



Validating the Revised Child Anxiety and Depression Scale-Short Version (RCADS-25) in Chinese Preadolescents

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Abstract

Youth anxiety and depression are rising rapidly worldwide, highlighting the need for efficient school-based assessment tools across sociocultural contexts. The Revised Child Anxiety and Depression Scale (RCADS) is one of the most widely used screening measures, with demonstrated cross-cultural applicability. However, its psychometric properties have rarely been evaluated in Chinese populations. This study assessed the psychometric properties of the 25-item short-version RCADS (RCADS-25) in a sample of 534 preadolescents in Mainland China (ages 9–12, 42% female). Participants completed self-reports on the RCADS-25, positive and negative affect, and psychological resilience, while their parents rated child internalizing and externalizing problems. The RCADS-25 showed adequate reliability and validity in our sample. RCADS-25 scores were positively associated with negative affect and emotional-behavioral difficulties, and negatively associated with positive affect and psychological resilience. Confirmatory factor analysis suggested that anxiety and depression are two distinct yet closely related constructs. In addition, participants at risk for clinical-level internalizing and externalizing problems had significantly higher RCADS-25 Total Depression scores. These findings provide initial psychometric support for using the RCADS-25 with Chinese preadolescents. Given its brevity, the RCADS-25 may be a valuable tool for large-scale mental health screening of Chinese students in school settings.

Keywords Anxiety · Depression · Measurement · School · Screening

Introduction

Emerging research shows that the prevalence of youth mental illness has increased rapidly in recent years. Depression and generalized anxiety disorder are two of the most common concerns. Globally, 25% of youth experience clinically elevated symptoms of depression and 21% experience symptoms of anxiety disorders, which is double the pre-COVID-19 pandemic level [47]. The rising youth mental

health burden necessitates a realignment of global public health services, particularly in low- and middle-income countries [14].

For instance, recent research suggests that youth in China are increasingly experiencing mental health symptoms at younger ages, and among the most prevalent symptoms are depression and anxiety [65]. This looming youth mental health crisis is attributed to several reasons. First, the highly competitive Chinese educational environment has heightened school-age children's academic stress, which increases their risk of depression [23] and anxiety [61]. Second, China's vast socioeconomic transitions over the past four decades have led to rising income inequality, growing crime rates, and declining social connectedness and family ties amidst the country's rapid urbanization. These risk factors are linked to increased youth depression and anxiety across birth cohorts [63]. Furthermore, China's lengthy school closures during COVID-19 and the prolonged isolation from peers and communities further increased children's depressive symptoms, self-injury, suicidal ideation, and suicide attempts [68].

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Schools are important settings to address youth mental health needs. Early identification and intervention of common mental health disorders in schools have been found to improve youth academic and psychosocial outcomes [18]. With the world's second largest child population [60], China has a massive need for school mental health assessment and services but lacks validated assessment tools. A recent review of 77 studies found that although there is increasing research on school mental health prevention and intervention programs in China, research evidence about assessment and screening is lacking [48]. To address youth mental health needs, the Chinese Ministry of Education [40] requires all schools to conduct annual school-wide mental health assessments since 2021. Considering China's massive student population and school mental health professionals' limited manpower, a brief self-report measure may serve as an efficient screening tool.

The Revised Child Anxiety and Depression Scale (RCADS) is one of the most widely used screening measures and has shown applicability to various cultures [45], making it a promising tool for early identification of common youth mental health issues in school settings. While depressive and anxiety disorders share common predictors such as loneliness and worry, they also present distinct risk profiles [37]. By measuring anxiety and depressive symptoms simultaneously [9], the RCADS captures the distinct risk profiles of major depressive disorder and anxiety disorders, while taking the high level of overlap between these disorders into account.

The RCADS includes the original 47-item version and a 25-item short version [9, 12]. All current and supported versions of the RCADS are available at <https://rcads.ucla.edu>. The 47 items yield six subscales: separation anxiety, social phobia, generalized anxiety, panic disorder, obsessive-compulsive disorder, and major depressive disorder [9]. The short version, RCADS-25, includes 25 items that yield three scores: Total Anxiety, Total Depression, and Total Anxiety and Depression [8, 12]. While the RCADS-47 specifies various types of anxiety disorders, the RCADS-25 reduces participant assessment burden and administration time. By balancing efficiency, breadth, and scale score reliability, the RCADS-25 can be particularly useful for large-scale screening of anxiety and depressive problems [12]. Additional versions of the RCADS exist, such as a 30-item version yielding six subscales [50, 54].

The RCADS was originally developed using a diverse sample of over 1,600 children and adolescents in Hawaii, representing more than 20 ethnicities—Japanese American (28.2%), Filipino (13.2%), Hawaiian (12.4%), Chinese American (8.4%), Caucasian (8.1%), multi-ethnic (16.8%), and others (12.8%), such as Korean, Okinawan, Portuguese, African American, Hispanic American, Samoan, Southeast

Asian, Puerto Rican, Native American, Tongan, Fijian, and Guamanian [9]. The RCADS has been translated into many languages and used across various cultures, including the U.S., the Netherlands, Belgium, Australia, Spain, Germany, the U.K., Chile, Iran, Italy, the Philippines, Ireland, and Poland [45, 54]. However, according to a systematic review, most studies employing the RCADS have been conducted in the U.S. and Europe [45]. Its psychometric properties remain under-examined in East Asian countries, such as China.

Experiences of depression and anxiety can vary across sociocultural contexts due to differences in the causes, interpretation, and expression of symptoms. For instance, research in the U.S. has shown that Asian Americans consistently endorse anxiety symptoms less frequently than other racial groups, highlighting the role of cultural influences on symptom presentation [17]. Similarly, Asian Americans are less likely than European Americans to report certain somatic and psychological symptoms, despite exhibiting comparable levels of depressive symptomatology [24].

People from collectivist East Asian societies may also perceive themselves as extensions of their social group. As a result, their feelings and thoughts influence behavior less directly than in individualistic societies [17]. Instead, interpersonal relationships—such as familial relationships—play a more important role throughout the lifespan [62]. For example, a study of adults who migrated from Mainland China to Hong Kong found that family resilience significantly contributed to predicting depressive symptoms, beyond the influence of individual factors such as personal resilience [67].

In addition, sociocultural and economic differences exist even among societies with majority-Chinese populations and shared cultural roots. A study of university students in Mainland China, Macau, and Hong Kong found that the prevalence of depression and its associated factors varied across the three regions [30]. In contrast, another study found that Chinese adolescents in China and Singapore did not differ significantly in anxiety levels, but both groups reported significantly higher anxiety than the American normative sample [29]. In sum, sociocultural differences in the experience, expression, and reporting of emotional symptoms can influence the assessment of anxiety and depression [35], underscoring the need to evaluate assessment tools in underexamined cultural contexts.

Research suggests that the RCADS's psychometric properties may differ across cultures [5], but previous research has rarely investigated the RCADS in Chinese youth. Only three out of 146 studies in a meta-analysis of RCADS were conducted with Chinese samples, and these studies only reported RCADS's reliability but did not examine its validity (see [45]). A recent study preliminarily supported the

validity of the translated Chinese version of RCADS-47 among Chinese 4th–11th graders. However, its marginal-to-adequate fit statistics suggested that the original six-factor structure needs further evaluation [35]. To our knowledge, no previous study has evaluated the psychometric properties of the Chinese translation of the RCADS-25 in Chinese youth. Moreover, previous research with Chinese youth indicated sex differences in depression and anxiety scores [35], warranting further assessment of the RCADS's measurement invariance across demographic subgroups such as age and sex.

