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Adaptation of the State-Trait Inventory for Cognitive and Somatic Anxiety for Use in Children: A Preliminary Analysis

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Abstract

Objective Anxiety has both state/trait and cognitive/somatic dimensions, and these distinctions may be particularly relevant for children with medical problems. This two-part study adapted the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) and confirmed its factor structure in a sample of children in a primary care clinic. **Methods** STICSA items were adapted for reading level and piloted in a small group of children. Next, 250 children (12.3 ± 2.7 years) completed the adapted version, the STICSA-C. **Results** Separate confirmatory factor analyses conducted on the State and Trait forms of the STICSA-C confirmed the two-factor structure of the original measure (i.e., cognitive and somatic anxiety) and suggested an improved parsimonious model. **Conclusions** Support was found for use of the STICSA-C as a reasonably good internally consistent measure for assessing cognitive and somatic anxiety in pediatric samples. Further investigation of its reliability and validity with replication in pediatric populations is warranted.

Key words: anxiety; assessment; children; chronic illness.

Anxiety is a normal response to life's stressors but becomes troublesome when it leads to impairment in everyday functioning. Anxiety symptoms are common in youth, with the prevalence of diagnosable anxiety disorders in childhood thought to be between 15% and 20% (Beesdo, Knappe, & Pine, 2009). Impairing in their own right, clinical levels of anxiety in childhood also are predictive of persistent anxiety into adulthood and increased risk for other disorders, such as depression and substance abuse (Beesdo et al., 2009).

Despite its prevalence and importance, anxiety can be difficult to accurately assess owing to its complexity. Anxiety is a multidimensional experience, manifesting as both an enduring personality style and an immediate cognitive and somatic response to a stressful situation. This distinction has been described extensively in the literature as state versus trait anxiety (Kocovski, Endler, Cox, & Swinson, 2004; Spielberger, 1985; Zuckerman, 2015). State anxiety is defined as the transient experience of subjective feelings of tension, apprehension, nervousness, and worry, as well as arousal of the autonomic nervous system, likely owing to a specific situation. Trait anxiety, in contrast, is considered a more stable propensity to perceive threat and to experience state anxiety.

Further, anxiety is composed of both cognitive and somatic aspects (Donegan & Dugas, 2012; Duivis, Vogelzangs, Kupper, de Jonge, & Penninx, 2013). Somatic, or physiological, symptoms of anxiety

include sensations such as a racing heart, muscle tension, and shortness of breath, as well as abdominal upset and headaches. Cognitive symptoms of anxiety, by contrast, include mental rumination, poor concentration and memory, as well as biased and negative thinking.

The conceptual distinctions between state and trait and cognitive and somatic anxiety may be especially relevant for children experiencing medical symptoms and/or undergoing medical treatments. First, children with medical conditions appear particularly at risk for experiencing anxiety. In fact, anxiety and fear are among the most commonly reported emotional symptoms experienced by hospitalized children (Foster & Park, 2012), and the risk for developing these symptoms in children with medical conditions has been reported at about double that of their healthy counterparts (Lavigne & Faier-Routman, 1992). However, these findings may reflect an overestimation of the true prevalence of anxiety in this group given that symptoms commonly associated with medical conditions (e.g., shortness of breath, tremors, abdominal pain, a racing heart, dizziness) also are common symptoms of anxiety disorders. Thus, it can be difficult to distinguish actual anxiety symptoms from the medical condition itself (Pao & Bosk, 2010). Further, behaviors that are adaptive in the context of a medical condition may appear problematic when assessed outside of this context (e.g., "obsessive" hand washing, frequent school absences; Pao & Bosk, 2010), again leading to a possible overestimation of anxiety symptoms among ill children.

Second, having a more nuanced understanding of medical patients' anxiety profiles may be helpful in anticipating their specific vulnerability to more frequent and repeated medical appointments, tests, and interventions. In one study of college students (Ree, French, MacLeod, & Locke, 2008), trait cognitive anxiety was found to predict elevations in both state cognitive and somatic anxiety following presentation of a cognitive (i.e., exam) stressor, while trait somatic anxiety predicted elevations in state cognitive and somatic anxiety following a somatic (CO_2 challenge) stressor. As such, it is possible that those pediatric patients who score high on trait somatic anxiety, but not cognitive anxiety, may be especially vulnerable to the multiple somatic stressors often experienced as part of routine care for chronic medical issues (i.e., appointments, laboratory tests, and other medical procedures). The ability to assess for and document this specific facet of anxiety offers the possibility of uniquely targeting pediatric patients that are most likely to struggle with anxiety as a primary sequela of medical care.

Numerous and varied measures exist for assessing anxiety in children, with a range of conceptual bases, psychometric properties, specificity, and content (see Holmbeck et al., 2008 for a review). However, currently available measures of childhood anxiety allow only for the assessment of either state/trait anxiety or cognitive/somatic anxiety, but not all four dimensions simultaneously. Further, only one has attempted to distinguish between cognitive and somatic anxiety specifically in hospitalized children (Hospital Anxiety and Depression Scale; Zigmond, & Snaith, 1983). Thus, validated options for concurrent assessment of these relevant dimensions of anxiety in children with medical issues remain limited.

