SEM ANOVA · Tukey's HSD

Abbreviations

HRQOL	Health-related quality of life
SF-36	Medical outcome study short form 36
PCS	Physical component summary
MCS	Mental component summary
CFA	Confirmatory factor analysis
ANOVA	Analysis of variance
1st Qu	One fourth quartile
3rd Qu	Three quarter quartile
PF	Physical functioning
RP	Role physical
RE	Role emotional
SF	Social functioning
BP	Body pain
GH	General health
VT	Vitality
MH	Mental health

1 Introduction

The lives and health of people affected by natural disasters are often vulnerable and disadvantaged. In recent years, severe natural disasters have occurred frequently worldwide. These disasters have significantly affected the health of survivors, which aroused the concern of many scholars. As the largest developing country in the world, China also suffered from the damaging impacts of natural disasters, especially earthquakes. Since the Wenchuan earthquake in 2008, several devastating earthquakes, such as the Yushu earthquake and Lushan earthquake, hit Mainland China and caused severe casualties. Sichuan Province, one of the western provinces with large population, has suffered from the most frequent and destructive earthquakes. The residents of Sichuan Province are facing earthquake threats. The health of the people in this province is the concern of domestic and international scholars. Thus, studying the health of survivors during reconstruction is indispensable. Figures 1, 2 show the affected houses in the rural communities of Guangyuan and Ya'an after the 2013 Lushan earthquake.¹

¹ The two photos below were taken in Guangyuan and Ya'an, two of the sites where the questionnaires were distributed.

Fig. 1 Affected houses in Guangyuan



Fig. 2 Ya'an rural community



Since the devastating 2008 Sichuan earthquake, the health of survivors in the affected districts has been an important issue. Many studies determined whether or not the survivors have developed post-traumatic stress disorder (PTSD). Some scholars have studied the reactions of survivors with different demographics to PTSD (Wang et al. 2012; Dell'Osso et al. 2011; Goenjian et al. 2011; Jia et al. 2010). Age and gender are strongly related to the health of survivors. A three-year follow-up investigation on the survivors of the Chi-Chi earthquake has shown that the public health system has a significant effect on the initial period of PTSD. The impact of PTSD on the pressure toward survivors has significantly decreased (Su et al. 2010). Evidently, these studies have limitations. These studies did not determine the overall health of survivors because they only used PTSD as basis to assess the mental health of survivors. Moreover, only a few studies have examined the health of survivors based on health-related quality of life (HRQOL).

People have become more concerned about the overall physical and mental health since 1980. HRQOL refers to the health status of individuals affected by diseases, injuries, medical interventions, aging, and social environment. HRQOL also represents the subjective satisfaction linked to economic, cultural background, and individual values (Sprangers and Schwartz 1999; Burckhardt and Anderson 2003). HRQOL describes the functional status of individuals in terms of physical, psychological, and social aspects. HRQOL covers physical health and MH and can clearly determine the health status indexes of individuals (Cummins et al. 2004; Tan et al. 2013). As an important indicator of the quality of life of people in terms of physical health and mental health, HRQOL has also

become an important means to evaluate and monitor the health status of people (Ashing-Giwa 2005). HRQOL can reduce the boundaries between various disciplines and can be widely applied to social, psychological, and medical services (Herdman et al. 1998; Desouky et al. 2013; Nesterko et al. 2013). HRQOL also has a significant effect on the health of people (Quinn et al. 2013; O'Neil et al. 2013; Gothwal et al. 2013).

Tools such as the sickness impact profile (SIP), the Nottingham health profile (NHP), the EuroQol questionnaire (EQ-5D), the medical outcomes study short form 12 (SF-12), the medical outcome study short form 36 (SF-36), and the WHO quality of life—best available technique reference (WHOQOL-BREF) can be used to measure HRQOL. SIP can be applied to any health status evaluation of any diseases. NHP is used to measure the health status of large populations and is a self-reported scale composed of 45 items, six health domains, and seven living domains. Among the aforementioned tools, EQ-5D is the simplest for measuring the health status of people. EQ-5D is divided into five domains and a visual scale. SF-36 is one of the most commonly used scales worldwide. SF-36 includes 36 items and eight domains, namely, physical functioning (PF), role physical (RP), role emotional (RE), social functioning (SF), body pain (BP), general health (GH), vitality (VT), and mental health (MH). SF-12 is the simplified version of SF-36. (Guyatt et al. 1993) cleared the concept and measuring methods of HRQOL; their study served as the reference of using scales to measure HRQOL. WHOQOL-BREF consists of 26 items and six domains, namely, physical health, psychological health, independence, social relationship, environment, and spirituality. These scales are important for evaluating the health status of individuals. Compared with clinical diagnoses, these scales can help better characterize the physical, psychological, and functional states of individuals. In this study, we employed SF-36 to measure HRQOL. SF-36 is a versatile short scale that consists of a physical component summary (PCS) and a mental component summary (MCS) based on eight small domains. More than 5,000 published studies worldwide have used SF-36, which has been proven to be a global tool for measuring HRQOL. SF-36 is suitable for HRQOL measurement because it can be applied under different conditions (Ware Jr and Gandek 1998; Ware Ware 2000).

Only a few studies have focused on the HRQOL of survivors. Previous studies have investigated the HRQOL of survivors from different angles (Zhang et al. 2009; Chen 2011; Wang et al. 2012; Ke et al. 2010). For example (Zhang et al. 2012) used SF-36 to measure the HRQOL of fracture survivors in an affected area while considering physiologic factors. Other studies focused on psychological health and ignored the overall health of survivors (Zhang et al. 2010; Kiliç et al. 2003; Zhang et al. 2011). A study conducted in Taiwan indicated that elders, divorced or widowed, and low-educated people have poor scores in psychiatric examinations (Chou et al. 2004). Thus, improving the HRQOL of survivors and finding the key factors affecting HRQOL have become urgent issues. However, only a few studies have measured the HRQOL of survivors via PCS and MCS domains. Accordingly, the present study aims to examine Chinese earthquake survivors in terms of both PCS and MCS.

In addition, our research used SF-36 to measure HRQOL because this tool has been deemed suitable to evaluate quality of life (Fuh et al. 2000). Many studies have shown that SF-36 is appropriate for analyzing the situation of Mainland China. The reliability and validity of SF-36 have also been proven. For example, a previous study employed SF-12 to measure the HRQOL of the Chinese population. SF-12, the simplified version of SF-36, is valid to assess the Chinese population (Lam et al. 2005). In addition, previous research evaluated the HRQOL of Chinese urban construction workers and found that the reliability and validity of SF-36 are suitable for studying this vulnerable group (Qu et al. 2009; Zhu et al. 2012). Another research compared the Chinese version of SF-36 with the original

version and revealed that both versions have excellent validity. The difference in internal consistencies between the two versions is negligible (Yu et al. 2003). SF-36 was also used to explore whether or not the life model affects the HRQOL of rural residents by comparing the scores of eight domains of urban residents (Liu et al. 2010).

The present study used the Chinese version of SF-36 to investigate the HRQOL and health of survivors. This study promotes social concern for the survivors and improves their HRQOL.

To date, the HRQOL of earthquake survivors remains unclear. Previous studies showed that survivors suffer from serious health problems. Some of these survivors suffered physical and mental problems after losing their families and homes. The survivors also experienced terrible health problems. But after a long time of rest, has their health improved? These are what we want to learn. Thus, we propose the first hypothesis.

Hypothesis 1 The scores of all HRQOL domains of the survivors are low. But they are improving.