This study examines the psychometric properties of the RCADS-25 among preadolescents in China, including its factor structure, internal consistency, measurement invariance, convergent validity, and concurrent validity. Although this brief scale has been widely used in other countries, research evidence on school mental health screening tools is lacking in China. We therefore aim to evaluate the applicability of RCADS-25 as a potential tool for depression and anxiety assessment for Chinese youth in school settings.

Table 1 Means and standard deviations for demographic and key variables (N=534)

	<i>M</i> (<i>SD</i>)
Age	10.36 (0.80)
Sex (<i>n</i> , %)	
Female	222 (41.57%)
Male	312 (58.43%)
Grade (<i>n</i> , %)	
4th	179 (33.52%)
5th	355 (66.48%)
Household income ^{a, b} (<i>n</i> , %)	
Lower-income household	348 (65.17%)
Higher-income household	165 (30.90%)
Parent education level ^a (<i>n</i> , %)	
Elementary school degree or below	53 (9.93%)
Middle school degree	264 (49.44%)
High school degree	90 (16.85%)
Associate degree	99 (18.54%)
College degree or above	14 (2.62%)
Total anxiety and depression	22.23 (13.29)
Total anxiety	14.27 (8.58)
Total depression	7.95 (5.52)
Psychological resilience	25.11 (7.12)
Positive affect	17.07 (4.70)
Negative affect	11.67 (4.28)
Prosocial behavior	6.95 (2.03)
Total difficulty	11.50 (4.87)

Note. ^a Percentages for income and parent education level do not sum to 100% due to missing data (missing *n* = 21 for income, *n* = 14 for education level)

^b Lower-income is defined as monthly household income lower than CNY 10,000 (approximately USD \$1,450), based on local median wage for dual-income households in 2021

Method

Participants and Procedure

This study was approved by the University of Hong Kong Human Research Ethics Committee (#EA1802014). Written informed consent was obtained from all participants and their guardians before the study. A total of 608 students from three elementary schools in Shenzhen, a metropolitan city in southeast China, were invited to join the study. Most students in these schools were migrant children, whose parents relocated from other regions to work in Shenzhen.

Participants were recruited from 4th and 5th grades (ages ranged 9–12 years). We focused on this age group because research showed that China's socioeconomic environments had the greatest mental health impact on elementary school-age children [63], who have a high prevalence of depression (14.6%) and anxiety (12.3%) [20]. As children in middle childhood become increasingly vulnerable to environmental risk factors [6], elementary school students are at the forefront of mental health prevention. In particular, preadolescence, or “tween years” (ages 9–12), is a unique period when children undergo substantial neurodevelopmental changes and increasingly complex social and moral reasoning. Preadolescents' mental health vulnerability and its associated downstream consequences require targeted prevention [38] and therefore targeted assessment.

Trained research assistants distributed and collected questionnaires in classroom settings. Students completed paper-and-pencil surveys during regular school hours. Parents were also invited to rate their children's emotions and behaviors based on their daily-life observations. Parents also reported demographic information such as income and educational level through self-administered questionnaires.

We excluded 37 students who did not provide consent and 34 participants with invalid responses (e.g., all items rated the same score across scales). Considering a few extreme observations may bias the estimation of the sample's average values [11], we also excluded three extreme outliers whose RCADS scores were 3-SDs above the mean. As shown in Table 1, our final sample size was 534. Most participants (65%) came from lower-income families, and most parents (59%) had educational levels below high school. The participants' mean age was 10.36 ± 0.80 , and 41.57% were girls.

Measures

Anxiety and Depression

The short version of the Revised Child Anxiety and Depression Scale (RCADS-25) [12] includes 25 items about

participants' symptoms of depression and anxiety. The scale yields three scores: Total Anxiety (sum of 15 items), Total Depression (sum of 10 items), and Total Anxiety and Depression (sum of all items). Example items include: "I feel sad or empty" on the Total Depression subscale, and "I worry when I think I have done poorly at something" on the Total Anxiety subscale. The full version RCADS-47 has been translated to over 20 languages including Chinese [59]. We reused item translations from the RCADS-47 Chinese version and made age-based adaptations based on a 4th-grade reading level to ensure the developmental appropriateness of items. For example, the word "filled with anxiety" (忧心忡忡) was changed to "very anxious" (很烦恼) in Item 2 (which corresponds to Item 4 in the RCADS-47). Supplemental Table S1 presents the full survey instrument used in our study. Participants self-rated their frequency of experiencing each symptom on a scale of 0 (*never*) to 3 (*always*) in the past two weeks; higher scores represent higher levels of anxiety and depression. In this study, Cronbach's α was 0.86 for Total Anxiety, 0.82 for Total Depression, and 0.91 for Total Anxiety and Depression.

Positive and Negative Affect

Children's affect was assessed by the 10-item Positive and Negative Affect Schedule for Children [13, 28]. The Schedule includes five items on positive affect and five items on negative affect. Participants self-rated each item on a scale of 1 (*very slightly or not at all*) to 5 (*extremely*) based on their experiences in the past week. The full scale was validated in Chinese children [44]. In this study, Cronbach's α was 0.84 for positive affect and 0.77 for negative affect.

Behavioral Strengths and Difficulties

Parents rated their children's internalizing and externalizing problems using the Strengths and Difficulties Questionnaire (SDQ), Parent Version [15]. The SDQ includes five items about children's Prosocial Behaviors, with higher scores indicating more behavioral strengths. The SDQ also includes 20 items about children's Total Difficulty that include emotional symptoms, conduct problems, hyperactivity or inattention problems, and peer problems; higher total scores indicate more emotional and behavioral difficulties. Each item was rated on a scale of 0 (*not true*) to 2 (*certainly true*). The Chinese version showed satisfactory reliability and validity in previous research [33]. In this study, Cronbach's α was 0.72 for Total Difficulty and 0.70 for Prosocial Behavior.

Psychological Resilience

Child psychological resilience was assessed by the 10-item Connor-Davidson Resilience Scale, Chinese version [10], [66]. The scale consists of 10 items, each rated based on participants' experiences in the past month on a scale of 0 (*not at all true*) to 4 (*true nearly all the time*). The total score ranges 0–40, with higher scores indicating higher levels of resilience, or less difficulty in bouncing back from adversity. In this study, Cronbach's α was 0.83. All instruments were administered in Simplified Chinese.

Analytic Approach

In total, 39.66% ($n = 213$) of the cases had missing data, representing approximately 4% of all values. We examined missingness patterns by comparing the sex and grade of cases with and without missing values; no significant difference was found. For child-reported outcomes such as RCADS-25, positive and negative affect, and psychological resilience, most cases had missing values below 5%, except for four cases that had missing values ranging from 20% to 25%. Parent-reported SDQ scores are considered valid only if at least three of the five items are completed in each subscale (according to the scoring manual; [64]). Therefore, we conducted imputation for valid SDQ responses that had fewer than three missing items in all subscales ($n = 493$). We addressed missing data through multiple imputation, which reduces bias and is flexible in handling various levels and patterns of missingness [36]. All variables were normally distributed based on the criterion that absolute skewness values above 3 and absolute kurtosis values above 10 indicate violations of normality [27]. We excluded extreme outliers beyond 3 SDs above the mean ($n = 3$).

