Youth and Parent Versions of the Asthma-Related Anxiety Scale: Development and Initial Testing

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Among adults, anxiety related to asthma has been acknowledged to influence asthma self-management. However, it has not been addressed in pediatric samples and there have been no measures developed to assess asthma-related anxiety in youth or parents. The objective of this study was to develop and test the psychometric properties of novel instruments assessing asthma-related anxiety: the Youth Asthma-Related Anxiety Scale (YAAS) and Parent Asthma-Related Anxiety Scale (PAAS). Scale items were analyzed for content validity. We determined the factor structure using exploratory factor analysis and tested the scales' psychometric properties with 285 Hispanic and African American early adolescents with uncontrolled asthma (mean age = 12.8) and their parents ($n=230$) who participated in a larger randomized control trial testing the efficacy of an asthma intervention; control group families (134 youth and 103 parents) provided follow-up data to assess temporal stability. Both the YAAS and PAAS contained 2 factors with Cronbach alpha coefficients ranging from 0.75 to 0.90. The 2 factors, anxiety about asthma severity and about disease-related restrictions, were highly correlated within each measure. The measures displayed content and construct validity and demonstrated moderate temporal stability over 2–3 months (range: 0.36–0.42). The YAAS and PAAS have adequate psychometric properties and can meaningfully contribute to the assessment of asthma-related anxiety in adolescents and their parents, filling a clinical need in this population.

Introduction

PEDIATRIC ASTHMA IS ASSOCIATED with elevated prevalence of anxiety symptoms^{1–4} and anxiety disorders,^{5,6} which poses significant concern because of their association with asthma severity,^{7,8} medication overuse,⁹ poorer adherence to daily peak flow rate monitoring,¹⁰ longer and more frequent hospitalizations,¹¹ and more asthma-related school absences.⁷ Ethnic minority youth and youth from lower socioeconomic backgrounds—those at the most risk for asthma^{12–14}—face increased risk for anxiety related, in part, to their sociocontextual experiences, such as urban stressors,^{15,16} living in poverty,^{17–19} and acculturative stress,^{20,21} and this anxiety may impact asthma management.

Studies of adults have shown that a moderate level of anxiety about the illness is associated with optimal asthma management.^{22–24} Adults at both extremes of the anxiety spectrum (ie, low and high levels of anxiety) have relatively more maladaptive asthma management behaviors. Patients with low asthma-related anxiety tend to disregard their symptoms and, consequently, use inadequate doses of

medication, even when objective measures of lung functioning indicate marked airway obstruction.^{22,23} In contrast, adult patients with high levels of disease-specific anxiety often respond to asthma symptoms in anxious and ineffective ways²⁵; even in the absence of airway obstruction, they overreact to asthma symptoms and overutilize medication.²³

A similar pattern may also occur in children, who are potentially at greater risk for developing asthma-related anxiety. Therefore, youth may be less able to cope with and manage their disease. Asthma-related anxiety is important because lack of such anxiety may lead them to ignore symptoms and not take medication. In contrast, excessive asthma-related anxiety may result in unwarranted use of medication and, therefore, overuse. Alternatively, it may result in inefficient management because the child is paralyzed by fear. Indeed, anxiety regarding hypoglycemia has been found to be related to poor diabetes management and metabolic control in pediatric patients.²⁶ To date, the impact of asthma-related anxiety in youth has not been studied. One reason may be the lack of asthma-related anxiety measures for youth.

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Parents' anxiety regarding their child's asthma may also be important to disease management because, as has been found in pediatric diabetes,²⁷⁻³⁰ asthma-related anxiety may impede parents from coping and may lead to maladaptive behaviors and, consequently, to poor disease control. Despite these possibilities, no studies have examined parent asthma-related anxiety. Here again, lack of validated parental asthma-related anxiety measures has limited pertinent investigations.

Given the potential clinical relevance of asthma-related anxiety to pediatric asthma and the assessment armamentarium gap, we developed the Youth Asthma-Related Anxiety Scale (YAAS) and a parallel parent version, the Parent Asthma-Related Anxiety Scale (PAAS). This report describes their development, factor structure, and psychometric properties assessed in a sample of urban ethnic minority adolescents and their parents. In addition to estimating the internal consistency, reliability, and temporal stability of the measures, convergent validity was examined. We hypothesized that the YAAS and PAAS each would have significant, modest correlations with asthma severity and asthma-related quality of life because asthma severity and asthma-related quality of life are expected to be more salient if the illness is more severe and because asthma-related quality of life has been shown to be predicted by anxiety.¹ We also hypothesized that there would be moderate, statistically significant associations between the YAAS and separation and social anxiety because one expects that those with specific anxieties are likely to be more vulnerable to asthma-related anxiety.

