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Relationships Among Social Anxiety Measures and its Invariance

A Confirmatory Factor Analysis

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Keywords: Adolescence, assessment, invariance, social anxiety

Summary: Social phobia is becoming increasingly recognized as an important disorder among adolescents. The body of research on assessment measures in adolescents with social phobia has grown considerably. Unfortunately, little is known about the relationship among these measures and its invariance across clinical and community samples. The objective of the present study is to examine this issue. Results show that all of these measures are invariant among samples and assess a single higher-order factor, labeled as "social anxiety," although each measure appears to tap a specific symptom (cognitive, behavioral, and somatic). Further, results do support the The Social Phobia and Anxiety Inventory (SPAI) and the the Social Anxiety Scale for Adolescents (SAS-A) as first-line assessment measures for adolescents' social anxiety.

The social anxiety disorder, also known as social phobia, "is a marked and persistent fear of one or more social or performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others" (American Psychiatric Association, 1994). Although in the past the social anxiety disorder was labeled "the neglected anxiety disorder" (Liebowitz, Gorman, Fyer, & Klein, 1985), over the last decade research on assessment for adolescents' social phobia has increased considerably (Beidel & Turner, 1998). Among questionnaires designated or validated for an adolescent population, four have been thoroughly studied: The Social Phobia and Anxiety Inventory (SPAI; Turner, Beidel, Dancu, & Stanley, 1989), the Social Anxiety Scale for Adolescents (SPSA; La Greca & López, 1998), the Fear of Negative Evaluation (FNE; Watson & Friend, 1969) and the Social Avoidance and Distress (SAD; Watson & Friend, 1969).

The purpose of this study is to examine: (1) the relationships among different social anxiety measures for addressing the question of whether a single factor appears to measure the construct of social anxiety and (2) the factorial invariance for clinical and community populations.

Method

Subjects

The sample consisted of 303 subjects (202 social phobics and 101 nonsocial phobics) in the 10th and 11th grades, attending two private and eight public high schools in several cities of a medium size county in Spain. The sam-

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ple ranged in age from 14 to 17 years (M = 15.6, SD = 0.83) and was composed of 112 boys (37%) and 191 girls (63%).

Measures

- *SPAI* (Turner et al., 1989). This is a self-report inventory that assesses behavioral, physiological, and cognitive symptoms associated with social phobia. The SPAI is comprised of two scales: the 32 item Social Phobia subscale (SPAI-SP) and the 13-item Agoraphobia subscale. In order to control for social anxiety attributable to agoraphobia, a *difference score* was derived. Although the SPAI was developed for adults, English and Spanish studies have demonstrated its validity and reliability in adolescence (Clark et al., 1994; García-López, Olivares, Hidalgo, Beidel, & Turner, 2001; Olivares, García-López, Hidalgo, Turner, & Beidel, 1999).
- *SAS-A*. La Greca and Lopez (1998) developed the SAS-A from a conceptualization of social anxiety by Watson and Friend (1969), who identified two aspects of social anxiety in adults: fear of negative evaluation (FNE) and social avoidance and distress (SAD). Factor analysis revealed a three factor structure for youngsters' social anxiety (La Greca & Lopez, 1998). The three primary factors of the SAS-A include a subscale reflecting fears or worries of negative evaluations from peers (FNE) and two subscales reflecting social avoidance and distress, of which one is specific to new social situations or unfamiliar peers (SAD-New) and one reflects generalized social inhibition (SAD-General). The subscales contain eight, six, and four items, respectively. In general, SAS-A consists of 22 items (four are filler items) arranged in a 5-point Likert rating format. The SAS-A has shown good psychometric properties for English- and Spanish-speaking populations (García-López et al., 2001; La Greca, 1998; Olivares, Ruiz, Hidalgo, & García-López, 1999).
- *FNE and SAD*. Watson and Friend (1969) developed these scales to measure social evaluative anxiety and social anxiety/distress and avoidance of social situations in a sample of college student prior to DSM-III recognition of social phobia as a diagnostic entity. The FNES is a 30-item scale and the SADS is a 28-item scale, both of which consist of a true-false format. Recent studies have demonstrated the reliability and validity of the FNES and SADS in an adolescent Spanish-speaking sample (García-López et al., 2001).
- *Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV)*. DiNardo, Brown, and Barlow (1994) developed this semistructured interview in order to assess current and lifetime DSM-IV anxiety, mood, and substance use disorders. Initial findings indicate an adequate level of interrater agreement for anxiety, mood, and substance use disorders in a Spanish-speaking population ($k \geq 0.75$; Olivares & García-López, 1997). The social phobia section (ADIS-SP) consists of 13 dimensional ratings that evaluate fear and avoidance using a clinical severity rating (a 9-point scale ranging from 0, *none,* to 8, *very severely disturbing/disabling*).