Sichuan earthquakes, including the Wenchuan earthquake, have destroyed the lives and homes of thousands of people. The Chinese culture may also contribute to the effects of earthquake. Thus, we propose the second hypothesis.

Hypothesis 2 The scores of the survivors for each HRQOL domain are affected by different genders, ages, educational levels, and monthly incomes.

In this study, we employed SF-36, which includes MCS and PCS, to measure the HRQOL of survivors. Many studies indicated that all eight SF-36 domains are related to one another (Gandhi et al. 2013; Touma et al. 2011). Thus, we propose the third hypothesis.

Hypothesis 3 Positive correlations exist among the eight HRQOL domains.

As one of the most destructive natural disasters, earthquakes affect the health of survivors. The health of survivors has been an important research issue. However, the factors affecting the HRQOL of survivors remain unknown. This study aims to recognize and promote the HRQOL of survivors. We divided the survivors into different ages, genders, monthly income, and educational level to explore the structural differences among various demographics. We also investigated the MCS and PCS of the survivors. The eight SF-36 domains, namely, PF, RP, BP, GH, VT, SF, RE, and MH, were included. We appeal that health services should be provided to increase the HRQOL of survivors.

2 Methods

2.1 Objects

In 2013, a preliminary survey and a follow-up survey were conducted in five hard-hit areas in Sichuan. The data analysis in this paper is mainly based on the first survey, and the collected data from the follow-up survey were used to perform a supplementary analysis. Two surveys have been conducted in Sichuan, China within half a year. The first survey was in May and June 2013, distributing 2000 questionnaires and received 1672, yielding a recovery rate of 83.6 %. To further complement and corroborate the conclusions, a follow-up survey was conducted in October and November 2013, where 1526 effective questionnaires were received.

Earthquake damages in Sichuan varied with location. Five cities (Aba, Guangyuan, Deyang, Ya'an, and Chengdu) were first selected randomly from 39 hard-hit areas, followed by five counties (Wenchuan, Qingchuan, Mianzhu, Lushan, and Dujiangyan) being selected from each city, using the same random sampling method. 400 survivors were randomly picked from each county using the quota sampling method. Note that vigorous and professional training were conducted to the survey workers. The questionnaires were distributed in community and relief centers. Questionnaires were completed by each respondent under guidance from the survey workers. In the first survey conducted half a year ago, the respondents were asked to leave their contact details such as telephone and family address. For the second survey conducted half a year later, the respondents were telephoned them to answer the questionnaires again. Should the phone call fail, the respondents were visited from their homes according to the family address.

2.2 Methods

2.2.1 Analysis of Variance (ANOVA) Analysis

ANOVA or F test, which was designed by R.A. Fisher, is a significance test regarding the difference of the mean values of two or more samples. The research data are fluctuating because of the influence of various factors. The causes of these fluctuations that affected the results of studies may be divided into two categories, namely, uncontrollable random factors and controllable factors.

We used ANOVA to check whether or not significant differences exist between the scores of all domains under different control variables. For values with significant differences, we used Tukey's honestly significant difference (HSD) test to determine which groups are significant.

ANOVA and Tukey's HSD are proven effective measurement tools. (Yoon et al. 2012) designed the questionnaire and used ANOVA and Tukey's tests to analyze the efficacy of an herbal plant. The aged Maggi experimental product was found to be better than the fresh Maggi product. In addition, the minty STW5 is different from the herbal products (Lim et al. 2012) used ANOVA and Tukey's tests to determine whether or not subclinical atherosclerosis in elderly is worse than in that in young people. Siegrist et al. (2010) explored the influence of three healthcare systems on work-related pressure. They used ANOVA and Tukey's tests to analyze the differences among groups. Brock et al. (2010) studied the requirements of pathogen testing and equipment in the disaster. ANOVA and Tukey's multiple comparison tests were used to compare the rating questionnaires. Lee et al. (2010) used ANOVA and Tukey's multiple comparison tests to compare the different effects of three external fluorides on surface micro hardness, fluoride uptake, and fluorescence lesion area in enamel.

In the present study, we explored whether or not significant differences exist between the scores of each domain under different control variables. We used Tukey's HSD multiple comparison test to compare the differences of scores under each control variable.

2.2.2 Reliability Evaluation

An ideal questionnaire should not only accurately reflect the properties of the object of study but also obtain all the required information with the smallest measurement error under certain conditions. Thus, testing the quality of the scales is necessary. Reliability analysis can test the consistency, stability, and reliability of questionnaires. If research unit

properties and the measurement results are unchanged, then this measure is credible. Currently, several reliability assessment methods, including repeat test, staggered method, binary method, and internal consistency, can be used.

In the current study, we assessed the internal consistency of SF-36 using the statistical software of Stata. Cronbach's alpha coefficient was used to represent the internal consistency of the scale. In general, an alpha coefficient that exceeds 0.7 indicates that the questionnaire is credible.

2.2.3 SEM-Based Model

The structural equation modeling-based model (SEM-based model) starts from the concept model, fits with the observation data and concept models, and tests the support degree of the observation data to the concept model. This model can test whether or not the fit of the concept model is reasonable. The SEM-based model can also explore the relationship between observations and potential variables within the model. We will use this model to evaluate and discuss all HRQOL domains of survivors.

3 Results

3.1 SF-36 Basic Statistics

Table 1 presents the SF-36 scale results from two surveys, each comprising eight domains. From the scores of eight domains, the HRQOL and health improvement the survivors after half a year can be determined.

The scores in all domains are lower than 50 for the first survey (Table 1). The scores of PF, BP, and RE are higher than those of GH, SF, and MH. The second survey shows that with the exception of domains with scores higher than 50, the mean values of all domains are not ideal. However, the scores are better compared that of first survey; for instance, the mean value of SF increased by 53.87 %.

ANOVA was used to further determine any significant differences between the survey results. All domains except GH have passed the significance test, and the scores have increased significantly, with the SF having the most significant increase.

3.2 ANOVA Analysis

Differences between the HRQOL of the survivors were determined based on gender, age range, educational attainment, and previous monthly income. The HRQOL of the survivors has been improved after half a year (i.e., the second survey). We chose the data collected from the first survey, which was closer to the disaster occurrence, to further explore the effect of different control variables on the HRQOL.

3.2.1 Gender-SF36

According to the data of each domain for different genders, we established eight ANOVA models to determine whether or not significant differences exist among the scores of all domains under different genders. The judging criteria for the single-factor ANOVA are based on the F value. In general, significant differences are considered to occur when the

Table 1 Results of the preliminary survey and the follow-up survey

	Half a year ago (First survey)		Half a year later (Second survey)		Variance test results		
	Mean	Standard deviation	Mean	Standard deviation	<i>F</i> value	<i>P</i> value	Significance
BP	45.87	26.46	50.7	26.85	19.75	0.000	***
GH	31.49	19.03	32.63	21.56	2.54	0.111	
MH	39.25	24.63	44.10	26.55	28.72	0.000	***
PF	44.84	24.38	49.10	25.21	23.52	0.000	***
RE	44.37	35.46	51.88	36.74	34.49	0.000	***
RP	43.19	32.39	48.91	33.48	24.11	0.000	***
SF	39.52	27.74	60.81	33.00	392.50	0.000	***
VT	41.26	25.21	45.06	26.36	17.30	0.000	***

Table 2 Results of ANOVA of each domain and gender

Domain	<i>F</i> value	<i>P</i> value	Sig
PF	467.3	0.000	***
RP	241.7	0.000	***
BP	277.5	0.000	***
GH	367.5	0.000	***
VT	385.1	0.000	***
SF	267.0	0.000	***
RE	257.5	0.000	***
MH	450.7	0.000	***

*** The value has passed the test of significance. The following are the same

Table 3 Comparison using pairwise groups using Tukey’s HSD

Domain	Difference	<i>P</i> value
PF	-22.79	0.000
RP	-20.31	0.000
BP	-17.61	0.000
GH	-14.47	0.000
VT	-19.62	0.000
SF	-18.06	0.000
RE	-22.59	0.000
MH	-20.48	0.000

Table 3 shows the result of comparison between males and females using Tukey’s HSD. The second column “difference” indicates the differences between the mean value of females and males in each domain. The *P* value reflects whether the difference is significant or not

P value that corresponds to the *F* value is lower than 0.05. The results are shown in Table 2.