Materials and Methods

Development of the YAAS and PAAS

To identify pertinent items, we interviewed asthma experts (3 pediatric pulmonologists and 1 nurse practitioner) from very diverse clinical practices that cut across all ethnic and socioeconomic groups, as well as 2 adolescents with persistent asthma and their mothers. One pediatric pulmonologist was employed at a teaching hospital in New York City where they treat patients both privately and in clinic.

The private patients are primarily Caucasian, middle- to upper-middle-class patients; the clinic patients were primarily Hispanic and African American and belonged to low-income families. Another pediatric pulmonologist was from a private practice in New Jersey where they treat primarily middle- to upper-middle-class Caucasian patients, and the last was from Alabama, where, although he drew from nearly the entire state and all socio-economic status (SES) groups, most were low income, with an almost equal distribution of Caucasian and African American youth. The nurse practitioner treated lower-income, African American and Hispanic youth in both a high-school-based and an asthma clinic in NYC. With respect to the families, both adolescents were from NYC; one was middle-class Caucasian with heritage from several European countries; the other was a lower-income Puerto Rican family member with the parents being the first U.S.-born generation. Providers described anxiety experienced by patients and their parents regarding the adolescent's asthma; parents reported their own concerns. There was considerable overlap in provider and parent responses. Common themes that emerged included anxiety regarding medication side effects, being embarrassed in front of peers, activity limitations (eg, school absences), and having asthma attacks, including possible death from an attack. Next, we wrote 10 items for the YAAS and 12 items for the PAAS using the respondents' words whenever possible; we did not exclude any reported theme. Ten PAAS items paralleled the YAAS items. Youth and parents rate how often they became nervous or worried over the last 2 weeks using a 6-point Likert scale (0=never; 5=always). Last, the experts and parents reviewed the final item list and agreed that the items were relevant and appropriately worded, supporting their content validity. Table 1 lists the initial YAAS and PAAS items.

Participants

Families were participating in a larger controlled clinical trial testing the efficacy of a 6-week family-focused behavioral intervention to teach the students and their parents

TABLE 1. MEANS AND STANDARD DEVIATIONS FOR INITIAL YOUTH ASTHMA-RELATED ANXIETY SCALE AND PARENT ASTHMA-RELATED ANXIETY SCALE ITEMS

Item (range: 0-5) ^a	YAAS ^b	PAAS ^c
Having an attack out of the blue and without warning	1.42 (1.55)	1.90 (1.54)
Having an attack and not having asthma medication	1.68 (1.63)	1.74 (1.75)
Child having an asthma attack when you are not there ^d	—	2.18 (1.73)
Child knowing how to manage an asthma attack without you ^d	—	2.58 (1.79)
Dying because of asthma	1.41 (1.70)	1.98 (2.18)
What friends think if child has symptoms in front of them	1.09 (1.54)	1.03 (1.44)
What friends think if child takes medication in front of them	0.72 (1.26)	0.89 (1.31)
Side effects of medication	1.38 (1.48)	2.07 (1.69)
Missing school because of asthma	1.45 (1.58)	2.06 (1.61)
Not keeping up with other kids because of asthma	1.58 (1.74)	1.73 (1.70)
Having an attack when doing physical activity (e.g., sports, dancing, or exercising)	1.58 (1.59)	2.26 (1.60)
Not doing well in sports or dancing because of asthma	1.35 (1.62)	1.86 (1.68)

^aYouth and parents endorsed the full range of possible values for each item.

^b*n* = 285.

^c*n* = 230.

^dItem not included in youth version.

PAAS, Parent Asthma-Related Anxiety Scale; YAAS, Youth Asthma-Related Anxiety Scale.

asthma management strategies and their parents child-rearing skills to support the child's growing need to self-manage their asthma.³¹ We utilized baseline data from all participants to examine the scales' factor structure and psychometric properties, with the exception of temporal stability wherein we excluded intervention group families because participation in the intervention may have reduced asthma-related anxiety. Study procedures were approved by the institutional review boards of the NYU School of Medicine, NYC Department of Education, NYC Department of Health and Mental Hygiene, and Columbia University College of Physicians and Surgeons.

Families were recruited over 3 years from 19 schools (5–8 schools per year), where >50% of the students were African American or Hispanic, and on average, 79% of students were eligible for free or reduced lunch. We selected students whose parents reported that the child had received an asthma diagnosis, had used prescribed asthma medication in the previous 12 months, had uncontrolled asthma, and had no significant learning or behavioral issues that would hinder participation. Uncontrolled asthma was defined as meeting NHLBI criteria³² for (1) moderate or severe persistent asthma, (2) mild persistent asthma and having at least 1 urgent visit for asthma to a doctor, hospital, or emergency department in the past 12 months, and (3) mild intermittent asthma and at least 2 urgent visits. This information was ascertained by asking all parents in a school to complete a symptom-focused case detection form using a multistage process to reach parents: (1) study personnel distributed the form to all students; (2) the school nurse redistributes the form to students known to have asthma who did not return the form in step 1; (3) school personnel mailed the form home to parents who did not return it in steps 1 and 2; and (4) study personnel attended school functions (eg, open school night) and asked parents to complete the form. This process yielded a 53% return rate.