We conducted confirmatory factor analyses (CFA) to assess the RCADS-25's structural validity. Given the items' ordered, discrete nature as they were rated on an ordinal scale, we used the robust diagonally weighted least squares (DWLS) estimator, an approach often used in the context of structural equation modeling that better handles categorical and ordinal data and is more robust to non-normally distributed data [39, 46]. As shown in Table 2, we estimated five CFA models with different theoretical bases, using the *lavaan* package in RStudio (Version 2023.09.1+494). Model 1 was a unidimensional model that all 25 items loaded on one factor (hereafter referred to as the "general distress factor"). Model 2 was a bifactor model in which the 25 items were allowed to load on a general distress factor as well as on a depression or anxiety subfactor. This bifactor model estimation was based on the hypothesis that an underlying general distress factor partially accounts for the commonality in depression and anxiety [3]. Model 3 was a correlated

Table 2 Model comparison

	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Model fit:</i>					
TLI	.974	.991	.978	.969	.995
CFI	.976	.989	.976	.964	.993
RMSEA	.059	.038	.057	.075	.032
SRMR	.066	.05	.065	.071	.044
χ^2	787.35***	434.726***	749.445***	361.815***	53.555*
df	275	247	274	90	35
<i>Model estimation:</i>					
Items loaded on general RCADS factor	Yes	Yes	No	No	No
Items loaded on anxiety factor	No	Yes	Yes	Yes	No
Items loaded on depression factor	No	Yes	Yes	No	Yes
Correlation allowed between anxiety and depression	N/A	No	Yes	N/A	N/A

Note. Model 1 = 25-item uni-dimensional model; Model 2 = bifactor model; Model 3 = correlated two-factor model; Model 4 = 15-item anxiety model; Model 5 = 10-item depression model

* $p < .05$, *** $p < .001$

two-factor model, in which the 25 items were allowed to load solely on either anxiety or depression. Thus, anxiety and depression were viewed as distinct yet closely related constructs. Last, as previous RCADS psychometric evaluation research suggested that anxiety and depression could be assessed as two independent constructs [25], we also examined the 15-item anxiety scale (Model 4) and the 10-item depression scale (Model 5) separately.

We evaluated the structural validity based on five model fit indices. Respectively, acceptable and good model fit are indicated by the comparative fit index (CFI) of 0.90 and 0.95 or above, the root mean square error of approximation (RMSEA) of 0.08 and 0.06 or lower, the standardized root mean square residual (SRMR) of 0.10 and 0.08 or lower, and the Tucker-Lewis Index (TLI) of 0.90 and 0.95 or higher [26]. Due to the sensitivity of χ^2 to large samples and the resulting frequent underestimation of model fit, χ^2 is considered a secondary fit index [4].

To examine measurement invariance, we employed correlated two-factor CFA models to assess whether the RCADS structure remained consistent across demographic subgroups, including sex, grade, family income, and parental education. Specifically, we used a multigroup confirmatory factor analysis (MG-CFA) approach, which was developed for ordinal indicators and was previously applied in RCADS measurement invariance studies [5]. First, we assessed configural invariance, a basic-level invariance that indicates whether the factor structure (i.e., the number of factors and the pattern of indicator-factor loadings) is the same across groups. Second, we assessed metric invariance, which indicates whether the factor loadings are equivalent across groups. Third, we assessed scalar invariance, which is a strict-level invariance that tests whether the intercepts of the observed scores and the factor loadings are equivalent across groups. To help compare with RCADS validation studies in other countries, we followed the thresholds of previous research, where a change in CFI (Δ CFI) of less

than 0.01 indicates that the more-constrained model and the less-constrained model had similar fit to the data [5].

We used Cronbach's α to assess the internal consistency of RCADS-25 total score and its subscales. An α of 0.70 or above was considered acceptable and an α of 0.80 or above was preferred for measures used in clinical or high-risk settings [57]. We examined convergent validity through the correlations between RCADS-25 and related measures (i.e., positive and negative affect, psychological resilience, and internalizing/externalizing problems).

In addition, we assessed concurrent validity by comparing participants' RCADS-25 total and subscale scores between normal and at-risk samples as classified by their SDQ Total Difficulty score. Considering potential correlations between the dependent variables, a multivariate analysis of variance (MANOVA) was used. Receiver operating characteristic (ROC) curve analysis was performed with the *pROC* package in RStudio to determine the predictive accuracy of a diagnostic scale [43]. An area under the curve (AUC) value above 0.50 suggests that the scale predicts diagnostic categories better than chance, with higher values indicating stronger predictive ability. Last, we used MANOVA to examine whether RCADS-25 total and subscale scores differed by sex (female vs. male) and grade (4th vs. 5th grade). Data were analyzed using SPSS Version 29.

Results

Item-Total Correlations and Internal Consistency

All 25 items showed moderate-to-strong significant positive correlations with the total RCADS score (range 0.45–0.71, $p < 0.001$), based on the criteria that weak $r < 0.30$; moderate $r = 0.30$ –0.70, strong $r > 0.70$ [42]. The internal consistency of RCADS was strong. Cronbach's α for the Total Anxiety

and Depression, the Total Anxiety subscale, and the Total Depression subscale was 0.91, 0.86, and 0.82, respectively.

Structural Validity

Table 2 presents the five models' fit statistics. In the unidimensional model (Model 1), standardized factor loadings were significant for all 25 items (range: 0.479–0.762, $p < 0.001$). The model fit statistics were: TLI=0.974, CFI=0.976, RMSEA=0.059, and SRMR=0.066 ($\chi^2=787.35$, $df=275$, $p < 0.001$). The bifactorial model (Model 2) showed a better fit: TLI=0.991, CFI=0.989, RMSEA=0.038, and SRMR=0.05 ($\chi^2=434.726$, $df=247$, $p < 0.001$). However, most factor loadings were greater than 1 on the general distress factor, the anxiety factor, and the depression factor. Given that factor loadings in factor analysis or structural equation modeling generally range from -1 to 1, this result indicates that the items loaded strongly on the general factor as well as the specific factors, which might lead to loadings exceeding 1 due to shared variance. Thus, the bifactor model may not be appropriate for the data.

In the correlated two-factor model (Model 3), standardized factor loadings were significant for all 10 depression items and 15 anxiety items (depression: 0.531–0.731; anxiety: 0.485–0.773; $p < 0.001$). The model fit statistics were: TLI=0.978, CFI=0.976, RMSEA=0.057, and SRMR=0.065 ($\chi^2=749.445$, $df=274$, $p < 0.001$). In the model with only the 15 anxiety items (Model 4), standardized factor loadings were significant for all items (range: 0.474–0.763). Fit statistics were: TLI=0.969, CFI=0.964, RMSEA=0.075, and SRMR=0.071 ($\chi^2=361.815$, $df=90$, $p < 0.001$). Last, in the model with only the 10

depression items (Model 5), standardized factor loadings were significant for all items (range: 0.538–0.728). Fit statistics were: TLI=0.995, CFI=0.993, RMSEA=0.032, and SRMR=0.044 ($\chi^2=53.555$, $df=35$, $p < 0.05$).