The results of single-factor ANOVA indicate that the *F* test of the scores for each domain under different genders is highly significant ($P < 0.0001$). Therefore, differences in the scores of each domain exist between males and females. As shown in Table 3 and Fig. 3, the differences in the scores of each domain between males and females are significant. The scores of women are obviously lower than those of men among the eight domains. According to the results of Tukey’s HSD test, the mean value of the eight domains of females is 20 points lower than those of males. All eight domains pass the

significance test ($P < 0.001$). Figure 3 shows that the mean values of males for PF, RP, BP, VT, SF, RE, and MH are above 50. However, their mean score for GH is approximately 40. Among these domains, the mean values of males for PF, BP, VT, and RE are relatively high. The mean values of females for each domain are lower than 40. Moreover, the mean values for RP, GH, SF, and MH are approximately 20, which is relatively low.

3.2.2 Age-SF36

Considering that the age range of the correspondents of the survey was [18, 70], we divided the subjects into three groups according to the WHO age criteria (Table 4).

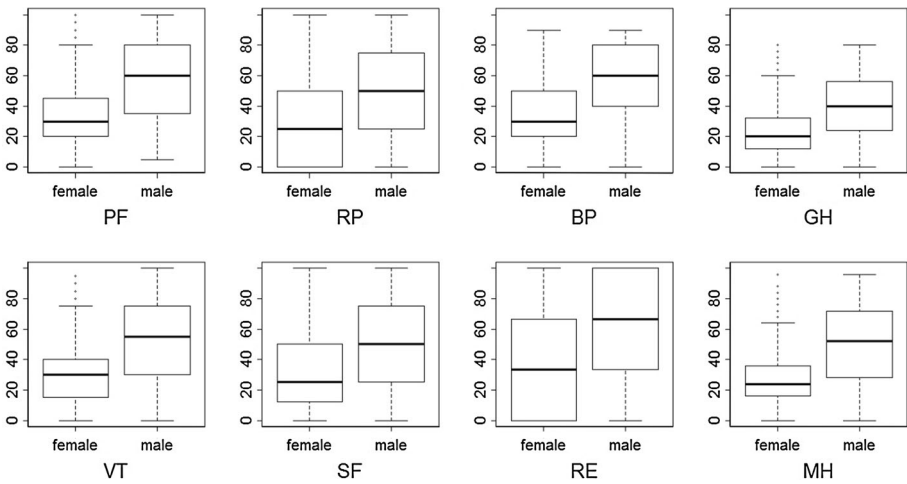


Fig. 3 Box diagrams of scores of different genders

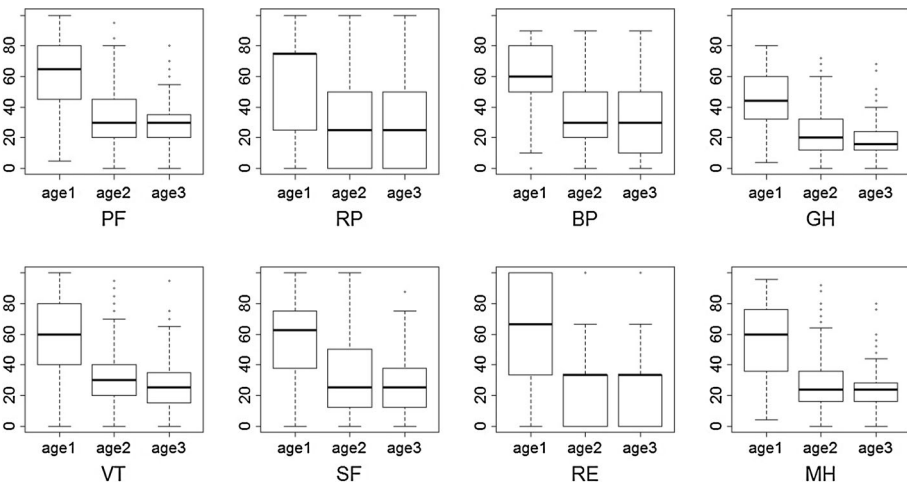


Fig. 4 Box diagrams of scores under different age ranges

Table 4 Ages of respondents

Name	Range of ages
Age1	$x < 45$
Age2	$45 \leq x < 60$
Age3	$x \geq 60$

Table 5 Results of ANOVA of the eight domains in different age ranges

Domain	F value	P value	Sig
PF	454.9	0.000	***
RP	215.5	0.000	***
BP	297	0.000	***
GH	499.2	0.000	***
VT	365.7	0.000	***
SF	241.1	0.000	***
RE	203.6	0.000	***
MH	425.5	0.000	***

Single-factor ANOVA was then conducted to determine the HRQOL of the survivors according to the three age groups (Table 5). The results of ANOVA for the eight domains in different age ranges indicate that all the *F* test results of each domain under different age ranges are highly significant ($P < 0.0001$). These results suggest that significant differences exist among the scores of the eight domains under different genders. The differences between the scores can be observed in Table 6 and Fig. 4. The mean values of all domains of the survivors under Age 1 are higher than those under the two groups. No significant differences exist between Age 2 and Age 3. Significant differences exist between Age 1 and the other two groups ($P < 0.001$, Table 6). The mean value of Age 1 is also 30 points higher than those of Age 2 and Age 3.

The scores of each domain tend to decline as age increases. For example, the mean SF score of the first age range is above 60; whereas that of the last age range is lower than 40.

Table 6 Comparison with pairwise groups using Tukey’s HSD

Domain		Difference	P value	Domain		Difference	P value
PF	Age2–Age1	–28.94	0.000	VT	Age2–Age1	–27.91	0.000
	Age3–Age1	–31.39	0.000		Age3–Age1	–30.35	0.000
	Age3–Age2	–2.45	0.145		Age3–Age2	–2.44	0.188
RP	Age2–Age1	–29.55	0.000	SF	Age2–Age1	–26.26	0.000
	Age3–Age1	–32.8	0.000		Age3–Age1	–29.32	0.000
	Age3–Age2	–3.28	0.210		Age3–Age2	–3.07	0.143
BP	Age2–Age1	–27.76	0.000	RE	Age2–Age1	–31.59	0.000
	Age3–Age1	–29.34	0.000		Age3–Age1	–34.93	0.000
	Age3–Age2	–1.58	0.547		Age3–Age2	–3.34	0.257
GH	Age2–Age1	–23.23	0.000	MH	Age2–Age1	–27.99	0.000
	Age3–Age1	–25.05	0.000		Age3–Age1	–31.95	0.000
	Age3–Age2	–1.83	0.161		Age3–Age2	–3.96	0.008

Table 6 shows the result of comparison among groups under different age ranges using Tukey’s HSD

The scores of the three ages exhibit a “tiered” phenomenon. The first age range has the highest mean value of each domain, whereas the second and third age ranges have the lowest mean value of each domain. For example, the mean MH score of the first age range is 60, whereas that of the second and third age ranges is approximately 20.