Participants were 285 early adolescents and 230 English-speaking parents, with 228 being parent-child dyads. In this report, we excluded parents who completed the instruments in Spanish ($n=57$), participants missing at least one asthma-related anxiety item (2 adolescents and 1 parent), and an adolescent who had difficulty comprehending the survey. Youth age ranged from 10.0 to 15.9 [$M=12.8$, standard deviation (SD)=1.1]; 56% were male. Most self-identified as Hispanic/Latino (51%) or African American/Black (32%), 6% had intermittent asthma, 35% mild persistent, 30% moderate persistent, and 29% severe persistent. Most parents were mothers (91%) and U.S. born (76%); 36% reported being married or cohabitating. Parent education levels included less than high school (33%), high school (24%), partial college or vocational school (29%), and college or postcollege (14%); half the parents were unemployed and 12% worked part-time.

Measures

Parents and adolescents completed surveys after school, evenings, or weekends at the adolescent's school. A trained research assistant read the surveys aloud to small groups of up to 5 parents or students while the participants followed and recorded their responses.

Asthma severity. To assess asthma morbidity, parents and adolescents each completed a modified version of the 4-item Asthma Symptom Scale,³³ which has established reliability

and validity and rates the youth's asthma symptom severity during the last 2 weeks on a 4-point scale (0=*none*, 3=*severe/distressing*).

Asthma-related quality of life. Youth completed the 9-item emotional reactions subscale of the Pediatric Asthma Quality of Life Questionnaire (PAQLQ).³⁴ Parents' completed the Pediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ), a 13-item measure with 2 subscales: (1) emotions and concerns about the child and (2) interference with activities.³⁵ Reliability and validity of the PAQLQ and PACQLQ were established.^{34,35}

Social and separation anxiety. Adolescents completed the social and separation anxiety subscales of the Screen for Child Anxiety and Emotional Disorders (SCARED),^{36,37} a self-report measure of anxiety symptoms with well-established psychometric properties.^{36–39} Adolescents indicated how much each of 16 statements "seems to describe them" in the last 3 months using a 3-point Likert scale (0=*not true or hardly ever true* to 2=*very true or often true*). Sample items on the social anxiety subscale include "I don't like to be with people I don't know well" and "I feel nervous when I am with other children or adults and I have to do something while they watch me." Sample separation anxiety items include "I am afraid to be alone in the house" and "I get scared if I sleep away from home."

Asthma-related anxiety scales. Youth completed the 10-item YAAS and parents the 12-item PAAS, which have been detailed earlier.

Data analysis

Factor analysis. We explored the factor structure of the YAAS and PASS by examining the fit of 1-, 2-, and 3-factor models using exploratory factor analysis (EFA). We decided on the number of factors using multiple criteria, including scree plots,⁴⁰ the size of the eigenvalues, the interpretation of results, as well as multiple fit statistics computed from a maximum likelihood factor solution.⁴¹ Specifically, we examined chi-square (χ^2), comparative fit index (CFI), Tucker-Lewis index (TLI), root-mean-squared error of approximation (RMSEA), and standardized root-mean-squared residual (SRMR). We report the χ^2 statistic for completeness, but, because it is sensitive to sample size and violations of normality,⁴² it is not used to draw specific conclusions about the model fit.⁴¹ Well-fitting models should have CFI and TLI ≥ 0.90 and RMSEA values ≤ 0.08 .^{41,42} The SRMR represents the difference between observed item correlations and the correlations expected given the model. Concurrent CFI values ≥ 0.96 and SRMR values ≤ 0.08 provide protection against Type I and Type II error rates, especially in sample sizes ≤ 250 .⁴¹ None of these fit statistics are affected by the choice of factor rotation method in EFA. EFA was conducted using Mplus (version 5.1, Los Angeles, CA; Muthen & Muthen), which rotates the maximum likelihood solution with a Geomin oblique factor rotation.⁴³

Reliability and temporal stability. We estimated internal consistency reliability of the YAAS and PAAS using Cronbach's alpha. To assess temporal stability of the measures, we computed the correlation of baseline and immediate posttreatment scores for the youth ($n=134$) and parents randomized to the control group ($n=103$).

External validation. To study the convergent validity of the YAAS and PAAS, we conducted a series of correlational

analyses with measures expected to be moderately to strongly associated with asthma-related anxiety: (1) asthma severity; (2) asthma-related quality of life; and (3) separation and social anxiety.