Procedure

In a previous phase of this study, SPAI was administered to a large sample of Spanish adolescents to detect socially anxious subjects (Olivares, García-López et al., 1999). Because there was no normative data for SPAI in the adolescent population at that time, one standard deviation above the mean on the difference score was used. Thus, subjects with a score above 74 on the difference score were selected. Of the 422 that scored above this score, 228 (54%) were available for participation. Recruitment was conducted in the classes of the high school where the students were found.

Two research assistants attended the classes and reported to the students that some of them had been arbitrarily selected from each class to pass to the second phase of the study concerning adolescent interpersonal relationships which had been conducted the year before. Normal subjects were selected along with the subjects with social phobia to prevent identification of subjects as having social anxiety. Therefore, the sample consisted of 303 subjects: 228 scoring above 74 on the difference score and 75 subjects with lower scores.

After explaining the procedures, research assistants called out the names of the selected subjects and those students who left their class to go to a lounge where, as a group, they completed a battery of standardized questionnaires (range: 8–15 subjects). Once they completed the self-report measures, the complete ADIS-IV was administered to the subjects with a difference score above 74 and only the ADIS-IV social phobia section was administered to the control subjects. It should be noted that the assessment was conducted during school hours so time was minimized. Control subjects who completed the social phobia section were administered the entire interview. Although they scored above 74 on the SPAI-Difference, if they did not meet social phobia criteria (as measured by the ADIS) no social phobia diagnosis was made. Therefore, subjects only received a social phobia diagnosis if, after they were administered the interview (ADIS), they met DSM-IV social phobia criteria.

After the assessment process, according to the ADIS-IV, the definitive sample was composed of 202 subjects

with social phobia and 101 nonsocial phobics. All subjects (control and social phobics) were informed about their scores and the conclusions drawn from their interview. Finally, subjects with a social phobia diagnosis were offered treatment.

Statistical Analysis

The total sample was split into two subsamples: socially anxious adolescents and normal sample (socially nonanxious). Statistical analysis on measures were conducted for the total sample as well as subsamples. First, factor structure of all measures, based on the correlations between scale scores, was examined using exploratory principal-components analysis with varimax rotation. Second, factors provided by the exploratory analysis were evaluated using a confirmatory factor analysis. Models were evaluated using the statistical program LISREL 8.12 (Jöreskog & Sörbom, 1993).

Furthermore, logistic regression analyses were performed in order to explore how well the instruments predicted the outcome of the ADIS-IV-SP.

Results

Exploratory Factor Analysis

Factor structure of the SPAI, SAS-A, FNE, and SAD were explored using iterative principal axis factor analysis with varimax rotation. For the total sample, unrotated, one factor with eigenvalue greater than 1.0 was obtained. This factor accounted for 64.13% of the variance. A second factor accounted for 6.09% of the variance (eigenvalue = 3.85), with additional factors adding less than 1% to the explained variance. Table 1 presents the rotated factor solution, the eigenvalue and percent of explained variance. As demonstrated, the first factor accounted for 38.30% of the variance (eigenvalue = 2.30). This factor showed high loadings (0.40) on the SPAI-SP, SASA-N, SASA-G, and SAD. The second factor accounted for 31.20% of the variance. SAS-A/FNE, FNE, SAS-A/SAD-G, SAS-A/SAD-N, and SPAI-SP had factor loadings higher than 0.40 on this factor. Subsequent factors added little to the explained variance (5%).

In order to examine whether the factor structure of the total sample is similar to subsamples (socially anxious and nonanxious adolescents), a common factor analysis with varimax rotation was conducted. Results are summarized in Table 2.