The State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008) was developed to reflect the above conceptual distinctions and measure both state/trait and cognitive/somatic dimensions concurrently in adults. As such, it provides a comprehensive picture of adults' anxiety experience, including both symptom manifestation and vulnerability. The STICSA is divided into two separate, yet parallel, assessment forms, the STICSA-State and the STICSA-Trait, each of which contains two subscales that independently assess cognitive and somatic symptoms of anxiety. Preliminary studies in adults have found the measure to be reliable and internally consistent, as well as to possess excellent convergent and discriminant validity on each dimension (Ree et al., 2008; Gros, Antony, Simms, & McCabe, 2007). For example, the STICSA-Trait Somatic subscale was shown to correlate more strongly with measures of somatic anxiety than did the STICSA-Trait Cognitive subscale (Gros, Simms, & Antony, 2010). Furthermore, the four-dimensional STICSA was able to better discriminate between symptoms of anxiety and depression than a two-dimensional measure of solely state and trait anxiety (Gros et al., 2007). However, the performance of this measure has not been assessed in children.

Thus, the current study explored the potential value of the STICSA for younger participants, specifically a sample of general pediatric patients seeking routine care in a primary care clinic. The two-part project used a single-site, cross-sectional design using a convenience sample. Using Holmbeck and Devine's (2009) specific recommendations for measure development and validation as a guide, Study 1 adapted the original STICSA for use with children, while Study 2 focused on preliminary confirmation of the factor structure of the child version of the STICSA (STICSA-C). It was hypothesized that the STICSA-C would demonstrate a factor structure similar to that of the original STICSA, thereby lending support to the cognitive/somatic anxiety distinction in children. The initial development of the STICSA used samples of healthy young adults; herein, we provide confirmation of the feasibility and factor structure of our adapted version of the measure, the STICSA-C, using a general
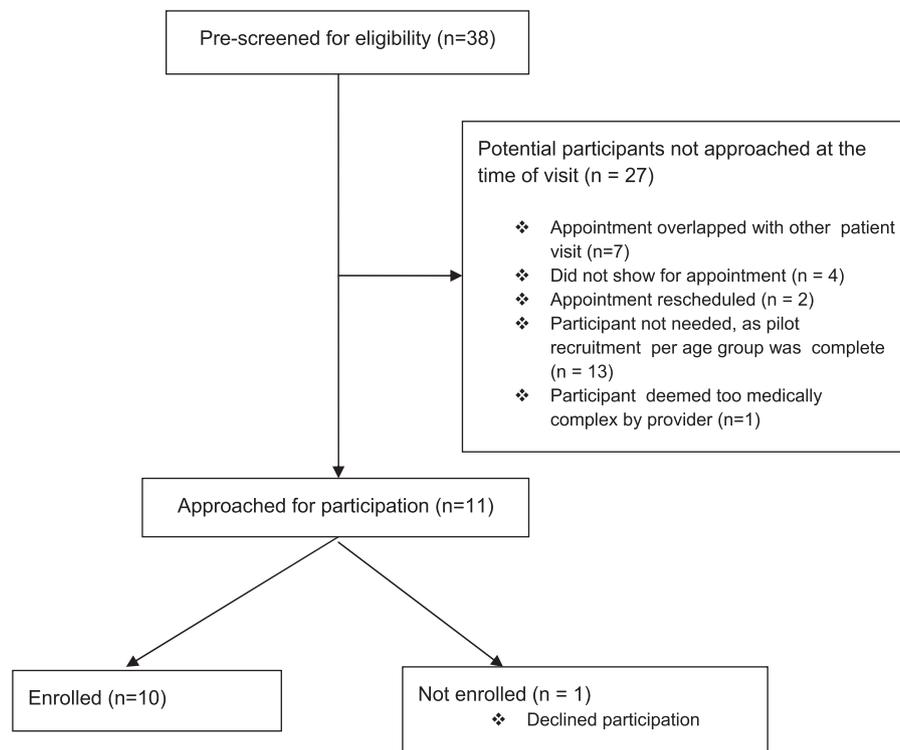
Figure 1. Study 1 participant flow diagram.

pediatric sample. This is an essential step in evaluating this instrument for use with children with medical conditions.

Study 1: Measure Adaptation and Content Validity Pilot

Method

Participants

To be eligible for participation in the content validity pilot, children had to be between 8 and 17 years of age, be scheduled for well-child examinations, routine care of mild illness (e.g., colds, ear infections, rash) or injury (e.g., bug bites, wound care), or school/sports physicals in a primary care pediatric clinic, and be able to read and speak English. Consent was obtained for a total of 10 patients (91% recruitment rate) with a mean age of 12.5 years (range 8–17 years, inclusive); 30% were female. The ages were as follows: age 8 (one), 9 (one), 10 (two), 12 (one), 13 (one), 14 (one), 16 (two), and 17 (one). Reasons for the clinic visits of recruited participants included: well child physical ($n = 4$), injury ($n = 1$), vaccination ($n = 2$), illness ($n = 1$), and asthma follow-up ($n = 2$). For a fuller description of study recruitment and the enrollment process, please see Figure 1.

Procedure

Measure Adaptation. Study 1 was conducted in two phases. First, the original pool of 21 items of the STICSA was examined by a group of approximately eight physicians and psychologists with backgrounds in pediatric psychology, developmental pediatrics, and child psychiatry. By consensus, experts identified items that were thought to exceed the developmental capability of children ages 8–17 years. These items were reworded to improve readability while attempting to retain the intended meaning, keeping the original language intact where possible. Twelve of the 21 items underwent some form of word change. For example, "My muscles are tense" was changed to "My muscles feel tight" and several of the Likert scale response options were adjusted (e.g., the option "moderately" was changed to read "some," "occasionally" was changed to "sometimes"). Finally, the adapted items were submitted to the developer of the original measure Melissa J. Ree (MR) who approved the item changes and affirmed that the alterations were consistent with the intended meaning of the original items.