Results

Item and initial scale distributions

Table 1 shows item means and SDs for the initial questions for the YAAS and PAAS. On the YAAS, the means were close to the lower bound of the 0–5 scale, ranging from 0.72 (worries about what friends think when taking medications) to 1.68 (worries about having an attack without having medications). Means for the individual PAAS items were higher than the YAAS items, ranging from 0.89 (worries about what friends think when taking medications) to 2.58 (worries about child managing an attack without you). All YAAS item distributions and the majority of PAAS items distributions had a positive skew. The overall mean of the 10-item YAAS was 1.44 (SD=1.02) and the 12-item PAAS was 1.94 (SD=1.22).

Factor analysis

Factor solution. Figure 1 shows the scree plots for both the YAAS and PAAS items; these plots suggest that one factor dominates each scale. We proceeded to examine the fit statistics for solutions that extracted 1, 2, and 3 factors (Table 2). One-factor models did not appear to fit the data for either scale. Although the 2-factor model had improved fit, the 3-factor model appeared to be best. When we examined the loadings of the 3-factor model, we found that the extra dimensions came from pairs of items that had unexpectedly high correlations (see Supplementary Table S1; Supplementary Data are available online at www.liebertonline.com/ped). In particular, fears about what friends would say when taking medication was highly correlated with fears about what friends would think if the youth experienced symptoms in front of them. Because the former was the least endorsed by both parent and youth (Table 1), we re-examined the fit statistics after removing this item. Table 2 shows that the 2-factor solutions of the reduced set provide a minimally acceptable fit for both scales with the reduced item sets. For the YAAS the CFI=0.95, TLI=0.90, RMSEA=0.084 and SRMR=0.037, and for the PAAS the CFI=0.96, TLI=0.95, RMSEA=0.069 and RMSR=0.026. When the single item was removed, the 3 factor solution converged for the PAAS but

not the YAAS. However, the additional PAAS factor did not add to the conceptual understanding of the item set, and so we eliminated the item concerning fears of what friends think about medication from both the YAAS and PAAS. Appendix Figures 1 and 2 provide final, ready-to-use copies of 9-item YAAS and 11-item PAAS, respectively.

Factor loadings: YAAS. Table 3 presents Geomin-rotated factor loadings. The first YAAS factor had high loadings on fears related to having attacks out of the blue, having attacks without medications, dying, reactions to symptoms by friends, and medication side effects. The second factor had high loadings on fears related to not keeping up with other youth, asthma attack during physical activity, and performance on sports. We interpret the first to be fears related to the physical aspects of the illness (ie, severity and treatment), and the second to fears related to performance and social comparisons (ie, disease-related restrictions). For children, fear of missing school had small loadings on both factors, but it was larger on the first factor and hence we included it in this factor. The correlation between the YAAS factors estimated by the Geomin rotation was 0.55, suggesting that the 2 factors shared considerable variance.

Factor loadings: PAAS. The PAAS items had a factor pattern similar to that of the YAAS. One item specific to the PAAS, fearing that the child will have an attack when the parent was absent, loaded with the asthma severity items (fearing attack out of blue, attack without medications, child dying, what friends think about symptoms). The disease-related restrictions items again included not keeping up with other kids, attack when involving physical activity and not doing well in sports. Also, parents' fears about the child missing school and medication side effects loaded with the disease-related restrictions factor. The Geomin rotation led to an estimated correlation of 0.63 between the 2 factors, again suggesting that the 2 accounted for common anxiety variation.

Descriptive statistics for the YAAS and PAAS

We scored each scale by averaging the items (possible range=0–5). Means and SDs of the resulting 9-item YAAS and 11-item PAAS scales and subscales are in Table 4. Both scales were positively skewed, suggesting that extreme anxiety is relatively rare. The YAAS and PAAS each had an average grade level readability below Grade 6 (Flesch-Kincaid Grade Levels: YAAS=5.8, PAAS=5.7).⁴⁴

Based on factor analysis results, we constructed 2 subscales, (1) asthma severity, and (2) disease-related restrictions

FIG. 1. Cattell scree plots showing ordered eigenvalues. PAAS, Parent Asthma-Related Anxiety Scale; YAAS, Youth Asthma-Related Anxiety Scale.

TABLE 2. FIT INDICES FOR EXPLORATORY FACTOR ANALYSIS OF YOUTH ASTHMA-RELATED ANXIETY SCALE ($n=285$) AND PARENT ASTHMA-RELATED ANXIETY SCALE ($n=230$) ITEMS: COMPARISON OF ONE-, TWO-, AND THREE-FACTOR MODELS IN FULL AND REDUCED ITEM SETS

	CFI	TLI	LL	df	RMSEA	SRMR
YAAS-10						
1-factor	0.79	0.73	198.0	35	0.128	0.071
2-factor	0.90	0.83	103.4	26	0.102	0.050
3-factor	0.96	0.90	49.8	18	0.079	0.031
YAAS-9 ^a						
1-factor	0.82	0.76	153.58	27	0.128	0.067
2-factor	0.95	0.90	56.9	19	0.084	0.037
3-factor ^b	—	—	—	—	—	—
PAAS-12						
1-factor	0.78	0.73	382.1	54	0.163	0.079
2-factor	0.89	0.83	205.4	43	0.128	0.058
3-factor	0.97	0.94	78.5	33	0.077	0.026
PAAS-11 ^a						
1-factor	0.83	0.79	269.8	44	0.149	0.066
2-factor	0.96	0.93	94.3	34	0.088	0.031
3-factor	0.97	0.94	63.4	25	0.082	0.024

^aReduced item version eliminated item concerning fears about friends' reactions to taking medication.

