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Childhood Anxiety Sensitivity Index Factors Predict Unique Variance in DSM-IV Anxiety Disorder Symptoms

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Abstract. Anxiety sensitivity (AS) is an established cognitive risk factor for anxiety disorders. In children and adolescents, AS is usually measured with the Childhood Anxiety Sensitivity Index (CASI). Factor analytic studies suggest that the CASI is comprised of 3 lower-order factors pertaining to Physical, Psychological and Social Concerns. There has been little research on the validity of these lower-order factors. We examined the concurrent and incremental validity of the CASI and its lower-order factors in a non-clinical sample of 349 children and adolescents. CASI scores predicted symptoms of DSM-IV anxiety disorder subtypes as measured by the Spence Children’s Anxiety Scale (SCAS) after accounting for variance due to State-Trait Anxiety Inventory scores. CASI Physical Concerns scores incrementally predicted scores on each of the SCAS scales, whereas scores on the Social and Psychological Concerns subscales incrementally predicted scores on conceptually related symptom scales (e.g. CASI Social Concerns scores predicted Social Phobia symptoms). Overall, this study demonstrates that there is added value in measuring AS factors in children and adolescents. Key words: CASI; Spence Children’s Anxiety Scale; child; adolescent; STAIC.

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Anxiety sensitivity (AS) is a cognitive individual difference variable involving fear of anxiety-related sensations (e.g. increased heart rate), due to beliefs that such sensations can lead to negative consequences, such as physical illness, psychological incapacitation or social embarrassment (Reiss & McNally, 1985). The study and measurement of AS in children have the potential to inform us about the development and maintenance of anxiety, to identify children at risk for anxiety disorders and to evaluate interventions designed to prevent or treat anxiety. In adults, AS is typically measured using the Anxiety Sensitivity Index (ASI), a 16-item self-report questionnaire (Peterson & Reiss, 1992). In children and adolescents, AS is usually measured with the 18-item Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991). CASI items are similar to those on the ASI, but are adapted to be age-appropriate.

The CASI possesses good internal consistency and test-retest reliability in both clinical and non-clinical samples (Silverman et al., 1991). It has good concurrent validity (e.g. Kearney, Albano, Eisen, Allan, & Barlow, 1997; Rabian, Embry, & MacIntyre, 1999), and there is emerging evidence for its predictive validity (e.g. Ginsburg & Drake, 2002). The CASI also has incremental validity over
scores on the trait version of the State-Trait Anxiety Inventory for Children (STAIC-T; Spielberger, 1973) in predicting children’s fears (e.g. Weems, Hammond-Laurence, Silverman, & Ginsburg, 1998) and anxiety symptoms (e.g. Calamari et al., 2001; Muris, 2002; Muris, Schmidt, Merckelbach, & Schouten, 2001).

There is support for a hierarchical factor structure for AS, involving 3 oblique lower-order factors that load onto 1 higher-order (Global AS) factor. Though studies with the ASI and CASI have also found support for solutions with 2 and 4 lower-order factors, the weight of the evidence supports the existence of 3 lower-order factors (Muris et al., 2001; Silverman, Ginsburg, & Goedhart, 1999; Zinbarg, Mohlman, & Hong, 1999). These relate to Physical Concerns (the fear of anxiety-related physical sensations, such as nausea, due to beliefs these sensations will lead to physical illness), Psychological Concerns (the fear of anxiety-related mental sensations, such as difficulty concentrating, due to beliefs these sensations will lead to mental illness), and Social Concerns (the fear of publicly observable anxiety-related sensations, such as shaking, due to beliefs that demonstrating anxiety will lead to social censure).

In the adult literature, research on the construct validity of the ASI factors has led to a sophisticated understanding of the AS construct. A review by Cox, Borger, and Enns (1999) concluded that panic disorder was most associated with ASI Physical Concerns, and social phobia was most associated with ASI Social Concerns. They further theorized that obsessive compulsive disorder (OCD) and generalized anxiety disorder (GAD) should be most associated with ASI Psychological Concerns. Zinbarg, Barlow, and Brown (1997) conducted a profile analysis of the 3 lower-order ASI subscales in adults with and without anxiety disorders. Physical Concerns scores were higher in those with panic disorder with or without agoraphobia than in those with other anxiety disorders, and Social Concerns scores were highest in those with social phobia. Those with specific phobias had elevated Physical and Social Concerns scores relative to individuals with no mental disorder, and those with OCD or GAD had elevated scores on all 3 subscales compared with those with no mental disorder.

