Validation of the Chinese version of the Connor-Davidson Resilience Scale-10 among young people in Hong Kong

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* Equal contribution

Abstract

Objectives: To investigate the psychometric properties of the Chinese version of the Connor-Davidson Resilience Scale-10 (CD-RISC-10) in a representative sample of young people in Hong Kong. Measurement invariance across age and sex was assessed to ensure valid subgroup comparisons.

Methods: Participants were recruited between May 2019 and April 2022 using stratified multistage cluster sampling. They were asked to complete a battery of self-report measures to collect data related to sociodemographics, childhood adversities, personality traits, and various psychological constructs. Each participant also underwent a structured diagnostic screening for lifetime and current psychiatric disorders, which was repeated 1 year later during longitudinal follow-up. Resilience was measured using the Chinese version of the CD-RISC-10. Depressive and anxiety symptoms were assessed using the Chinese versions of the nine-item Patient Health Questionnaire and the seven-item Generalised Anxiety Disorder Scale, respectively. Exploratory and confirmatory factor analyses were conducted. Reliability was assessed using McDonald's omega (ω). Measurement invariance and discriminant validity were tested. Predictive validity for the 12-month onset of major depressive episode and generalised anxiety disorder was evaluated using receiver operating characteristic analysis.

Results: In total, 3175 participants (41.9% male) aged 15 to 24 years completed the diagnostic interview. At the 1-year follow-up, 1766 (55.6%) participants completed reassessment. Only those without a lifetime history of depression or anxiety at baseline were included in the predictive validity analysis. Exploratory and confirmatory factor analyses supported a two-factor structure (comparative fit index = 0.962, root mean square error of approximation = 0.058). Internal consistency was acceptable to excellent (ω = 0.767-0.873). Metric invariance was supported across age and sex; scalar and strict invariance were not fully established. Discriminant validity analyses confirmed that resilience was empirically distinct from depression and anxiety. Predictive validity was low; the area under the curve was 0.626 for major depressive episode and 0.632 for generalised anxiety disorder. The Youden index values were modest, indicating limited predictive utility of the CD-RISC-10.

Conclusions: The Chinese version of the CD-RISC-10 is reliable and valid for resilience assessment among adolescents and young adults in Hong Kong. However, it has limited capacity to predict future psychiatric diagnoses. These findings highlight the importance of a broader assessment framework and tailored interventions based on sex and developmental stage.

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Introduction

Resilience refers to the capacity to maintain or regain psychological well-being in the face of adversity, encompassing both exposure to stressors and positive adaptation.[1] It has been conceptualised as: (1) a stable, trait-like attribute that predisposes individuals to adaptive functioning, (2) a dynamic process of interaction between

internal and external resources, and (3) a trajectory of recovery after adversity.[2-5] These models highlight distinct aspects—personal attributes, contextual interactions, and recovery patterns—each influences measurement of resilience.

The trait-based, 10-item Connor-Davidson Resilience Scale (CD-RISC-10) is a self-report instrument designed to assess perceived resilience capacity. Although it may oversimplify the construct of resilience and show limited predictive validity,[3] it is widely used to assess resilience-related attitudes within specific populations.

Emerging adulthood (15 to 24 years of age) is characterised by psychological transitions and exposure to various stressors. In Hong Kong, young people commonly face intense academic pressure, high population density, political instability, and lingering psychological effects of the COVID-19 pandemic.[6,7] These factors may influence how resilience is manifested and reported, with potential variation across age and sex due to differences in emotion regulation, autonomy, and social support.[8,9] Given these developmental and sociocultural dynamics, it is essential to determine whether the CD-RISC-10 functions equivalently across demographic subgroups. Measurement invariance testing ensures that observed differences reflect true psychological variation, rather than measurement bias.[10]

The original CD-RISC consisted of 25 items across five factors;[11] it was later refined into the one-factor, 10-item CD-RISC-10 to improve parsimony and factorial stability.[12] The CD-RISC-10 has demonstrated good psychometric properties in diverse populations including students, patients with chronic illness, and trauma survivors.[13-20] However, most validation studies have involved Western or clinical populations, limiting generalisability to Chinese populations. Although studies have reported that resilience is associated with lower levels of anxiety and post-traumatic stress disorder symptoms among Chinese youth,[21,22] their sample sizes were small or demographically homogeneous.[23,24] The present study investigated the psychometric properties of the Chinese version of the CD-RISC-10 in a representative sample of young people in Hong Kong. Measurement invariance across age and sex was assessed to ensure valid subgroup comparisons. Additionally, correlations of the CD-RISC-10 with self-esteem, mindfulness, quality of life, and adaptive traits were explored.