^bThree-factor model for reduced YAAS item set did not converge.

CFI, comparative fit index; TLI, Tucker-Lewis index; LL, log-likelihood chi-square; df, degrees of freedom; RMSEA, root-mean-squared error of approximation; SRMR, standardized root-mean-squared residual.

for both instruments (see Table 3 for final items in each subscale). As shown in Table 4, Cronbach's alpha estimates for the YAAS subscales and total score ranged from 0.75 to 0.82, and for the PAAS 0.82–0.90.

The correlation between the YAAS subscales was 0.54, and 0.70 for the PAAS. These 2 correlations were significantly different from each other, $\chi^2(1)=13.23$, $P<0.001$, suggesting that youth differentiate the severity of asthma from its effect on their functioning more than parents.

Temporal stability

Because enrollment and baseline survey completion took place over 2 months, the interval between baseline and immediate post-treatment assessments varied. The average interval length for youth was 86 days (range 56–112 days), and for parents 89 days (range 47–124 days). Over this in-

terval stability was moderate, ranging from 0.42 to 0.50 for the YAAS and 0.36 to 0.48 for the PAAS.

External validation of the YAAS and PAAS

As shown in Table 5, correlation coefficients relevant to construct validation provide support for hypotheses regarding convergent validity. Both the total 9-item YAAS and the 2 YAAS subscales had significant moderate correlations⁴⁵ to youth-reported symptom severity, asthma-related quality of life, social anxiety, and separation anxiety. A similar pattern was found for the 11-item PAAS: the total and subscale scores had significant moderate correlation to parent-reported symptom severity and asthma-related quality of life.

The correlations between YAAS and PAAS scores and youth and parent reports of symptom severity were signifi-

TABLE 3. FACTOR LOADINGS FOR YOUTH ASTHMA-RELATED ANXIETY SCALE AND PARENT ASTHMA-RELATED ANXIETY SCALE FINAL ITEMS: MAXIMUM LIKELIHOOD ESTIMATES FOLLOWED BY GEOMIN OBLIQUE ROTATION

Item	YAAS ^a		PAAS ^b	
	Factor I	Factor II	Factor I	Factor II
Child having an attack out of the blue	0.69	0.005	0.56	0.16
Child having an attack and not having medication	0.68	0.05	0.95	–0.19
Child having an attack when you are not there ^c	—	—	0.87	0.01
Child knowing how to manage attack without you ^c	—	—	0.29	0.20
Child dying	0.73	–0.12	0.58	0.20
Friends think: symptoms	0.44	0.14	0.31	0.27
Side effects of medication	0.53	–0.02	0.27	0.47
Missing school	0.29	0.17	–0.05	0.81
Not keeping up with other children	0.16	0.53	–0.003	0.82
Attack when doing physical activity	0.14	0.64	0.21	0.70
Not doing well in sports	–0.09	0.79	0.14	0.84

Values in bold are used to create subscales.

^a $n=285$. Geomin estimate of correlation between factors: 0.52.

^b $n=230$. Geomin estimate of correlation between factors: 0.66.

^cItem not included in youth version.

TABLE 4. DESCRIPTIVE STATISTICS, INTERNAL CONSISTENCY, AND TEMPORAL STABILITY COEFFICIENTS FOR THE YOUTH ASTHMA-RELATED ANXIETY AND PARENT ASTHMA-RELATED ANXIETY SCALES AND SUBSCALES

	Mean (SD)	α	Temporal stability
YAAS			
Total	1.44 (1.02) ^a	0.82	0.50 ^{b,c}
Asthma severity subscale	1.40 (1.06) ^a	0.75	0.42 ^{b,c}
Disease-related restrictions subscale	1.50 (1.36) ^a	0.77	0.49 ^{b,c}
PAAS			
Total	1.94 (1.22) ^d	0.90	0.43 ^{c,e}
Asthma severity subscale	1.90 (1.27) ^d	0.82	0.36 ^{c,e}
Disease-related restrictions subscale	2.00 (1.38) ^d	0.89	0.48 ^{c,e}

^a $n=285$.

^b $n=134$.

^c $P \leq 0.01$.

^d $n=230$.

^e $n=103$.

