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Regular Article

Psychometric properties of the 10-item Connor–Davidson Resilience Scale in Chinese earthquake victims

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Aim: Resilience refers to positive adaption in the face of stress or trauma. Assessing resilience is crucial in trauma-related research and practice. The 10-item Connor–Davidson Resilience Scale (CD-RISC) has been demonstrated to be a valid and reliable tool to achieve this goal. This study was designed to examine the psychometric properties of the 10-item CD-RISC in a sample of Chinese earthquake victims.

Methods: A total of 341 participants (185 women, 156 men) aged 20–63 years were recruited from a psychological relief program supported by the Institute of Psychology, Chinese Academy of Sciences following the 'Wenchuan' earthquake. The participants were given the 10-item CD-RISC and the 17-item post-traumatic stress disorder (PTSD) subscale of the Los Angeles Symptom Checklist (LASC) 4 months after the earthquake.

Results: The results of exploratory factor analysis indicated that a single-factor model consistent with the original design of the 10-item CD-RISC was support. The scale was also demonstrated to have good internal consistency (Cronbach's alpha = 0.91) and test–retest reliability ($r = 0.90$ for a two-week interval). Scores on the scale could reflect different levels of resilience in populations that are thought to be differentiated (probable PTSD vs healthy controls, $t(339) = -7.60$, $P < 0.01$, Cohen's $d = 0.84$). Moreover, the total resilience scores were significantly negatively correlated with scores on total PTSD scale and its three subscales for all participants.

Conclusion: The Chinese version of the 10-item CD-RISC has excellent psychometric properties, and is applicable for Chinese people.

Key words: China, Connor–Davidson Resilience Scale, psychometrics, resilience.

RESILIENCE REFERS TO personal qualities that enable one to withstand the effects of exposure to trauma, to thrive in the face of adversity, or to bounce back after a challenge or setback.[1–3] It also can be viewed as a measure of stress-coping ability.[2] As resilience can be used to represent an individual's successful adaptation to trauma, increasing attention has been paid to this concept in the fields of trauma-related research and practice in recent years.[4–6] Several workers have even proposed that resilience should be used as either an index of overall mental health in the aftermath of trauma or a measure of treatment outcome of trauma-related psychiatric disorders, such as post-traumatic stress disorder (PTSD).[7,8]

The Connor–Davidson Resilience Scale (CD-RISC) is a well-used instrument for measuring resilience.[2] The original version of the CD-RISC has 25 self-rated items, each of which is rated on a 5-point scale from 0 ('not true at all') to 4 ('true nearly all the time'). Preliminary psychometric analyses of the CD-RISC in different samples, including the general population, primary care outpatients, psychiatric inpatients, and clinical trial patients, support its internal consistency, its test–retest reliability, and convergent and

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divergent validity.[2] Subsequent studies have revealed that those with higher scores on CD-RISC show less distress and pathological symptomology following trauma than those with lower scores.[9,10] Furthermore, CD-RISC scores have also been found to have high sensitivity to overall improvement of PTSD patients after receiving psychopharmacological treatments.[8,11] The 25-item CD-RISC has been translated into many languages, including Chinese and Persian, each of which has been demonstrated to have good reliability and validity.[12,13]

Despite the preliminary promising findings, there are also several queries about the psychometric properties of the CD-RISC that need to be clarified. A major question is whether it is suitable to use a total score on the 25 items to evaluate an individual's resilience, as some evidence has revealed that the CD-RISC has a multifactorial structure. By using exploratory factor analysis (EFA), Connor and Davidson found that the CD-RISC yielded five factors ('personal competence, high standards, and tenacity', 'trust in one's instincts, tolerance of negative affect, and strengthening effects of stress', 'positive acceptance of change and secure relationships', 'control' and 'spiritual influences') in 577 normal adult participants.[2] However, this 5-factor model has never been replicated in subsequent studies by using EFA. For example, Lamond *et al.* obtained a 4-factor model ('personal control and goal orientation', 'adaptation and tolerance for negative', 'leadership and trust in instincts', and 'spiritual coping') in 1395 community-dwelling women over age 60 in the USA.[14] Yu and Zhang obtained a three-factor model ('tenacity', 'strength', and 'optimism') in a general population sample of 560 Chinese adults,[12] and Khoshouei obtained a four-factor model ('achievement motivation', 'self-confidence', 'tenacity', and 'adaptability') in 323 Iranian undergraduates.[13] Although one or two factors of these reported factor models may be similar, there is little agreement between them in terms of other factors. Moreover, it should be noted that as the only study employing a maximum likelihood method with an oblique solution that allows the factors to intercorrelate, Khoshouei reported the correlations between his four factors ranging from 0.14 to 0.35.[13] The relative low correlations between latent factors do not support a general high-order factor underlying them, which means that it may not be suitable to use a total score on the 25 items to evaluate an individual's resilience.