For the subsample of socially anxious adolescents, unrotated, one factor with eigenvalue greater than 1.0 was obtained. This factor accounted for 47.22% of the variance (eigenvalue = 2.83). A second factor accounted for 9.40% of the variance (eigenvalue = 0.56), the third factor accounted for 2.36 of the variance (eigenvalue = 0.14), and the fourth factor accounted for 1.32% of the variance (eigenvalue = 0.08) with additional factors adding less than 1% to the explained variance. For the factors

Table 1. Exploratory factor analysis for total sample.

Measures	Factor I	Factor II
SPAI-SP	0.72	0.41
SAS-A/FNE	0.37	0.79
SAS-A/SAD-N	0.72	0.47
SAS-A/SAD-G	0.62	0.49
FNE	0.35	0.73
SAD	0.79	0.28
Eigenvalue	2.30	1.87
% Explained variance	33.304	31.20

Note. SPAI-SP: Social Phobia and Anxiety Inventory-Social phobia subscale; SAS-A: Social Anxiety Scale for Adolescents (FNE: Fear of Negative Evaluation subscale, SAD-N: Social Avoidance Distress-New subscale, SAD-G: Social Avoidance Distress-General subscale); FNE: Fear of Negative Evaluation; SAD: Social Avoidance Distress.

Table 2. Exploratory factor analysis for clinical (socially anxious) and normal (socially non-anxious) subsamples.

Measures	Factor I Clinical subsample	Factor I Normal subsample	Factor II Clinical subsample	Factor II Normal subsample	Factor III Clinical subsample	Factor III Normal subsample
SPAI-SP	0.51	0.69	0.17	0.17	0.46	0.39
SAS-A/FNE	0.21	0.18	0.74	0.76	0.35	0.21
SAS-A/SAD-N	0.64	0.56	0.35	0.30	0.16	0.43
SAS-A/SAD-G	0.55	0.22	0.38	0.27	0.15	0.50
FNE	0.20	0.14	0.69	0.73	0.01	0.19
SAD	0.77	0.65	0.15	0.11	0.14	0.087
Eigenvalue	1.65	1.31	1.34	1.31	0.40	0.68
% Explained variance	27.54	21.84	22.39	21.77	6.74	11.37

Note. SPAI-SP: Social Phobia and Anxiety Inventory-Social phobia subscale; SAS-A: Social Anxiety Scale for Adolescents (FNE: Fear of Negative Evaluation subscale, SAD-N: Social Avoidance Distress-New subscale, SAD-G: Social Avoidance Distress-General subscale); FNE: Fear of Negative Evaluation; SAD: Social Avoidance Distress.

Table 3. Goodness-of-fit statistics for total sample.

Model	χ^2	*df*	*p*	SRMR	GFI	AGFI	NFI	NNFI
Null	1149.77	15	0.000					
1-factor	65.16	9	0.000	0.044	0.93	0.84	0.94	0.92
2-factors	18.15	8	0.020	0.023	0.98	0.95	0.98	0.98

Note. χ^2: index that reflects the discrepancy between hypothesized values for the a priori model and empirically derived data that have been observed. *df:* degrees of freedom; *p:* probability associate; SRMR: Standardized Root Square Residual; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index; NFI: Normed Fit Index; NNFI: Nonnormed Fit Index

1–3, Table 2 presents the rotated factor solution, the eigenvalue, and percent of explained variance. As noted, the first factor accounted for 27.54% of the variance (eigenvalue = 1.65). This factor showed high loadings (> 0.40) on the SPAI-SP, SASA-N, SASA-G, and SAD. The second factor accounted for 22.39% of the variance. SAS-A/FNE and FNE had factor loadings higher than 0.40 on this factor. The third factor accounted for 6.74% of the variance (eigenvalue = 1.65) and was composed of the SPAI-SP. Additional factors added less than 5% to the explained variance.

For the socially nonanxious adolescents subsample, unrotated, one factor with eigenvalue greater than 1.0 was obtained. This factor accounted for 42.60% of the variance (eigenvalue = 2.56). A second factor accounted for 11.01% of the variance (eigenvalue = 0.66), the third factor accounted for 2.51% of the variance (eigenvalue = 0.15), and the fourth factor accounted for 1.78% of the variance (eigenvalue = 0.11) with additional factors adding less than 1% to the explained variance. For the factors 1–3, Table 2 presents the rotated factor solution, the eigenvalue and percent of explained variance. As observed, the first factor accounted for 21.84% of the variance. This factor showed high loadings (> 0.40) on the SPAI-SP, SASA-N, and SAD. The second factor accounted for 21.77% of the variance, with factor loadings higher than 0.40 on the SAS-A/FNE and FNE. The third factor accounted for 11.37% of the variance and was composed of the SAS-A/SAD-G and SAS-A/SAD-N with factor loadings higher than 0.40. Additional factors added less than 5% to the explained variance.