3.2.3 Education-SF36

We divided the education of the respondents into five levels: illiterate, elementary, middle, high school, and college and above. We then determined whether or not differences in HRQOL exist among the survivors with different levels of education.

Table 7 shows that the *F* test scores of each domain under different educational levels are highly significant ($P < 0.001$). Therefore, differences exist in the scores of each domain under different educational levels. Furthermore, the box diagram shows that the differences in the scores of each domain are significant (Fig. 5).

As shown in Table 8, no significant differences exist between some groups. Significant differences in the mean scores of the domains other than PF, BP, and GH are noted in the

Table 7 Results of ANOVA of the eight domains under different levels of education

Domain	<i>F</i> value	<i>P</i> value	Sig
PF	4,079	0.000	***
RP	1,266	0.000	***
BP	1,581	0.000	***
GH	2,657	0.000	***
VT	2,793	0.000	***
SF	1,507	0.000	***
RE	1,177	0.000	***
MH	3,537	0.000	***

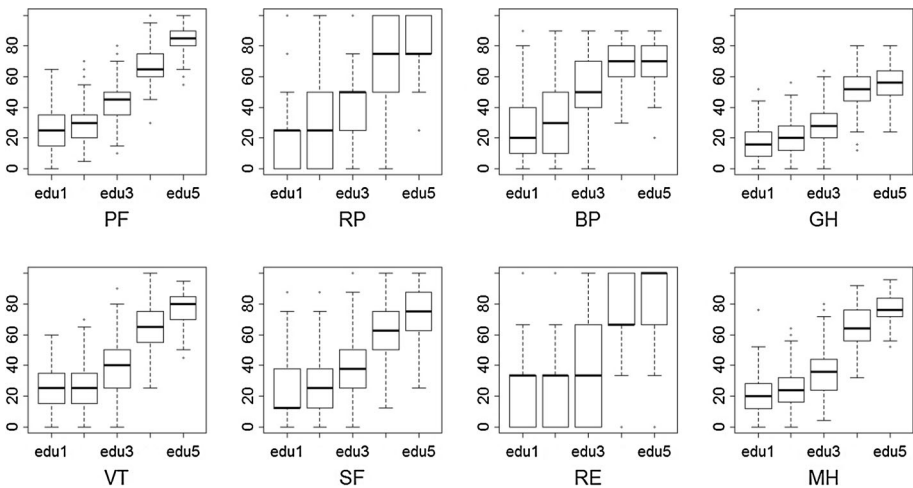


Fig. 5 Box diagrams of scores under different levels of education. The abscissas edu1, edu2, edu3, edu4, and edu5 in the figure indicate the educational levels illiterate, elementary, middle, high school, and college and above, respectively

Edu2–Edu1 group. No significant differences in the mean BP score of the Edu5–Edu4 group exist (Table 9).

1. Tukey’s HSD test shows that not all levels of education have significant differences. However, the scores of each domain generally increase with the level of education. The box diagrams show similar results.
2. The HRQOL of the survivors whose education is below high school (high school excluded) is relatively poor. As shown in Fig. 5, the HRQOL of the survivors whose educational level is illiterate, elementary or middle school differs significantly from that of the survivors whose education is high school and above.

Table 8 Comparison with pairwise groups using Tukey’s HSD

Domain		Difference	<i>P</i> value	Domain		Difference	<i>P</i> value
PF	Edu2–Edu1	3.50	0.000	VT	Edu2–Edu1	1.02	0.840
	Edu3–Edu1	17.49	0.000		Edu3–Edu1	14.71	0.000
	Edu4–Edu1	42.38	0.000		Edu4–Edu1	40.84	0.000
	Edu5–Edu1	56.68	0.000		Edu5–Edu1	54.20	0.000
	Edu3–Edu2	13.98	0.000		Edu3–Edu2	13.69	0.000
	Edu4–Edu2	38.87	0.000		Edu4–Edu2	39.82	0.000
	Edu5–Edu2	53.18	0.000		Edu5–Edu2	53.18	0.000
	Edu4–Edu3	24.89	0.000		Edu4–Edu3	26.12	0.000
	Edu5–Edu3	39.19	0.000		Edu5–Edu3	39.49	0.000
	Edu5–Edu4	14.30	0.000		Edu5–Edu4	13.36	0.000
RP	Edu2–Edu1	5.77	0.004	SF	Edu2–Edu1	1.42	0.820
	Edu3–Edu1	16.06	0.000		Edu3–Edu1	14.34	0.000
	Edu4–Edu1	49.27	0.000		Edu4–Edu1	38.92	0.000
	Edu5–Edu1	57.73	0.000		Edu5–Edu1	52.29	0.000
	Edu3–Edu2	10.30	0.000		Edu3–Edu2	12.92	0.000
	Edu4–Edu2	43.50	0.000		Edu4–Edu2	37.49	0.000
	Edu5–Edu2	51.96	0.000		Edu5–Edu2	50.86	0.000
	Edu4–Edu3	33.21	0.000		Edu4–Edu3	24.58	0.000
	Edu5–Edu3	41.67	0.000		Edu5–Edu3	37.94	0.000
	Edu5–Edu4	8.46	0.000		Edu5–Edu4	13.37	0.000
BP	Edu2–Edu1	5.85	0.000	RE	Edu2–Edu1	4.26	0.129
	Edu3–Edu1	28.49	0.000		Edu3–Edu1	14.77	0.000
	Edu4–Edu1	44.33	0.000		Edu4–Edu1	50.20	0.000
	Edu5–Edu1	47.33	0.000		Edu5–Edu1	62.30	0.000
	Edu3–Edu2	22.64	0.000		Edu3–Edu2	10.52	0.000
	Edu4–Edu2	38.48	0.000		Edu4–Edu2	45.94	0.000
	Edu5–Edu2	41.48	0.000		Edu5–Edu2	58.04	0.000
	Edu4–Edu3	15.84	0.000		Edu4–Edu3	35.43	0.000
	Edu5–Edu3	18.84	0.000		Edu5–Edu3	47.52	0.000
	Edu5–Edu4	3.00	0.370		Edu5–Edu4	12.10	0.000

Table 8 continued

Domain		Difference	<i>P</i> value	Domain		Difference	<i>P</i> value
GH	Edu2–Edu1	3.69	0.000	MH	Edu2–Edu1	3.02	0.004
	Edu3–Edu1	12.61	0.000		Edu3–Edu1	13.03	0.000
	Edu4–Edu1	34.49	0.000		Edu4–Edu1	44.06	0.000
	Edu5–Edu1	39.93	0.000		Edu5–Edu1	55.40	0.000
	Edu3–Edu2	8.92	0.000		Edu3–Edu2	10.01	0.000
	Edu4–Edu2	30.81	0.000		Edu4–Edu2	41.04	0.000
	Edu5–Edu2	36.25	0.000		Edu5–Edu2	52.39	0.000
	Edu4–Edu3	21.88	0.000		Edu4–Edu3	31.03	0.000
	Edu5–Edu3	27.32	0.000		Edu5–Edu3	42.37	0.000
	Edu5–Edu4	5.44	0.000		Edu5–Edu4	11.34	0.000

Table 6 shows the result of comparison of groups with different levels of education using Tukey’s HSD. The abscissas, edu1, edu2, edu3, edu4, and edu5 in the figure indicate the educational levels illiterate, elementary, middle, high school, and college and above, respectively

Table 9 Results of ANOVA of the eight domains under different levels of monthly income

Domain	<i>F</i> value	<i>P</i> value	Sig
PF	2,789	0.000	***
RP	1,042	0.000	***
BP	1,036	0.000	***
GH	1,784	0.000	***
VT	2,188	0.000	***
SF	1,224	0.000	***
RE	1,043	0.000	***
MH	2,875	0.000	***

3.2.4 Monthly Income-SF36

We divided the monthly income of respondents into six levels: below RMB 1000, RMB 1000–1500, RMB 1500–2000, RMB 2000–3000, RMB 3000–4000, and above RMB 4000. Afterward, we analyzed whether or not differences in HRQOL exist among the survivors with different levels of monthly income.