There has been less research linking specific CASI factors to particular anxiety disorders in children and adolescents. Kearney et al. (1997) reported that, relative to anxiety-disordered youth (8–17 years) without panic disorder, those with panic disorder scored higher on all of the CASI items except for 2 pertaining to Social Concerns. Chorpita and Daleiden (2000) created 2 CASI subscales: Physical Concerns (Autonomic items) and Non-Physical Concerns (Non-Autonomic items). Physical Concerns scores were correlated with clinician ratings of panic (but not GAD) severity, even after accounting for trait anxiety and depression. Non-Physical Concerns scores were not correlated with clinician severity ratings of panic or general anxiety, leading the authors to question the value of these items. The value of the Non-Autonomic items might be observed if criterion variables were expanded to include other DSM-IV anxiety disorders (e.g. social phobia) or if the Non-Physical Concerns subscale was separated into Psychological and Social Concerns factors.

Muris (2002) examined correlations between 4 lower-order factors on the CASI-R (a revised version of the CASI with 31 items) and scores on each of the 6 subscales of the Spence Children’s Anxiety Scale (SCAS; Spence, 1997) in a large non-clinical sample of adolescents (12–18 years). The strongest correlations for each of the CASI-R factors were with the SCAS Panic/Agoraphobia (P/A) scale. The only exception was a strong correlation between the Social Concerns factor and the SCAS Social Phobia scale. This provides some support for the construct validity of lower-order childhood AS factors. However, because the shared variance between the CASI-R lower-order factors was not considered, the relative contributions of the various factors to the prediction of each type of anxiety disorder symptom could not be determined. Moreover, trait anxiety was not controlled; thus, the incremental validity of the CASI-R factors in the prediction of anxiety symptoms could not be determined.

Deacon, Valentiner, Gutierrez, and Blacker (2002) partially addressed the above limitations in a study using the 12-item Anxiety
Sensitivity Index for Children (ASIC) – a measure with 2 subscales (Physical and Psychological Concerns). They examined subscale relations to a panic symptom composite, partly comprised of scores on the SCAS P/A scale. They demonstrated incremental validity of both AS subscales over a composite measure of general anxiety symptoms in predicting panic in a non-clinical sample of adolescents (12–18 years). Whether these results would hold for predicting other types of DSM-IV anxiety disorder symptoms after controlling for trait anxiety remains to be determined.

In sum, although there is evidence for the construct validity of the CASI, questions remain regarding the incremental and construct validity of its lower-order factors. We evaluated whether the 18-item CASI and subscale scores based on a 3-factor lower-order solution (Physical, Social, Psychological Concerns) predicted variance in DSM-IV anxiety disorder symptoms on the SCAS in a non-clinical sample of children and adolescents. Validation of the CASI in non-clinical samples will allow for its use as a potential screening measure, and will demonstrate its generalizability outside of the clinic, or before clinical difficulties emerge. Our analyses controlled for scores on the STAIC-T to evaluate incremental validity, and examined the statistically unique contributions of each CASI subscale to the prediction of anxiety symptoms.

We expected that total CASI scores would predict significant variance in anxiety disorder symptoms on all SCAS scales above scores on the STAIC-T, particularly in the case of the P/A scale (Muris, 2002; Muris et al., 2001). We further hypothesized that each CASI subscale would predict conceptually-related anxiety disorder symptoms, after controlling STAIC-T scores. We predicted that SCAS P/A scores would be related to scores on the CASI Physical Concerns (Chorpita & Daleiden, 2000; Cox et al., 1999; Kearney et al., 1997; Zinbarg et al., 1997) and Psychological Concerns (Deacon et al., 2002) subscales. We also predicted that SCAS Social Phobia (SP) scores would be related to Social Concerns (Cox et al., 1999; Zinbarg et al., 1997) and that SCAS OCD and GAD scores would be related to Psychological Concerns (Cox et al., 1999). We expected that SCAS Physical Injury Fears (PIF) would be related to Physical and Social Concerns (Zinbarg et al., 1997). We conducted an exploratory analysis of the CASI predictor(s) of SCAS Separation Anxiety Disorder (SAD) scale scores.