SD, standard deviation.

cantly different from zero, but modest in magnitude. YAAS scores were more strongly correlated with youth reports of severity (median: 0.36) than with parent severity reports (median: 0.19), whereas the pattern for PAAS was the reverse (median was 34 for parent severity and 0.14 for youth severity).

Discussion

We found that the YAAS and PAAS were best represented as 2 factors—asthma severity and disease-related restrictions—contrary to the expectation that they were explained by a single, global asthma-related anxiety factor. However, the subscales within the YAAS and within the PAAS were highly correlated, suggesting that the 2 subscales measure slightly similar manifestations of distress and that it

may be best to use the scales as global measures of asthma-related anxiety. Further supporting evidence for not distinguishing the factors comes from the fact that the YAAS and PAAS subscales had similar correlations with symptom severity, asthma-related quality of life, separation anxiety, and social anxiety, factors used to establish construct validity. Youth and parents who are elevated on these separate constructs tend to be high on both asthma-related anxiety subscales. Therefore, we recommend that the YAAS and PAAS be used as single global measures of asthma-related anxiety. However, the subscales would be useful if clinicians or clinical researchers have a particular interest in severity versus disease-related restriction issues in asthma-related anxiety.

The YAAS and PAAS have adequate psychometric properties, including content and construct validity and moderate temporal stability over 2–3 months. YAAS total and subscale scores were related to adolescent-reported asthma-related quality of life, social anxiety, and separation anxiety, and PAAS total and subscale scores were related to parent-reported asthma-related quality of life, providing support for the convergent validity of the 2 measures. Specifically, the YAAS and PAAS had correlations with youth- and parent-reported asthma-related quality of life, which were medium to large in effect size, respectively. This is consistent with prior research that has demonstrated that asthma-related quality of life in adolescents was predicted primarily by self-reported anxiety.¹ There were medium effect size correlations between the YAAS total and subscale scores, and social and separation anxiety, suggesting that youth who experience these forms of anxiety are also more likely to be anxious about their asthma.

Both the YAAS and PAAS demonstrated moderate stability over a 3-month interval. Because in the larger clinical trial, control group parents and students each received a single educational workshop about asthma management, although unlikely, it is feasible that this intervention reduced their asthma-related anxiety. Also, families completed baseline surveys in the winter and immediate posttreatment surveys in the spring; youth may have been experiencing

TABLE 5. CORRELATION COEFFICIENTS OF YOUTH ASTHMA-RELATED ANXIETY SCALE AND PARENT ASTHMA-RELATED ANXIETY SCALE WITH VARIABLES RELEVANT TO CONSTRUCT VALIDATION TESTS

Scales	YAAS			PAAS		
	Total	Severity	Restriction	Total	Severity	Restriction
Child report						
Asthma Symptom Scale	0.38 ^a	0.32 ^a	0.36 ^a	0.16 ^b	0.14 ^b	0.14 ^b
PAQLQ:						
Emotional	−0.53 ^a	−0.46 ^a	−0.48 ^a	−0.13 ^b	−0.14 ^b	−0.11
SCARED:						
Social anxiety	0.30 ^a	0.27 ^a	0.25 ^a	0.03	0.00	0.05
Separation anxiety	0.40 ^a	0.40 ^a	0.27 ^a	0.02	0.01	0.03
Parent report						
Asthma Symptom Scale	0.21 ^a	0.18 ^a	0.19 ^a	0.35 ^a	0.30 ^a	0.34 ^a
PACQLQ						
Total	−0.16 ^b	−0.14 ^b	−0.14 ^b	−0.53 ^a	−0.46 ^a	−0.53 ^a
Emotion	−0.13	−0.10	−0.13	−0.50 ^a	−0.43 ^a	−0.50 ^a

^a $P \leq 0.01$.

^b $P \leq 0.05$.

PAQLQ, Pediatric Asthma Quality of Life Questionnaire; PACQLQ, Pediatric Asthma Caregiver's Quality of Life Questionnaire; SCARED, Screen for Child Anxiety-Related Disorders.

fewer posttreatment symptoms because of the seasonal nature of asthma, and thus parents and youth may have less asthma-related anxiety immediate posttreatment. As such, the temporal stability is a conservative estimate. These results indicate that asthma-related anxiety might be sensitive to treatment effects. The potential plasticity of asthma-related anxiety suggests that clinicians can help patients achieve an optimal level of anxiety to successfully manage their asthma by increasing alertness about the disease when it is too low and decreasing anxiety when it is unduly elevated.

