Original Article

Trajectories of mental health symptoms predict long-term quality of life among Wenchuan adolescent survivors: A 10-year follow-up study

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ABSTRACT

Purpose: Previous studies usually examine the associations between psychological distresses and quality of life (QOL) with a variable-centred approach, while little is known about the effect of the individual variance in time-varying changes of psychological distresses on QOL. Therefore, this study aimed to examine whether individual variance in psychological distresses during the early phases post-earthquake would develop different QOL's levels among adolescent survivors 10-year after the Wenchuan earthquake.
Methods: Data were extracted from the Wenchuan Earthquake Adolescent Health Cohort Study. The current study included 744 adolescent survivors who effectively completed surveys at 6 months, 24 months, and 10 years after the earthquake. Self-report questionnaires were administered to collect information on socio-demographic characteristics, earthquake exposure, life events, anxiety symptoms, depressive symptoms, posttraumatic stress symptoms (PTSS), and QOL. Data were analysed using hierarchical multiple regression.
Results: Trajectories of psychological distresses were classified as follow: resistance (anxiety 40.73%; depression 54.70%; PTSS 74.46%), recovery (anxiety 17.20%; depression 9.27%; PTSS 10.35%), delayed dysfunction (anxiety 10.35%; depression 18.15%; PTSS 6.18%), and chronicity (anxiety 31.72%; depression 17.88%; PTSS 9.01%). After controlling covariates, hierarchical multiple regression only revealed that the anxiety trajectory with delayed dysfunction remained significantly predictive for four domains of QOL (physical health, psychological health, social relationships, and environment).
Conclusion: The current study highlights the importance of focusing on the variations in trajectories of anxiety symptoms among disaster survivors and providing individualized mental health services to improve survivors' QOL.

Introduction

Wenchuan county in Sichuan province, located in the southwest of China, was hit by an earthquake with a magnitude of 8.0 on May 12, 2008, resulted in 69,197 deaths, 374,176 injuries, and 18,222 missing individuals.[1] When China had achieved a reconstruction miracle, more attention was paid on earthquake survivors' physical disease, mental health, and quality of life (QOL). Many studies conducted within 2-year after the earthquake have emphasized

that earthquakes impaired the mental health and QOL of survivors.[2,3] For example, Wang et al.[2] pointed out that there was a multidimensional impairment in QOL, including physical, psychological, and environmental domains. It has also been noted that poor QOL might persist for years after the disaster.[4] Therefore, research into factors related to QOL among disaster-exposed population is of great implications to reconstruction of disaster areas.[5]

The QOL defined by the World Health Organization Quality of Life (WHOQOL) Group is that individuals' perceptions of their

position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns.[6] QOL is a comprehensive and multi-dimensional concept incorporating domains related to physical health, psychological health, social relationships, and environment.[6,7]

Several studies have identified the risk factors associated with a poor QOL, such as mental distress following earthquakes.[3,5,8,9] For example, Choul et al.[8] pointed out that the greater severity of psychiatric impairment, the poorer QOL among 4223 earthquake survivors. Specifically, anxiety,[4] depression,[3,5] and posttraumatic stress symptoms (PTSS)[3–5] were negatively associated with QOL among disaster survivors. In addition, some longitudinal studies also found that there were negative relationship between QOL and anxiety, depression, and PTSS.[9–11] Goenjian et al.[8] also found that depressive symptoms at 3-month was the best predictor of poor QOL at 32-month.[9] Above studies have usually examined the associations between psychological distresses and QOL based on a variable-centred approach, while little is known about the effect of the individual variance in time-varying changes of psychological distresses on QOL. Since physical injuries recovered, and mental status also changed among disaster survivors over time, understanding trajectories of psychological distresses and their effects on the long-term QOL is beneficial to improve survivors' QOL.