Methods

Participants were recruited between May 2019 and April 2022 using stratified multistage cluster sampling. Households were randomly selected, and eligible individuals within each household were invited to participate based on age, housing type, and geographic location. For participants aged 15 to 17 years, parental consent was obtained. Eligible participants were assessed through face-to-face or online video conferencing interviews. They were asked to complete a battery of self-report measures to collect data related to sociodemographics, childhood adversities,

personality traits, and various psychological constructs. Each participant also underwent a structured diagnostic screening for lifetime and current psychiatric disorders, which was repeated 1 year later during longitudinal follow-up.

Resilience was measured using the validated Chinese version of the CD-RISC-10.[25-27] Each item is rated on a five-point Likert scale ranging from 0 (never) to 4 (almost always). Total scores range from 0 to 40; higher scores indicate greater resilience.

Participants were screened for major depressive episode (MDE) and generalised anxiety disorder (GAD) using the Composite International Diagnostic Interview – Screening Scales (CIDI-SC),[28] a standardised diagnostic tool for identifying multiple mental disorders. The instrument has demonstrated high test-retest and inter-rater reliability ($\kappa > 0.90$) across diverse populations.[29,30]

Depressive and anxiety symptoms were assessed using the validated Chinese versions of the nine-item Patient Health Questionnaire (PHQ-9)[31] and the seven-item Generalised Anxiety Disorder Scale (GAD-7),[32] respectively. Items on both instruments were rated using a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 27 for the PHQ-9 and 0 to 21 for the GAD-7. Both scales have demonstrated high internal consistency and test-retest reliability.[33-36]

Statistical analyses were conducted using the *lavaan and psych packages* in R software (version 4.4.2). Given uncertainty about the factor structure of the CD-RISC-10 in youth populations, the sample was randomly divided into two equal subsets. Exploratory factor analysis (EFA) using principal axis factoring with oblimin rotation was performed on the first subset to identify the optimal factor structure. Factors were retained based on parallel analysis and eigenvalues >1; items with loadings ≥0.4 were retained. Confirmatory factor analysis (CFA) was then conducted on the second subset to test the EFA-derived structure and compare it with the commonly reported one-factor model, using robust maximum likelihood estimation. Model was considered fit when comparative fit index (CFI) ≥0.95, Tucker-Lewis index (TLI) ≥0.95, root mean square error of approximation (RMSEA) ≤0.08, and standardised root mean square residual (SRMR) ≤0.08. Internal consistency of the CD-RISC-10 was assessed using McDonald's omega (ω). Measurement invariance across sex (male/female) and age groups (15-19 vs 20-24, based on a developmental threshold) was tested using multi-group CFA by sequentially constraining factor loadings (metric invariance), intercepts (scalar invariance), and residuals (strict invariance). Invariance was supported if ΔCFI was ≤-0.01 and ΔRMSEA was ≤0.015. If scalar invariance was established, latent mean differences were assessed using Wald tests.

For discriminant validity of the CD-RISC-10, a CFA model was constructed to define latent factors representing resilience and depression/anxiety constructs. The Fornell-Larcker criterion was applied by comparing the square root of the average variance extracted for each construct

against inter-construct correlations, ensuring that each construct explained more variance in its indicators than was shared with other constructs. Additionally, the heterotrait-monotrait ratio was calculated to confirm discriminant validity. A Chi-squared difference test was also conducted, comparing a constrained model (correlations fixed at 1.0) with the original model.

The predictive validity of the CD-RISC-10 was evaluated using receiver operating characteristic (ROC) analysis. The onset of MDE and GAD at the 1-year follow-up (as determined by the CIDI-SC) served as diagnostic gold standards. The optimal cut-off score was determined using the Youden index, which is calculated as (sensitivity + specificity − 1),[37] providing an objective criterion for identifying the threshold with the maximum discriminative performance. The optimal cut-off score corresponded to the highest Youden index. The onset of MDE and GAD was defined as newly identified positive cases at the 1-year follow-up, excluding participants with lifetime diagnoses of MDE or GAD at baseline.

Results

In total, 3175 participants (41.9% male) aged 15 to 24 (mean, 24.0) years completed the diagnostic interview and provided valid, non-missing responses on the CD-RISC-10. Participants were not excluded based on current or past psychiatric diagnoses. At the 1-year follow-up, 1766 (55.6%) participants completed reassessment. Only those without a lifetime history of depression or anxiety at baseline were included in the predictive validity analysis.