Campbell-Sills and Stein conducted a more thorough analysis of the psychometric properties of the 25-item CD-RISC.[15] The initial two independent EFA showed that the factor structure of the CD-RISC was unstable across two demographically equivalent undergraduate samples ($n = 511$ and 512, respectively). Based on the results of these initial EFA and further confirmatory factor analysis (CFA) in another undergraduate sample ($n = 537$), Campbell-Sills and Stein made a series of empirical modifications to the CD-RISC, and finally created a 10-item unidimensional scale. The new 10-item CD-RISC has good internal consistency (Cronbach's $\alpha = 0.85$), and excellent structure validity in terms of goodness of fit to the data. Scores on the 10-item CD-RISC were shown to moderate the correlations between childhood maltreatment and current psychiatric status.[15] In a recent placebo-controlled study, Davidson *et al.* found that compared with placebo, flexible-dose venlafaxine extended-release treatment could significantly increase PTSD patients' scores on the 10-item CD-RISC with moderate effect sizes (0.36 for 12 weeks, 0.34 for 24 weeks).[8] Taken together, this preliminary evidence indicates that the new 10-item CD-RISC has good psychometric properties and is an efficient measurement of resilience in the Western world.

The Asia–Pacific region has been strongly hit by natural disasters in the recent past.[16] As the largest country in this region, China often risks natural disasters. Studies on psychological sequelae of disasters revealed that PTSD is also a common mental health problem among victims in China.[17–19] However, compared with the Western world, the history of trauma research in China is relatively short, and knowledge and practice concerning the mental health of disaster victims are inadequate. In particular, there is a lack of scientific and valid instruments for mental health assessment and treatment-monitoring following disasters. The aim of this study was to examine the psychometric properties of the new 10-item CD-RISC in a sample of survivors after a destructive earthquake in China.

METHODS

Participants

At 14.28 hours, on 12 May 2008, a very destructive earthquake, measuring 8.0 on the Richter scale, occurred in Sichuan province of southwest China.

During the earthquake, 69 197 people were killed, 374 176 were injured, 18 209 were listed as missing, and about 4.8 million were left homeless. After the disaster, the Institute of Psychology, Chinese Academy of Sciences established seven psychological relief workstations in areas affected severely by the earthquake, and organized expert groups (including clinical psychologists, psychiatrists, psychotherapists, and social workers) to offer mental health help to the survivors.

The sample of this study consists of 341 primary and secondary school teachers (185 women, 156 men) who came from a psychological relief program supported by the Institute aiming to promote school teachers' mental health and to train them to manage students' adjustment after the earthquake. Ages ranged from 20 to 63 years (mean = 39.0, SD = 9.6). Of the participants, 270 (80.6%) were married and 220 (64.5%) had completed college. All the participants had experienced the earthquake in Beichuan County, which was the most severely affected by the earthquake. A total of 208 (61%) participants were injured, and 61 (17.9%) were bereaved during the disaster. The data were collected 4 months after the earthquake, and at the beginning of the program. Before giving self-report questionnaires to the participants, interviewers obtained oral consent and introduced the aim and significance of the survey in detail. To examine the test–retest reliability of the 10-item CD-RISC, 40 of these participants (22 women, 18 men; mean age = 40.95, SD = 9.39, range = 22–57 years) completed the CD-RISC again two weeks after the first time.

Instruments

10-item CD-RISC

The Chinese version of the 25-item CD-RISC was adapted by a two-stage process of translation and back translation, and its reliability and validity in the Chinese population have been well documented.[12] According to Campbell-Sills and Stein,[15] the new 10-item CD-RISC was extracted from the original 25-item CD-RISC. Each item is rated on a 5-point scale from 0 ('not true at all') to 4 ('true nearly all the time'). The description of each item is presented in Table 1.