Previous studies indicated that there is individual difference in survivors' adaptation processes to traumatic events,[12] and distinct trajectories for anxiety/depressive/PTSS were observed in previous studies as follow[12–15]: (1) chronic dysfunction (persist severe symptoms following disaster over time); (2) recovery (initial moderate to severe symptoms followed by diminishing gradually); (3) delayed dysfunction (initially no or minimal psychiatric symptoms followed by the outbreak of severe symptoms); and (4) resilience (after trauma with minimal or no symptoms over time). Therefore, it is vital to examine the effect of distinct trajectories for anxiety/depressive/PTSS on QOL after earthquakes.

The current study aimed to examine whether individual variance in psychological distresses during the early phases of post-earthquake would develop different QOL levels among adolescent survivors 10-year after the Wenchuan earthquake. Firstly, we would present the trajectories of psychological distresses including anxiety, depression, and PTSS. Second, the impacts of the trajectory of psychological distresses on four domains of QOL would be tested among adolescent survivors 10-year after the Wenchuan earthquake.

Methods

Participants and procedures

Data were extracted from the Wenchuan Earthquake Adolescent Health Cohort (WEAHC) Study.[1] In total of 1357 adolescents participated in the WEAHC study at 6-month post-earthquake (T_{6m}) from a senior high school (10th grade) in Dujiangyan city, one of the most devastated area in the earthquake. At the 10-year post-earthquake, 799 participants responded to follow-up surveys (T_{10y}, response rate: 58.9%), and 55 subjects were excluded due to great data loss. The current study included 744 adolescent survivors effectively completed surveys at 6 months (T_{6m}), 24 months (T_{24m}), and 10 years (T_{10y}) after the earthquake. Self-report questionnaires were administered to collect information on socio-demographic characteristics, earthquake exposure, life events, anxiety symptoms, depressive symptoms, PTSS, and QOL.

The WEAHC study was approved by the Human Research Ethics Committee of South China Normal University, and the boards of the participating schools and the Chengdu Women's Federation also permitted and supported this study. Written informed consent was obtained from all participants and their parents prior to administration to the survey.

Measurement

Socio-demographic variables (gender and age) were collected at T_{6m}. Other variables, including education level, current residence location, marital status, personal income per year, physical activity, and cigarette and alcohol consumption, were assessed at T_{10y}.

Earthquake exposure was evaluated by four self-report items at T_{6m}, respectively item 1: death, missing and/or injury of family members (1 = death of family members, 2 = disappearance of family members, 3 = severe injury of family members, 4 = moderate injury of family members, 5 = none of the above); item 2: house damage (1 = complete damage, 2 = severe damage, 3 = moderate damage, 4 = slight damage, 5 = none of the above); item 3: property loss other than house damage (1 = complete loss, 2 = severe loss, 3 = moderate loss, 4 = slight loss, 5 = none of the above); and item 4: direct witness of tragic scenes (1 = directly viewing many tragic scenes, 2 = directly viewing some tragic scenes, 3 = hearing many from others, 4 = hearing some from others, 5 = none of the above). The above 4 items were recoded to account for the low number of responses observed in certain categories. The first 3 items were recoded onto a 3-point scale, with item 1 was recoded as "no", "injured", and "death/missing"; item 2 and item 3 both recoded as "minor/no", "moderate", and "severe"; item 4 was simply recoded as "no" and "yes".

Life events were assessed at T_{10y} by the self-made 16-item on negative life events (10 items: death of family members, relatives, or friends; serious physical diseases) and positive life events (5 items: e.g., achieve important life goal, find meaningful hobbies). Responses were recorded as a dichotomous variable: "yes" and "no". Cronbach's alpha was 0.72 in the current sample.

Anxiety symptoms were assessed by the 41-item Screen for Child Anxiety Related Emotional Disorders at T_{6m} and T_{24m}.[16,17] Items rated each item on a 3-point Likert scale (0 = "almost never" to 2 = "often"). Total scores range from 0 to 82, and a higher score indicates more severe anxiety symptoms. A cut-off score of 25 had been recommended for identifying probable anxiety.[17] In the current study, Cronbach's alpha at T_{6m} and T_{24m} was 0.92 and 0.95, respectively.