The mean CD-RISC score was 24.01 ± 6.31. Male participants reported significantly higher resilience than female participants (24.75 vs 23.48, $t = 5.60$, df = 2779, Cohen's $d = 0.20$, $p < 0.001$). Younger and older participants were comparable in terms of resilience (23.68 vs 24.10).

Data were suitable for factor analysis, as indicated by a Kaiser-Meyer-Olkin value of 0.93 and a significant Bartlett's test of sphericity ($\chi^2(45) = 14.316$, $p < 0.001$). EFA was conducted on the first subset (n = 1587) using principal axis factoring with oblimin rotation. Both parallel analysis and eigenvalues >1 supported a two-factor solution, which explained 62.1% (54.9% + 7.2%) of the total variance. The two-factor structure was then selected for testing (factor 1: items 3, 4, and 6-10; factor 2: items 1, 2, and 5). CFA was performed on the second subset (n = 1588) to evaluate the EFA-derived two-factor model and compare it with the commonly reported one-factor model. The two-factor model demonstrated superior fit, yielding CFI = 0.962, TLI = 0.950, RMSEA = 0.058, SRMR = 0.034, and AIC (Akaike information criterion) = 33506.61. In contrast, the one-factor model produced lower fit indices (CFI = 0.944, TLI = 0.928, RMSEA = 0.070, SRMR = 0.037, and AIC= 33624.22), indicating a less fit (χ^2 difference (1) = 72.787, $p < 0.001$) [Table 1]. These findings support the EFA-derived two-factor structure as more representative of the CD-RISC-10 in this sample.

The internal consistency of the total score was excellent, with McDonald's $\omega = 0.767$ for factor 1 and 0.873 for factor 2.

Measurement invariance across sex (male vs female) and age groups (15-19 vs 20-24 years) was evaluated using a series of progressively restrictive CFA models (Table 2). For sex, metric invariance was supported; however, scalar invariance ($\Delta\chi^2 = 66.056$, df = 8, $p < 0.001$) and strict invariance ($\Delta\chi^2 = 24.851$, df = 10, $p = 0.006$) were not achieved. Similarly, in age group comparisons, metric invariance was supported, whereas scalar invariance ($\Delta\chi^2 = 35.448$, df = 8, $p < 0.001$) and strict invariance ($\Delta\chi^2 = 23.570$, df 10, $p = 0.009$) were not achieved. These findings should be interpreted with caution because ΔCFI and ΔRMSEA values remained below the established thresholds (-0.01 and 0.015, respectively), suggesting that the statistically significant Chi-squared results are due to large sample size rather than meaningful measurement non-invariance.

Discriminant validity between resilience and the constructs of depression and anxiety was assessed using several complementary methods. A CFA model specifying resilience, depression, and anxiety as separate latent constructs demonstrated good overall fit. According to the Fornell-Larcker criterion, discriminant validity was supported: the square root of the AVE for resilience (0.693) exceeded its correlations with both depression (-0.462) and anxiety (-0.403). The heterotrait-monotrait ratios were also well below the conservative threshold of 0.85 (0.454 for resilience-depression and 0.408 for resilience-anxiety), further confirming the distinctiveness of the constructs. Additionally, Chi-squared difference tests were conducted to compare models in which the latent correlations between resilience and each internalising construct were constrained to 1.0 versus freely estimated. For resilience and depression, the constrained model demonstrated significantly worse fit than the unconstrained model ($\Delta\chi^2 = 4486.7$, Δdf = 1, $p < 0.001$). A similar result was observed for resilience and anxiety ($\Delta\chi^2 = 4325.0$, Δdf = 1, $p < 0.001$). These findings provide robust evidence that resilience is empirically distinct from both depression and anxiety in this sample.

To assess the predictive validity of the CD-RISC-10, ROC analyses were performed using the onset of MDE and GAD (as determined by the CIDI-SC) at the 1-year follow-up as diagnostic gold standards. Participants with a lifetime diagnosis of MDE (n = 420) or GAD (n = 60) at baseline were excluded from these analyses. The CD-RISC-10 showed poor discriminatory ability in predicting the onset of MDE (area under the curve = 0.626, 95% confidence interval = 0.559-0.692) and GAD (area under the curve = 0.632, 95% confidence interval = 0.496-0.769). Although prediction of MDE was statistically better than chance, the wide confidence intervals and inclusion of the null value in the GAD model suggest limited clinical utility of CD-RISC-10 scores alone for early identification of these disorders. The optimal cut-off score for predicting MDE was 25, yielding a sensitivity of 0.73 and specificity of 0.43 (Youden index = 0.16) [Table 3]. This threshold prioritises

Table 1. Confirmatory factor analysis of the Chinese version of the 10-item Connor-Davidson Resilience Scale: comparison of one-factor and two-factor models.