Content Validity Pilot. In the second phase, participants were recruited to pilot test readability of the new measure, the STICSA-C, and ensure that no additional modifications to item language were required. Eligible participants and their parent(s)/guardian(s) were approached by a research coordinator in their assigned exam room during a primary care visit. Using a standardized instruction set, the research coordinator introduced the study, discussed permission/assent, and answered questions, as needed. Child participants, for

whom permission was obtained, completed the two study questionnaires and, subsequently, an exit interview. The exit interview used a standardized set of questions, posed in a semi-structured format. Items asked participants to describe what they liked best and least about the questionnaires, what they might change about each of them, and whether they found any of the items difficult to understand. In so doing, we relied on children's self-report of readability of the items. All procedures were approved by the participating hospital's institutional review board (IRB).

Measures

State-Trait Inventory for Cognitive and Somatic Anxiety—Child Version. The STICSA-C, like the STICSA from which it was adapted, is composed of two separate 21-item self-report questionnaires, the State form and the Trait form, each of which measures cognitive and somatic manifestations of anxiety (Supplementary Appendices). The State form asks children to indicate how they feel *right now, at this very moment*; the Trait form, in contrast, asks children to respond about how they feel, *in general*. On both forms, children provide their responses using a 4-point Likert scale (i.e., from "Never" to "Almost always" on the Trait form, and from "Not at all" to "Very much" on the State form). The adult version of the STICSA has demonstrated good reliability and validity (Gros et al., 2007; Ree et al., 2008).

Exit Interview. An exit interview was constructed by the authors. The interview's open-ended questions, posed in a semi-structured fashion, were administered verbally by a research assistant.

Study 1 Results

All participants agreed that the items were easy to understand and no wording changes to the items were recommended. The majority of participants reported that what they liked best about the questionnaires was the ability to say how they feel, with one participant suggesting that the measure should contain *more* items to reflect other physical feelings that he sometimes experienced (e.g., stomach pain). Feedback concerning the ways in which the measure could be changed included reformatting to make reading across the page easier (e.g., shading of alternate rows) and allowing for open-ended, rather than closed-ended, responses. For the purposes of Study 2, we opted to shade every other row on both the State and Trait forms for improved readability. However, no item modifications were made before preliminary validation testing in Study 2.

Study 2: Confirmatory Factor Analysis of the STICSA-C

Method
Participants
Eligible participants were scheduled for a primary care visit in a general pediatric clinic at a children's hospital in a large Midwestern city. The recommended sample sizes for factor analytic studies (e.g., Costello & Osborne, 2005) suggest subject-to-item ratios of at least 10:1 and subject-to-parameter ratios of at least 5:1. Given that each form of the STICSA-C contains 21 items, and up to 42 estimated parameters; it was anticipated that adequate power would be achieved with a sample size of 210–220 participants. Because this was a minimum recommended size, we targeted a sample size of 250 to provide greater confidence in the results of analyses.

Like Study 1, to be considered for participation in Study 2, children had to be between 8 and 17 years of age, be scheduled for well child examinations, routine care of mild illness (e.g., colds, ear infections, rash) or injury (e.g., bug bites, wound care), or school/sports physicals, and be able to read and speak English. Ultimately, consent was obtained for 250 children (82% of those who were approached) and their legal guardians, who then completed the study measures. The average age of Study 2 participants was 12.3 years ($SD = 2.7$, uniformly distributed), and 56% were female. A slight majority of the sample was Black/African American (57.6%) and had an annual household income of between $0 and $25,000 (52.8%). For additional participant demographics, please see Table I. For a fuller description of study recruitment and the enrollment process, please see Figure 2.

Procedure
Study 2 focused on confirmation of the STICSA-C factor structure. Eligible participants and their parent(s)/guardian(s) were approached by a research coordinator in their assigned exam room during a primary care visit. Study 2 procedures were unchanged from Study 1 with the exception that child participants did not respond to Exit Interview items and parent/guardian participants completed a short demographics questionnaire. Parents/guardians were assured that their responses would be anonymous and not linked to their child's health information in any way. As in Study 1, all Study 2 procedures were approved by the participating hospital's IRB.

Measures
State-Trait Inventory for Cognitive and Somatic Anxiety – Child Version. Please see description provided in Study 1. No item modifications were made before preliminary validation testing in Study 2.

Demographic Form. A demographic form was constructed by the authors to aid in establishing generalizability of the sample. This form included basic questions about the child participant's age, gender, and ethnicity, as well as household family income.

Table I. Study 2 Sample Characteristics

Demographic variable	Mean years ± SD	%	n
Age	12.3 ± 2.7		
Gender			
Male		44	110
Female		56	140
Ethnicity			
American Indian		2.0	5
Black/African-American		57.6	144
Hispanic/Latino		6.4	16
Native Hawaiian/Pacific Islander		0.8	2
White/Caucasian		28.0	70
Missing		5.2	13
Household income			
$0–25,000		52.8	132
$25,000–50,000		32.8	82
$50,000–75,000		6.0	15
$75,000–100,000		2.4	6
$100,000+		1.6	4
Missing		4.4	11
Reason for visit			
Well child physical		44.0	110
Illness/injury		34.8	87
Vaccination		1.2	3
Psychosocial/behavioral/lifestyle		10.0	25
Multiple/complex		3.2	8
Missing/unknown		6.8	17

Data Analytic Plan

Data were screened before analysis, revealing few missing values (33 of 5,250, or <1%, on the Trait form, and 50 of 5,250, <1% on the State form). On the Trait form, no items were missing more than five responses, and no participants were missing more than five responses. On the State form, only Item 11 was missing more than five responses (missing six), and two participants were missing more than five responses (missing six and eight, respectively). We performed analyses after the few missing values were replaced with imputed values from regression analysis and then repeated the analyses without imputed values and found no statistical or practical differences in the results.