We also found that youth and parent perspectives regarding asthma-related anxiety partly overlap, but are distinct constructs. Parental anxiety is more strongly related to parents' perception of the youth's asthma, whereas the adolescent's anxiety is more strongly related to their perception of their asthma. The YAAS and PAAS demonstrated medium effect size correlations with symptom severity reports from the same respondent (eg, YAAS and youth report of asthma severity) and small effect size correlations with symptom severity reports from the other respondent (eg, YAAS and parent report of asthma severity). Further evidence of the independence of youth and parent asthma-related anxiety is supported by the lack of significant correlations between the PAAS and the SCARED, and the YAAS and PAAS, and by the factor loadings of the YAAS and PAAS subscales. Although there is significant overlap, 2 items load differently for parents and youth: anxiety regarding the side effects of medication and anxiety regarding missing school because of asthma. Both items load on the Asthma Severity Subscale for youth, but on the Disease-related Restrictions Subscale for parents. With respect to side effects, one possible explanation for this differential loading is that youth know that side effects are from the medication, which they take when symptomatic. Therefore, they associate the side effects with asthma severity. However, parents observe how the medications alter their child's behavior (eg, being jittery after taking quick-reliever medication); parents may be concerned about how such behavior changes impact how the child is viewed by peers, the child's ability to execute certain activities, or the child's ability to fit in with peers. Similarly, for a child to miss school, the child must experience symptoms severe enough to inform parents about them and thus are focusing on symptoms when thinking of school absences. In contrast, parents view absences as restricting performance or activity, and consequently, their child may have problems getting along with and relating to peers or fall behind academically. Taken together, these results suggest that youth and parent asthma-related anxiety are linked conceptually, but are distinct constructs. Therefore, we recommend using both scales in research and clinical practice.

Some limitations should be considered. Participants were part of a clinical trial testing the efficacy of a school-based intervention for youth with uncontrolled asthma.³¹ We targeted schools that serve primarily low-income, African American and Latino middle-school students because they are an underserved group^{46–48} greatly impacted by asthma.^{12,14,49,50} As a result, the sample was restricted with respect to asthma severity, socioeconomic status, age, and race/ethnicity. However, the scale was devised as a scale for pediatric asthma and not one restricted to the study sample. Future research should enroll new groups of families from different sociocontextual backgrounds who would be asked

whether there are other aspects of asthma-related anxiety that they would like to report, which may lead to further item development. Also, item-level analysis should also be considered to determine whether there are different concerns among families from different sociocontextual backgrounds (e.g., racial/ethnic backgrounds, socioeconomic status levels) or with children of different ages and levels of asthma severity.

Also, although we translated the PAAS into Spanish, we excluded parents who completed the Spanish version of the measure because this subsample of parents was relatively small. Our future research will assess the Spanish version of the PAAS. Additionally, because of time constraints, we did not measure general anxiety. Instead, we focused on other types of anxieties that may be associated with adherence to the intervention protocol or may have been impacted by our intervention. Therefore, we do not know whether asthma-related anxiety is a manifestation of general anxiety, and further studies are necessary to determine this.

Study findings may have important implications for clinicians and clinical researchers. Identifying patients and their parents for whom asthma-related anxiety is a significant clinical issue is a critical first step. The YAAS and PAAS are psychometrically sound, novel instruments that are brief and can be completed in waiting rooms or during medical evaluations. Clinicians should consider querying patients and their parents directly about how the anxiety may impact asthma management, providing education to counter this anxiety and, when appropriate, referring patients and/or their parents to a mental health professional. Clinical researchers can utilize the YAAS and PAAS to investigate the relationship between asthma-related anxiety and disease management and control, an important next step to develop effective interventions to alleviate asthma-related anxiety when it is maladaptive. For a full clinical picture related to anxiety, clinicians and clinical researchers may use the YAAS and PAAS in conjunction with other anxiety measures that tap other types of anxiety.

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Author Contributions

J.-M.B. (1) conceptualized and designed the study, including developing data acquisition methods, and contributed to the analyses and interpretation of analyses; (2) took the lead on writing and revising the manuscript; and (3) provided final approval of the submitted version. L.H.U. (1) supervised the data acquisition and contributed to the analyses and interpretation of analyses; (2) assisted in writing and revising the manuscript, including drafting part of the methods and discussion sections; and (3) provided final approval of the submitted version. P.E.S. (1) contributed substantially to the analyses and interpretation of analyses; (2) drafted parts of the methods section and the full results section and revised the manuscript; and (3) provided final approval of the submitted version. R.G.K. (1) assisted with the design of the study and contributed to the interpretation

of analyses; (2) revised the manuscript for important intellectual content; and (3) provided final approval of the submitted version.

Author Disclosure Statement

J.-M.B., L.H.U., P.E.S., and R.G.K. have no actual or potential conflicts of interest, either personal or financial. This study was performed primarily at the NYU School of Medicine with collaboration from investigators at Columbia University College of Physicians and Surgeons. This was a school-based study, and the schools were drawn from public schools that comprise the NYC Department of Education.

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Appendix

YOUTH ASTHMA-RELATED ANXIETY SCALE (YAAS)

DIRECTIONS: Below is a list of sentences that describe how some kids feel. Read each phrase and decide how often it happened to you over the LAST 2 WEEKS. Check NEVER, HARDLY EVER, SOMETIMES, OFTEN, MOST OF THE TIME, or ALWAYS.