Measurement Invariance

Table 3 presents the model fit indices and ΔCFI of multigroup confirmatory factor analyses between male and female participants. We used the correlated two-factor model (Model 3) for invariance testing given its satisfactory factor loadings and model fit. The configural invariance test showed adequate fit (TLI=0.978, CFI=0.980, RMSEA=0.056, SRMR=0.075; $\chi^2=997.440$, $df=548$, $p < 0.001$), indicating that the same items loaded on the same factors in males and females. The metric invariance test, which involved constraining factor loadings across groups, yielded a marginal decrease in model fit (TLI=0.974, CFI=0.976, RMSEA=0.060, SRMR=0.079; $\chi^2=1118.684$, $df=571$, $p < 0.001$). Specifically, the more constrained model showed a decrease of 0.004 points in CFI compared with the less constrained model. The magnitude of this decrease ($\Delta CFI < 0.01$) suggests that metric invariance could be reasonably assumed between groups. Last, the scalar invariance test, which examines the equivalence of intercepts and factor loadings across male and female participants, strongly supported invariance assumptions as the decrease in model fit was minimal (TLI=0.972, CFI=0.974, RMSEA=0.063, SRMR=0.079; $\chi^2=1118.684$, $df=546$, $p < 0.001$). The more constrained model showed a decrease of 0.002 points in the CFI index compared with the less constrained model.

Table 3 Results of multigroup confirmatory factor analyses by sex and grade

	TLI	CFI	RMSEA	SRMR	χ^2	df
Sex (male vs. female)						
Configural model	.978	.980	.056	.075	997.440***	548
Metric model	.974	.976	.060	.079	1118.684***	571
Scalar model	.972	.974	.063	.079	1118.684***	546
Grade (4th vs. 5th)						
Configural model	.979	.981	.056	.074	1003.962***	548
Metric model	.969	.971	.067	.082	1255.486***	571
Scalar model	.967	.970	.070	.082	1255.486***	546
Income (lower vs. higher) ^a						
Configural model	.975	.977	.059	.078	1032.534***	548
Metric model	.968	.969	.067	.085	1220.138***	571
Scalar model	.965	.968	.070	.085	1220.138***	546
Education (lower vs. higher) ^b						
Configural model	.978	.980	.055	.075	974.201***	548
Metric model	.974	.975	.059	.080	1093.495***	571
Scalar model	.971	.974	.062	.080	1093.495***	546

Note. *** $p < .001$

^a Lower-income is defined as monthly household income below CNY 10,000 (approximately USD 1,450)

^b Lower-education refers to middle school degree and below

As for measurement invariance between 4 and 5th grades, the configural invariance test showed adequate fit (TLI=0.979, CFI=0.981, RMSEA=0.056, SRMR=0.074; $\chi^2=1003.962$, $df=548$, $p<0.001$). The metric invariance test, which involved constraining factor loadings across groups, yielded a decrease in model fit (TLI=0.969, CFI=0.971, RMSEA=0.067, SRMR=0.082; $\chi^2=1255.486$, $df=571$, $p<0.001$) and $\Delta CFI=0.01$, which was considered acceptable for a more constrained model of factor loadings. Last, the scalar invariance test resulted in a minimal decrease in model fit (TLI=0.967, CFI=0.970, RMSEA=0.070, SRMR=0.082; $\chi^2=1255.486$, $df=546$, $p<0.001$) and $\Delta CFI=0.001$, thereby confirming that scalar invariance was established across grades.

For preadolescents from higher- versus lower-income families, the configural invariance test showed adequate fit (TLI=0.975, CFI=0.977, RMSEA=0.059, SRMR=0.078; $\chi^2=1032.534$, $df=548$, $p<0.001$). The metric invariance test yielded an acceptable decline in fit (TLI=0.968, CFI=0.969, RMSEA=0.067, SRMR=0.085; $\chi^2=1220.138$, $df=571$, $p<0.001$), $\Delta CFI=0.008$. Finally, the scalar invariance test showed negligible fit deterioration (TLI=0.965, CFI=0.968, RMSEA=0.070, SRMR=0.085; $\chi^2=1220.138$, $df=546$, $p<0.001$), $\Delta CFI=0.001$, which suggests equivalent latent constructs across income groups.

For preadolescents from higher- versus lower-education families, the configural invariance test demonstrated excellent fit (TLI=0.978, CFI=0.980, RMSEA=0.055, SRMR=0.075; $\chi^2=974.201$, $df=548$, $p<0.001$). The metric invariance test showed an acceptable decline in fit (TLI=0.974, CFI=0.975, RMSEA=0.059, SRMR=0.080; $\chi^2=1093.495$, $df=571$, $p<0.001$), $\Delta CFI=0.005$. The scalar invariance test also showed minimal deterioration in model fit (TLI=0.971, CFI=0.974, RMSEA=0.062, SRMR=0.080; $\chi^2=1093.495$, $df=594$, $p<0.001$), $\Delta CFI=0.001$, which establishes equivalent latent construct interpretation across parental education levels.

Convergent Validity

We assessed convergent validity through the correlations between RCADS-25 and psychological resilience, positive and negative affect, total difficulty, and prosocial behavior.

As shown in Table 4, consistent with our expected directions, the RCADS-25 Total Anxiety and Depression had small, significant negative correlations with Resilience ($r=-0.19$, $p<0.001$) and Positive Affect ($r=-0.21$, $p<0.001$), and a small, significant positive correlation with SDQ Total Difficulty ($r=0.14$, $p<0.001$). Notably, RCADS-25 total scores had a strong positive correlation with Negative Affect ($r=0.55$, $p<0.001$). In terms of the RCADS subscales, both Total Anxiety and Total Depression subscales had small negative correlations with Resilience and Positive Affect, and small positive correlations with SDQ Total Difficulty. Similarly, both RCADS subscales had strong positive correlations with Negative Affect ($r=0.52$, $p<0.001$). Prosocial Behavior was negatively correlated with Total Depression ($r=-0.14$, $p<0.01$) but not with Total Anxiety.

Concurrent Validity

SDQ is a validated instrument to measure Chinese-ethnic children's internalizing and externalizing problems [31, 33]. As SDQ Total Difficulty scores of 14 or above indicate heightened risks for clinically significant problems [64], we classified participants into normal ($n=342$) and at-risk ($n=151$) samples. The MANOVA showed significant classification differences in the normal and at-risk samples' RCADS-25 total score and subscales ($p<0.01$). We then further examined these differences through univariate analyses of variance (ANOVAs). As shown in Table 5, compared with the normal sample, the at-risk sample scored significantly higher on Total Depression (Mean difference=1.40, $F=6.99$, $p=0.008$). The at-risk sample also scored higher on Total Anxiety and Depression as well as Total Anxiety than the normal sample, but these differences were not significant (Total Anxiety and Depression: Mean difference=2.18, $F=2.89$, $p=0.09$; Total Anxiety: Mean difference=0.78, $F=0.88$, $p=0.348$).