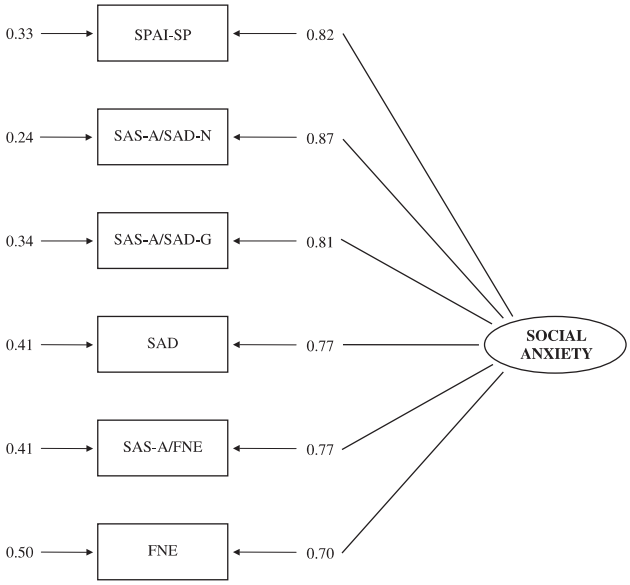

Figure 1. On the right appears the factor loading in the latent variable and on the left of the figure appears the unique component.

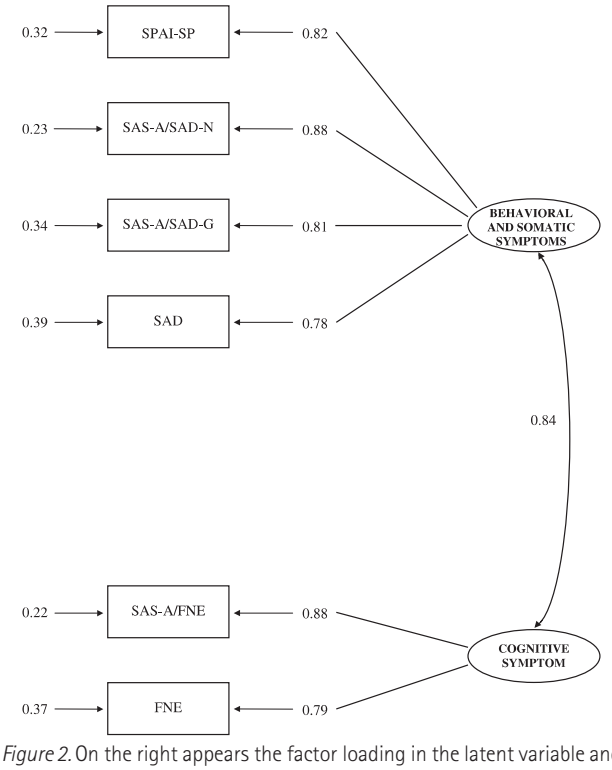

Figure 2. On the right appears the factor loading in the latent variable and on the left of the figure appears the unique component.

Confirmatory Factor Analysis

Factors provided by the exploratory analysis were evaluated using a confirmatory factor analysis. Because the χ^2 statistical test is significantly affected by the sample size, four practical fit indexes were used to evaluate the adequacy of the model tested: (1) the goodness-of-fit index (GFI) such that 0.90 or above indicates a good fit, (2) the adjusted goodness-of-fit index (AGFI) such that 0.85 or above indicates a good fit, (3) the standardized root mean-square residual (SRMR) such that value less

Table 4. Goodness-of-fit statistics for clinical (socially anxious) and normal (socially nonanxious) subsamples.