IN THE <u>LAST 2 WEEKS</u> , HOW OFTEN DID YOU BECOME NERVOUS OR WORRIED ABOUT:	(0) NEVER	(1) HARDLY EVER	(2) SOMETIMES	(3) OFTEN	(4) MOST OF THE TIME	(5) ALWAYS
1. HAVING AN ASTHMA ATTACK OUT OF THE BLUE AND WITHOUT WARNING?	☐	☐	☐	☐	☐	☐
2. HAVING AN ASTHMA ATTACK AND NOT HAVING YOUR ASTHMA MEDICINE?	☐	☐	☐	☐	☐	☐
3. DYING BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐
4. WHAT YOUR FRIENDS THINK IF YOU HAVE ASTHMA SYMPTOMS IN FRONT OF THEM?	☐	☐	☐	☐	☐	☐
5. THE SIDE EFFECTS OF ASTHMA MEDICINE (SIDE EFFECTS ARE PROBLEMS THE ASTHMA MEDICINE MIGHT CAUSE)?	☐	☐	☐	☐	☐	☐
6. MISSING SCHOOL BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐
7. NOT KEEPING UP WITH OTHER KIDS BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐
8. HAVING AN ASTHMA ATTACK WHEN DOING PHYSICAL ACTIVITY LIKE SPORTS, DANCING, OR EXERCISE?	☐	☐	☐	☐	☐	☐
9. NOT DOING WELL IN SPORTS OR DANCING BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐

SCORING:

Average all items to compute the *Total Asthma-Related Anxiety Score*.

Average items 1, 2, 3, 4, 5, and 6 to compute the *Severity and Treatment Subscale Score*.

Average items 7, 8, and 9 to compute the *Disease-related Restrictions Subscale Score*.

Higher scores indicate worse asthma-related anxiety.

APPENDIX FIG. 1. Youth Asthma-Related Anxiety Scale.

PARENT ASTHMA-RELATED ANXIETY SCALE (PAAS)

DIRECTIONS: Below is a list of sentences that describe how some parents feel. Read each phrase and decide how often it happened to you over the LAST 2 WEEKS. Check NEVER, HARDLY EVER, SOMETIMES, OFTEN, MOST OF THE TIME, or ALWAYS.

IN THE <u>LAST 2 WEEKS</u> , HOW OFTEN DID YOU BECOME NERVOUS OR WORRIED ABOUT:	(0) NEVER	(1) HARDLY EVER	(2) SOMETIMES	(3) OFTEN	(4) MOST OF THE TIME	(5) ALWAYS
1. YOUR CHILD HAVING AN ASTHMA ATTACK OUT OF THE BLUE AND WITHOUT WARNING?	☐	☐	☐	☐	☐	☐
2. YOUR CHILD HAVING AN ASTHMA ATTACK AND NOT HAVING HIS/HER ASTHMA MEDICINE?	☐	☐	☐	☐	☐	☐
3. YOUR CHILD HAVING AN ASTHMA ATTACK WHEN YOU ARE NOT THERE?	☐	☐	☐	☐	☐	☐
4. YOUR CHILD KNOWING HOW TO MANAGE AN ASTHMA ATTACK WITHOUT YOU?	☐	☐	☐	☐	☐	☐
5. YOUR CHILD DYING BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐
6. WHAT YOUR CHILD'S FRIENDS THINK IF YOUR CHILD HAS ASTHMA SYMPTOMS IN FRONT OF THEM?	☐	☐	☐	☐	☐	☐
7. THE SIDE EFFECTS OF ASTHMA MEDICINE (SIDE EFFECTS ARE PROBLEMS THE ASTHMA MEDICINE MIGHT CAUSE)?	☐	☐	☐	☐	☐	☐
8. YOUR CHILD MISSING SCHOOL BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐
9. YOUR CHILD NOT KEEPING UP WITH OTHER KIDS BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐
10. YOUR CHILD HAVING AN ASTHMA ATTACK WHEN DOING PHYSICAL ACTIVITY LIKE SPORTS, DANCING, OR EXERCISE?	☐	☐	☐	☐	☐	☐
11. YOUR CHILD NOT DOING WELL IN SPORTS OR DANCING BECAUSE OF ASTHMA?	☐	☐	☐	☐	☐	☐

SCORING:

Average all items to compute the *Total Asthma-Related Anxiety Score*.

Average items 1, 2, 3, 4, 5, and 6 to compute the *Severity and Treatment Subscale Score*.

Average items 7, 8, 9, 10, and 11 to compute the *Disease-related Restrictions Subscale Score*.

Higher scores indicate worse asthma-related anxiety.

APPENDIX FIG. 2. Parent Asthma-Related Anxiety Scale.