The Chinese version of the Depression Self-Rating Scale for Children (DSRSC) was employed to measure adolescents' depressive symptoms at T_{6m} and T_{24m}.[18] The DSRSC consists of 18 items rated on a 3-point Likert scale (0 = never, 1 = sometimes, 2 = most of the time), the total scores of which range from 0 to 36, where a higher score indicates severe depressive symptoms. A cut-off score of 15 had been recommended for identifying probable clinical depression. In the present study, Cronbach's α of DSRSC at T_{6m} and T_{24m} was 0.79 and 0.83, respectively.

The 24 items Posttraumatic Stress Disorder Self-Rating Scale (PTSD-SS) was used to evaluate PTSS at T_{6m} and T_{24m}.[19] Items are rated on 5-point Likert scale from 1 (not at all) to 5 (extremely severe). Total scores are between 24 and 120 with a higher score indicating more severe PTSS. A total score of 50 was considered as the cut-off score for probable PTSS.[19] In the current study, the Cronbach's α at T_{6m} and T_{24m} was 0.95 and 0.96, respectively.

The Chinese brief version of the World Health Organization Quality of Life Instrument (WHOQOL-BREF) was used to evaluate QOL at T_{10y}.[7] The WHOQOL-BREF comprises 26 items, which measure the following four domains: physical health (7 items), psychological health (6 items), social relationships (3 items), and
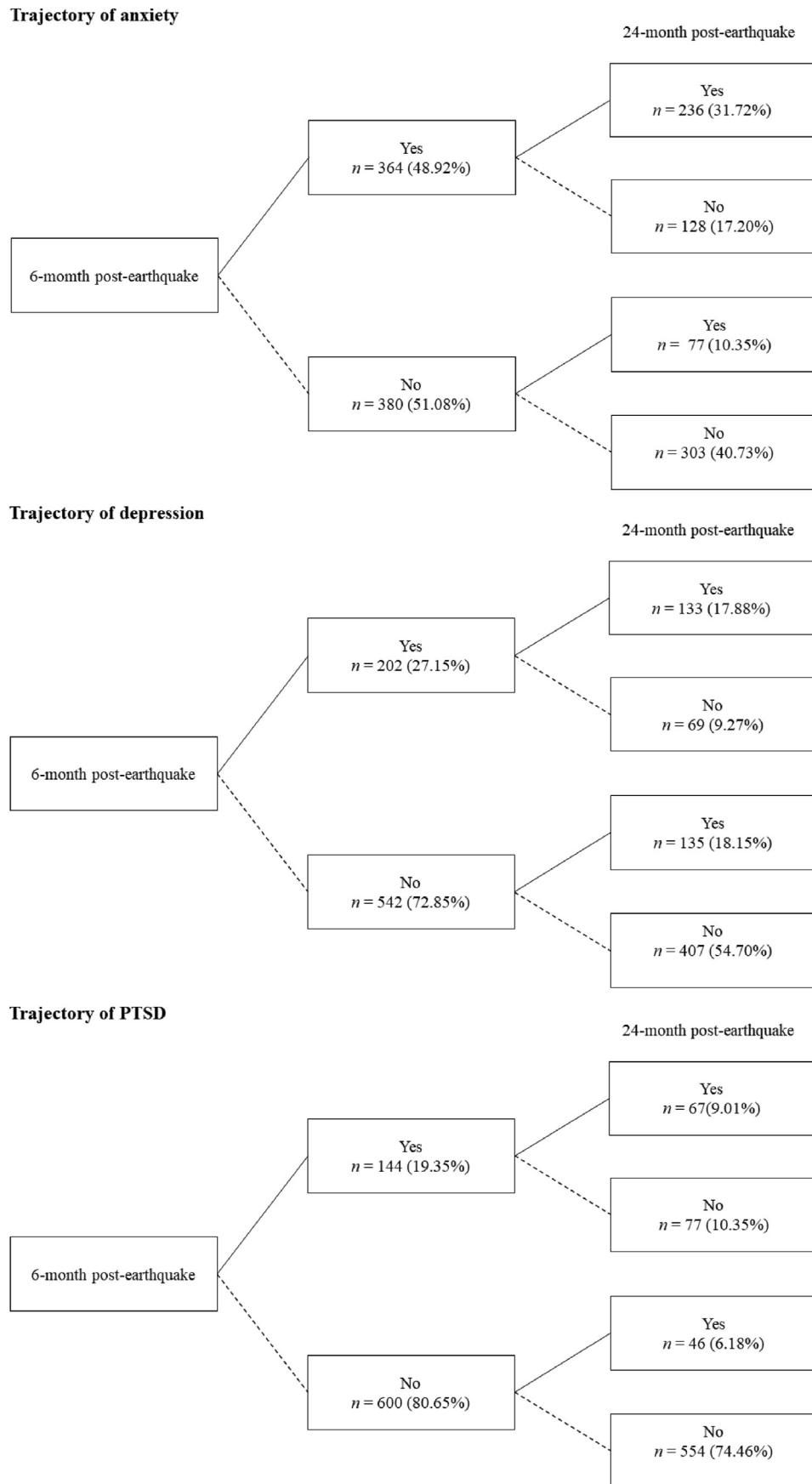
Trajectory of anxiety