Item	One-factor model	Two-factor model	
		Factor 1 (persistence through challenge)	Factor 2 (adaptive capacity)
1. I am able to adapt when changes occur.	0.665	-	0.740
2. I can deal with whatever comes my way.	0.711	-	0.782
3. I try to see the humorous side of things when I am faced with problems.	0.627	0.628	-
4. Having to cope with stress can make me stronger.	0.652	0.651	-
5. I tend to bounce back after illness, injury, or other hardships.	0.630	-	0.648
6. I believe I can achieve my goals, even if there are obstacles.	0.697	0.707	-
7. Under pressure, I stay focused and think clearly.	0.634	0.636	-
8. I am not easily discouraged by failure.	0.761	0.778	-
9. I think of myself as a strong person when dealing with life's challenges and difficulties.	0.782	0.795	-
10. I am able to handle unpleasant or painful feelings such as sadness, fear, and anger.	0.670	0.665	-
McDonald's omega (ω)	0.90	0.77	0.87
Tucker-Lewis index	0.928	0.950	
Root mean square error of approximation (90% confidence interval)	0.070 (0.064-0.076)	0.058 (0.052-0.064)	
Chi-squared difference		72.787	
Degrees of freedom difference		1	
p Value		<0.001	

Table 2. Measurement invariance across sex and age groups.

	Chi-square statistic (χ^2)	Degrees of freedom (df)	Comparative fit index (CFI)	Tucker-Lewis Index (TLI)	Root mean square error of approximation (RMSEA)	$\Delta\chi^2$(df)	p Value	ΔCFI	ΔRMSEA
Sex (male vs female)									
Configural model	485.96	68	0.958	0.945	0.062	-	-	-	-
Metric model	505.94	76	0.957	0.949	0.060	8.319 (8)	0.403	0.001	-0.002
Scalar model	569.00	84	0.952	0.948	0.060	66.056 (8)	<0.001	0.005	0.000
Strict model	591.37	94	0.951	0.953	0.058	24.851 (10)	0.006	0.001	-0.002
Age group (15-19 vs 20-24 y)									
Configural model	470.35	68	0.960	0.948	0.061	-	-	-	-
Metric model	488.91	76	0.952	0.952	0.059	3.020 (8)	0.933	0.001	-0.002
Scalar model	528.06	84	0.956	0.953	0.058	35.448 (8)	<0.001	0.003	-0.001
Strict model	549.84	94	0.955	0.957	0.055	23.570 (10)	0.009	0.001	-0.003

Table 3. Validity of the Chinese version of the 10-item Connor-Davidson Resilience Scale in predicting major depressive episode (MDE) and generalised anxiety disorder (GAD), as identified by the Composite International Diagnostic Interview – Screening Scales at 1-year follow-up.

Cut-off	Sensitivity	Specificity	Youden index	Positive predictive value	Negative predictive value	Positive likelihood ratio	Negative likelihood ratio
MDE							
≤22	0.460	0.608	0.069	0.042	0.968	1.175	0.887
≤23	0.556	0.555	0.111	0.044	0.971	1.250	0.800
≤24	0.603	0.502	0.105	0.043	0.972	1.211	0.790
≤25*	0.730	0.432	0.162	0.045	0.977	1.286	0.624
≤26	0.762	0.383	0.145	0.044	0.978	1.235	0.622
≤27	0.810	0.329	0.138	0.043	0.979	1.206	0.579
≤28	0.857	0.269	0.126	0.042	0.981	1.172	0.531
GAD							
≤17	0.318	0.864	0.182	0.029	0.990	2.332	0.790
≤18	0.364	0.831	0.194	0.026	0.990	2.150	0.766
≤19	0.409	0.780	0.189	0.023	0.991	1.863	0.757
≤20*	0.545	0.710	0.256	0.023	0.992	1.884	0.640
≤21	0.545	0.661	0.207	0.020	0.991	1.610	0.688
≤22	0.636	0.609	0.245	0.020	0.993	1.627	0.597
≤23	0.636	0.554	0.190	0.018	0.992	1.427	0.657

*　Optimal cut-off

sensitivity, increasing the likelihood of identifying true positives, but at the expense of a higher false-positive rate. For GAD, the optimal cut-off was 20, with a sensitivity of 0.54 and specificity of 0.71 (Youden index = 0.25) [Table 3]. Although this cut-off improves specificity, it reduces sensitivity, reflecting a trade-off between missed cases and false positives. In both cases, modest Youden index values highlight the limited utility of the CD-RISC-10 as a standalone predictive instrument for these disorders.