Model	χ^2	*df*	*p*	SRMR	GFI	AGFI	NFI	NNF
Clinical subsample								
1-factor	47.51	9	0.000	0.065	0.93	0.83	0.89	0.84
2-factors	16.96	8	0.031	0.036	0.97	0.93	0.96	0.96
3-factors	12.52	6	0.051	0.029	0.98	0.93	0.97	0.96
3-factors-2	16.90	6	0.010	0.036	0.97	0.91	0.96	0.93
Normal subsample								
1-factor	32.76	9	0.000	0.082	0.90	0.76	0.82	0.76
2-factors	8.94	8	0.350	0.045	0.97	0.92	0.95	0.99
3-factors	7.26	6	0.300	0.036	0.98	0.92	0.96	0.98
3-factors-2	6.63	6	0.360	0.041	0.98	0.92	0.96	0.99

Note. χ^2: index that reflects the discrepancy between hypothesized values for the a priori model and empirically derived data that have been observed. *df:* degrees of freedom; *p:* probability associate; SRMR: Standardized Root Square Residual; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index; NFI: Normed Fit Index; NNFI: Nonnormed Fit Index

Table 5. Results of logistic regression for each instrument.

Variable	B	SE	Wald Statistic	*df*	*p*	R^2	Exp(B)	Percent of correct classification
SPAI-SP	0.082	0.010	65.537	1	< .001	0.665	1.085	87.70
Constant	−6.247	0.831	56.486	1	< .001	0.002		
SAS-A/FNE	0.078	0.033	5.663	1	< .001	0.608	1.081	84.50
SAS-A/SAD-N	0.244	0.058	17.461	1	< .001	1.276		
SAS-A/SAD-G	0.340	0.081	17.732	1	< .001	1.405		
Constant	−8.164	1.045	61.066	1	< .001	0.000		
FNE	0.247	0.029	71.974	1	< .001	0.430	1.280	78.90
Constant	−3.927	0.550	51.027	1	< .001	0.020		
SAD	0.324	0.039	67.692	1	< .001	0.482	1.383	78.50
Constant	−2.718	0.408	44.465	1	< .001	0.066		

Note. B: coefficient for each variable in equation. SE: Standard Error; *df:* degrees of freedom; R^2: Nagelkerke multiple correlation squared

than 0.10 indicates a good fit, and (4) the ratio χ^2 statistical test/degrees of freedom (χ^2/df) such that value less than 2 or 3 indicates a good fit. Additional fit indexes were: (1) normed fit index (NFI) and (2) nonnormed fit index (NNFI). Models were evaluated using maximum likelihood confirmatory factor analysis.

For the total sample, three models were examined: (1) the null model or independent model, (2) a one-factor model, in which all variables were forced to load on a general social anxiety factor, and (3) a two-factor model, consisting of one factor ("behavioral and somatic symptoms") with factor loadings on the SPAI-SP, SAS-A/SAD-N, SAS-A/SAD-G, and SAD and another factor ("cognitive symptoms") with factor loadings on the SAS-A/FNE and FNE (Table 3). The results demonstrated that the one- and two-factor models fit the data well (SRMR less than 0.10, GFI higher than 0.90, and AGFI higher than 0.85). Although the χ^2 statistical test was significant for all models ($p < .05$), indicating a rather poor absolute fit, sometimes (mainly in large samples) significant differences are produced when the model fits. According to χ^2/df, the two-factor model shows a lower value (2.27) than the one-factor model (7.24). Thus, data indicated the adequacy of the two-factor solution. On the other hand, Figures 1 and 2 present the factor loadings for one- and two-factor models. As observed, the right column contains the factor loading in the latent variable while the left column contains the vector of unique components. Figure 1 shows that the estimated relationship among each observed indicator and the latent variable was higher than 0.40 in all of the measures, with factor loadings higher than 0.80 on the SPAI-SP, SAS-A/SAD-N, and SAS-A/SAD-G. These results seem to support unidimensional structure, providing additional data as to what is labeled "social anxiety," as assessed by instruments employed in our work. In Figure 2, the estimated relationship among each measure and respective latent variable was higher than 0.40. Further, the correlation between the first and the second factor was high (0.84).

Table 6. Results of hierarchical logistic regression analysis.

