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ORIGINAL ARTICLE

Factor Structure of Measures of Anxiety and Depression Symptoms in African American Youth

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Abstract Previous research has suggested that the factor structure of anxiety measures is different in African American samples compared to majority population samples. However, these findings may be due to misuse of analytic methods rather than meaningful differences in the underlying presentation of anxiety. To address this, we examined the factor structure of two measures of child anxiety: the Revised Children's Anxiety and Depression Scale and the Multidimensional Anxiety Scale for Children in a sample of 229 African American youth. Contrary to previous research, confirmatory factor analyses yielded good fit for the original factor structures of both measures. These results suggest that the underlying factor structure of these measures may not be significantly different for African American and majority population youth as previously thought. The effect of data analytic procedures on subsequent conclusions and theory is discussed and recommendations are made.

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Introduction

Whereas research on the identification and treatment of anxiety disorders in youth is common, studies on anxiety disorders in African American youth have lagged behind [1]. Available epidemiological studies of anxiety and depression in African American youth is mixed with some studies showing greater or equivalent rates [2, 3] and others reporting significantly lower prevalence rates compared to Caucasian youth [4]. Unfortunately, African American youth with internalizing symptoms, such as anxiety and depression, are much less likely to be identified or to receive state of the science treatment compared to Caucasian youth [5–7]. This depends upon several factors including culture-specific symptom presentation (e.g., greater report of somatic symptoms [3, 8]), attributions of anxious behaviors by caregivers and professionals [9], and the availability of measures that have demonstrated adequate validity and reliability with African American youth [10].

Research suggests economic disadvantage is associated with risk for mental health problems in youth [11], and that this relationship may account for a substantial proportion of the relationship between ethnicity and mental health problems [12–14]. Furthermore, parents faced with chronic financial stress may be less aware of their child's distress, and make it less likely that they will access help [15]. Because, low-income African American youth with internalizing symptoms, like other mental health problems, are disproportionately under-identified and underserved, they may disproportionately suffer the negative outcomes

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associated with untreated mental illness [16, 17]. Thus, the field's progress in validating measures of anxiety across ethnic and socioeconomic groups must include a focus on such under-represented populations.

The development and use of well-validated measures of anxiety in low-income African American youth is an important step toward understanding the role of race/ethnicity and economic disadvantage in the development of internalizing symptoms, as well as helping school and healthcare professionals identify youth in need of treatment. Self-report measures represent an important tool in assessing symptoms, such as anxiety and depression, that might not be easily observable by caregivers [18]. Several self-report measures exist for child anxiety that apply a DSM-IV [19] conceptualization of anxiety [e.g., Screen for Child Anxiety Related Emotional Disorders, SCARED, [20], Revised Children's Anxiety and Depression Scale, RCADS, [21], Spence Children's Anxiety Scale, SCAS, 22] and non-DSM conceptualization [e.g., The Multidimensional Anxiety Scale for Children, MASC, 23]. Psychometric studies of each of these measures are abound [24]. However, despite the large number of measures and studies of their psychometric properties, there are only a handful of studies that included a significant number of African American youths and even fewer studies have directly examined validity in this population, with mixed findings [10, 25–28].

Results from psychometric studies of anxiety measures among African American youths cast some doubt on the generalizability of factor structures between Caucasian and African American samples [29]. For example, Neal and colleagues [27] found that a principal component analysis (PCA) of the Fear Survey Schedule for Children-Revised [FSSC-R; 30] yielded a 3-component structure in a sample of African American youth, rather than the 5-component structure that emerged in predominately Caucasian samples. Similarly, Boyd et al. [31] failed to replicate the 5-factor structure of the Screen for Child Anxiety Related Emotional Disorders [SCARED; 20] that was commonly seen in Caucasian youth, and instead found a better fit for a 3-factor model among the African American sample. Likewise, Kingery et al. [26] found that a 3-factor model of the MASC fit better in a community sample of African American youth using a PCA rather than the original 4-factor model [23]. However, there is little convergence between the factor-solutions derived across these studies, suggesting that structure differences may not reflect consistent underlying constructs. Together, these studies show poor correspondence in factor structures between Caucasian or population samples and African American samples, and highlight the need for psychometric studies of anxiety measures among African American youth to understand these discrepancies.

Seemingly discrepant findings in factor structures may be due in part to methodological factors that influence model estimation rather than true differences in symptom presentation among African American youth. The first is the use of maximum likelihood (ML) algorithms. ML is a frequently used approach, and the default estimation method in many statistical packages. However, ML assumes continuous, normally distributed data [32], and results in biased estimates of factor loadings, standard errors, and poor coverage of parameter estimates with items that contain fewer than 5 points on the response scale [i.e., categories; 33–35]. Although alternative methods have existed for sometime, it has only been recently that the effect of ML versus alternative methods of estimations has been evaluated and these preferred methods of estimation have yet to be fully disseminated into psychological research potentially leading to erroneous conclusions [36–39]. For example, Boyd et al. [31] and [26] used ML, and as these measures (i.e., the SCARED & MASC) used 3-category and 4-category response scales, it is unclear to what extent their findings were a product of the limitations of ML. The application of ML-based analyses to the 4-category items of measures such as the MASC [26] may have inadvertently led to premature dismissal of the original factor structure. In order to evaluate whether meaningful differences exist in the underlying latent construct of anxiety in African American youth, analytic methods that can adequately model categorical data must be used [33, 34].