Trajectory of depression

Trajectory of PTSD

Fig. 1. Trajectories of mental health among 744 Wenchuan adolescent survivors. PTSD: posttraumatic stress disorder.

Table 1
Correlation between main variables (*p* value).

Variables	Trajectories of anxiety	Trajectories of depression	Trajectories of PTSS	Physical health	Psychological health	Social relationships	Environment
Trajectories of anxiety	1						
Trajectories of depression	0.48***	1					
Trajectories of PTSS	0.46***	0.36**	1				
Physical health	−0.17***	−0.18***	−0.08*	1			
Psychological health	−0.24***	−0.25***	−0.14***	0.66***	1		
Social relationships	−0.20***	−0.17***	−0.13**	0.57***	0.64***	1	
Environment	−0.23***	−0.19***	−0.13**	0.62**	0.78**	0.68**	1

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$. PTSS: posttraumatic stress symptoms.

Table 2
Trajectories of mental health predict four domains of QOL among 744 Wenchuan adolescent survivors.

Characteristics	Layer 2		Layer 3		Layer 3	
	β	B (95% *CI*)	β	B (95% *CI*)	β	B (95% *CI*)
Physical health [a]						
Trajectories of anxiety						
Resistance	Ref		Ref		Ref	
Recover	−0.05	−0.39 (-0.93, 0.16)	−0.04	−0.31 (-0.87, 0.25)	−0.04	−0.30 (-0.87, 0.27)
Delayed dysfunction	−0.11**	−1.01 (-1.67, -0.34)	−0.09*	−0.88 (-1.56, -0.19)	−0.10**	−0.95 (-1.65, -0.24)
Chronic dysfunction	−0.12**	−0.73 (-1.19, -0.27)	−0.09	−0.52 (-1.04, 0.00)	−0.09	−0.55 (-1.11, 0.00)
Trajectories of depression						
Resistance			Ref		Ref	
Recover			−0.02	−0.22 (-0.91, 0.47)	−0.02	−0.23 (-0.92, 0.46)
Delayed dysfunction			−0.04	−0.27 (-0.81, 0.26)	−0.04	−0.30 (-0.84, 0.24)
Chronic dysfunction			−0.07	−0.49 (-1.08, 0.09)	−0.07	−0.52 (-1.12, 0.09)
Trajectories of PTSS						
Resistance					Ref	
Recover					0	−0.03 (-0.69, 0.64)
Delayed dysfunction					0.03	0.36 (-0.47, 1.19)
Chronic dysfunction					0.01	0.09 (-0.67, 0.85)
R²	0.185**		0.188		0.189	
Psychological health [b]						
Trajectories of anxiety						
Resistance	Ref		Ref		Ref	
Recover	−0.05	−0.52 (-1.20, 0.16)	−0.03	−0.29 (-0.98, 0.41)	−0.03	−0.25 (-0.96, 0.46)
Delayed dysfunction	−0.12**	−1.44 (-2.27, -0.60)	−0.10**	−1.16 (-2.01, -0.30)	−0.10*	−1.15 (-2.03, -0.27)
Chronic dysfunction	−0.19***	−1.48 (-2.06, -0.89)	−0.13**	−1.00 (-1.65, -0.35)	−0.13**	−1.02 (-1.71, -0.32)
Trajectories of depression						
Resistance			Ref		Ref	