Method

Participants
Participants were 349 elementary and junior high school children (184 girls, 165 boys) ranging from 7 to 15 years (M (SD)=10.1 (2.3) years); 73% of the sample was younger than 12 years. The sample was primarily Caucasian, and from a cross-section of socioeconomic levels. All participants spoke English fluently, and were from 2 schools in the Halifax Regional Municipality, Nova Scotia, Canada.

Measures
The CASI (Silverman et al., 1991) is a self-report questionnaire designed to assess children’s fear of anxiety sensations. Children rate each of 18 items on a 1–3 scale referring to the extent to which they endorse each item (None, Some, A lot). Total scores can range from 18 to 54. See Table 1 for sample items. The CASI has good internal consistency and test-retest reliability in clinical and non-clinical samples (Silverman & Weems, 1999).

The SCAS (Spence, 1997) consists of 38 items designed to assess children’s symptoms of DSM-IV anxiety disorders, and 6 positively worded filler items (not scored). Children rate each item on a 0–3 relative frequency scale (Never, Sometimes, Often, Always). Items are summed to form 6 scales, reflecting different anxiety domains in children: GAD, OCD, SAD, SP, P/A and PIF. See Table 1 for sample items. The internal consistency of the 6 scales is acceptable to good (Spence, 1998). Confirmatory factor analyses support the existence of the hypothesized 6 factors (Muris, Schmidt, & Merckelbach, 2000; Spence, 1997, 1998). Spence (1998) demonstrated good discriminant and convergent validity of the SCAS scales in a clinical and non-clinical sample.

The STAIC-T (Spielberger, 1973) is a 20-item self-report questionnaire designed to measure trait anxiety. Items are rated on a 1–3 scale (Hardly Ever, Sometimes, Often).
The STAIC-T has been widely used and has demonstrated reliability and validity (Walker & Kaufman, 1984).

Participants also completed an author-compiled demographic questionnaire.

**Procedure**

Study information and consent forms were sent to parents/guardians of all children at the schools involved. Consent forms indicated that the child’s participation was voluntary, and that the child’s confidentiality would be maintained. Students were also told about the study. Only those with written parental consent, who also voluntarily assented, participated. The participation rate was 65%.

Data was collected on a class-by-class basis. Questionnaire order was counterbalanced across classes. Items were read aloud to younger students (ages 7–9 years). Teachers identified older students with reading difficulties so research assistants could read the items at the students’ own pace. Students were permitted to ask for clarification during testing. Students were debriefed following completion of the questionnaires. No compensation was provided.

**Results**

**Creation of CASI subscales**

Principal components analyses with oblique rotation were performed to extract the lower-order factors of the CASI. A 3-factor solution was favoured with the factors relating to Physical, Social and Psychological Concerns, respectively (cf. Muris et al., 2001; Silverman et al., 1999; Zinbarg et al., 1999). Each CASI item was assigned to 1 of 3 subscales according to the factor on which it had its highest loading. Subscale scores were computed by adding scores from each factor (see Table 1 for item numbers). Means, standard deviations and internal consistencies for the CASI, STAIC-T, SCAS, and their subscales are presented in Table 1.

**Multiple regression analyses**

Two sets of hierarchical multiple regression analyses (MRAs) were conducted to determine whether CASI scores could account for significant variance in each of the SCAS scales over and above STAIC-T scores. Bivariate correlations between the predictor and criterion measures are displayed in Table 2. All are significant ($p < 0.001$).
In the first set of MRAs, STAIC-T scores were entered at Step 1, and the total CASI score was entered at Step 2. As indicated in Table 3, STAIC-T scores accounted for significant variance in all 6 SCAS scale scores in both the initial and final models. CASI total scores accounted for unique variance in each SCAS scale, particularly P/A, even after controlling for STAIC-T scores.