The frequent use of ML may have contributed to the second methodological factor affecting the factor structure of the previous studies; the use of exploratory data-driven methods. When researchers have failed to find adequate fit using confirmatory factor analysis (CFA) with ML estimation, they have employed exploratory factor analyses such as PCA [26, 27]. PCA is an atheoretical, data-driven approach to identify groups of items that capture the greatest amount of variance; it does not consider latent structures that are purportedly measured by the items [40]. In doing so, findings from PCA analyses are likely discordant with results obtained from exploratory factor analysis [EFA; also called principle axis factoring (PAF)] and confirmatory factor analyses (CFA) that are designed specifically to identify latent structures that explain covariance among items [41]. CFAs rely on substantive theory in formation of factors, which make them a robust approach for testing the structure of existing measures in novel populations [32, 42, 43]. As results from such studies informs our theories of anxiety and depression across diverse populations and influences the course of future research, we are in need of research that explores whether factor structures of anxiety measures are truly different for African American youth compared to majority populations,

or whether these differences are due to methodological factors. If differences are due to commonly used, but inappropriate, analytic procedures, dissemination of preferred methods is critical to ensure that theories are based on sound state-of-the-science procedures.

The Present Study

To address the question of whether inadequate model fit of anxiety measures in African American youth is the result of differences in the latent constructs or data-analytic strategies, we examined the factor structure of two common measures of anxiety in a sample of low-income African American youth. Specifically, we examined the fit of the RCADS [21], and the MASC [23]. The RCADS and MASC were chosen as the focus of the study because the two share a multi-dimensional conceptualization of child anxiety while differing in that conceptualization: the RCADS scales were organized around the DSM and the MASC scales were empirically derived. Thus, the study permits a test of these two distinct conceptualizations of child anxiety in a sample of African-American children and adolescents using an estimation methods suited for categorical data [33, 34, 36].

We also extend the research on the factor structure of the RCADS and MASC by examining higher-order and bifactor factor models that represent broadband internalizing symptoms. Broad internalizing symptoms are well documented in youth [cf. 44], and their measurement shows clinical utility [i.e., 45]. Indeed, higher order structures have been called upon to explain covariation among anxiety disorders and between anxiety and depressive disorders [i.e., 46–48].

Hierarchical and bifactor models can be used to assess the factorial validity of measures that include subscales (e.g., panic, social anxiety, separation anxiety, etc.) and aggregate scores (e.g., Total Anxiety) that assume the presence of a broadband phenomena such as internalizing or generalized distress. An exploratory bifactor model of a shortened version of the RCADS has found good fit [49], in contrast to previous attempts to fit aggregate scores using one- and two-factor models [50]. Hierarchical models have yet to be explored to understand the relationship between the MASC scales and whether the MASC total score can be used to represent an internalizing distress factor. Together, these models examine the factorial validity of two measures of anxiety in African American youth, utilizing methods ideally suited for categorical data (i.e. scales with fewer than 5 points) and the presence of higher-order factors to examine the question of whether the factor structure of depression and anxiety in African American youth is different than the majority population, or whether these differences are due to methodological limitations and whether these current measures do indeed adequately capture the symptom presentation of African American youth.

Methods

Participants

Participants were 229 primarily low-income, urban African American children and adolescents recruited to participate in a larger study investigating prevalence of mental health problems among a pediatric primary care clinic in a medical university in a metropolitan area in the Mid-Atlantic region of the United States [e.g., 51]. The study was approved by the university Institutional Review Board (IRB). The IRB preferred that study staff not approach patients in the waiting room. Thus, parents and youth were invited to participate in the study while waiting for an appointment with their pediatrician via a sign posted at the reception desk. Study staff were volunteer undergraduate research assistants and paid graduate research assistants. Staff sat in the waiting room with an additional sign advertising the study. Study staff kept a record of the approximate number of families that entered the waiting room that appeared within the appropriate age range (i.e., age 7–17), the numbers of patients that expressed interest in the study, declined participation, were ineligible due to cognitive or language barriers (self-reported intellectual disability, autism, illiteracy, or non-English speaking). Of participants who were age-eligible, approximately 38 % approached study staff for information about the study. Of these, approximately 34 % consented to participant, 48 % declined to participate, 13 % were ineligible due to self-reported developmental disability, and 6 % were ineligible due to language barriers.

If they agreed to participate, a child and parent completed consent and assent procedures, completed a battery of self-report measures, and received compensation in the waiting room (i.e., $10 gift card to a large national retail chain). Some participants were not able to complete the measures before being called into the doctor's office and were given the option to complete the forms and return them to study staff after the doctor's appointment or return the forms by mail (11 % completed packets at home and returned by mail).

All participants were African American. Mean household income of participants with valid data was $21,800 ($SD$ = $17,800; range $0–$100,00). Of parents reporting marital status (93.9 %), 25.5 % were married, 5.1 % were widowed, 13.3 % were divorced, 8.2 % were separated, and 41.8 % were never married. The mean household size was 4.13 (SD = 1.3; range 1–7), and mean number of

dependent children was 2.6 ($SD = 1.3$; range 1–6). Mean age of participants was 12.13 years ($SD = 2.7$; range 7–17), grade level ranged from 3 to 12, with modal grade of 5, and 63.4 % of participants were female ($n = 111$).