Recover			−0.07*	−0.93 (-1.79, -0.07)	−0.07*	−0.94 (-1.80, -0.08)
Delayed dysfunction			−0.06	−0.59 (-1.26, 0.08)	−0.06	−0.61 (-1.28, 0.07)
Chronic dysfunction			−0.12**	−1.1 (-1.84, -0.36)	−0.12**	−1.14 (-1.89, -0.38)
Trajectories of PTSS						
Resistance					Ref	
Recover					−0.02	−0.26 (-1.09, 0.58)
Delayed dysfunction					0	−0.01 (-1.05, 1.03)
Chronic dysfunction					0.02	0.25 (-0.70, 1.20)
R²	0.237***		0.248**		0.249	
Social relationships [c]						
Trajectories of anxiety						
Resistance	Ref		Ref		Ref	
Recover	−0.02	−0.12 (-0.54, 0.30)	−0.01	−0.07 (-0.50, 0.37)	0	0.00 (-0.44, 0.44)
Delayed dysfunction	−0.08*	−0.61 (-1.12, -0.10)	−0.08*	−0.57 (-1.10, -0.04)	−0.08*	−0.59 (-1.13, -0.04)
Chronic dysfunction	−0.18***	−0.83 (-1.18, -0.48)	−0.15***	−0.73 (-1.12, -0.33)	−0.14**	−0.66 (-1.09, -0.24)
Trajectories of depression						
Resistance			Ref		Ref	
Recover			−0.03	−0.21 (-0.75, 0.32)	−0.03	−0.21 (-0.75, 0.32)
Delayed dysfunction			−0.01	−0.03 (-0.45, 0.38)	−0.01	−0.06 (-0.48, 0.36)
Chronic dysfunction			−0.05	−0.26 (-0.72, 0.20)	−0.04	−0.24 (-0.71, 0.23)
Trajectories of PTSS						
Resistance					Ref	
Recover					−0.06	−0.42 (-0.94, 0.10)
Delayed dysfunction					0.02	0.14 (-0.51, 0.78)
Chronic dysfunction					−0.01	−0.09 (-0.68, 0.51)
R²	0.186***		0.188		0.191	
Environment [d]						
Trajectories of anxiety						
Resistance	Ref		Ref		Ref	
Recover	−0.09*	−1.09 (-1.92, -0.26)	−0.08*	−0.96 (-1.81, -0.11)	−0.08*	−0.91 (-1.78, -0.05)
Delayed dysfunction	−0.13***	−1.83 (-2.83, -0.82)	−0.12**	−1.74 (-2.78, -0.69)	−0.13**	−1.81 (-2.89, -0.73)

Table 2 (*continued*)

Characteristics	Layer 2		Layer 3		Layer 3	
	β	B (95% *CI*)	β	B (95% *CI*)	β	B (95% *CI*)
Chronic dysfunction	−0.22***	−2.06 (−2.75, −1.37)	−0.20**	−1.86 (−2.64, −1.07)	−0.19***	−1.79 (−2.63, −0.95)
Trajectories of depression						
Resistance			Ref		Ref	
Recover			−0.04	−0.64 (−1.70, 0.41)	−0.04	−0.64 (−1.70, 0.42)
Delayed dysfunction			−0.01	−0.16 (−0.98, 0.66)	−0.02	−0.19 (−1.02, 0.64)
Chronic dysfunction			−0.04	−0.46 (−1.36, 0.45)	−0.04	−0.41 (−1.34, 0.52)
Trajectories of PTSS						
Resistance					Ref	
Recover					−0.02	−0.23 (−1.25, 0.80)
Delayed dysfunction					0.02	0.37 (−0.92, 1.65)
Chronic dysfunction					−0.02	−0.33 (−1.50, 0.84)
R^2	0.210***		0.212		0.213	

Note: CI: confidence interval.