Table 10 shows that all the *F* test scores of each domain under different levels of monthly income are highly significant ($P < 0.0001$). Therefore, differences in the scores of each domain exist among the survivors with different levels of monthly income. Furthermore, the box diagram shows that the differences in the scores of each domain are significant (see Fig. 6).

As shown in Table 10, no significant differences exist between some groups. The mean scores of the domains, except for RE, show significant differences in the Inc6–Inc5 group. In addition, no significant differences exist in the scores of the VT, RP, and SF domains in the Inc2–Inc1 group; RP, BP, and GH domains in the Inc5–Inc4 group; and BP and GH domains in the Inc6–Inc4 group.

Table 10 Comparison with pairwise groups using Tukey’s HSD

Domain		Difference	<i>P</i> value	Domains		Difference	<i>P</i> value
PF	Inc2–Inc1	4.17	0.040	VT	Inc2–Inc1	3.74	0.009
	Inc3–Inc1	12.70	0.000		Inc3–Inc1	14.41	0.000
	Inc4–Inc1	35.63	0.000		Inc4–Inc1	37.49	0.000
	Inc5–Inc1	47.27	0.000		Inc5–Inc1	50.29	0.000
	Inc6–Inc1	52.93	0.000		Inc6–Inc1	54.50	0.000
	Inc3–Inc2	8.53	0.000		Inc3–Inc2	10.67	0.000
	Inc4–Inc2	31.46	0.000		Inc4–Inc2	33.75	0.000
	Inc5–Inc2	43.10	0.000		Inc5–Inc2	46.55	0.000
	Inc6–Inc2	48.76	0.000		Inc6–Inc2	50.76	0.000
	Inc4–Inc3	22.93	0.000		Inc4–Inc3	23.08	0.000
	Inc5–Inc3	34.57	0.000		Inc5–Inc3	35.88	0.000
	Inc6–Inc3	40.23	0.000		Inc6–Inc3	40.09	0.000
	Inc5–Inc4	11.64	0.000		Inc5–Inc4	12.81	0.000
	Inc6–Inc4	17.30	0.000		Inc6–Inc4	17.01	0.000
	Inc6–Inc5	5.66	0.168		Inc6–Inc5	4.20	0.208
RP	Inc2–Inc1	8.54	0.004	SF	Inc2–Inc1	4.17	0.040
	Inc3–Inc1	17.32	0.000		Inc3–Inc1	12.70	0.000
	Inc4–Inc1	47.69	0.000		Inc4–Inc1	35.63	0.000
	Inc5–Inc1	53.19	0.000		Inc5–Inc1	47.27	0.000
	Inc6–Inc1	58.21	0.000		Inc6–Inc1	52.93	0.000
	Inc3–Inc2	8.77	0.000		Inc3–Inc2	8.53	0.000
	Inc4–Inc2	39.18	0.000		Inc4–Inc2	31.46	0.000
	Inc5–Inc2	44.65	0.000		Inc5–Inc2	43.10	0.000
	Inc6–Inc2	49.66	0.000		Inc6–Inc2	48.76	0.000
	Inc4–Inc3	30.37	0.000		Inc4–Inc3	22.93	0.000
	Inc5–Inc3	35.87	0.000		Inc5–Inc3	34.57	0.129
	Inc6–Inc3	40.89	0.000		Inc6–Inc3	40.23	0.000
	Inc5–Inc4	5.50	0.375		Inc5–Inc4	11.64	0.000
	Inc6–Inc4	10.52	0.004		Inc6–Inc4	17.30	0.000
	Inc6–Inc5	5.02	0.507		Inc6–Inc5	5.66	0.168
BP	Inc2–Inc1	9.34	9.340	RE	Inc2–Inc1	5.44	0.000
	Inc3–Inc1	22.12	0.000		Inc3–Inc1	15.88	0.000
	Inc4–Inc1	39.75	0.000		Inc4–Inc1	47.04	0.000
	Inc5–Inc1	45.17	0.000		Inc5–Inc1	57.89	0.000
	Inc6–Inc1	46.34	0.370		Inc6–Inc1	63.15	0.000
	Inc3–Inc2	12.87	0.000		Inc3–Inc2	10.43	0.004
	Inc4–Inc2	30.41	0.000		Inc4–Inc2	41.59	0.000
	Inc5–Inc2	35.83	0.000		Inc5–Inc2	52.45	0.000
	Inc6–Inc2	37.00	0.000		Inc6–Inc2	57.70	0.000
	Inc4–Inc3	17.54	0.000		Inc4–Inc3	31.16	0.000
	Inc5–Inc3	22.95	0.000		Inc5–Inc3	42.01	0.000
	Inc6–Inc3	24.12	0.000		Inc6–Inc3	47.27	0.000
	Inc5–Inc4	5.41	0.186		Inc5–Inc4	10.86	0.000
	Inc6–Inc4	6.58	0.067		Inc6–Inc4	16.11	0.000
	Inc6–Inc5	1.17	0.996		Inc6–Inc5	5.26	0.000

Table 10 continued

Domain		Difference	<i>P</i> value	Domains	Difference	<i>P</i> value	
GH	Inc2–Inc1	4.87	0.000	MH	Inc2–Inc1	4.58	0.000
	Inc3–Inc1	11.76	0.000		Inc3–Inc1	14.47	0.000
	Inc4–Inc1	32.37	0.000		Inc4–Inc1	42.00	0.000
	Inc5–Inc1	37.53	0.000		Inc5–Inc1	51.01	0.000
	Inc6–Inc1	37.80	0.000		Inc6–Inc1	56.06	0.000
	Inc3–Inc2	6.89	0.000		Inc3–Inc2	9.89	0.000
	Inc4–Inc2	27.50	0.000		Inc4–Inc2	37.43	0.000
	Inc5–Inc2	32.66	0.000		Inc5–Inc2	46.43	0.000
	Inc6–Inc2	32.92	0.000		Inc6–Inc2	51.48	0.000
	Inc4–Inc3	20.61	0.000		Inc4–Inc3	27.53	0.000
	Inc5–Inc3	25.77	0.000		Inc5–Inc3	36.54	0.000
	Inc6–Inc3	26.03	0.000		Inc6–Inc3	41.59	0.000
	Inc5–Inc4	5.16	0.005		Inc5–Inc4	9.00	0.000
	Inc6–Inc4	5.42	0.004		Inc6–Inc4	14.06	0.000
Inc6–Inc5	0.26	0.999	Inc6–Inc5	5.05	0.260		