The Total Depression scale (AUC=0.57, 95% CI [0.52, 0.62]) demonstrated AUC values greater than 0.50, indicating that it could predict diagnostic categories classified by parent-reported SDQ. The Total Anxiety and Depression scale and the Total Anxiety scale's AUCs were not statistically significant, as their confidence intervals included values below the threshold of 0.50 (Total Anxiety and

Table 4 Correlation between RCADS-25 and related measures

	Total anxiety and depression	Total depression	Total anxiety	Psychological resilience	Positive affect	Negative affect	Prosocial behavior	Total difficulty
Total anxiety and depression	-			-.19***	-.21***	.55***	-.09*	.14**
Total depression	.91***	-		-.24***	-.24***	.52***	-.14**	.19***
Total anxiety	.96***	.77***	-	-.14**	-.16***	.52***	.05	.09*

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

Table 5 RCADS-25 total score and subscales by at-risk and normal samples

	SDQ Total difficulty	N	Mean	SD	F	p
Total anxiety and depression	Normal	342	21.33	12.83	2.89	.090
	At-risk	151	23.51	13.85		
Total anxiety	Normal	342	13.89	8.37	0.88	.348
	At-risk	151	14.67	8.82		
Total depression	Normal	342	7.44	5.30	6.99	.008
	At-risk	151	8.84	5.73		

Note. SDQ = Strengths and Difficulties Questionnaire (parent-reported, N = 493)

Table 6 Ranges, means, and standard deviations of RCADS-25 total score and subscales by sex and grade

Sex	Grade	Scale	N	Minimum	Maximum	Mean	SD
Male	4th	Total anxiety and depression	106	1	60	23.31	13.44
		Total anxiety	106	0	37	14.5	8.61
		Total depression	106	0	25	8.81	5.7
	5th	Total anxiety and depression	206	0	54	20.47	12.93
		Total anxiety	206	0	34	13.12	8.34
		Total depression	206	0	25	7.35	5.24
	All male	Total anxiety and depression	312	0	60	21.44	13.15
		Total anxiety	312	0	37	13.59	8.44
		Total depression	312	0	25	7.85	5.44
Female	4th	Total anxiety and depression	73	5	53	26.26	12.24
		Total anxiety	73	2	39	16.94	7.91
		Total depression	73	0	26	9.31	5.79
	5th	Total anxiety and depression	149	1	59	21.9	13.78
		Total anxiety	149	0	37	14.4	8.96
		Total depression	149	0	23	7.5	5.5
	All female	Total anxiety and depression	222	1	59	23.34	13.42
		Total anxiety	222	0	39	15.24	8.69
		Total depression	222	0	26	8.10	5.65
Total sample		Total anxiety and depression	534	0	60	22.23	13.29
		Total anxiety	534	0	39	14.27	8.58
		Total depression	534	0	26	7.95	5.52

Depression scale: AUC=0.54, 95% CI [0.48, 0.59]; Total Anxiety scale: AUC=0.52, 95% CI [0.46, 0.57]).

Sex and Grade Differences

Table 6 presents the distributions of RCADS-25 total and subscale scores by sex and grade. The MANOVA showed significant sex and grade differences in the RCADS-25 total score and subscales (sex: $p < 0.05$; grade: $p < 0.01$). Girls scored significantly higher on Total Anxiety than boys ($p = 0.03$). Compared with 5th graders, 4th graders scored significantly higher on Total Anxiety and Depression ($p = 0.005$), Total Anxiety ($p = 0.02$), and Total Depression ($p = 0.002$). To examine the interaction between sex and grade, we divided participants into four groups (4th-grade boys, 5th-grade boys, 4th-grade girls, and 5th-grade girls). The MANOVA revealed significant sex $\times$ grade differences in the RCADS-25 total score and subscales ($p < 0.01$). Post hoc tests indicated that 4th-grade girls scored significantly

higher than 5th-grade boys on Total Anxiety and Depression and Total Anxiety ($p < 0.01$).

Discussion

Reliability and Validity of the RCADS-25

Using a sample of 534 Chinese preadolescents, our results provide initial support for the reliability and validity of the Chinese-version RCADS-25. The RCADS-25 showed adequate reliability (Cronbach's $\alpha = 0.91$). This is comparable to a previous study of the RCADS 47-item version among Chinese youth, in which Cronbach's α was 0.93 for participants aged 9–12 years [35]. Our analysis supported a correlated two-factor model, indicating that the RCADS-25 consists of a Total Anxiety subscale and a Total Depression subscale. This factor structure was consistent across sex, grade, family income, and parental education attainment. Additionally, the RCADS-25 was positively correlated with

Negative Affect and Total Difficulty, and negatively correlated with Positive Affect and Psychological Resilience, indicating convergent validity. The RCADS-25 showed partial concurrent validity with the SDQ, evidenced by significantly different Total Depression scores between at-risk and normal samples based on their SDQ scores.

Previous research suggests that negative affect may be a common component shared by depression and anxiety [7], and it is important to consider the common factor as well as the unique components in depression and anxiety [3]. Therefore, in addition to treating depression and anxiety as separate constructs, we explored a bifactor model (Model 2) to test whether an underlying general distress factor explains the shared variance between depression and anxiety symptoms, and whether depression and anxiety account for unique components beyond the underlying distress factor [3]. However, our bifactor model showed suboptimal model fit. This result differs from a few previous studies that favored a general latent construct underlying depression and anxiety scales (e.g., [21, 58]). But note that these two previous studies had older samples (ages 18–85 in [21], 16 years and above in [58]). As suggested by previous research on adolescents' comorbidity of anxiety and depression, anxiety may be a more central symptom and may lead to secondary depression in adolescence [53].

As suggested by the initial RCADS-47 scale development study, treating depression and anxiety as two closely related constructs addresses the significant comorbidity and frequent overlap between anxiety and depressive disorders [9]. Supporting this argument, our correlated two-factor model (Model 3) showed satisfactory factor loadings and model fit. Our CFA also supported an independent 15-item Total Anxiety scale (Model 4) when similar items were allowed to correlate, as well as an independent 10-item Total Depression scale (Model 5) with satisfactory factor loadings and good model fit. Moreover, the Total Depression subscale significantly differentiated between normal and at-risk samples as classified by the SDQ Total Difficulty scores, whereas the Total Anxiety subscale did not. A possible reason is that adolescents' depressive symptoms may manifest as irritability and a tendency to react angrily [2], which might be more easily observable by parents and reflected in the parent-rated SDQ scores.

We also examined convergent validity based on the hypotheses that youth with higher levels of anxiety and depression would exhibit lower psychological resilience [19], more negative affect, less positive affect [19, 50], and more behavioral difficulties [1]. As expected, the RCADS-25 total score, as well as the Total Depression and Total Anxiety subscales, had a strong and positive correlation with negative affect, a small positive correlation with

internalizing and externalizing problems, and a small negative correlation with psychological resilience and positive affect.

Sex and Age Differences

In terms of sex differences, consistent with previous RCADS studies [9, 35], we found that girls reported significantly higher levels of anxiety than boys. This result is also consistent with previous studies of East Asian children using other measurement tools, including a Japanese study using the Spence Children's Anxiety Scale [22] and a study of Chinese adolescents in Singapore using the Revised Children's Manifest Anxiety Scale [29].