Individual item means and standard deviations were calculated for each of the 21 items on the State and Trait forms, respectively. In addition, we assessed individual item and subscale score correlations, as well as internal consistency. Mean differences on questionnaire items between genders and on other demographic variables were compared using independent samples t tests and Analysis of Variance. Exploratory factor analysis (i.e., principal components analyses with promax rotation) was performed and provided initial support for the established two-factor model of the original STICSA (Stevens, 2002). Finally, the factor structure of the STICSA-C was examined using Confirmatory Factor Analysis (CFA) and examination of Goodness of Fit (GOF) indices (Kline, 2011).
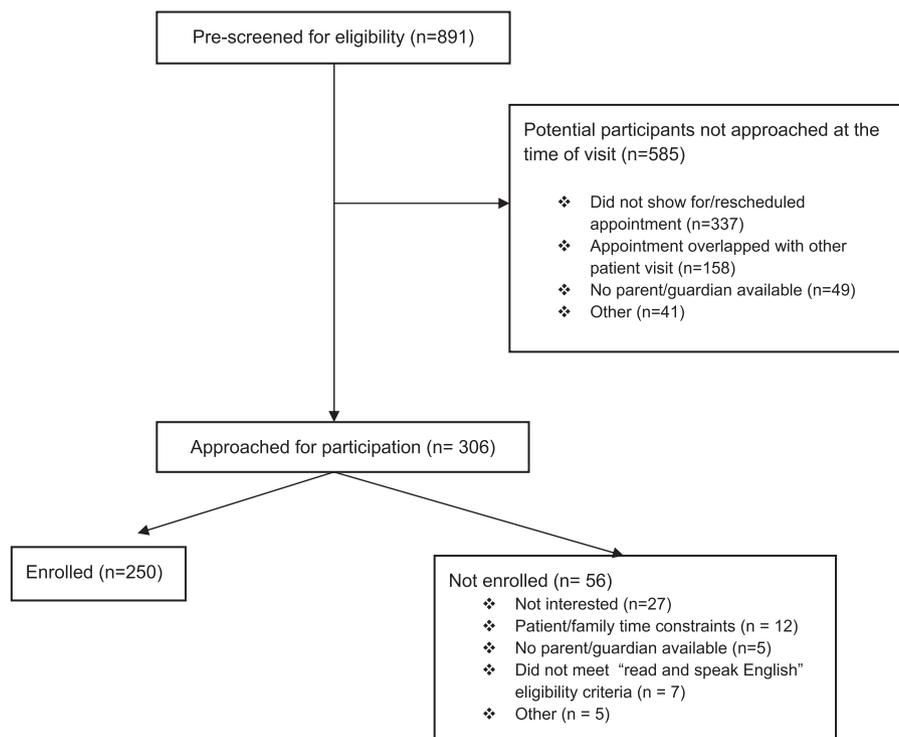
Figure 2. Study 2 participant flow diagram.

We employed commonly used GOF measures, along with rules of thumb for *acceptable* and *good* indicators of model fit. These rules of thumb are not absolutes and do not trump strong theoretical justifications for model specifications and selections. Where appropriate, the following rules were applied to both State and Trait CFA models. Theoretically, the χ^2 statistics should have a low, nonsignificant value ($p > .05$); however, it is common that this is not achieved even with theoretically sound models. This was true for Ree et al. (2008), as well as for our analyses (both $p < .001$). In CFA, the χ^2 test indicates the difference between observed and expected covariance matrices with values closer to zero indicating a better fit. Despite the limitations of χ^2, it can be used to compare the fits of nested models developed here. To counter the limitations of χ^2, the ratio of the χ^2/degrees-of-freedom is used to assess model fit. Values of this ratio <3 are consistent with an adequate model fit. Additionally, a root mean square error of approximation (RMSEA) value of <0.05 indicates very good fit, while a value of 0.08 indicates acceptable fit. Also shown for CFAs herein are the 95% confidence intervals of RMSEA and the additional measure of root mean square residual (RMR), both of which are used to confirm adequate-to-good fitting models. When the upper 95% confidence interval of RMSEA <0.08 (0.05) or the RMR <0.08 (0.05) the model is considered to have an acceptable (very good) fit. The Adjusted Goodness of Fit Index (AGFI) provides an additional measure of overall fit with values >0.90 indicating an acceptable fit. Likewise, the Comparative Fit Index (CFI) is used to compare models wherein 0.90 indicates an acceptable fit. The Parsimonious Normed Fit Index (PNFI) provides an indication of model parsimony, where higher values indicate better fit; specifically, values >0.50 have been found to be consistent with good models. The expected cross validation index, or ECVI, should be <3.0 (Kline, 2011). Finally, we have included the Akaike Information Criterion (AIC), which balances model complexity and fit in a single index. This index is used to compare models of the same variables and, everything else being equal, a model with a lower AIC denotes that one model fits and predicts the same data better than another model with a higher AIC.

Study 2 Results
Descriptive Data
STICSA-C State. We assessed State and Trait scores using the structure and factors proposed by Ree et al. (2008). The possible (and actual) range of total scores for items hypothesized to load on the Cognitive subscale was 9–36. The mean was 17.72 ($SD = 6.24$). The range of total scores possible for items hypothesized to load on the Somatic subscale was 11–44; actual was

11–38. The mean on this subscale was 16.40 ($SD = 5.14$). As expected, there were statistically significant correlations ($p < .01$) between each item and both subscale scores; the maximum correlations, however, occurred between presumed cognitive items and the Cognitive subscale score and the presumed somatic items and the Somatic subscale score. Internal consistency reliability (i.e., Cronbach's) was acceptable for both subscales (i.e., $\alpha = .77$ for the Cognitive subscale and $\alpha = .74$ for the Somatic subscale). Individual item means and standard deviations, as well as item-to-subscale total correlations, Cronbach's alpha, and standardized regression coefficients for each item (i.e., factor loadings from CFA) on the State form are displayed in Table II.