In the second set of MRAs, STAIC-T scores were entered at Step 1, 2 CASI subscale scores were entered as a block at Step 2, and scores on the CASI subscale of interest were entered at Step 3. For example, variance due to the CASI Physical Concerns subscale was measured in Step 3 by controlling for variance due to the Social and Psychological Concerns subscales at Step 2. The results of these analyses are presented in Table 3, in Steps 3a, b, and c. The Physical Concerns factor accounted for significant additional variance in all 6 SCAS scales. The Social Concerns factor accounted for significant additional variance in the GAD, SP, and PIF scales, whereas the Psychological Concerns factor accounted for significant additional variance in the P/A, SAD and OCD scales.

**Discussion**

We examined the incremental validity of the CASI and its lower-order factors in predicting the frequency of anxiety disorder symptoms in a non-clinical sample of children and adolescents. Scores on the STAIC-T were a significant predictor of variance on each of the 6 SCAS scales (corresponding to the 6 DSM-IV anxiety disorder subtypes in children). We examined whether the CASI could predict variance in anxiety disorder symptoms over and above STAIC-T scores. As hypothesized, total CASI scores incrementally predicted scores on each of the SCAS scales, with the strongest incremental prediction in the case of P/A. This is consistent with research in the adult literature demonstrating an association between AS and anxiety disorder symptoms. It also extends Muris’ (2002) finding of significant correlations between the SCAS and CASI-R. We found significant correlations between the SCAS and CASI even after controlling for STAIC-T scores. This finding was identified in children younger and older than 12 years.

Cox et al. (1999) found evidence of a relation between AS and each of the anxiety disorders, with the exception of specific phobia. In contrast, Zinbarg et al. (1997) found AS to be elevated in individuals with specific phobia. Although our study involved non-clinical participants, we did find a significant relation between total CASI scores and each SCAS scale, including the PIF scale, which measures specific fears (Spence, 1997). This result, found also by Muris et al. (2001) and Muris (2002), is consistent with the theory of AS (Reiss & McNally, 1985), because high AS should lead to an exacerbation of general fears.
Of most theoretical interest was whether CASI subscales possessed incremental validity in predicting levels of conceptually-related childhood anxiety disorder symptoms, after controlling for STAIC-T scores. CASI Physical Concerns incrementally predicted scores on each of the SCAS scales. We had predicted a relation between CASI Physical Concerns and the SCAS P/A (cf. Chorpita & Daleiden, 2000; Deacon et al., 2002; Muris, 2002; Muris et al., 2001) and PIF (cf. Zinbarg et al., 1997) scales, but not with the others. The significant relation between CASI Physical Concerns and the SCAS SP scale may be due to the inclusion of items referring to fears of publicly observable anxiety symptoms (e.g. shaking, vomiting) in the empirically-derived Physical Concerns subscale (see Table 1). The relation between Physical Concerns and the GAD scale may be because children with generalized anxiety have worries across a variety of domains, including physical safety (Silverman & Ginsburg, 1995). Alternatively, the Physical Concerns subscale had the largest number of items (10 vs 5 and 3 items in the other 2 subscales), and the highest internal consistency (see Table 1), which may partly account for this subscale’s stronger associations with the various SCAS scales. Or, the Physical Concerns items may be the most theoretically fundamental CASI items with respect to Table 3. Hierarchical regression analyses predicting anxiety symptoms from anxiety sensitivity and trait anxiety.

<table>
<thead>
<tr>
<th>Dependent Variable: SCAS Subscale</th>
<th>Step</th>
<th>Predictor</th>
<th>df</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\beta$</th>
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<td>0.02</td>
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</table>

CASI = Childhood Anxiety Sensitivity Index; SCAS = Spence Children’s Anxiety Scale; STAIC-T = Trait subscale of the State Trait Anxiety Inventory for Children. $\beta$ = Standardized coefficients in final model. Steps 3a, b, and c were conducted in separate regression analyses. In each of these analyses (e.g. 3a), variance due to 1 CASI subscale (e.g. Physical Concerns) was measured after controlling the other 2 CASI subscales (e.g. Social and Psychological Concerns) and trait anxiety. *$p<0.05$. **$p<0.01$, ***$p<0.001$. 