Measures

Revised Child Anxiety and Depression Scale [RCADS; 21]

The RCADS is a 47-item child self-report measure that assesses symptoms of several DSM-IV-TR anxiety and depressive disorders. Items are rated according to four response categories ranging from 0 ("never") to 3 ("always"). It includes six DSM-IV-based subscales: separation anxiety disorder (SA), social phobia (SOC), obsessive–compulsive disorder (OCD), panic disorder (PD), generalized anxiety disorder (GAD), and major depressive disorder (MDD). Scores can be aggregated into two total scores: a Total Anxiety score, and a total internalizing score (i.e. anxiety and depression). Several psychometric studies have found favorable internal consistency, factor structure, and concurrent and discriminant validity with diverse community and clinical samples [21, 50, 52]. Cronbach's alpha was calculated as an estimate of internal consistency (Table 1). Alphas ranged from .64 (OCD) to .82 (GAD) for the individual subscales. For the Total Anxiety Scale, $\alpha = .91$, and for the Total Internalizing $\alpha = .92$.

Multidimensional Anxiety Scale for Children [MASC; 23]

The MASC is a 39-item child-report measure of anxiety symptoms across several dimensions of anxiety. Items are rated according to four response categories ranging from 0 ("never true about me") to 3 ("often true about me"). The measure has demonstrated a four-factor structure: (a) physical symptoms, (b) social anxiety, (c) harm avoidance, and (d) separation/panic anxiety. Internal consistency and retest reliability statistics were all in acceptable ranges [23]. Convergent and divergent validity evidence is also strong [23]. The four-factor solution has been confirmed with CFAs in several additional, independent studies [53, 54], although poor fit has been reported for a sample of African American youth [26]. Three-week test–retest reliability was more stable for Caucasian (ICC = .91) compared to African American youth [ICC = .76; 55]. Internal consistency was good for this sample with $\alpha = 89$ for the Total Anxiety Scale. Alphas ranged from .66 (Separation/Panic) to .86 (social phobia) for the subscales (see Table 1). The ADI, which is comprised of items with the highest predictive validity of an anxiety disorder [56], had the lowest internal consistency ($\alpha = 58$), but is comprised of items across the scales.

Data Analysis Plan

Univariate and multivariate analyses (e.g., Pearson correlations, MANOVA, etc.) were conducted to examine

Table 1 Descriptive statistics and correlations among RCADS and MASC subscales

Measures	M (*SD*)	α	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. R-GAD	4.80 (3.61)	.82													
2. R-MDD	5.98 (4.18)	.71	.43												
3. R-PD	3.77 (3.67)	.75	.55	.50											
4. R-SP	7.93 (7.46)	.78	.47	.36	.42										
5. R-SAD	3.4 (3.22)	.67	.47	.36	.45	.38									
6. R-OCD	3.94 (3.20)	.64	.44	.50	.46	.44	.37								
7. M-SP	7.94 (6.13)	.86	.41	.30	.42	.38	.33	.20							
8. M-PS	7.43 (6.27)	.80	.31	.50	.54	.24	.25	.34	.47						
9. M-SAD	7.08 (4.81)	.66	.27	.30	.31	.29	.46	.16	.45	.43					
10. M-Harm	14.87 (5.47)	.73	.21	.24	.23	.09	.18	.27	.29	.35	.36				
11. R-Tot.Anx.	23.12 (14.50)	.91	.81	.57	.79	.83	.69	.66	.56	.43	.37	.30			
12. R-Tot. Int	29.00 (17.36)	.92	.79	.71	.77	.80	.67	.68	.53	.45	.38	.32	.98		
13. M-Anx	10.01 (4.69)	.89	.42	.46	.50	.52	.42	.34	.75	.74	.75	.71	.57	.58	
14. M-ADI	10.01 (4.70)	.58	.40	.43	.46	.54	.34	.30	.73	.61	.59	.60	.53	.52	.87

1–6 RCADS: generalized anxiety, major depression, panic, social phobia, separation anxiety, and obsessive compulsive disorder subscales, 7–10 MASC: social phobia, physical symptoms, separation anxiety, and harm avoidance subscales. 11, 12 RCADS: Total Anxiety score and Total Anxiety and Depression score, 13–14. MASC: Total Anxiety score & Anxiety Disorder Index. rs $\geq .14$ significant at $p \leq .05$; rs $\geq .18$ significant at $p \leq .01$

response distributions on the MASC and RCADS and to describe the sample. A series of confirmatory factor analyses (CFAs) were then fit to evaluate factor structures of the RCADS and MASC using diagonally weighted least squares (WLSMV) estimation in Mplus version 6.1 software [57]. The WLSMV algorithm is robust and efficient with categorical outcomes, and has been shown to perform well in samples of approximately 200 [36–38]. Confirmatory Fit Index values (CFI) approximating .95 and Root Mean Square Error of Approximation (RMSEA) values $\leq$.06 were used as standards for good model fit, and CFI $\geq$.90 and RMSEA $\leq$.08 represent modest fit [58, 59].