Variable in the model	χ^2	*df*	*p*	R^2	$\Delta\chi^2$	*df*	*p*	ΔR^2	Percent of correct classification
AS-A/FNE SAS-A/SAD-N SAS-A/SAD-G	207.853	3	0.000	0.616	–	–	–	–	84.50
SPAI-SP	155.264	4	0.000	0.739	52.589	1	0.000	0.123	89.40
FNE	139.963	5	0.000	0.771	15.301	1	0.000	0.032	90.40
SAD	135.640	6	0.000	0.780	4.323	1	0.038	0.009	91.10

Note. χ^2: Chi-square statistic –2-log likelihood ratio; *df:* degrees of freedom; *p:* probability; R^2: Nagelkerke multiple correlation squared; $\Delta\chi^2$: differences in χ^2 between step; ΔR^2: differences in R^2 between step

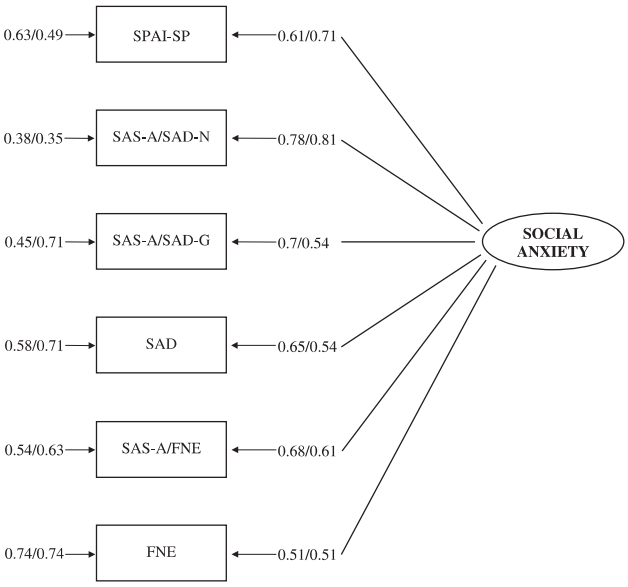

Figure 3. On the right appears the factor loading in the latent variable and on the left of the figure appears the unique component.

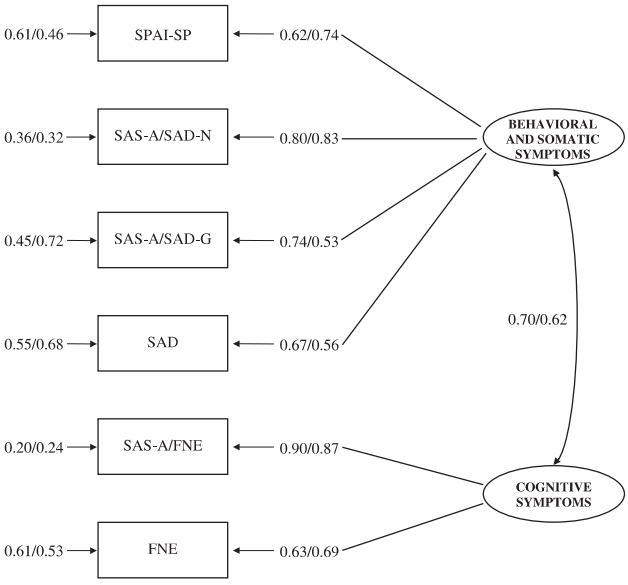

Figure 4. On the right appears the factor loading in the latent variable and on the left of the figure appears the unique component.

In addition, four models were examined for subsamples: (1) a one-factor model, in which all variables were forced to load on a general social phobic factor, (2) a two-factor model, consisting of one factor ("behavioral and somatic symptoms") with factor loadings on the SPAI-SP, SAS-A/SAD-N, SAS-A/SAD-G, and SAD and another factor ("cognitive symptoms") with factor loadings on the SAS-A/FNE and FNE; (3) a three-factor model with one factor comprised of the SPAI-SP, SAS-A/SAD-N, and SAD items, SAS-A/FNE and FNE loaded on a second factor, and a third factor composed of the SAS-A/SAD-G; and (4) the three-factor model-2 with one factor comprised of SAS-A/SAD-N, SAS-A/SAD-G, and SAD items, SAS-A/FNE and FNE loaded on a second factor, and a third factor composed of the SPAI-SP (see Table 4). Consistent with data obtained in the total sample, the results indicated that the tested models fit the data well for subsamples: SRMR less than 0.10, GFI higher than 0.90, and AGFI higher than 0.85.