However, whereas a previous validation study of RCADS-47 among Chinese youth found that girls also scored significantly higher on depression than boys [35], our results did not show a significant sex difference in depression. In a meta-analysis of nationally representative samples, the sex difference in depressive symptoms was negligible at ages 8–11, increased from age 12, and peaked at age 16 [51]. Another meta-analysis of worldwide epidemiological estimates showed that the onset age of anxiety-related disorders (peak age of onset = 5.5) was much earlier than depressive disorders (peak age of onset = 19.5) [55]. Therefore, our nonsignificant sex difference in depression may be due to the young age of our sample before adolescents fully develop depressive symptoms and before any sex differences emerge. Our results also echo Salk et al.'s [51] argument that although men may be less likely to develop depression than women in certain age groups, it is equally important to acknowledge and treat depression across sex groups.

In terms of age differences, the 4th graders in our sample reported significantly higher levels of Total Anxiety and Depression, Total Anxiety, and Total Depression than 5th graders. This may be because children learn to use more emotion regulation strategies as they grow older [49, 52]. This result is overall consistent with previous research. In a study of the Spence Children's Anxiety Scale (from which the RCADS-47 was originally adapted) in an Australian sample of 2,052 elementary school students in 4th–7th grades, younger children reported higher total anxiety scores than their older peers [56]. A recent Chinese study of 30,746 4th–9th graders across 29 provinces also showed that 5th graders had a lower risk of depression than 4th graders [16].

Notably, Guo et al. [16] also found that middle school students had higher risks of depression than elementary school students, and the risk increased with grade. This age trend may be attributed to the increased academic stress over time in the Chinese education system. For instance, older

Chinese adolescents have higher rates of suicidal thoughts and attempts, which are linked to increased academic pressure from middle school to high school [69]. A study using the RCADS-47 in Chinese adolescents also found that compared with participants aged 9–12 (elementary school age), those aged 13–18 (middle- and high school age) reported significantly higher depression and anxiety in all domains except separation anxiety [35]. While our study only compared 4th and 5th graders, future research should investigate age-related differences and potential interaction effects between age and sex across a broader age range.

Limitations and Future Research Directions

Our study has several limitations. First, we used a relatively homogeneous sample of elementary school students from a southern metropolis in Mainland China, which may differ in cultural values and social norms from other regions, such as rural areas. Additionally, as previous research has indicated, school and clinical samples may respond differently to the RCADS-25 as certain Anxiety items may not apply to school samples [12]. Furthermore, although the RCADS was developed for children aged 8–18 years, our study focused only on preadolescents aged 9–12. Therefore, future research should replicate our findings in children from other regions, clinical populations, and broader age ranges.

Second, our sample predominantly consisted of migrant youth who face more daily-life challenges than local youth, including lower family socioeconomic status and less access to public welfare resources [34]. On the one hand, our sample represents a group of disadvantaged youth who are at higher risk of psychological distress and therefore should be prioritized in school mental health screening research. On the other hand, it is possible that our sample's mean depression-anxiety scores exceeded population average, which warrants future studies to compare our results with nonmigrant youth. Future studies may also compare our findings with those from youth living in other Chinese-speaking societies, such as Singapore—where school-aged youth similarly experience significant academic stress and school-related anxieties [29]—or Taiwan, where adolescents exhibit a high prevalence of depression [32].

Third, as explained earlier, we adapted the instrument language to 4th-grade reading level. Although the item contents were the same as those in the Chinese-version RCADS-47, these language nuances may influence the comparability between research findings based on the Chinese-version RCADS-47 and RCADS-25. Given the subjective nature of the experiences of depression and anxiety, future research comparing the RCADS-25 results across cultures should also distinguish which differences are attributed to

the measurement's cultural equivalence, and which differences are attributed to the cultural variations in children's experience or expression of symptoms. Considering the limited information from survey data, future research may also use qualitative approaches to explore children's interpretation of anxiety and depressive symptoms, as well as their understanding of the measured items.

Despite these limitations, our study represents an initial step toward validating the RCADS-25 in a previously under-examined cultural context. Given that many mental disorders onset occurs well before age 18, proactive screening for risk of developing specific mental disorders should start early in life [55]. China has 108 million elementary school-aged children enrolled across 143,500 elementary schools [41], averaging more than 750 students per school—highlighting a significant potential demand for mental health support. Our findings provide preliminary support for using the RCADS-25 to assess anxiety and depression in Chinese preadolescents. This brief self-report measure may serve as an efficient triage tool to facilitate large-scale school mental health screening and subsequent prevention efforts.

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Author Contribution SL: conceptualization, project administration, data collection, manuscript writing. RL: data analysis, literature review, manuscript writing. BFC: instrument development, results interpretation, manuscript review.

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Data Availability Due to privacy and ethical restrictions, the data associated with this study are not publicly available. Deidentified data are available upon reasonable request.

Declarations

Conflict of interest The authors declare no competing interests.