Female participants scored significantly higher on the STICSA-C State version compared with their male counterparts ($t = -2.65(248)$, $p = .009$). There were no significant differences in total scores based on identified ethnic group, level of annual household income, or reason for primary care visit.

STICSA-C Trait. The possible (and actual) range of total scores for items hypothesized to load on the Cognitive subscale was 9–36. The mean was 18.75 ($SD = 6.68$). The range of total scores possible for items hypothesized to load on the Somatic subscale was 11–44; actual was 11–39. The mean on this subscale was 18.51 ($SD = 5.57$). Similar to the State form, there were statistically significant correlations ($p < .01$) between each item and both subscale scores, with maximum correlations between the presumed cognitive items and the Cognitive subscale score and between the presumed somatic items and the Somatic subscale score. Also, similar to the State form, internal consistency reliability (i.e., Cronbach's) was acceptable for both subscales (i.e., $\alpha = .78$ for the Cognitive subscale and $\alpha = .75$ for the Somatic subscale). Individual item means and standard deviations, as well as item-to-subscale total correlations, Cronbach's alpha, and standardized regression coefficients for each item (i.e., factor loadings from CFA) on the Trait form are displayed in Table III.

There were no significant differences in mean scores on the STICSA-C Trait for any of the demographic variables (i.e., gender, ethnicity, annual household income, or reason for primary care visit).

Confirmatory Factor Analysis
The equivalent CFA measurement models of Ree et al. (2008) were fitted to our data on both the STICSA-C State and Trait forms. The responses were analyzed in CFA using a Maximum Likelihood Estimation (MLE) of a structural equation model (SEM) including all 21 indicator variables of Ree et al. MLE was chosen because it has consistently outperformed other methods

Table II. STICSA-C State Item Means and SDs, Item-to-Subscale Total Correlations, and Factor Loadings

STICSA-C state items	Mean	SD	Item-to-subscale total correlations[a]		Factor loadings[a] All Qs (parsimonious)	
			Cognitive[b]	Somatic[c]	Cognitive	Somatic
1. My heart beats fast.	1.70	0.859	.353	.622	*	0.55 (0.55)
2. My muscles feel tight.	1.50	0.822	.189	.525	*	0.41
3. I worry a lot (stress out) about my problems.	2.07	1.103	.652	.357	0.74 (.57)	*
4. I think that others won't like me.	1.60	0.902	.555	.377	0.48	*
5. I have a hard time making up mind.	2.26	1.051	.553	.300	0.65	*
6. I feel dizzy.	1.31	0.710	.244	.475	*	0.41
7. My muscles feel weak.	1.41	0.771	.257	.536	*	0.46 (0.44)
8. I feel shaky.	1.52	0.846	.338	.664	*	0.57 (0.61)
9. I imagine something bad happening in the future.	1.82	1.083	.697	.310	0.69 (0.62)	*
10. It's hard for me to stop thinking about some things.	2.43	1.106	.729	.363	0.49 (0.73)	*
11. I have trouble remembering things.	2.09	1.072	.438	.400	0.61	*
12. My face feels hot.	1.39	0.779	.272	.521	*	0.46
13. I think that the worst will happen.	1.51	0.865	.656	.315	0.50 (0.55)	*
14. My arms and legs feel stiff.	1.35	0.713	.319	.573	*	0.51 (0.48)
15. My throat feels dry.	1.60	0.911	.340	.604	*	0.58 (0.53)
16. I try to stay busy to keep my mind off upsetting thoughts.	2.09	1.138	.607	.216	0.68 (0.52)	*
17. It's hard for me to concentrate because different thoughts keep popping into my mind.	2.17	1.158	.708	.450	0.49 (0.67)	*
18. My breathing feels fast.	1.46	0.797	.360	.608	*	0.44 (0.63)
19. My worries are hard to control.	1.76	1.058	.753	.467	0.57 (0.76)	*
20. I have butterflies in my stomach.	1.47	0.846	.292	.502	*	0.51
21. My hands feel sweaty.	1.69	1.005	.334	.584	*	0.62 (0.52)

[a]$n = 250$, all $p < .001$.
[b]Cognitive subscale $\alpha = .773$
[c]Somatic subscale $\alpha = .740$
*Fixed, zero factor loading.

Table III. STICSA-C Trait Means and SDs, Item-to-Subscale Total Correlations, and Factor Loadings

STICSA-C trait items	Mean	SD	Item-to-subscale total correlation[a]		Factor loadings[a] All Qs (parsimonious)	
			Cognitive[b]	Somatic[c]	Cognitive	Somatic
1. My heart beats fast.	1.86	0.771	.241	.582	*	0.66 (0.50)
2. My muscles feel tight.	1.63	0.739	.323	.585	*	0.52
3. I worry a lot (stress out) about my problems.	2.19	1.063	.780	.411	0.79 (0.75)	*
4. I think that others won't like me.	1.78	0.974	.553	.329	0.55	*
5. I have a hard time making up mind	2.37	0.958	.603	.339	0.65	*
6. I feel dizzy.	1.61	0.829	.360	.616	*	0.57
7. My muscles feel weak.	1.62	0.823	.380	.565	*	0.53 (0.56)
8. I feel shaky.	1.72	0.925	.429	.682	*	0.51 (0.66)
9. I imagine something bad happening in the future.	1.95	1.052	.706	.346	0.77 (0.61)	*
10. It's hard for me to stop thinking about some things.	2.40	1.051	.800	.437	0.47 (0.77)	*
11. I have trouble remembering things.	2.21	1.008	.481	.446	0.68	*
12. My face feels hot.	1.56	0.795	.277	.531	*	0.47
13. I think that the worst will happen.	1.70	0.960	.740	.343	0.52 (0.65)	*
14. My arms and legs feel stiff.	1.52	0.797	.341	.625	*	0.57 (0.53)
15. My throat feels dry.	1.79	0.886	.392	.688	*	0.59 (0.68)
16. I try to stay busy to keep my mind off upsetting thoughts.	2.24	1.112	.667	.323	0.78 (0.62)	*
17. It's hard for me to concentrate because different thoughts keep popping into my mind.	2.25	1.117	.788	.510	0.60 (0.78)	*
18. My breathing feels fast.	1.71	0.859	.391	.629	*	0.45 (0.62)
19. My worries are hard to control.	1.87	1.034	.792	.585	0.75 (0.81)	*
20. I have butterflies in my stomach.	1.63	0.836	.321	.526	*	0.50
21. My hands feel sweaty.	1.87	0.971	.277	.593	*	0.65 (0.47)