Los Angeles Symptom Checklist

PTSD symptomatology was assessed with the 17-item PTSD subscale of the Los Angeles Symptom Checklist.[20] The scale is an easily administered self-report instrument designed to measure symptoms of PTSD (three items for 're-experiencing/intrusion'; six items for 'avoidance and numbing', and eight items for 'hyperarousal'). Each item is a word or phrase that is rated on a five-point Likert scale ranging from 0 (*no problem*) to 4 (*extreme problem*), reflecting the extent to which the particular symptom was a problem for the respondent during the past one month. The LASC is a commonly used PTSD-evaluating instrument in trauma-related research and practices,[21] and reliability and validity of this scale have been well documented.[22] The Chinese version of the LASC has been demonstrated to have high internal consistency (Cronbach's alpha = 0.91) in a large sample of

Table 1. Means, SD and Pearson correlations among items of the 10-item CD-RISC

Item	Description	Mean	SD	1	2	3	4	5	6	7	8	9	10
1	Able to adapt to change	2.10	1.05	–	0.44	0.43	0.42	0.47	0.34	0.35	0.43	0.40	0.39
2	Can deal with whatever comes	2.48	0.89		–	0.48	0.58	0.45	0.42	0.45	0.36	0.43	0.50
3	Tries to see humorous side of problems	2.66	0.91			–	0.58	0.50	0.52	0.51	0.42	0.49	0.56
4	Coping with stress can strengthen me	2.77	1.06				–	0.61	0.63	0.53	0.51	0.62	0.61
5	Tend to bounce back after illness or hardship	2.41	1.04					–	0.53	0.53	0.56	0.56	0.61
6	Can achieve goals despite obstacles	2.43	1.04						–	0.59	0.53	0.52	0.54
7	Can stay focused under pressure	2.14	1.03							–	0.53	0.53	0.54
8	Not easily discouraged by failure	2.58	1.02								–	0.60	0.54
9	Thinks of self as strong person	2.75	1.00									–	0.53
10	Can handle unpleasant feelings	2.51	0.95										–

$n = 341$. All correlations are significant at the 0.01 level (2-tailed).
CD-RISC, Connor–Davidson Resilience Scale.

earthquake victims.[18] Cronbach's alpha for the scale was 0.96 in the current sample. For a categorical diagnosis, the respondent must have responded positively (with a rating of 2 or higher) at least one item assessing re-experiencing of the trauma, three items assessing avoidance and numbing, and two items assessing hyperarousal. As suggested by King *et al.*, those who met all three criteria were identified as having probable PTSD.[20] By using the Structured Clinical Interview for DSM-III-R (SCID-R), researchers found that the clinical diagnostic validity of the 17-item PTSD subscale was high, with an overall hit rate of 80%.[20]

Statistical analysis

Simple descriptive statistics, such as means and SD, were used when appropriate. The factor structure of the 10-item CD-RISC was investigated using exploratory factor analysis with maximum likelihood method. Parallel analysis was employed to determinate the number of factors to retain. As recommended by O'Connor, 100 random datasets were generated using an SPSS procedure, and the 95th percentiles of the eigenvalues from these random datasets were compared to the eigenvalues from the actual dataset.[23] Factors are retained as long as the eigenvalue from the actual data is greater than the corresponding eigenvalue from the random data. The internal consistency was evaluated by calculating Cronbach's alpha. Pearson's correlation coefficient r was computed to assess the test–retest reliability based on scores of 40 participants who were re-administrated the scale two weeks later. The Student's t-test was used to compare the difference of resilience scores between probable PTSD and healthy controls. To evaluate the concurrent validity of the 10-item CD-RISC, Pearson's correlation coefficient r between resilience scores and scores on total PTSD scale and its three subscales were computed for all participants. All analyses were conducted with SPSS (Version 11.5 for Windows), and statistical significance was set at $P < 0.01$ (two-tailed).

RESULTS

Descriptive statistics

Means, standard deviations, and Pearson's correlations for the 10 items of the new CD-RISC are shown in Table 1. Correlations among scores on the 10 items were all statistically significant ($P < 0.01$). The mean score was 24.83 ($SD = 7.42$, range: 3–40) for the total resilience scores. With respect to PTSD severity, the mean LASC score was 23.86 ($SD = 14.77$, range: 0–68). According to the criteria recommended by King *et al.*,[20] 113 (33.1%) participants were identified as having probable PTSD.