Of most theoretical interest was whether CASI subscales possessed incremental validity in predicting levels of conceptually-related childhood anxiety disorder symptoms, after controlling for STAIC-T scores. CASI Physical Concerns incrementally predicted scores on each of the SCAS scales. We had predicted a relation between CASI Physical Concerns and the SCAS P/A (cf. Chorpita & Daleiden, 2000; Deacon et al., 2002; Muris, 2002; Muris et al., 2001) and PIF (cf. Zinbarg et al., 1997) scales, but not with the others. The significant relation between CASI Physical Concerns and the SCAS SP scale may be due to the inclusion of items referring to fears of publicly observable anxiety symptoms (e.g. shaking, vomiting) in the empirically-derived Physical Concerns subscale (see Table 1). The relation between Physical Concerns and the GAD scale may be because children with generalized anxiety have worries across a variety of domains, including physical safety (Silverman & Ginsburg, 1995). Alternatively, the Physical Concerns subscale had the largest number of items (10 vs 5 and 3 items in the other 2 subscales), and the highest internal consistency (see Table 1), which may partly account for this subscale’s stronger associations with the various SCAS scales. Or, the Physical Concerns items may be the most theoretically fundamental CASI items with respect to the SCAS.
anxiety symptoms (Chorpita & Daleiden, 2000). Regardless of the reason, the CASI Physical Concerns factor appears to be a global or non-specific predictor of anxiety symptoms. In contrast, the relations between the other 2 CASI factors and the SCAS appear to be more conceptually-specific.

As expected, CASI Social Concerns incrementally predicted SCAS SP scores. This extends previous results with the ASI Social Concerns scale in adults (Cox et al., 1999; Zinbarg et al., 1997) and the CASI-R in adolescents (Muris, 2002) to children. It also shows that Muris’ (2002) findings persist after controlling for STAIC-T scores. CASI Social Concerns also predicted scores on the SCAS GAD scale, which may be because children with GAD have concerns with social evaluation, among other worries. The relation between CASI Social Concerns and the SCAS PIF scale is consistent with previous findings that specific phobia in adults is related to AS Social Concerns and Physical Concerns (Zinbarg et al., 1997). Because phobic fears are excessive, children may be embarrassed at demonstrating anxiety to their peers in the presence of their phobic object. The lack of contribution of CASI Social Concerns to variance in SCAS P/A is consistent with the findings of Kearney et al. (1997).

Our hypotheses with regard to the CASI Psychological Concerns factor were only partially supported. We had predicted a significant relation with SCAS GAD scores (see speculations of Cox et al., 1999). This hypothesis was not supported, suggesting that the fear of worry is not a specific predictor of generalized anxiety symptoms in children. Our prediction that CASI Psychological Concerns would predict OCD symptoms was supported (see speculations of Cox et al., 1999). Scores on the SCAS P/A scale were also predicted by CASI Psychological Concerns scores. This is consistent with the findings of Deacon et al. (2002), and emerging evidence in the adult literature regarding the importance of AS Psychological Concerns in relation to panic phenomenology (e.g. Schmidt, Lerew, & Jackson, 1999). This pattern of results may be explained by the fact that Panic/Agoraphobia and OCD, but not GAD, entail concerns about loss of mental control or "phrenophobia" (American Psychiatric Association, 1994).

Although previous research has shown total CASI scores to be related to greater separation anxiety disorder symptoms in both adolescents (Muris, 2002; Muris et al., 2001) and young adults (Ollendick, Lease, & Cooper, 1993), no previous work has examined which lower-order AS factors are most associated with this childhood anxiety disorder. Scores on the SCAS SAD scale were predicted by CASI Physical and Psychological Concerns, the same CASI factors that predicted variance in SCAS P/A scores. This is consistent with the epidemiological and theoretical association between panic disorder and separation anxiety disorder, and with suggestions that separation anxiety disorder may be a manifestation of, or risk factor for, panic/agoraphobia in some children (Silove, Manicavasagar, Curtis, & Blaszczynski, 1996). This idea is by no means universally accepted, however, and more recent data has challenged the notion that there is a unique association between these 2 disorders (e.g. Aschenbrand, Kendall, Webb, Safford, & Flannery-Schroeder, 2003).