[a]$n = 250$, all p values $< .001$.
[b]Cognitive subscale $\alpha = .784$.
[c]Somatic subscale $\alpha = .750$.
*Fixed, zero factor loading.

Table IV. Goodness of Fit Statistics[a] for CFA Models of STICSA-C State and Trait Forms as Compared With Ree et al. (2008)

Model	AIC	Number of coefficient[b]	χ^{2c}	(df)	χ^2/df	RMSEA	AGFI	CFI	PNFI	ECVI
State form models ($n = 250$)										
One-factor	641.2	13	515.2	(189)	2.73	0.083	0.80	.76	.60	2.58
Two-factor correlated	469.8	43	383.8	(188)	2.04	0.065[d]	.85	.85	.67	1.89
Parsimonious two-factor[e]	186.3	30	126.3	(75)	1.68	0.052[f]	0.91	.94	.72	0.75
Two-factor orthogonal	557.4	42	473.4	(189)	2.51	.078	.83	.78	.63	2.24
State form models (Ree et al.; $n = 225$)										
One-factor			452.8	(189)	2.39	.08	.57	.60	.51	2.40
Two-factor correlated			316.1	(188)	1.68	.05	.66	.66	.56	1.80
Two-factor orthogonal			348.7	(189)	1.85	.06	.63	.62	.53	1.94
Trait form models ($n = 250$)										
One-factor	613.1	13	587.1	(189)	3.11	.088	.77	.76	.60	2.58
Two-factor correlated	482.1	43	396.1	(188)	2.11	.067[g]	.85	.86	.72	1.94
Parsimonious two-factor[e]	156.7	30	96.6	(75)	1.29	.034[h]	.93	.98	.77	0.63
Two-factor orthogonal	584.7	42	500.7	(189)	2.65	.081	.83	.83	.68	2.35
Trait form models (Ree et al.; $n = 687$)										
One-factor			561.8	(189)	2.97	.05	.96	.97	.86	0.93
Two-factor correlated			482.5	(188)	2.56	.05	.97	.98	.86	0.82
Two-factor orthogonal			1438.6	(189)	7.61	.10	.74	.81	.71	2.19

[a]Lower is better for AIC and χ^2, χ^2/df (<3), root mean square error of approximation (RMSEA) (<0.08); higher is better for Adjusted Goodness of Fit Index (AGFI) (0.90), Comparative Fit Index (CFI) (0.90), Parsimonious Normed Fit Index (PNFI) (>0.50), and expected cross validation index (ECVI) (<3).

[b]Number of coefficients estimated in the relationship.

[c]For all χ^2 $p < .01$ except the Trait Parsimonious $p = .05$.

[d]Lower (Upper) 95% confidence interval of RMSEA of state model is 0.055 (0.074). Absolute fit RMR = 0.053 with 0.08 (0.05) deemed acceptable (well fitting).

[e]State and Trait parsimonious models, items for Somatic subscale: 1, 7, 8, 14, 15, 18, and 21; items for Cognitive subscale: 3, 9, 10, 13, 16, 17, and 19.

[f]Lower (Upper) 95% confidence interval of RMSEA of State Model is 0.036 (0.068). Absolute fit RMR = 0.044 with 0.08 (0.05) deemed acceptable (well fitting).

[g]Lower (Upper) 95% confidence interval of RMSEA of Trait Model is 0.057 (0.076). Absolute fit RMR = 0.050 with 0.08 (0.05) deemed acceptable (well fitting).

[h]Lower (Upper) 95% confidence interval of RMSEA of Trait Model is 0.004 (0.050). Absolute fit RMR = 0.037 with 0.08 (0.05) deemed acceptable (well fitting).

with nonnormal data for all but the largest sample sizes ($n > 1,000$; Olsson, Foss, Troye, & Howell, 2000). Table IV summarizes 14 CFAs to facilitate comparisons of our results with those of Ree et al. (2008) in their replication study. We discuss four CFA measurement models for each of the State and Trait latent variables, and then provide model comparisons of our models with those of Ree et al. (2008) using the previously introduced (GOF) statistics.