Factor analysis

By using principal components analysis, the first two eigenvalues from the actual dataset of the CD-RISC scores were 5.56 and 0.78. The corresponding first two 95th percentile random data eigenvalues generated by parallel analysis procedure were 1.28 and 1.20. Therefore, based on the parallel analysis, one factor was extracted. The resilience factor could account for 55.57% of the total variance in the current sample. The factor loading matrix for the 10-item CD-RISC is presented in Table 2. As we can see, all items exhibited salient factor loading (higher than 0.40) on the latent variable. These findings suggest that the Chinese version of the 10-item CD-RISC has good structure validity.

Reliability and validity

Based on the single-factor model, the reliability of the 10-item CD-RISC was evaluated with internal consistency (Cronbach's alpha) and test–retest correlation. The alpha value of 0.91 indicated sufficient high reliability to provide confidence in interpreting the score. The test–retest correlation across 2 weeks was

Table 2. Exploratory factor analysis of the 10-Item Connor–Davidson Resilience Scale in Chinese earthquake victims

Item	Factor loading
1	0.56
2	0.64
3	0.70
4	0.81
5	0.76
6	0.73
7	0.71
8	0.70
9	0.74
10	0.76
Eigenvalue	5.56
Variance explained (%)	55.57

Table 3. Pearson's correlations between resilience scores and scores on total PTSD scale and its three subscales

	Resilience
Total PTSD scale	−0.53*
Intrusion subscale	−0.45*
Avoidance subscale	−0.49*
Hyperarousal subscale	−0.52*

*$P < 0.01$. $n = 341$. PTSD, post-traumatic stress disorder.

0.90 ($P < 0.01$), which was also substantial to provide confidence in the stability of the resilience measure.

The validity of the 10-item CD-RISC was evaluated by comparing the difference of resilience scores between probable PTSD and healthy controls. We hypothesized that individuals with PTSD would have lower levels of resilience than the healthy controls. The result showed that the participants identified as probable PTSD rated lower scores on the 10-item CD-RISC than the healthy controls (mean = 20.82, SD = 7.88, range: 3–37 vs mean = 26.82, SD = 6.31, range: 8–40), $t(339) = -7.60$, $P < 0.01$, Cohen's $d = 0.84$). This result confirms our hypothesis, and indicates that the 10-item CD-RISC is a valid measure of resilience. Correlations between the total resilience scores and scores on total PTSD scale and its three subscales for all participants are presented in Table 3. It is obvious from the table that the total resilience scores were significantly negatively correlated with scores on total PTSD scale and its three subscales. Therefore, the results also provide convincing evidence for the concurrent validity of the 10-item CD-RISC.

DISCUSSION

The current study examined the psychometric properties of the 10-item CD-RISC in a sample of Chinese earthquake victims. Exploratory factor analysis indicated that the data could be well represented by a single-factor model, which is consistent with the original design of the 10-item CD-RISC,[15] and suggests that the 10-item CD-RISC is a unidimensional measure of resilience. The scale demonstrated good internal consistency (Cronbach's alpha = 0.91) and test–retest reliability ($r = 0.90$ for a two-week interval), which indicate that the measurement error of this scale is small. Therefore, it is a scale that can confidently assess resilience in China. Furthermore, this study found that compared with healthy controls, individuals identified as probable PTSD rated lower scores on the scale. This finding suggests that scores on the 10-item CD-RISC can reflect different levels of resilience in populations that are thought to be differentiated. Moreover, the total resilience scores were significantly negatively correlated with scores on total PTSD scale and its three subscales. Therefore, it is also a valid scale to assess resilience in China. Taken together, these major findings provide preliminary evidence to indicate that the Chinese version of the new CD-RISC is a reliable and valid measure of resilience. Furthermore, these empirical findings are also welcome, given that the 10-item CD-RISC is a newly developed measure, and there is very limited literature on its psychometric properties.

Several limitations to this study should be noted. First, the generalizability of these findings is limited by our utilization of a relatively small and convenient sample of teachers who suffered from a destructive natural disaster, and came from a training program. In future studies, the findings should be further tested with larger and representative samples from a range of trauma populations in China. Second, the psychometric indicators we adopted are relatively few. In order to accumulate more empirical evidence to support the Chinese version of the 10-item CD-RISC, more psychometric indicators should be included in future studies, such as convergent validity, discriminant validity, and, especially, sensitivity of scores changing to treatments hypothesized to enhance resilience, which is important for trauma-related rehabilitation research and practice.

Notwithstanding these limitations, the findings of this study indicate that the Chinese version of the 10-item CD-RISC has excellent psychometric properties, and is applicable for Chinese people.