Study limitations should be acknowledged. Despite the fact that many of our hypotheses were supported, the CASI subscale scores accounted for, at most, 6% of the unique variance in SCAS scores. While our findings do demonstrate statistically significant concurrent validity, the observed associations may not be large enough to discriminate reliably between children with different types of anxiety disorders. It could be that our findings are, in part, due to the restricted range of scores in a non-clinical sample. The predictive utility of the lower-order CASI factors should be examined next in a clinical sample.

We examined the incremental validity of the CASI by controlling for scores on the STAIC-T, which was chosen as a measure of trait anxiety. Some have argued, however, that measures such as this may, in fact, be largely measuring negative affectivity or general distress (cf. Watson & Clark, 1984). Regardless of the extent to which the STAIC-T measures general distress, in future validation research on the CASI it would be useful to include a measure that specifically measures negative affectivity, in order to determine whether the CASI factors predict anxiety symptoms after controlling for general
distress. This would be a highly stringent test of the predictive powers of the CASI.

The data in the present study were correlational and cross-sectional in nature, thereby precluding the establishment of causal relations. Other studies support the causal role of AS in the development of anxiety in children (e.g. Rabian et al., 1999) and adults (e.g. Schmidt et al., 1999). Nevertheless, we are unable to conclude, based on our data, that the particular AS factors cause particular sets of anxiety symptoms. Even if a causal relation exists, the direction of causality remains unclear. There may be a bidirectional relationship, where AS amplifies anxiety symptoms, and symptoms of severe anxiety or panic amplify AS scores (Taylor, 1995). Longitudinal research is needed to determine the nature and direction of these observed relations. Also, these data were collected exclusively through self-report, creating possible problems with common method variance. Future research should use clinician-based (e.g. Chorpita & Daleiden, 2000) or parent-based criterion variables, or responses to lab-based challenges (e.g. Rabian et al., 1999). Furthermore, we do not know whether the observed results would be upheld beyond this primarily Caucasian sample, given findings that the factor structure of the CASI may differ in other ethnic groups (Lambert et al., 2004).

The fact that the CASI Physical Concerns subscale was a global predictor and the Social and Psychological Concerns subscales were more specific may be related to the fact that the Physical Concerns subscale is comprised of more items. In response to similar issues with the ASI, Taylor and Cox (1998) developed an expanded ASI (ASI-R), with more items on the Psychological and Social Concerns factors. Later, Muris (2002) developed the CASI-R, a 31-item measure with items from the CASI and ASI-R. The incremental validity of the lower-order factors of the CASI-R has yet to be established.

The utility of the AS construct as a cognitive risk factor for anxiety disorder symptoms is now well established in both children and adults. With the first study to establish the incremental, construct, and criterion-related validity of the lower-order CASI factors, we have demonstrated that there is added value in measuring the underlying factors of AS in children and adolescents.

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Notes

1. Silverman et al. (1999) labeled this factor Mental Incapacitation Concerns. We are applying the terminology outlined by Stewart, Taylor, and Baker (1997); that is, Physical, Psychological, and Social Concerns.
2. Because there is variability across studies in the items comprising the lower-order factors, we used exploratory rather than confirmatory factor analysis.
3. Oblique (direct Oblimin) rotations were performed based on previous research demonstrating inter-correlated AS dimensions (e.g. Silverman et al., 1999). Based on the literature and the extraction of 4 eigenvalues >1, we examined 2-, 3- and 4-factor solutions. Using a cut-off of 0.30 to define salient loadings, the 3-factor solution (with no hyperplane items and 1 complex item) showed the best simple structure. The 2-factor solution had 1 complex item and 2 hyperplane items, and the 4-factor solution had 4 complex loadings and 3 factors with 3 or fewer salient loadings. The 2- and 4-factor solutions were difficult to interpret. Moreover, our 2-factor solution was not similar to that obtained by Chorpita and Daleiden (2000) and our 4-factor solution was not similar to those obtained by Muris et al. (2001) and Silverman et al. (1999). In contrast, the 3-factor solution

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had relatively straightforward interpretability. All 3 solutions are available upon request.

4. Multicollinearity among the CASI subscales was not a problem, because tolerance values were moderately large (>0.42) and variance inflation factors were small (<2.38).

5. This pattern of results is maintained when the analyses are replicated with the subset of children (n=290) under the age of 13 years.

References