STICSA-C State. A number of GOF measures are used to determine the SEM that most closely and validly reflects the presumed theory underlying a data set. As the first step in this process, we assessed alternative structures as indicated by the three different models applied to our State form data (see Table IV). These models include a one-factor model (1FM), a two-factor model with correlated latent variables (2FCor), and a two-factor model with uncorrelated latent variables (2FUnC). The χ^2 fit statistics indicated superiority of the 2FCor model. The χ^2 difference between the 1FM ($\chi^2 = 515.1$) and the 2FCor model (i.e., $\chi^2 = 383.8$) was significant ($p < .001$), confirming a

better fit with the 2FCor model. The χ^2 difference between the two-factor orthogonal (2FUnC) model ($\chi^2 = 473.4$) and the 2FCor ($\chi^2 = 383.8$) also was significant ($p < .001$), further confirming a better fit with the 2FCor. Additionally, there were no significant item cross loadings found via modification indices. The correlation between subscale scores for the Cognitive and Somatic factors was 0.68. The factor loadings (i.e., standardized regression coefficients) of the 2FCor (see Table II) all were significant at the $p < .001$ level, with ranges of 0.41–0.74. All alternative regression weights were fixed at zero. The GOF measures were very good to marginal; however, when marginal, they were consistent with the results of Ree et al. (2008). Modification indices were used to consider alternative or additional structure but none yielded significant changes in regression weights nor suggested cross-loadings with the alternative latent variable.

STICSA-C Trait. The CFAs of the Trait data were identical to those of the State form. Again, the χ^2 fit statistics indicated superiority of the 2FCor. The χ^2

difference between the 1FM ($\chi^2 = 587.1$) and 2FCor model ($\chi^2 = 396.1$) was significant ($p < .001$), confirming a better fit with the 2FCor model. The χ^2 difference between the two-factor orthogonal (2FUnC) model ($\chi^2 = 500.7$) and the 2FCor model ($\chi^2 = 396.1$), also was significant ($p < .001$), lending further support to the 2FCor. There were no significant item cross loadings, and all loadings on the specified factors were significant at the $p < .001$ level, with a range of 0.47–0.79 (see Table III). All alternative factor loadings were fixed at zero. The correlation between subscale scores for the Cognitive and Somatic factors was 0.67.

Intra-Scale GOF Measures. In addition to the GOF used in Ree et al. (i.e., χ^2, χ^2/df, RMSEA, AGFI, CFI, PNFI, and ECVI), we included the AIC, 95% confidence intervals for RMSEA, and the RMR, as displayed in Table IV. The chi-square (χ^2)/degrees of freedom ratio, and the RMSEA, its confidence intervals, and RMR were used to assess the overall fit of each model. For both the State and Trait forms, the 2FCor is the best fitting using all of the included GOF statistics. The RMSEA, RMR, and ECVI achieve better than acceptable values (<0.08, <0.06, and <3, respectively) for both the State and Trait forms. The AIC balances model fit (i.e., χ^2) and model complexity (df), where a lower AIC is indicative of a more parsimonious model. Similar to the χ^2 and χ^2/df, the AIC confirms that the 2FCor model has superior fit. Based on these results, there is justification for the indicator variables, the two latent factors, and the correlations of the two latent factors as there was in Ree et al.

In our models, the AGFI and CFI fall somewhat below the common benchmarks of fit acceptability; however, our indicators are almost within bounds of an adequate fit for the 2FCor model, suggesting that our (relatively) small sample size is the reason for these low values. That is, it is not uncommon with models having a relatively large number of indicator variables and covariance measures (i.e., $21 + 21$) to not achieve common benchmarks for AGFI and CFI with a relatively small number of observations (i.e., $n = 250$). (As an example, one can compare the Ree et al. GOF statistics of the 2FCor models in Table IV for State versus Trait models to assess the likely impact of sample size differences of 229 and 687, respectively.) The slightly low AGFIs and CFIs suggest that our measurement models may have either too many indicator variables in them or slight misspecifications, as also might be the case for the Ree et al. models. Nonetheless, while these two GOF indices are relatively low, other GOF measures *are* consistent with acceptable fits and support the conclusions of Ree et al. (2008).

Parsimonious Two-Factor Model. To address the aforementioned indices of fit that fell below the benchmark criteria, we present additional results in Table IV of a set of parsimonious two-factor models, whose indices of fit also can be compared with those of the traditional CFA models. In this model, the State and Trait forms of the STICSA-C were reduced to 14 items (seven Cognitive, seven Somatic). Notably, the parsimonious two-factor models confirm an acceptable fit and demonstrate superior fit for all indices relative to the 1FM, the 2FCor, and the 2FUnC for both the State and Trait forms. As such, based on the PNFI ranks, we infer that these GOF statistics are confirmation of an acceptable SEM.

Model Comparisons With Ree et al. When compared with those of Ree et al., the GOF statistics for the Trait models in our child sample ($n = 250$ vs. Ree et al. $n = 687$) were somewhat inferior, while those of the State model ($n = 250$ vs. Ree et al. $n = 225$) were somewhat superior. Also important is that our Trait, 2FCor model possesses lower χ^2 and χ^2/df values than the equivalent Ree et al. model. This suggests that this model is equal to that of Ree et al. on this dimension. The fact that GOF indices for the Trait and State models are at times inferior, or superior, to those of the Ree et al. models is not unexpected because of the influences of randomness and smaller sample sizes. Overall, however, our good GOF indices, in combination with our statistically significant factor loadings, provide robust confirmation of the influences of the cognitive and somatic latent factors on the levels of reported state and trait anxiety in children. Nonetheless, we hypothesize that the best theoretical and practical model explaining somatic and cognitive levels of anxiety may be less complicated than the 21 indicator variable models and approximately as complex as the 14 indicator variables of the parsimonious models.

Discussion

Results from this study suggest support for use of the adapted version of the STICSA in pediatric samples. Our results specifically demonstrated that only minor wording and format changes to the original adult version provided an instrument appropriate for youth. Furthermore, CFAs of the State and Trait forms of the STICSA-C confirmed two latent, correlated factors within each scale, thereby lending support to the distinction between cognitive and somatic aspects of anxiety among children.