Results

Descriptive Statistics

Correlations between the RCADS and MASC subscales are presented in Table 1. Endorsements of RCADS and MASC items ranged from 0 to 3 ($M = .62$, $SD = .29$; $M = .96$, $SD = .50$) and were largely monotonic. Modal responses ranged from 0 to 1 on all RCADS items, but were more variable for MASC items. Items of both scales displayed modest inter-item correlations (RCADS, $M = .20$, $SD = .11$; MASC, $M = .17$, $SD = .11$), and showed low frequencies of missing data (0–2 %). Means and standard deviations are presented in Table 1. The probability of missing data was unrelated to demographic variables, or endorsement of other RCADS and MASC items or scale scores (all $ps < .05$). This suggests that the data were missing completely at random [MCAR; 60].

Prevalence of youth meeting subclinical (T-score between 60 and 69) and clinical thresholds (T-score $\geq$ 70) for each subscale and total score of the RCADS and MASC are presented in Table 2. On the RCADS Total Anxiety and Depression score, 1.7 % of children reported symptoms above clinical levels, with scores on subscales ranging from 4.0 % (SAD) to 1.1 % (DEP). Clinical levels on the MASC subscales ranged from 10.3 % (Separation/Panic) to 1.1 % (harm avoidance). Although the MASC total score yielded more children above clinical (8.0 %) and subclinical (8.0 %) cutoffs compared to the RCADS, the Anxiety Disorder Index (ADI) of the MASC yielded identical prevalence rates (1.7 %) as the RCADS.

Age and Gender Differences

A series of Multivariate Analysis of Variances (MANOVAs) were conducted in SPSS, version 19 software to examine the effects of age, gender, and their interaction on the RCADS and MASC scales. Age showed significant multivariate effects on RCADS and MASC subscales (RCADS, Wilk's lambda = .86, $F[6, 196] = 5.16$, $p < .001$, partial $\eta^2 = .14$; MASC, Wilk's lambda = .82, $F[4, 195] = 10.58$, $p < .001$, partial $\eta^2 = .18$) that reflected a modest tendency for older children to score lower on RCADS separation anxiety ($F[1, 201] = 6.09$, $p = .01$, partial $\eta^2 = .03$), and MASC social phobia, separation anxiety, and harm avoidance ($F[1, 198] = 5.58$, $p = .02$, partial $\eta^2 = .03$; $F[1, 198] = 12.95$, $p < .001$, partial $\eta^2 = .10$; $F[1, 198] = 3.82$, $p = .05$, partial $\eta^2 = .02$;). The effects of age, gender, and their interaction were statistically controlled and the residual correlation matrix was used in subsequent analyses.[1]

Table 2 Prevalence of subclinical and clinical anxiety and depression symptoms

	Below clinical (T-score < 65)		Subclinical cutoff (T-score = 65–69)		Clinical cutoff (T-score ≥ 70)	
	N	%	N	%	N	%
RCADS						
Social phobia	158	90.3	7	4.0	4	2.3
Panic	149	85.1	16	9.1	4	2.3
Separation	145	82.9	17	9.7	7	4.0
Generalized	158	90.3	5	2.9	6	3.4
Obsessive compulsive	157	89.7	7	4.0	5	2.9
Depression	154	88.0	13	7.4	2	1.1
Total anxiety	158	90.3	8	4.6	3	1.7
Total anxiety and depression	158	90.3	8	4.6	3	1.7
MASC						
Physical symptoms total	154	88.0	12	6.9	3	1.7
Harm avoidance total	148	84.6	19	10.9	2	1.1
Social anxiety total	144	82.3	13	7.4	12	6.9
Separation/panic	135	77.1	16	9.1	18	10.3
Anxiety disorder index	155	88.6	11	6.3	3	1.7
MASC total score	141	80.6	14	8.0	14	8.0

n = 175, based on participants without missing data. *RCADS* revised child anxiety and depression scale, *MASC* multidimensional anxiety scale for children

Factorial Validity

Revised Child Anxiety and Depression Scale

A series of CFAs were fit to test the single-, two-, and six-factor models of the RCADS that were previously

[1] The original and the residual correlation matrices did not significantly differ from one another (χ^2 [104] = 68.58, $p = 1.00$).

examined by Chorpita et al. [21, 50]. Hierarchical second-order and bi-factor models were also tested as alternate parameterizations of Chorpita's single- and two-factor models. The first hierarchical model fit a single second-order factor to explain covariance among anxiety and depression first-order factors. The second hierarchical model fit a second-order factor to the five first-order anxiety factors and the 10 depression items (limited bi-factor model). In limited bi-factor model, a separate first order factor was also fit to depression items and set orthogonal to other factors in the model. Under the described parameterizations, the second-order model corresponded to internalizing symptoms and the Total Anxiety/Depression Scale, while in the limited bi-factor model corresponds to common distress and depression-specific factors, and the separate Total Anxiety and Depression scales.

Loadings of the first indicator of each factor were set to a value of 1 for identification purposes in all models, and variance of each factor was freely estimated. In the limited bi-factor model, the loading of the general factor on first depression scale item was set to 0 [61]. Chi square difference tests were used to examine differences in fit among groups of nested models [32]. The first group consisted of the single-, two-, and six-factor models, and the second group was comprised of the six-factor, bi-factor, and the second-order factor models. Through the *generalized* Schmidt-Leiman transformation, others [i.e., 61, 62] have shown that the second-order factor models are nested, special case of bi-factor models. Therefore, comparisons were made between the six- and second-order factor models, and between the second-order and limited bi-factor models [cf. [61], [62], and, [63] for discussions on nesting of second-order and bi-factor models].