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

[a] Variables including gender, physical activity, direct witness of tragic scenes, life events (work setback, family member disputes, family financial difficulties, violence, achieve important life goal, find meaningful hobbies, significant achievements in academic or other fields, important others who have a positive influence on yourself) were put into layer 1 as covariates.

[b] Variables including gender, marital status, physical activity, direct witness of tragic scenes, life events (serious physical diseases, marital or emotional problems, work setback, family member disputes, family financial difficulties, violence, unpleasant sexual experience, achieve important life goal, find meaningful hobbies, significant achievements in academic or other fields, important others who have a positive influence on yourself) were put into layer 1 as covariates.

[c] Variables including education level, marital status, physical activity, direct witness of tragic scenes, life events (serious physical diseases, marital or emotional problems, work setback, family member disputes, family financial difficulties, violence, achieve important life goal, find meaningful hobbies, significant achievements in academic or other fields, important others who have a positive influence on yourself) were put into layer 1 as covariates.

[d] Variables including marital status, physical activity, direct witness of tragic scenes, life events (serious physical diseases, marital or emotional problems, work setback, family member disputes, family financial difficulties, violence, unpleasant sexual experience, achieve important life goal, find meaningful hobbies, significant achievements in academic or other fields, important others who have a positive influence on yourself) were put into layer 1 as covariates.

environment (8 items). Two other items assess on QOL and general health. Each item rate on a 5-point Likert scale from 1 to 5, with total scores of which range from 26 to 130 and a higher score indicates greater QOL. In the current study, Cronbach's alpha was 0.93.

Statistical analysis

The Harman's single factor test was used to examine the amount of variance of common method bias before processing data.[20] In the current study, total variance explained by a single factor was 12.62%, which falls well below the threshold of 40%.[20] Analysis of Variance (ANOVA) or independent-samples *t*-tests were used to examine differences in socio-demographic characteristics, earthquake exposure, life events after 18 years old, anxiety symptoms, depressive symptoms, and PTSS for four domains of QOL including physical health, psychological health, social relationships, and environment. Spearman correlation analysis was used to examine the relationships between main study variables. Hierarchical multiple regression was used to examine the predictive powers of trajectory membership of mental health on QOL, and variables with significant differences by independent sample *t*-test or ANOVA were considered as covariates. Among the trajectories of mental health were obtained according to the clinical cut-offs. All analyses were performed with IBM SPSS 25.0. Results with a $p < 0.05$ was considered statistically significant.

Results

Missing data

In the current study, there were missing data on earthquake experiences (T$_{6m}$: family member injury or killed/missing, 1.75%; house damage, 2.15%; property loss, 1.61%; direct witness of tragic scenes, 6.32%), current residence location (T$_{10y}$: 0.13%), personal income per year (T$_{10y}$: 0.13%), smoking (T$_{10y}$: 0.13%), alcohol use (T$_{10y}$: 0.13%), anxiety (T$_{6m}$: 0.27%; T$_{24m}$: 8.74%), depression (T$_{6m}$:

0.67%; T$_{24m}$: 8.60%), PTSS (T$_{6m}$: 0.67%; T$_{24m}$: 8.47%), and QOL (T$_{10y}$: 0.13%). Quantitative and qualitative variables were considered missing at random due to missing rate less than 10%.[21,22] Thus, expectation maximization algorithm was performed to impute missing data for quantitative variables[21] and series mean was selected to handing missing data for qualitative variables.

Sample characteristics and mean scores of QOL

Of the 744 participants, 304 (40.86%) were males. The participants' age ranged from 13 to 18 years at T$_{6m}$, with a mean age of 15.44 (SD = 0.66). Among the participants, 11.83% reported that their family members were injuried or killed/missing; 47.18% reported that their houses were seriously damaged; 21.77% reported that they had property loss other than house damage; and 60.75% reported that they witnessed the tragic scene directly.