Overall examination of the GOF indices further confirmed that the variances in state and trait anxieties were better explained when we included the cognitive and somatic factors identified and confirmed by Ree et al. With that said, we encountered a few fit indices that fell below the benchmark criteria, suggesting that our measurement models may have either too

many indicator variables in them or slight misspecifications. We did not find any significant problems with cross loadings of indicator variables, and thus, we inferred that these tested models could be made more parsimonious. A parsimonious two-factor model with only 14 indicator variables demonstrated superior fit for all indices relative to the 1FM, the 2FCor, and the 2FUnC for both the State and Trait forms. In sum, less than ideal GOF indices notwithstanding, our replication confirms cognitive and somatic factors on both the State and Trait forms, and attests to the potential for the 21-item STICSA-C to assess these dimensions of anxiety in children. The dramatic cut in items as called for by the parsimonious two-factor model, while capitalizing on the current data set, are only valid to the extent that it is strongly believed that the used data set reflects the population from which it is theoretically drawn (i.e., it is intended to represent). As such, replication of the revised, parsimonious model in a new sample will be vital.

The ability to separately assess cognitive and somatic symptoms of anxiety in children may be particularly relevant in pediatric populations, where physical symptoms consistent with a medical condition overlap with and/or confound the presence and assessment of somatic symptoms of anxiety (Pao & Bosk, 2010). In these cases, a more nuanced assessment of anxiety has the potential to reveal more accurate and fine-grained estimates of anxiety in these groups. As somatic items from the STICSA-C have the potential to function quite differently depending on the specific pediatric illness group being assessed, these possible variations in responding will need to be addressed in future validation studies of the measure.

The consideration of trait and state anxiety in both cognitive and somatic domains using a tool like the STICSA-C also has the potential benefit of highlighting differences in individuals' trait anxiety, as well as predicting the types of situations in which anxiety is most likely triggered, thus allowing for preventive and targeted intervention. As previously noted, Ree et al. (2008), in a preliminary construct validation study of the STICSA, determined that the STICSA Trait scale predicted not the type of *symptom* that would be experienced when the individual became state anxious, but instead the type of *trigger* (i.e., somatic trigger or cognitive trigger) that would elicit state anxiety in a given individual. Similarly, it stands to reason that one's trait anxiety profile might contribute useful information to the prediction of one's response to certain cognitive-behavioral treatments. For example, an individual high in trait somatic anxiety might experience a reduction in both state cognitive and somatic anxiety following intervention that targets physiological anxiety, specifically, as in the case of interoceptive exposure. In contrast, an individual who scores high in trait cognitive anxiety may experience reductions in both state cognitive and somatic anxiety following an intervention that is more cognitively focused, as in the case of cognitive restructuring. Although as yet untested, it would be useful to be able to determine, in advance, whether a particular medical patient might respond differentially to a cognitively oriented intervention or a somatically focused one based on their trait cognitive or somatic anxiety profile. As such, this would allow for better tailoring of treatments at the individual level (i.e., matching the treatment to the patient), as well as the potential for promoting earlier intervention efforts in patients who are identified as high risk for developing anxiety as a primary sequela of the illness/disease and its care.

Strengths of this study include its utilization of established guidelines (i.e., Holmbeck & Devine, 2009) and a large pediatric sample in the statistically robust evaluation of the adaptation of the STICSA. Participants were ethnically diverse and included roughly equal numbers of males and females, thus contributing to the broad generalization of the study findings. With that said, over half of the sample identified as Black/African American and reported an annual income of between $0 and $25,000, leaving open the possibility that the factor structure revealed through our analyses would be different in a more ethnically and socioeconomically diverse sample of children.

Future studies should continue to examine the reliability and validity of this newly adapted instrument by analyzing its test-retest reliability (of the Trait form, particularly), responsiveness to experimentally induced changes in anxiety (of the State form), and convergent and discriminant validity via comparison with existing similar and dissimilar measures, respectively. It is also worth noting, as shown in Table II and III, that some factor loadings were relatively weak, sharing only 15–25% of their variance with the total scale (i.e., loadings between 0.4 and 0.5). Loadings in this range can lead to a reliable factor (Stevens, 2002), but also weaken the internal consistency of the measure. Some of these items have been removed in creating the 14-item parsimonious versions of the measure, which has added potential interest for both clinical and research purposes. Future studies investigating the validity of the measure, however, should specifically evaluate the performance of all items to determine if they relate to unique and important aspects of the construct, or are simply weaker items and can be removed in favor of a more efficient measure. To ascertain the generalizability of the current study's findings to a broader sample, administration of the STICSA-C to children with a range of socioeconomic statuses (SES) and to specific and various pediatric disease and illness groups is recommended. Results from such

investigations would provide necessary information regarding the value of the instrument's application in specific clinical and medical settings. Finally, future research using the STICSA-C should address its value (and, thereby construct validity) in predicting increases in state anxiety following exposure to specific types of experimental stressors (i.e., either cognitive or somatic) based on children's trait anxiety profiles. Equally interesting and clinically applicable would be ongoing evaluation of the STICSA-C's ability to predict children's response to specific anxiety treatments based on their trait anxiety profiles.

In conclusion, these findings support the use of the STICSA-C as a reasonably internally consistent measure for assessing cognitive and somatic facets of anxiety in pediatric samples. Further investigation of its reliability, validity, and utility is warranted. Nevertheless, given its unique separation of trait and state, as well as cognitive and somatic aspects of anxiety, it has the potential to be of great value to pediatric psychologists working with children facing a variety of medical conditions and may provide relevant information related to response to treatment or response to anxiety-inducing medical procedures.

Supplementary Data

Supplementary data can be found at: http://www.jpepsy.oxfordjournals.org/.

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