Results of the factor analyses are presented in Table 3. Consistent with Chorpita et al. [21, 50], a six-factor model fit the data better than one- and two-factor models (χ^2_{diff} [14, 15] = 151.01 − 198.08, $p < .0001$). Like Chorpita, we found a high degree of correlation among the six-factors ($rs = .61$–$.76$). This correlation pattern suggests a high level of unexplained covariation among the RCADS scales, and supports the possible presence of a higher order factor. Consistent with the latter, a hierarchical factor analysis revealed that a second-order factor model fit the data as well as, and more parsimoniously than the six-factor model (χ^2_{diff} [9] = 14.57, $p = .10$). Further, the second-order factor demonstrated excellent composite reliability [64] ($\rho = .92$), and explained a large portion of variance and covariance among its six lower order indicators ($\lambda = .79$–$.90$; $R^2 = .63$–$.81$). It should also be noted that the six first order factors retained a significant portion of residual variance that was not explained by the second-order factor ($\psi_{1\text{-}6} = .19$–$.37$). Together these findings support factorial validity of the six DSM and the Total Anxiety and Depression scales of the RCADS. Further, these findings suggest that while the Total Anxiety and Depression scale is a reliable index of the combined six DSM scales, each DSM scale contributes additional information that is not captured by the total scale.

A limited bi-factor model was then estimated to determine if a depression-specific factor explained covariance among depression items in addition to the general distress factor. The second-order model served as the basis for comparison, given its nesting within the bi-factor model, and its greater parsimony than the six-factor model. Results of the bi-factor model are presented in Table 3 and Fig. 1. Consistent with expectation, the model fit the data well, and significantly better than the second-order model (χ^2_{diff} [9] = 30.42, $p < .001$). Visual inspection of standardized factor loadings revealed that four items loaded robustly on to the depression factor (items: 6, 19, 29, & 40; $\lambda = .40$–$.79$). These items appeared to capture the amotivational/anhedonic aspect of depression (i.e., "nothing is much fun anymore"; "I have no energy for things"; "I feel like I don't want to move") that is akin to low positive affect [cf. 65]. Despite these findings, the two factors did not significantly differ in the amount of unique variance contributed by each to these four items ($\psi_{depression} = .65$ vs. $\psi_{internalizing} = .33$; wald [1] = .84, $p = .36$) nor the depression scale as a whole ($\psi_{depression} = .48$ vs. $\psi_{internalizing} = .52$; wald [1] = .02, $p = .89$). These results support the presence of a depression-specific factor that accounts for a notable portion of covariance in the depression scale that is unrelated to the variance shared by the other five anxiety factors. The unique contribution of the depression factor lends support for aggregating anxiety items separately from the depression scale.

Multidimensional Anxiety Scale for Children

In lieu of divergent findings between Caucasian and African American samples, we conducted a series of CFAs that examined the MASC's factor structure. Based on the findings of March et al. [55], [26], and [66] we tested a three-, four-, and a hierarchical (i.e. second-order) factor models (see Table 3). Our results failed to replicate Kingery et al.'s [26] findings of a three-factor structure in an African American, but found support for March et al.'s four-factor model in a majority population [23]. The three-factor model displayed a modest fit to the data and fell well below recommended guidelines [59]. Conversely, the four-factor model fit the data well, and was preferred over the three-factor model in light of the robust CFI and RMSEA indices. Strong correlations among the four MASC subscales ($rs = .43$–$.68$) were well explained by a

Table 3 Confirmatory factor analysis model fit for RCADS and MASC

Models	χ^2	*df*	CFI	RMSEA (90 % CI)	AIC	BIC	χ^2(1–15)
RCADS[a]							
One-factor	1,486.99	1,034	.89	.05 (.04–.05)	20,801.27	21,271.81	–
Two-factor	1,437.81	1,033	.90	.04 (.04–.05)	20,741.21	21,213.08	151.01***[c]
Six-factor	1,296.55	1,019	.93	.04 (.03–.04)	20,482.55	21,000.94	198.01***[c]
Second-order	1,304.47	1,028	.94	.04 (.03–.04)	20,490.75	20,979.23	14.57[c]
Bi-factor	1,283.31	1,019	.94	.04 (.03–.04)	20,478.19	20,996.53	30.42***[d]
MASC[b¥]							
Three-factor	290.49	132	.90	.08 (.07–.09)	–	–	–
Four-factor	915.94	696	.92	.04 (.03–.05)	20,822.74	21,229.66	–
Second-order	916.03	698	.92	.04 (.03–.05)	20,823.58	212,233.88	2.26

Model fit estimated using diagonally weighted least squares (WLSMV). CFI approximating .95 & RMSEA $\leq$ .06 represent good fit; CFI $\geq$ .90 and RMSEA $\leq$ .08 represent modest fit. Each model was re-analyzed using maximum likelihood (ML) estimation to obtain AIC and BIC values. While applying ML to categorical data yields biased Chi Square and parameter estimates, this approach is appropriate for assessing relative differences in fit between non-nested models (Muthén, 2005, personal communication)

[a] N = 205. [b] N = 202. [¥] Difference in the number of items analyzed in the Three-factor model precluded its direct and relative comparisons with the other MASC models. [c] Comparisons made in relation to the six-factor mode. [d] Comparison made in relation to the Second-order model