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REFERENCES

1. Bonanno GA. Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? *Am. Psychol.* 2004; **59**: 20–28.
2. Connor KM, Davidson JRT. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress. Anxiety* 2003; **18**: 76–82.
3. Yehuda R. Risk and resilience in posttraumatic stress disorder. *J. Clin. Psychiatry* 2004; **65** (Suppl. 1): 29–36.
4. Agaibi CE, Wilson JP. Trauma, PTSD, and resilience: a review of the literature. *Trauma Violence Abuse* 2005; **6**: 195–216.
5. Charney DS. Psychobiological mechanisms of resilience and vulnerability: implications for successful adaptation to extreme stress. *Am. J. Psychiatry* 2004; **161**: 195–216.
6. Hoge EA, Austin ED, Pollack MH. Resilience: research evidence and conceptual considerations for posttraumatic stress disorder. *Depress. Anxiety* 2007; **24**: 139–152.
7. Connor KM. Assessment of resilience in the aftermath of trauma. *J. Clin. Psychiatry* 2006; **67** (Suppl. 2): 46–49.
8. Davidson J, Baldwin DS, Stein DJ *et al*. Effects of venlafaxine extended release on resilience in posttraumatic stress disorder: an item analysis of the Connor-Davidson Resilience Scale. *Int. Clin. Psychopharmacol.* 2008; **23**: 299–303.
9. Connor KM, Davidson JRT, Lee L. Spirituality, resilience, and anger in survivors of violent trauma: a community survey. *J. Trauma. Stress* 2003; **16**: 487–494.
10. Campbell-Sills L, Cohan SL, Stein MB. Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. *Behav. Res Ther.* 2006; **44**: 585–599.
11. Davidson J, Baldwin D, Stein DJ *et al*. Treatment of posttraumatic stress disorder with venlafaxine extended release: a 6-month randomized controlled trial. *Arch. Gen. Psychiatry* 2006; **63**: 1158–1165.
12. Yu X, Zhang J. Factor analysis and psychometric evaluation of the Connor-Davidson Resilience Scale (CD-RISC) with Chinese people. *Soc. Behav. Pers.* 2007; **35**: 19–30.
13. Khoshouei MS. Psychometric evaluation of the Connor-Davidson Resilience Scale (CD-RISC) using Iranian students. *Int. J. Test* 2009; **9**: 60–66.
14. Lamond AJ, Depp CA, Allison M *et al*. Measurement and predictors of resilience among community-dwelling older women. *J. Psychiatr. Res.* 2009; **43**: 148–154.
15. Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the Connor–Davidson Resilience Scale (CD-RISC): validation of a 10-item measure of resilience. *J. Trauma. Stress* 2007; **20**: 1019–1028.
16. Ofrin R, Salunke SR. Disaster preparedness in the South East Asia region. *Int. Rev. Psychiatry* 2006; **18**: 495–500.
17. Liu A, Tan H, Zhou J *et al*. An epidemiologic study of posttraumatic stress disorder in flood victims in Hunan China. *Can. J. Psychiatry* 2006; **51**: 350–354.
18. Wang L, Zhang Y, Wang W *et al*. Symptoms of posttraumatic stress disorder among adult survivors three months after the Sichuan Earthquake in China. *J. Trauma. Stress* 2009; **22**: 444–450.
19. Wang X, Gao L, Shinfuku N, Zhang H, Zhao C, Shen Y. Longitudinal study of earthquake-related PTSD in a randomly selected community sample in north China. *Am. J. Psychiatry* 2000; **157**: 1260–1266.
20. King LA, King DW, Leskin G, Foy DW. The Los Angeles Symptom Checklist: a self-report measure of posttraumatic stress disorder. *Assessment* 1995; **2**: 1–17.
21. Elhai JD, Gray MJ, Kashdan TB, Franklin CL. Which instruments are most commonly used to assess traumatic event exposure and posttraumatic effects? A survey of traumatic stress professionals. *J. Trauma. Stress* 2005; **18**: 541–545.
22. Orsillo SM. Measures for acute stress disorder and posttraumatic stress disorder. **In**: Antony MM, Orsillo SM (eds). *Practitioner's Guide to Empirically Based Measures of Anxiety*. KluwerAcademic/Plenum, New York, 2001; 255–307.
23. O'Connor BP. SPSS, SAS, and MATLAB programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behav. Res. Methods Instrum. Comput.* 2000; **32**: 396–402.