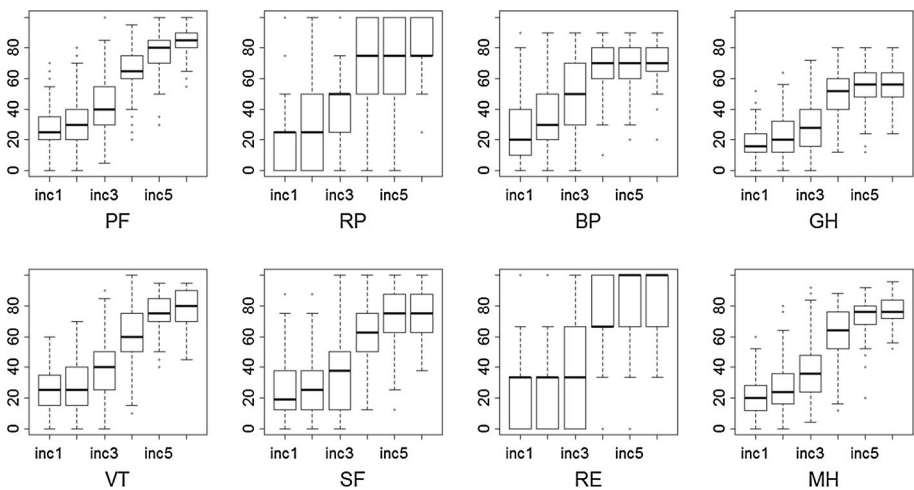


Fig. 6 Box diagrams of scores under different levels of monthly income. The abscissas inc1, inc2, inc3, inc4, inc5, and inc6 indicate the monthly income levels of below RMB 1000, RMB 1000–1500, RMB 1500–2000, RMB 2000–3000, RMB 3000–4000, and above RMB 4000, respectively

1. Tukey’s HSD test shows that not all levels of last monthly income show significant differences. However, the scores of each domain generally increase with the level of monthly income. The box diagrams show similar results.
2. The HRQOL of the survivors whose monthly income is below RMB 2000 is relatively poor. As shown in Fig. 6, the scores of each domain under monthly income levels of below RMB 1000, RMB 1000–1500, and RMB 1500–2000 are below 50, whereas those of each domain under monthly income levels of RMB 2000–3000, RMB

3000–4000, and above RMB 4000 are above 50. Significant differences exist in the HRQOL of the survivors whose monthly income is approximately RMB 2000.

3.3 Correlation Test

For factor analysis, the original variables should exhibit a strong correlation. Thus, raw data must be correlated before the factors are analyzed. The factor analysis for the original variables is statistically significant only when most of the correlation coefficients in the matrix are above 0.3. If most of these coefficients are lower than 0.3, then the original variables are suitable for factor analysis. Correlation analysis was then conducted using the raw data from the questionnaires (Table 11).

3.4 Tests of the SF-36 Scale

3.4.1 Reliability Analysis of the SF-36 Scale

The reliability of analysis to the survey results was determined. The total Cronbach's alpha coefficient of the SF-36 scale in the first and second surveys are 0.913 (Table 12) and 0.921 (Table 13). The reliability of scales is greater than 0.50. The questionnaire is reliable and has strong internal consistency when the coefficient is above 0.70. Subsequently, we calculated the total Cronbach's alpha coefficient when a domain is removed. After removing any domain, the corresponding Cronbach's alpha coefficient value generally declines, which makes the scale highly stable.

3.4.2 SEM-Based Model

In this section, the relationship among the eight SF-36 scale domains is studied using SEM (Fig. 7). We fit the concept model first and then evaluated the model-fitting results. Evaluating the CFA model is widely considered a comprehensive problem. Different fit indexes have different emphases. Thus, multiple indexes must be considered comprehensively to determine whether or not the model supports the observation data. We chose six model fit indexes, including Chi square (χ^2), Chi square/degrees of freedom (χ^2/df), comparative fit index (CFI), increasing fit index (IFI), and goodness-of-fit index (GFI).

The model fits better with the observations when the χ^2/df is less than 3. This result suggests that the model is good. Sample size influences χ^2/df . Thus, certain other indexes

Table 11 Correlation coefficient matrix of each domain

	PF	RP	BP	GH	VT	SF	RE	MH
PF	1.00	0.63	0.59	0.70	0.73	0.62	0.64	0.76
RP	0.63	1.00	0.46	0.56	0.58	0.48	0.50	0.59
BP	0.59	0.46	1.00	0.57	0.57	0.49	0.44	0.58
GH	0.70	0.56	0.57	1.00	0.66	0.57	0.56	0.70
VT	0.73	0.58	0.57	0.66	1.00	0.58	0.55	0.73
SF	0.62	0.48	0.49	0.57	0.58	1.00	0.49	0.62
RE	0.64	0.50	0.44	0.56	0.55	0.49	1.00	0.59
MH	0.76	0.59	0.58	0.70	0.73	0.62	0.59	1.00

Table 12 Cronbach's alpha coefficients when a domain is removed

Domains	Cronbach's alpha coefficients
PF	0.892
RP	0.907
BP	0.906
GH	0.901
VT	0.896
SF	0.904
RE	0.910
MH	0.894

Table 13 Cronbach's alpha coefficients for the second survey results (half a year later), upon domain removal

Domain	Cronbach's alpha coefficient
PF	0.903
RP	0.914
BP	0.916
GH	0.910
VT	0.896
SF	0.906
RE	0.917
MH	0.903

were utilized, such as CFI, IFI, and root mean square error of approximation (RMSEA). The fit of the model is good when both CFI and IFI are over 0.9 and when RMSEA is between 0 and 0.05. The SEM result of the first survey conducted half a year ago shows that $\chi^2/df = 1.41$, CFI = 0.987(> 0.9), and IFI = 0.987(> 0.9). Moreover, the estimated value of RMSEA is 0.016, which is within the precise fitting range. While in the model of the investigation conducted half a year later shows, $\chi^2/df = 2.80$, CFI = 0.914(> 0.9), and IFI = 0.914(> 0.9). Overall, the model fit are good.

In addition, the path coefficients of the eight domains are positive and pass the significance test. CR value is a Z statistic that consists of the ratio of the parameter estimates and their standard deviations. CR value can evaluate whether or not the estimated path coefficient is statistically significant. CR value corresponds to the *P* value. When the *P* value is less than 0.05, each path coefficient passes the significance test. Furthermore, the *P* value proves that all domains exhibit a certain degree of correlation. The domains are not completely independent and have common potential confounders.

The degree of correlation between each domain is not similar. Table 14, 15 show that the path coefficients of each domain are not similar. Greater path coefficient results in stronger degree of differences between the corresponding variables. For example, SF, BP, MH, and VT of survivors have a very strong correlation with each other.