*** $p < .001$

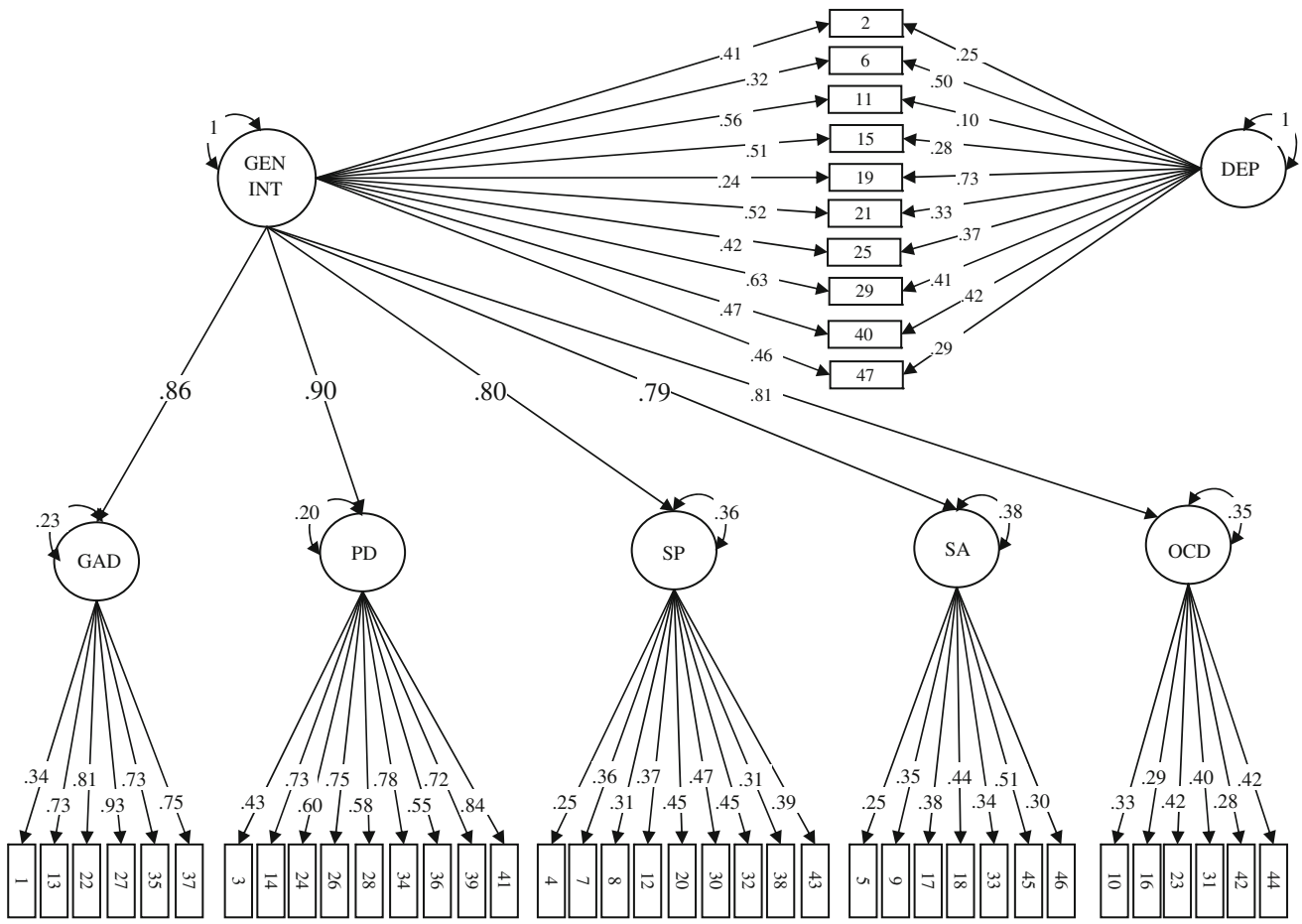

Fig. 1 Fully standardized solution for the Bi-Factor model of RCADS items. *GEN INT* general internalizing factor, *DEP* depression, *GAD* generalized anxiety disorder, *PG* panic disorder, *SP* social phobia, *SA* separation anxiety, *OCD* obsessive compulsive disorder. All parameters are significant at $p < .01$, except where $\lambda = .10$, $p = .23$

second-order factor, which fit the data more parsimoniously than the four-factor model. The second-order factor demonstrated good composite reliability ($\rho = .85$), and explained a large portion of variance and covariance among the lower order social phobia, physical symptoms, and separation anxiety factors ($\lambda = .77$–$.86$; $R^2 = .60$–$.74$), as well as in harm avoidance, but to a lesser degree ($\lambda = .59$; $R^2 = .34$).

Discussion

Previous research on self-report measures of youth internalizing symptoms has often failed to include significant numbers of African American youth; thus data on the psychometric properties of measures with African American samples is sparse. As a result, there is a gap in the available literature to address the question of how well measures of anxiety and depression capture meaningful symptoms in African American youth, particularly youth from low-income families. This study contributes to a growing body of research closing this gap [28].

The overall prevalence rates of youth reporting current scores in the clinically significant range (1.7 %) are somewhat lower than a previous epidemiological study with 3-month prevalence rates estimated around 2.5 % (Costello et al. 2003), although prevalence rates increase with the window of time being assessed. Few studies have reported prevalence rates based on T-scores for the RCADS and MASC, so direct comparison to other studies is difficult. However, comparison of scale means to other studies suggests that children in this study reported somewhat higher levels across subscales in some studies [67], but lower than others [21]. Thus, scores appear to be within the range of previously observed scores from majority samples.