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References

- Becker SP, Schindler DN, Luebbe AM, Tamm L, Epstein JN (2019) Psychometric validation of the revised child anxiety and depression scales-parent version (RCADS-P) in children evaluated for ADHD. *Assessment* 26(5):811–824. <https://doi.org/10.1177/1073191117735886>
- Brent DA, Birmaher B (2002) Adolescent depression. *N Engl J Med* 347:667–671. <https://doi.org/10.1056/NEJMcp012249>
- Brodbeck J, Abbott RA, Goodyer IM, Croudace TJ (2011) General and specific components of depression and anxiety in an adolescent population. *BMC Psychiatry* 11:191. <https://doi.org/10.1186/1471-244X-11-191>
- Brown TA (2006) Confirmatory factor analysis for applied research. Guilford Press
- Cervin M, Veas A, Piqueras JA, Martínez-González AE (2022) A multi-group confirmatory factor analysis of the Revised Children's Anxiety and Depression Scale (RCADS) in Spain, Chile and Sweden. *J Affect Disord* 310:228–234. <https://doi.org/10.1016/j.jad.2022.05.031>
- Charlesworth LW (2015) Middle childhood. In: ED Hutchison (Ed.), *Dimensions of human behavior: The changing life course* (5th ed., pp. 177–220). Sage.
- Chorpita BF, Daleiden EL (2002) Tripartite dimensions of emotion in a child clinical sample: measurement strategies and implications for clinical utility. *J Consult Clin Psychol* 70:1150–1160. <https://doi.org/10.1037/0022-006X.70.5.1150>
- Chorpita BF, Ebesutani C, Spence SH (2015) *Revised Children's Anxiety and Depression Scale User's Guide*. UCLA Child FIRST. <https://www.childfirst.ucla.edu/wp-content/uploads/sites/163/2018/03/RCADSUsersGuide20150701.pdf>
- Chorpita BF, Yim L, Moffitt C, Umemoto LA, Francis SE (2000) Assessment of symptoms of DSM-IV anxiety and depression in children: a revised child anxiety and depression scale. *Behav Res Ther* 38:835–855. [https://doi.org/10.1016/S0005-7967\(99\)00130-8](https://doi.org/10.1016/S0005-7967(99)00130-8)
- Connor KM, Davidson JR (2003) Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety* 18(2):76–82. <https://doi.org/10.1002/da.10113>
- Cowell FA, Victoria-Feser M-P (1996) Robustness properties of inequality measures. *Econometrica* 64(1):77–101. <https://doi.org/10.2307/2171925>
- Ebesutani C, Reise SP, Chorpita BF, Ale C, Regan J, Young J, Higa-McMillan C, Weisz JR (2012a) The revised child anxiety and depression scale-short version: scale reduction via exploratory bifactor modeling of the broad anxiety factor. *Psychol Assess* 24:833–845. <https://doi.org/10.1037/a0027283>
- Ebesutani C, Regan J, Smith A, Reise S, Higa-McMillan C, Chorpita BF (2012b) The 10-item positive and negative affect schedule for children, child and parent shortened versions: application of item response theory for more efficient assessment. *J Psychopathol Behav* 34(2):191–203. <https://doi.org/10.1007/s10862-011-9273-2>
- Ersikine HE, Moffitt TE, Copeland WE, Costello EJ, Ferrari AJ, Patton G, Degenhardt L, Vos T, Whiteford HA, Scott JG (2015) A heavy burden on young minds: the global burden of mental and substance use disorders in children and youth. *Psychol Med* 45(7):1551–1563. <https://doi.org/10.1017/S0033291714002888>
- Goodman R (1997) The strengths and difficulties questionnaire: a research note. *JCPP* 38:581–586. <https://doi.org/10.1111/j.1469-7610.1997.tb01545.x>
- Guo F, Wang X, Chen Z (2023) Adolescent mental health survey in 2022. In: Fu X, Zhang K (Eds.), *Report on national mental health development in China (2021–2022)* (pp. 30–69). Social Sciences Academic Press (China)
- Hofmann SG, Hinton DE (2014) Cross-cultural aspects of anxiety disorders. *Curr Psychiatry Rep* 16:450. <https://doi.org/10.1007/s11920-014-0450-3>
- Hoover S, Bostic J (2021) Schools as a vital component of the child and adolescent mental health system. *Psychiatr Serv* 72(1):37–48. <https://doi.org/10.1176/appi.ps.201900575>
- Hu T, Zhang D, Wang J (2015) A meta-analysis of the trait resilience and mental health. *Pers Individ Differ* 76:18–27. <https://doi.org/10.1016/j.paid.2014.11.039>
- Huang X, Zhang Y, Yu G (2022) Prevalence of mental health problems among elementary school students in Chinese mainland from 2010 to 2020: a meta-analysis. *Adv Psychol Sci* 30:953–964. <https://doi.org/10.3724/SP.J.1042.2022.00953>
- Iani L, Lauriola M, Costantini M (2014) A confirmatory bifactor analysis of the hospital anxiety and depression scale in an Italian community sample. *Health Qual Life Outcomes* 12:84. <https://doi.org/10.1186/1477-7525-12-84>
- Ishikawa S, Sato H, Sasagawa S (2009) Anxiety disorder symptoms in Japanese children and adolescents. *J Anxiety Disord* 23(1):104–111. <https://doi.org/10.1016/j.janxdis.2008.04.003>
- Jiang S, Ren Q, Jiang C, Wang L (2021) Academic stress and depression of Chinese adolescents in junior high schools: moderated mediation model of school burnout and self-esteem. *J Affect Disord* 295:384–389. <https://doi.org/10.1016/j.jad.2021.08.085>
- Kim JM, López SR (2014) The expression of depression in Asian Americans and European Americans. *J Abnorm Psychol* 123:754–763. <https://doi.org/10.1037/a0038114>
- Klaufus L, Verlinden E, van der Wal M, Kösters M, Cuijpers P, Chinapaw M (2020) Psychometric evaluation of two short versions of the revised child anxiety and depression scale. *BMC Psychiatry* 20:47. <https://doi.org/10.1186/s12888-020-2444-5>
- Kline RB (2016) *Principles and practice of structural equation modeling* (4th ed). Guilford Press.
- Kline TJB (2005) *Psychological testing: A practical approach to design and evaluation*. Sage Publications.
- Laurent J, Catanzaro SJ, Joiner TE Jr, Rudolph KD, Potter KI, Lambert S, Osborne L, Gathright T (1999) A measure of positive and negative affect for children: Scale development and preliminary validation. *Psychol Assess* 11(3):326–338. <https://doi.org/10.1037/1040-3590.11.3.326>
- Li H, Ang RP, Lee J (2008) Anxieties in mainland Chinese and Singapore Chinese adolescents in comparison with the American norm. *J Adolesc* 31(5):583–594. <https://doi.org/10.1016/j.adolescence.2007.10.003>
- Li L, Lok GKI, Mei S-L, Cui X-L, An F-R, Li L, Cheung T, Ungvari GS, Xiang Y-T (2020) Prevalence of depression and its relationship with quality of life among university students in Macau, Hong Kong and mainland China. *Sci Rep* 10:15798. <https://doi.org/10.1038/s41598-020-72458-w>
- Liang L, Yang J, Yao S (2019) Measurement equivalence of the SDQ in Chinese adolescents: a horizontal and longitudinal perspective. *J Affect Disord* 257:439–444. <https://doi.org/10.1016/j.jad.2019.06.049>
- Lin HC, Tang TC, Yen JY, Ko CH, Huang CF, Liu SC, Yen CF (2008) Depression and its association with self-esteem, family, peer and school factors in a population of 9586 adolescents in southern Taiwan. *Psychiatry Clin Neurosci* 62(4):412–420. <https://doi.org/10.1111/j.1440-1819.2008.01820.x>