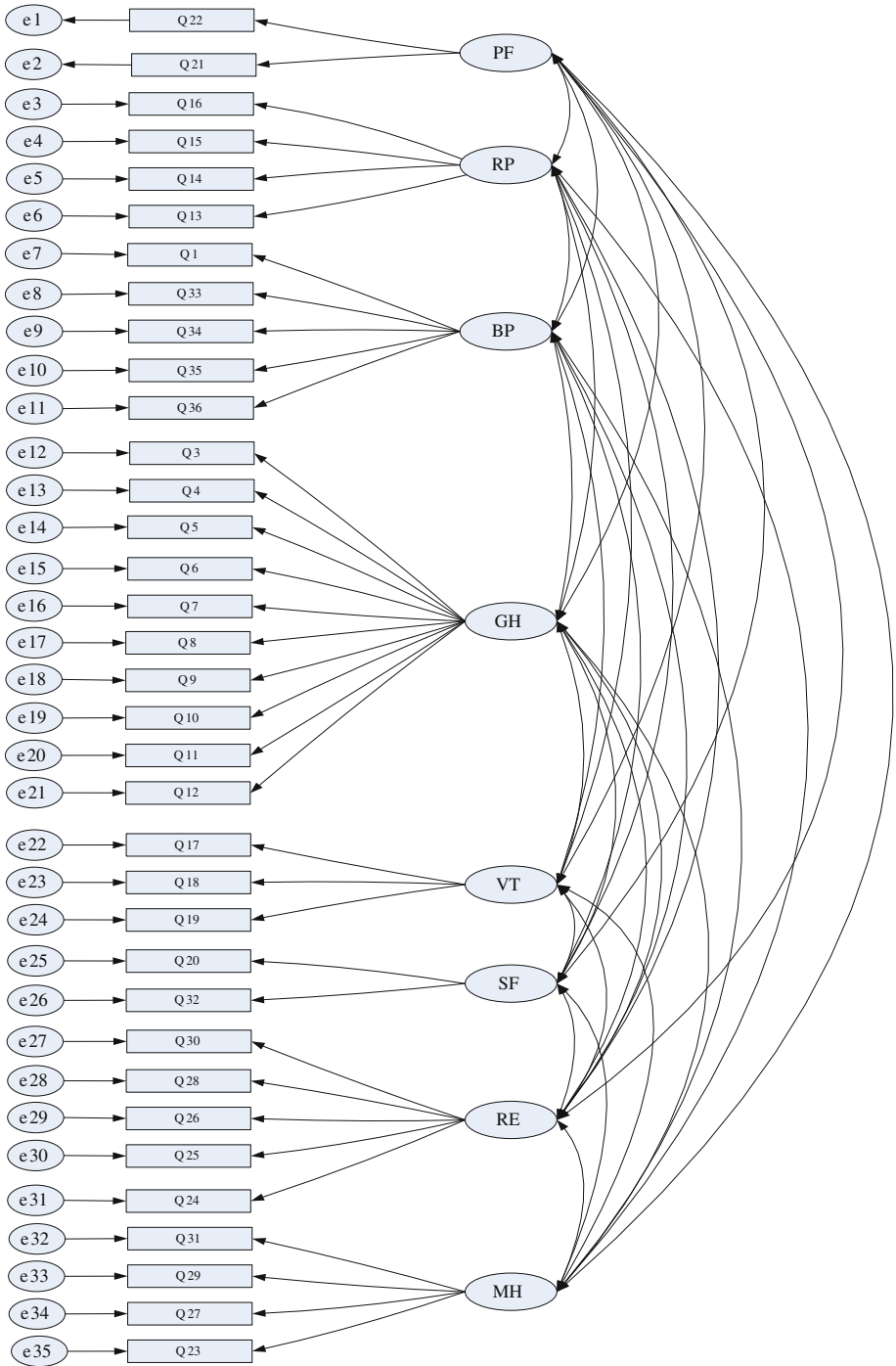


Fig. 7 SEM of SF-36 scale

Table 14 SEM model results

	Estimate	SE	C.R.	<i>P</i>		Estimate	SE	C.R.	<i>P</i>
PF-> Q11	1.000				RP-> Q13	0.790	0.057	13.869	***
PF-> Q10	1.056	0.059	17.910	***	RP-> Q14	1.006	0.061	16.541	***
PF-> Q9	1.097	0.059	18.732	***	RP-> Q15	0.927	0.060	15.475	***
PF-> Q8	0.977	0.057	17.206	***	RP <->BP	0.232	0.017	13.800	***
PF-> Q7	1.067	0.057	18.865	***	BP <->GH	0.548	0.044	12.560	***
PF-> Q6	1.093	0.056	19.405	***	PF <->BP	0.396	0.026	15.074	***
PF-> Q5	1.094	0.057	19.098	***	BP <->RE	0.241	0.017	13.947	***
PF-> Q4	0.996	0.054	18.330	***	BP <->SF	0.730	0.048	15.152	***
PF-> Q3	0.942	0.053	17.791	***	BP <->MH	1.065	0.065	16.335	***
PF-> Q2	0.985	0.056	17.449	***	RP <->GH	0.134	0.011	12.013	***
BP-> Q20	1.000				RP <->PF	0.105	0.007	14.548	***
BP-> Q21	0.904	0.047	19.149	***	RP <->RE	0.067	0.005	13.966	***
GH-> Q35	1.000				RP <->SF	0.178	0.013	14.154	***
GH-> Q34	1.315	0.098	13.462	***	RP <->MH	0.266	0.017	15.321	***
GH-> Q33	1.479	0.104	14.236	***	RP <->VT	0.256	0.017	14.868	***
GH-> Q32	1.657	0.114	14.569	***	PF <->GH	0.226	0.018	12.524	***
GH-> Q1	1.583	0.110	14.409	***	GH <->RE	0.146	0.012	12.363	***
VT-> Q22	1.000				GH <->SF	0.417	0.033	12.784	***
VT-> Q26	1.054	0.052	20.102	***	GH <->MH	0.612	0.046	13.240	***
VT-> Q28	0.873	0.047	18.512	***	GH <->VT	0.563	0.044	12.831	***
VT-> Q30	1.100	0.050	22.121	***	PF <->RE	0.117	0.008	15.280	***
SF-> Q31	1.000				PF <->SF	0.313	0.020	15.705	***
SF-> Q19	1.098	0.055	19.953	***	PF <->MH	0.461	0.028	16.431	***
RE-> Q18	1.000				PF <->VT	0.432	0.027	15.792	***
RE-> Q17	0.937	0.054	17.416	***	SF <->RE	0.201	0.013	15.001	***
RE-> Q16	0.856	0.053	16.190	***	RE <->MH	0.295	0.018	16.169	***
MH-> Q23	1.000				VT <->RE	0.266	0.017	15.219	***
MH-> Q24	1.003	0.042	23.943	***	SF <->MH	0.846	0.049	17.171	***
MH-> Q25	1.048	0.045	23.276	***	VT <->SF	0.779	0.048	16.218	***
MH-> Q27	0.871	0.039	22.248	***	BP <->VT	0.994	0.064	15.574	***
MH-> Q29	0.865	0.044	19.446	***	VT <->MH	1.175	0.068	17.330	***
RP-> Q12	1.000								

Table 15 SEM model results for the second survey (half a year later)

	Estimate	SE	CR	<i>P</i>		Estimate	SE	CR	<i>P</i>
PF-> Q12	1.000				RP-> Q14	0.879	0.056	15.775	***
PF-> Q11	0.990	0.052	18.969	***	RP-> Q15	1.058	0.059	18.034	***
PF-> Q10	1.039	0.053	19.762	***	RP-> Q16	0.946	0.057	16.622	***
PF-> Q9	0.892	0.051	17.564	***	RP <->BP	0.266	0.018	14.806	***
PF-> Q8	1.001	0.051	19.601	***	BP <-> GH	0.370	0.033	11.086	***
PF-> Q7	1.031	0.051	20.184	***	PF <-> BP	0.462	0.029	16.054	***