The primary aims of the present study were to evaluate the factor structure of two child-report measures of anxiety, the RCADS and MASC, with a low-income African American youth sample using analytic strategies better suited to these types of scales. In particular, this study was conducted in light of discrepant factor structures of measures of anxiety disorders in African American samples in previous studies [26, 27, 29, 31], potentially owing to differences in analytic techniques (e.g. EFA, principle component analysis, ML estimation) rather than meaningful differences in symptom presentation.

Indeed, our findings stand in contrast with findings from previous research that has failed to confirm the factor structure of anxiety measures validated on community samples (often predominately Caucasian) with samples of African American youth. Our results replicated the 6-factor structure of the RCADS observed by Chorpita et al. [21, 50], and extended previous findings by showing that hierarchical structures can well explain the notable covariance among the 6 DSM-IV factors. Likewise, the original 4-factor solution of the MASC [23] also fit the data better what has been found in a previous African American sample [26].

One interpretation of these findings is that the difference of estimation methods used accounted for the differences in model fit. Our analyses used diagonally weighted least squares (WLSMV), a more appropriate approach for categorical data compared to ML estimation, the more frequently used approach despite its tendency to generate misleading factor structures [32, 35, 68]. The application of ML-based analyses to the 4-category items of the RCADS and MASC may have inadvertently led to premature dismissal of the original factor solutions in previous studies. To test this secondary hypothesis, we reanalyzed the data using ML. Indeed, estimation of the same data with ML resulted in degraded fit indexes (Table 4), which would have led to rejection of the models, and the search for alternative structures using exploratory methods that may capture idiosyncrasies of the sample rather than theoretically meaningful factors [40]. The results presented here demonstrate the effect that selection of analytic strategies can have on subsequent conclusions. This is particularly important given that ML estimation is in wide use with categorical data despite its tendency to provide biased estimates. As such, we recommend the use of estimation strategies such as WLSMV instead of ML with the type of categorical data that is common in our field, such as Likert-type scales with fewer than 5 response categories [33]. Similarly, we highlighted the difference between CFA, EFA, and PCA methods, and encourage researchers to be clear about the underlying theory being tested and select the factor analytic methods most suited to the research question [40].

We also extended previous research by reexamining the single-factor (e.g. a Total Internalizing score) and two-factor (e.g. a Total Anxiety score and a Depression score) models of the RCADS [21, 50, 52]. The single- and two-factor models that have failed to find support in previous research [50, 52] were also not supported in the present study. However, a second-order factor structure was tested as an alternative to the single-factor model that identified a higher-order "internalizing" factor that explained the high levels of covariation among the anxiety factors and fit the data well. This model specified the relationship between the anxiety and depression factors as being due to a common construct, rather than allowing the factors to be randomly correlated or forcing them to be uncorrelated as in previous research [21, p. 847, 69]. The general internalizing factor explained a significant amount of variance, but also left a significant amount of variance that was

explained by the individual factors. This suggests that an aggregate Total Internalizing scale represents a meaningful construct, as do the individual DSM-based scales. A second-order model also fit the MASC as well as the 4-factor model, but represents a more parsimonious and preferred model. These analyses suggest that these measures are able to capture broadband internalizing distress symptoms in African American youth.

We also examined a limited bi-factor model as an alternative to the two-factor model examined previously [50]. The bi-factor model differs from the two-factor model tested by Chorpita et al. by simultaneously explaining covariance common to the RCADS depression and anxiety items, while allowing the unique variance of the anxiety scales and the depression scale to be estimated. The good fit evidenced by limited bi-factor model suggests that the unique depression factor explains covariance among depression items that is incremental to that of the general internalizing factor. This result lends support to the use of an aggregated anxiety scale and a separate depression scale.

The finding that the three alternative models (i.e. six-factor, second-order, and bi-factor) all fit the data well has several implications. From a theoretical standpoint, these findings are consistent with research that has suggested that the high degree of comorbidity between anxiety and depression is due to a common, underlying construct, alternately referred to as internalizing, general distress, or negative affect [48, 70]. This internalizing factor is consistent with research that has implicated a broad internalizing or general-distress construct underlying anxiety, depression, and to a lesser extent, substance-use disorders in adults and children [44, 45]. The results also suggest that there remains significant value in conceptualizing the anxiety and depressive disorders as separate constructs. From an empirical standpoint, these findings suggest that the RCADS is a versatile instrument for assessing both disorder-specific and general distress in research and clinical settings for African American youth.