Discussion

This study validated the Chinese version of the CD-RISC-10 in a representative sample of young people aged 15 to 24 years in Hong Kong. The scale demonstrated strong internal consistency for both factors. EFA and CFA supported a two-factor structure, suggesting that resilience, as measured by the CD-RISC-10, comprises two interrelated but distinct dimensions in this population. This structure may reflect culturally specific interpretations of resilience among Chinese youth and underscores the importance of validating psychological instruments within their sociocultural contexts.

Measurement invariance analyses supported metric invariance across sex and age groups, indicating that factor loadings were comparable between these subgroups. However, scalar and strict invariance were not supported.

Although ΔCFI and ΔRMSEA values remained within acceptable thresholds, the lack of scalar and strict invariance may reflect an effect of the large sample size, rather than true differences. Therefore, caution is advised when making comparisons of latent mean scores across demographic groups.

The CD-RISC-10 also demonstrated strong discriminant validity. Resilience was empirically distinct from both depression and anxiety. These findings enhance the scale's conceptual clarity and support its utility in differentiating resilience from internalising psychopathology. In contrast, the scale's predictive validity for the onset of psychiatric conditions over a 1-year period was limited. ROC analyses indicated poor discriminatory accuracy in predicting the onset of both MDE and GAD, with only modest sensitivity and specificity at the optimal cut-off values. The low Youden index values suggest limited clinical value in using CD-RISC-10 scores alone to predict psychiatric onset. These results suggest that, although lower resilience may be correlated with greater psychological vulnerability, it is not a strong predictor of future mental disorders. Furthermore, the scale's positive predictive values were relatively low, indicating that it is not suitable as a standalone clinical screening tool. Although negative predictive values were high, these were largely driven by the low base rate of clinical cases in the sample. Therefore, high negative predictive values should not be deemed indicative

of diagnostic accuracy. These findings highlight the need to consider base rate effects when interpreting predictive values.

Male participants reported slightly higher CD-RISC-10 scores than female participants, although the effect size was small. Age-related differences were negligible. These findings suggest generally comparable levels of resilience across youth subgroups, although subtle sex differences may exist.

Our findings have several practical implications. First, the CD-RISC-10 is a psychometrically robust instrument for assessing resilience among Chinese young people. Its brevity and strong internal consistency make it suitable for use in research, educational contexts, and community outreach, particularly for identifying individuals with low resilience who may benefit from preventive mental health interventions. Second, due to its limited predictive accuracy, the CD-RISC-10 should not be used to screen for future psychiatric diagnoses. Instead, it may be incorporated as a part of assessment battery that includes measurements for trauma exposure, social support, and cognitive vulnerability to improve risk detection and intervention planning. Finally, although some group differences were observed, the largely invariant measurement structure supports the use of the CD-RISC-10 across age and sex groups. Nonetheless, tailored resilience-building interventions may be warranted, particularly for subgroups with lower baseline resilience or differing responses to psychosocial stressors.

This study had several limitations. First, although the sample was representative, all assessments relied on self-reporting, which may have introduced response bias. Second, the 1-year follow-up period may not have fully captured the long-term trajectories of resilience and mental health. Longitudinal studies with multiple time points are needed to examine how resilience develops and interacts with environmental and psychological factors over time. Although the two-factor structure demonstrated good fit in this sample, future research should explore item-level functioning using item response theory and conduct cross-cultural comparisons to assess the scale's generalisability.

Conclusion

The Chinese version of the CD-RISC-10 is reliable and valid for resilience assessment among adolescents and young adults in Hong Kong. However, it has limited capacity to predict future psychiatric diagnoses. These findings highlight the importance of a broader assessment framework and tailored interventions based on sex and developmental stage.

Contributors

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

Funding / support

Data availability

All data generated or analysed during the present study are available from the corresponding author on reasonable request.

Ethics approval

This study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (reference: UW 19-017). Participants were treated in accordance with the Declaration of Helsinki. All participants provided written informed consent for all treatments and procedures and for publication.

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