The mean (SD) of physical health, psychological health, social relationships, and environment for all participants were 22.87 (2.85), 21.68 (3.67), 10.48 (2.21), and 27.64 (4.42), respectively. There were significant differences of physical health, psychological health, social relationships, and environment scores in physical activity, direct witness of tragic scenes, life events (work setback, family member disputes, family financial difficulties, violence, achieving important life goal, finding meaningful hobbies, significant achievements in academic or other fields, important others who have a positive influence on yourself), as well as trajectories of anxiety and depression. Significant differences of psychological health, social relationships, and environment scores were also found in marital status, life events (serious physical diseases, marital or emotional problems), as well as trajectories of PTSS. Significant differences of physical health and psychological health scores were found in gender. Significant differences of psychological health and environment scores were also found in life events (unpleasant sexual experience). In addition, there was significant differences of social relationships scores in education level. The detailed information can be seen Appendix Table 1.

Trajectories of anxiety, depression, and PTSS

Fig. 1 shows the change patterns of anxiety/depressive/PTSS among 744 survivors after Wenchuan earthquake. Specifically, the proportions of participants with each trajectory of anxiety symptoms were respectively 40.73% (resistance), 17.20% (recovery), 10.35% (delayed dysfunction), and 31.72% (chronic dysfunction). And 54.70% (resistance), 9.27% (recovery), 18.15% (delayed dysfunction), and 17.88% (chronic dysfunction) of participants were found with different trajectories of depressive symptoms. The percentages of participants were categorized with different trajectories of PTSS were as follow: 74.46% (resistance), 10.35% (recovery), 6.18% (delayed dysfunction), and 9.01% (chronic dysfunction).

Correlations between main study variables

Table 1 provies the correlation matrix between the main study variables. Spearman correlation analysis found that physical health domains of QOL were negatively associated with trajectories of anxiety ($r = -0.17$, $p < 0.001$), depression ($r = -0.18$, $p < 0.001$), and PTSS ($r = -0.08$, $p < 0.001$). Psychological health domains of QOL were negatively related to trajectories of anxiety ($r = -0.24$, $p < 0.001$), depression ($r = -0.25$, $p < 0.001$), and PTSS ($r = -0.14$, $p < 0.001$). In addition, there were negative correalation between social relationships, and environment domain of QOL and trajectories of anxiety (social relationships: $r = -0.20$, $p < 0.001$; environment: $r = -0.23$, $p < 0.001$), depression (social relationships: $r = -0.17$, $p < 0.001$; environment: $r = -0.19$, $p < 0.001$), and PTSS (social relationships: $r = -0.13$, $p < 0.001$; environment: $r = -0.13$, $p < 0.001$).

Predictors of QOL

As shown in Table 2, hierarchical multiple regression analyses were performed to examine the predictive powers of trajectory membership of mental health on QOL after controlling other variables (Appendix Table 1) which have significant differences on QOL. The findings showed that survivors in the delayed dysfunction group of anxiety symptoms were more likely to develop poor QOL including physical health ($\beta = -0.10$, $p < 0.01$), psychological health ($\beta = -0.10$, $p < 0.05$), social relationships ($\beta = -0.08$, $p < 0.05$), and environment ($\beta = -0.13$, $p < 0.05$) domains. Survivors in the chronic dysfunction group of anxiety symptoms were more likely to have poor QOL including psychological health ($\beta = -0.13$, $p < 0.01$), social relationships ($\beta = -0.14$, $p < 0.01$), and environment ($\beta = -0.19$, $p < 0.01$) domains. Individuals in recover group of anxiety symptoms would be prone to have poor QOL in environment domain ($\beta = -0.08$, $p < 0.05$). In addition, participants in recover ($\beta = -0.07$, $p < 0.05$) and chronic dysfunction group ($\beta = -0.12$, $p < 0.05$) of depression would like to develop poor QOL in paychological health domain. In sum, trajectory of anxiety was the stronger predictor for four domains of QOL, and trajectory of depression was only a preditor of QOL in psychological health domain.