Table 4 Model fit of RCADS and MASC models using ML, assuming continuous variables

	CFI	RMSEA
RCADS		
1-factor[a]	.59	.08
2-factor[a]	.61	.07
6-factor[a]	.71	.07
2nd Order	.70	.07
Bifactor	.76	.06
MASC		
3-factor[b]	.81	.08
4-factor[c]	.81	.05
2nd Order[d]	.81	.05

Model fit based on maximum likelihood (ML) estimation, which assumes variables are measured on a continuous scale

CFI approximating .95 & RMSEA $\leq$ .06 represent good fit; CFI $\geq$ .90 and RMSEA $\leq$ .08 represent modest fit

[a] Models based on Chorpita et al. [21, 50]

[b] Model based on Kingery et al. [26]

[c] Model based on March et al. [23]

[d] Model based on Baldwin and Dadds [66]

This study collected data in the waiting room of a pediatric primary care clinic of a large university-based medical center serving low-income families and demonstrates the feasibility of the use of self-report measures of anxiety and depression in a pediatric primary care clinic to identify children experiencing significant levels of internalizing distress that might otherwise go unnoticed in a standard office-visit. Given that African American youth with internalizing symptoms are more likely to present with somatic complaints, screening in pediatric clinics may be particularly important [3, 8]. The DSM-based factor structure of the RCADS may be particularly useful in the identification of anxiety and depressive disorders as part of routine screening in clinical and community (e.g. primary care or school settings), and as part of an evidence-based multi-method assessment that can inform treatment selection and monitor response to treatment. The RCADS has demonstrated sensitivity to change and utility as a treatment outcome measure in clinical and research settings [71, 72].

Dissemination of validated measures is another important step in closing the research and service disparities facing low-income, minority youth. Health care professionals can play an important role in the identification of anxiety in African American youth given that some studies demonstrate that African American families are more likely to seek help for mental health issues from medical (vs. mental health) professionals [8, 73]. A well-validated measure of anxiety would be an important step toward helping healthcare (and other) professionals identify youth in need of treatment. Screening for mental health problems and the availability of measures that are validated on minority populations may be particularly important for populations that are less likely to seek out mental health treatment.

Limitations

The results of the study should be considered in light of the following limitations. The sample represents a community sample rather than a clinical sample, and clinical diagnostic interviews were not conducted. As a result, we were not able to examine the sensitivity and specificity of the

RCADS and MASC in predicting diagnostic classification in African American youth. This limits our ability to determine the extent to which scores are associated with similar levels of impairment across racial and ethnic groups. Additional studies that include large samples of both clinical and nonclinical samples, as well as multi-informant diagnostic data, are needed to examine the extent to which elevated T-scores on the RCADS and MASC predict clinical diagnoses of anxiety and depression disorders for African Americans as well as Caucasians.

A related limitation is the low participation rate of patients in the clinic waiting rooms. Due to IRB restrictions, we were not allowed to actively approach patients in the waiting room, and thus relied on interested patients to approach study staff. Of patients who appeared age-eligible, only approximately 34 % expressed interest in the study, of which about 48 % subsequently declined to participate. Reasons for non-participation were not collected, so we can only speculate on the reasons patients passively declined by not approaching staff, or actively declined once the study was described. Historically, many African Americans have been reluctant to participate in research stemming from a mistrust of research, particularly in medical settings, due to past abuses (i.e. Tuskegee Syphilis Study [74, 75]), and this may have also affected participation rates. Research has also suggested that the study description and consent process itself may result in ethnic disparities in research participation [76]; given the rate of participants who declined after receiving a description of the study, this may have been a factor. Continued research on engaging minority samples in mental health research is needed.

Other potential reasons for non-participation include concern about stigma and/or confidentiality of surveys completed in the waiting room, or reluctance to disclose sensitive information such as illiteracy or other exclusionary criteria (e.g., developmental disability). If non-participants are different from participants in systematic ways, bias in prevalence estimates and/or associations between variables can occur. For example, researchers have found that participants tend to be of higher SES and healthier than non-participants [77]. Thus, it is possible that participants in our sample had less mistrust, higher SES, and were more physically or psychologically well than non-participants. Although our sample represents a low-income sample, and observed rates of clinical symptoms were commensurate with previous research, these possibilities cannot be ruled out.

The restricted socioeconomic status (SES) of the sample prevented an examination of the separate contributions of SES and ethnicity. Therefore, these results may not generalize to all African American youth. Some studies have found that ethnic differences in self-report measures are better accounted for by income and/or education rather than ethnic difference [14, 78]. However, considering that low-income minority youth represents an understudied and underserved group, research focusing specifically on this population is warranted.

Summary

In sum, the study contributes to the growing body of assessment research in ethnic minority samples. Although previous research has suggested that the factor structure underlying measures of internalizing symptoms in African American youth may be different than Caucasian youth, we demonstrated that these differences may be due to commonly-used, but inappropriate data analytic procedures (ML and exploratory analytic procedures) rather than meaningful differences in internalizing symptoms across these ethnic groups.

Indeed, the results of the CFA using WLSMV on the RCADS and MASC yielded good fit based on their original factor structures. These analyses suggest that these factor structures may indeed be valid for use with low-income African American youth, contrary to previous research with African American samples. Furthermore, we demonstrated that using ML estimation would have resulted in rejection of the original factor structure and potentially erroneous conclusions about the role of racial/ethnic and economic factors in assessment of internalizing symptoms. These results highlight the need for dissemination of state-of-the-science analytic approaches in assessment research.

Furthermore, second-order Internalizing Factor scores fit the data well for both the RCADS and MASC and a bi-factor Internalizing/Depression factor solution also fit the data well for the RCADS, adding support for the literature on the construct of general distress underlying anxiety and depressive disorders for this population. Although more studies are needed to examine sensitivity and specificity within African American populations, the results presented here provides support for the construct validity of the RCADS and MASC and may be useful tools in research examining specific DSM-based disorders (i.e. RCADS) and underlying internalizing symptoms and general distress factors (i.e. RCADS and MASC) in African American samples.

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