Table 15 continued

	Estimate	SE	CR	<i>P</i>		Estimate	SE	CR	<i>P</i>
PF-> Q6	1.021	0.051	20.021	***	BP <-> RE	0.282	0.019	15.111	***
PF-> Q5	0.975	0.050	19.622	***	BP <-> SF	1.074	0.068	15.860	***
PF-> Q4	0.905	0.048	18.761	***	BP <-> MH	1.299	0.075	17.395	***
PF-> Q3	0.977	0.052	18.857	***	RP <-> GH	0.087	0.008	10.674	***
BP-> Q21	1.000				RP <->PF	0.120	0.008	15.413	***
BP-> Q22	0.857	0.043	20.077	***	RP <-> RE	0.076	0.005	15.020	***
GH->Q36	1.000				RP <-> SF	0.264	0.018	15.052	***
GH-> Q35	1.117	0.103	10.880	***	RP<-> MH	0.313	0.019	16.117	***
GH-> Q34	1.188	0.104	11.461	***	RP <->VT	0.311	0.020	15.407	***
GH-> Q33	3.522	0.240	14.688	***	PF <-> GH	0.156	0.014	11.277	***
GH-> Q1	1.315	0.112	11.766	***	GH <->RE	0.096	0.009	10.932	***
VT-> Q23	1.000				GH <-> SF	0.372	0.033	11.253	***
VT-> Q27	0.428	0.025	16.911	***	GH <-> MH	0.425	0.037	11.632	***
VT->Q29	0.412	0.023	17.706	***	GH <->VT	0.888	0.067	13.208	***
VT-> Q31	0.486	0.022	21.931	***	PF <-> RE	0.132	0.008	16.167	***
SF-> Q32	1.000				PF <-> SF	0.465	0.028	16.418	***
SF-> Q20	0.928	0.043	21.697	***	PF<-> MH	0.549	0.032	17.291	***
RE-> Q19	1.000				PF <->VT	0.559	0.032	17.283	***
RE-> Q18	0.980	0.051	19.391	***	SF <->RE	0.292	0.019	15.761	***
RE-> Q17	0.875	0.049	17.697	***	RE <-> MH	0.348	0.02	17.031	***
MH-> Q24	1.000				VT <-> RE	0.342	0.021	16.084	***
MH-> Q25	0.999	0.040	25.279	***	SF <-> MH	1.292	0.073	17.734	***
	0.975	0.041	23.928	***	VT <-> SF	1.349	0.078	17.396	***
MH-> Q28	0.913	0.038	24.135	***	BP <-> VT	1.302	0.079	16.502	***
MH-> Q30	0.846	0.040	21.063	***	VT <-> MH	1.513	0.081	18.607	***
RP-> Q13	1.000								

4 Conclusion and Discussion

4.1 Conclusion

Sichuan Province, one of the central provinces with a large population in China, has suffered from destructive earthquakes. The Wenchuan and Lushan earthquakes have caused severe casualties and posed threats to the health of the survivors. Thus, the HRQOL of the survivors must be investigated.

The data analysis in this paper is mainly based on the first survey, and the collected data from the follow-up survey were used to perform a supplementary analysis. By analyzing data from five hard-hit areas in Sichuan and by establishing models, we drew the following conclusions:

1. The HRQOL of earthquake survivors is relatively poor, especially in the GH, MH, SF, VT,. And so on. We used SF-36 to measure the HRQOL domains of the survivors. The scores of each domain are relatively low, indicating that the HRQOL of the survivors

- is low, especially in the GH, MH, and SF domains. SF of survivors has been improved greatly at second survey.
2. ANOVA results show that all domains (except GH) have improved significantly, including the SF cores, wherein the mean value increased by 53.87 % compared with that of the first survey (half a year ago).
 3. There are several features of survivors' health. Gender, education, monthly income, and age significantly affect the HRQOL of the survivors. In general, the HRQOL scores of men are higher than those of women. Higher education or monthly income results in higher HRQOL scores. Moreover, younger survivors tend to have higher HRQOL scores. We present a detailed analysis based on four aspects.
 - (a) All domains of females have lower scores than those of males.
 - (b) The HRQOL of young people is better than that of middle-aged and elder people. In addition, no significant differences in HRQOL are present between middle-aged and elder people.
 - (c) In general, survivors with higher educational level have better HRQOL. Aside from the PF, BP, and GH domains, no significant differences exist in the HRQOL of the survivors with elementary and lower educational levels. Furthermore, no significant differences exist in the HRQOL of the survivors with high school and higher educational levels in the BP domain. Significant differences exist in the mean values of each domain under other different educational levels.
 - (d) In general, survivors with higher monthly income have better HRQOL. No significant differences exist in the HRQOL of the survivors with monthly income levels above RMB 3000 in the RE domain. In addition, no significant differences exist in the HRQOL of the survivors with monthly income levels below RMB 1500 in the VT, RP, and SF domains; RMB 2000–4000 in the RP, BP, and GH domains; and RMB 2000–3000 and above 4000 in the BP and GH domains.
 3. The HRQOL domains of all survivors exhibit correlations.
 - (a) The correlations are all positive. The domains are not completely independent and have common potential confounders.
 - (b) The degree of correlation between each domain is not similar. The SF, BP, MH, and VT of the survivors have a very strong correlation. SF, BP, MH, and VT also have a strong correlation. Other variables have a relatively weak correlation.
 - (c) The degree of influence varies between each domain. Here, the SF, BP, MH, and VT of the survivors strongly influence one another.

Based on the above analysis, several suggestions are presented.

First, the government should provide a different policy target to increase the HRQOL of the survivors. In particular, female, elder survivors with low educational and income levels require urgent social and policy support.

Second, the government should provide several aid policies, especially HRQOL-related policies, such as employment aid policy and social insurance policy. With regard to the employment aid policy, the government should ensure that one person in every family is employed and that every family has income. The government should also develop public projects for the reconstruction of affected areas that can employ jobless survivors, such as health and epidemic prevention, logistics, environmental sweeping, and police affairs assistance. Moreover, the government should encourage enterprises to hire the survivors.

Regulation-insured subsidies should be given to ensure that survivors will not be affected in terms of income. With regard to the social insurance policy, the government should protect elder survivors. If the survivors have reached the statutory retirement age, they should be eligible to apply for retirement and pension. In addition, if the survivors meet the minimum living security requirements, they should be given a subsistence allowance. If the survivors meet temporary living assistance requirements, they should be given temporary living assistance.

Third, health knowledge should be disseminated. The government health department should set up regular lectures in hospitals, primary schools, and primary health units to propagate health knowledge. By doing such, survivors can be encouraged to change bad habits, which will thereby increase their health (Jorm 2000). The government should also create primary health units in resettlement sites so that public health status may be improved. In addition, the government should invite experts to propagate the importance of mental health. A database should also be established for female, elder individuals with low income and educational levels. Traced surveys to improve survivors' HRQOL must be conducted.

Finally, the government should focus on the coordination and integration of policies. However, we should not increase their HRQOL using only one method. The process can be bidirectional. Survivors should be encouraged to participate in reconstruction work. The eight HRQOL domains are positively correlated with one another. SF, BP, MH, and VT have a strong mutual correlation. The spontaneous spirit will motivate the survivors to actively participate in the reconstruction, which can improve both MCS and PCS.

This study also has certain limitations. First, we selected only the most representative areas that suffered from destructive earthquakes. China is a country with diverse natural disasters, such as floods, landslides, and snowstorms. These disasters hit different areas every year. The health of survivors suffering from different types of natural disasters should also increase our concern. Second, this study focused on indicators of the HRQOL of earthquake survivors. In fact, many factors also affect the HRQOL of survivors. The objective environmental factor should not be ignored. Third, we attempted to improve the HRQOL of survivors and diversify the research perspective that focuses on influencing factors. Aside from the SF-36 scale, other tools that have been improved to have good reliability and validity are available. Future research may attempt to employ these tools to explore the HRQOL of survivors.

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Conflict of interests The authors declare that they have no conflict interests.

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