Discussion

To our knowledge, this is the first study to detect whether individual variance in symptoms of anxiety/depression/PTSS during the early phases of post-earthquake would develop different QOL levels among adolescent survivors 10-year after Wenchuan earthquake. The findings documented that the trajectoties of anxiety, depression, and PTSS among survivors were significantly and negatively associated with the four domains of QOL, which is in line with previous studies that have cross-sectionally[3,5] and longitudinally[23] incidated the relationships between psychological distress and QOL. Health-related QOL was found to be strongly and negatively related to PTSS and depression 15 months after the earthquake.[3] Similarly, Wen et al.[5] pointed out that the QOL was poor among victims in the hard-hit areas 3 years after the earthquake and was negatively associated with PTSS. In addition, Khachadourian et al.[4] found that earthquake related concurrent psychopathology symptoms (anxiety and PTSS) can have adverse impact on the QOL of survivors. The possible explanation is that invividuals with mental health problem may decrease job performance and social activities to reduce QOL.[4]

According to previous studies, each psychological distress was classified four trajectories including resistance (anxiety 40.73%; depression 54.70%; PTSS 74.46%), recovery (anxiety 17.20%; depression 9.27%; PTSS 10.35%), delayed dysfunction (anxiety 10.35%; depression 18.15%; PTSS 6.18%), and chronicity (anxiety 31.72%; depression 17.88%; PTSS 9.01%). After controlling covariates, hierarchical multiple regression revealed that survivors in delay dysfunction group of anxiety symptom were more likely to develop poor QOL in four domains, while in chronic dysfunction group tend to have poor QOL in three domains including psychological health, social relationships, and environment; survivors in chronic dysfunction of depressive symptoms were only more prone to have poor QOL in psychological health domain; and there were no significant associations between trajectory of PTSS and QOL. There are several possible explanations for these results as follow: (1) Individuals who experienced the current anxiety symptoms tend to worry many problems such as physical health and social relationships, which might, in turn, heighten the risk of developing poor QOL.[24] A similar associations between anxiety and QOL has also been found in several other studies.[4,11] Their findings emphasized that the current anxiety symptoms had more significant influence on poor QOL,[4] and even anxiety symptoms were more strongly related to QOL at 6 years after the tsunami than at 2 years.[11] (2) Survivors in the chronic dysfunction group experienced constantly depressive symptoms and they might be more likely to feel hopeless about their life, which might, in turn, heighten the risk of psychological distress. Researches regarding different trajectory for anxiety and depression suggested that earthquake survivors with a chronicity or delayed-onset pattern would be considered as the high-risk survivors compared to those with the resistance pattern.[12,15] Identifying the targeted trajectory of psychological distresses may be vital to improve QOL after the earthquake.

This study has several limitations. First, 744 adolescent survivors returned valid questionnaires at 10-year post-earthquake, but the efficiency rate was only 54.8%, which might exist subject bias. Future work should try best to promote the response rate in longitudinal study. Second, data on participants' QOL before the earthquake were unable to be collected, so we can not compare the difference between data before and after earthquake. Third, we conducted this study after earthquakes, thus, the findings were inevitably constrained the generalizability to other disasters' studies. Finally, self-report questionnaires were used to collect data, which might cause reporting bias.

In the current study, the symptoms of anxiety, depression, and PTSD were negatively associated with QOL. After controlling covariates, hierarchical multiple regression only revealed that the anxiety trajectory with delayed dysfunction remained significantly predictive for four domains of QOL. The current study highlights the importance of focusing on the variations in trajectories of anxiety symptoms among disaster survivors and providing individualized mental health services to improve survivors' QOL, particularly, individuals with anxiety symptoms.

Funding

Ethical statement

The WEAHC study was approved by the Human Research Ethics Committee of South China Normal University, and the boards of the participating schools and the Chengdu Women's Federation also permitted and supported this study. Written informed consent was obtained from all participants and their parents prior to the administration of the survey.

Declaration of competing interest

All authors declare no conflict of interest.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cjtee.2021.03.006.

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