33. Liu S-K, Chien Y-L, Shang C-Y, Lin C-H, Liu Y-C, Gau SS-F (2013) Psychometric properties of the Chinese version of strength and difficulties questionnaire. *Compr Psychiatry* 54:720–730. <https://doi.org/10.1016/j.comppsy.2013.01.002>
34. Lu S (2020) Family migration and youth psychosocial development: an ecological perspective. *Child Youth Serv Rev* 113:104953. <https://doi.org/10.1016/j.childev.2020.104953>
35. Lu W, Daleiden E, Higa-McMillan C, Liu S, Leong A, Almeida A, Kelleher K (2021) Revised Child Anxiety and Depression Scale: A psychometric examination in Chinese youth. *J Psychopathol Behav Assess* 43:707–716. <https://doi.org/10.1007/s10862-021-09879-y>
36. Madley-Dowd P, Hughes R, Tilling K, Heron J (2019) The proportion of missing data should not be used to guide decisions on multiple imputation. *J Clin Epidemiol* 110:63–73. <https://doi.org/10.1016/j.jclinepi.2019.02.016>
37. Mathew AR, Pettit JW, Lewinsohn PM, Seeley JR, Roberts RE (2011) Co-morbidity between major depressive disorder and anxiety disorders: shared etiology or direct causation? *Psychol Med* 41:2023–2034. <https://doi.org/10.1017/S0033291711000407>
38. McArthur BA, Madigan S, Korczak DJ (2021) Tweens are not teens: the problem of amalgamating broad age groups when making pandemic recommendations. *Can J Public Health* 112:984–987. <https://doi.org/10.17269/s41997-021-00585-6>
39. Mindrila D (2010) Maximum likelihood (ML) and diagonally weighted least squares (DWLS) estimation procedures: A comparison of estimation bias with ordinal and multivariate non-normal data. *IJDS* 1(1):60–66. <https://doi.org/10.20533/ijds.2040.2570.2010.0010>
40. Ministry of Education of China (2021) Notice of the general office of the Ministry of Education on strengthening the management of students' mental health. http://www.moe.gov.cn/srcsite/A12/moe_1407/s3020/202107/t20210720_545789.html
41. Ministry of Education of China (2024) 2023 Statistical bulletin on national education development. http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/202410/t20241024_1159002.html
42. Mukaka MM (2012) Statistics corner: a guide to appropriate use of correlation coefficient in medical research. *Malawi Med J* 24(3):69–71
43. Nahm FS (2022) Receiver operating characteristic curve: overview and practical use for clinicians. *Korean J Anesthesiol* 75(1):25–36. <https://doi.org/10.4097/kja.21209>
44. Pan T-T, Ding X-C, Sang B, Liu Y, Xie S-Y, Feng X-Y (2015) Reliability and validity of the Chinese version of the positive negative affect scale for children. *Chin J Clin Psychol* 23:397–400
45. Piqueras JA, Martín-Vivar M, Sandin B, San Luis C, Pineda D (2017) The revised child anxiety and depression scale: a systematic review and reliability generalization meta-analysis. *J Affect Disord* 218:153–169. <https://doi.org/10.1016/j.jad.2017.04.022>
46. Piqueras JA, Pineda D, Martín-Vivar M, Sandin B (2017) Confirmatory factor analysis and psychometric properties of the revised child anxiety and depression scale–30 (RCADS-30) in clinical and non-clinical samples. *Rev Psiquiatr Psicol Med Eur Am Lat* 22(3):183–196. <https://doi.org/10.5944/rppc.vol.22.num.3.2017.19332>
47. Racine N, McArthur BA, Cooke JE, Eirich R, Zhu J, Madigan S (2021) Global prevalence of depressive and anxiety symptoms in children and adolescents during COVID-19. *JAMA Pediatr* 175:1142–1150. <https://doi.org/10.1001/jamapediatrics.2021.2482>
48. Qu D, Wen X, Cheng X, Zhu A, Wu Z, Che L, Chen R (2024) School mental health prevention and intervention strategies in China: a scoping review. *The Lancet regional health – Western Pacific* 53:101243. <https://doi.org/10.1016/j.lanwpc.2024.101243>
49. Sala MN, Pons F, Molina P (2014) Emotion regulation strategies in preschool children. *Br J Dev Psychol* 32:440–453. <https://doi.org/10.1111/bjdp.12055>
50. Sandin B, Chorot P, Valiente R, Chorpita BF (2010) Development of a 30-item version of the revised child anxiety and depression scale. *Rev Psiquiatr Salud Ment (Barc)* 15(3):165–178
51. Salk RH, Hyde JS, Abramson LY (2017) Gender differences in depression in representative national samples: meta-analyses of diagnoses and symptoms. *Psychol Bull* 143:783–822. <https://doi.org/10.1037/bul0000102>
52. Sanchis-Sanchis A, Grau MD, Moliner A-R, Morales-Murillo CP (2020) Effects of age and gender in emotion regulation of children and adolescents. *Front Psychol* 11:946. <https://doi.org/10.3389/fpsyg.2020.00946>
53. Schleider JL, Krause ED, Gillham JE (2014) Sequential comorbidity of anxiety and depression in youth: Present knowledge and future directions. *Cur Psychiatry Rev* 10:75–87. <https://doi.org/10.2174/1573400509666131217010652>
54. Skoczni I, Rogoza R, Rogoza M, Ebesutani C, Chorpita B (2019) Structure, reliability, measurement stability, and construct validity of the Polish version of the revised child anxiety and depression scale. *Assessment* 26(8):1492–1503. <https://doi.org/10.1177/1073191117711019>
55. Solmi M, Radua J, Olivola M, Croce E, Soardo L, Salazar de Pablo G, Il Shin J, Kirkbride JB, Jones P, Kim JH, Kim JY, Carvalho AF, Seeman MV, Correll CU, Fusar-Poli P (2022) Age at onset of mental disorders worldwide: large-scale meta-analysis of 192 epidemiological studies. *Mol Psychiatry* 27:281–295. <https://doi.org/10.1038/s41380-021-01161-7>
56. Spence SH (1998) A measure of anxiety symptoms among children. *Behav Res Ther* 36:545–566. [https://doi.org/10.1016/s0005-7967\(98\)00034-5](https://doi.org/10.1016/s0005-7967(98)00034-5)
57. Streiner DL (2003) Starting at the beginning: an introduction to coefficient alpha and internal consistency. *J Pers Assess* 80:99–103. https://doi.org/10.1207/S15327752JPA8001_18
58. Teymouri A, Gorbunova A, Haghish FE, Real R, Zeldovich M, Wu YJ, Polinder S, Asendorf T, Menon D, CENTER-TBI Investigators and Participants, Steinbüchel N (2020) Factorial structure and validity of depression (PHQ-9) and anxiety (GAD-7) scales after traumatic brain injury. *J Clin Med* 9(3):873. <https://doi.org/10.3390/jcm9030873>
59. UCLA Child FIRST. (n.d.). *Revised Child Anxiety and Depression Scale*. <https://rcads.ucla.edu/versions>
60. United Nations Children's Fund (UNICEF). (2022). *Country office annual report 2022 – China*. <https://www.unicef.org/media/135611/file/China-2022-COAR.pdf>
61. Wang H, Fan X (2023) Academic stress and sleep quality among Chinese adolescents: chain mediating effects of anxiety and school burnout. *Int J Environ Res Public Health* 20(3):2219. <https://doi.org/10.3390/ijerph20032219>
62. Xie Q, Wong DFK (2021) Culturally sensitive conceptualization of resilience: a multidimensional model of Chinese resilience. *Transcult Psychiatry* 58(3):323–334. <https://doi.org/10.1177/1363461520951306>
63. Xin Z, Niu J, Chi L (2012) Birth cohort changes in Chinese adolescents' mental health. *Int J Psychol* 47:287–295. <https://doi.org/10.1080/00207594.2011.626048>
64. YouthMind (2015) *Scoring the SDQ*. [https://www.sdqinfo.org/py/sdqinfo/b3.py?language=Englishqz\(USA\)](https://www.sdqinfo.org/py/sdqinfo/b3.py?language=Englishqz(USA))
65. Yu G, He Y (2023) Detection rate and educational strategies of mental health problems among primary and secondary school students. *Mental Health Education in Primary and Secondary School* 531(4):4–9. <https://doi.org/10.3969/j.issn.1671-2684.2023.04.002>
66. Yu X, Zhang J (2007) Factor analysis and psychometric evaluation of the Connor-Davidson Resilience Scale (CD-RISC) with

- Chinese people. *Soc Behav Personal Int J* 35(1):19–30. <https://doi.org/10.2224/sbp.2007.35.1.19>
67. Yu X, Stewart SM, Liu IK, Lam TH (2014) Resilience and depressive symptoms in mainland Chinese immigrants to Hong Kong. *Soc Psychiatry Psychiatr Epidemiol* 49(2):241–249. <https://doi.org/10.1007/s00127-013-0733-8>
 68. Zhang L, Zhang D, Fang J, Wan Y, Tao F, Sun Y (2020) Assessment of mental health of Chinese elementary school students before and after school closing and opening during the COVID-19 pandemic. *JAMA Netw Open* 3:e2021482. <https://doi.org/10.1001/jamanetworkopen.2020.21482>
 69. Zhao X, Selman RL, Haste H (2015) Academic stress in Chinese schools and a proposed preventive intervention program. *Cogent Educ* 2:1000477. <https://doi.org/10.1080/2331186X.2014.1000477>

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