For the socially anxious adolescents subsample, the χ^2 statistical test was significant ($p < .001$) for the one-factor model, indicating a rather poor absolute fit, but not significant for the remaining models. Based on the χ^2/df, both the two-factor and the three-factor models yielded values close to 2 (2.12 and 2.09, respectively). Thus, data indicated the adequacy of both solutions, but according to two criteria (goodness of fit and model parsimony), a two-factor model was adopted.

For the socially nonanxious adolescents subsample, the χ^2 statistical test was also significant ($p < .001$) for the one-factor model, indicating a rather poor absolute fit, but not significant for the remaining models. Based on χ^2/df, both the two-factor and the three-factor model yielded values lower than 2: 1.12 for the two-factor mod-

el, 1.21 for the first three-factor solution, and 1.11 for the three-factor model 2 structure.

Based on data for socially anxious and nonanxious subjects, the two-factor model was adopted. Figures 3 and 4 present the factor loadings for one- and two-factor model for subsamples.

Figure 3 shows that the estimated relationship among each of the observed indicators and the latent variables for all measures and for subsamples were higher than 0.40. The SAS-A/SAD-N showed the higher factor loadings for subsamples. Thus, the factor loadings estimates were 0.78 (socially anxious adolescents) and 0.81 (socially nonanxious adolescents). As observed in Figure 4, the estimate correlations for each measure and respective latent variables were higher than 0.40. Overall, similar results for each subsample were found. Furthermore, the correlations between the two factors were high for subsamples: 0.70 for socially anxious adolescents and 0.62 for socially nonanxious adolescents.

In order to explore how well the instruments predict the outcome of the ADIS-IV-SP, four logistic regression analyses were performed. Results of these analysis can be found in Table 5. As can be seen, the four social anxiety measures were significant predictors of the social phobia diagnosis ($p < .001$). The SPAI-SP and the SAS-A subscales show higher percentages of correct classification in comparison to FNE or SAD.

Furthermore, a logistic regression analysis in a forward hierarchical fashion was performed, starting in a first block with the SAS-A subscales, and progressing toward incrementally more complex models; where in a second step SPAI-SP was entered, in a third step FNE was entered and finally SAD was included in the model. Results of this analysis can be found in Table 6. In summary, these results do support the predictive validity of the SPAI-SP and SAS-A.

Discussion

This study examines the relationship among different measures designated or adapted to assess adolescents' social anxiety.

For total sample and subsamples, both exploratory and confirmatory factor analysis revealed a two-factor solution, which consisted of one factor called "cognitive symptoms" and composed of the SAS-A/FNE and FNE and the other labeled as "behavioral and somatic symptoms" including the SPAI-SP and SAS-A/SAD subscales and the SAD. As anxiety is comprised of cognitive, behavioral, and somatic components (Lang, 1968), our results do support that all these measures appear to assess the three-response-systems approach. Information on the subject's predominant anxiety components may be useful for therapists or researchers during treatment planning.

But even if factor analyses supported the two-factor model, the correlation between them was high and exploration of measures administered revealed that all of them load on a single factor, which appears to indicate that both factors tap different aspects of a single higher-order dimension, "social anxiety." This is consistent with previous works for adolescents (García-López et al., 2001) and adults (Cox, Ross, Swinson, & Direnfeld, 1998; Mattick & Clarke, 1998; Olivares, García-López, & Hidalgo, 2001; Safren, Turk, & Heimberg, 1998).

Combining these two sources, although each instrument assesses a specific domain, our results suggest that the SPAI, the SAS-A, the FNE, and SAD appear to measure a unidimensional structure, the social anxiety construct. Further, results suggest the social anxiety construct is invariant among socially anxious and nonanxious adolescents.

Our data raised an additional question: Is there any reason to recommend that the FNE, the SAD, and the SAS-A be used together as SAS-A subscales are conceptually similar to those developed for adults (FNE and SAD)?

Figures 1–4 show that the factor loadings for SAS-A/FNE are higher than FNE and the factor loadings for SAS-A/SAD subscales are higher than SAD.Thus, the SAS-A seems to be a more specific measure to assess adolescents' social anxiety. Although FNE and SAD appear to be useful instruments, they do not seem to provide additional information to the SAS-A. Results of logistic regression suggest SPAI and SAS-A are better predictors of social phobia than FNE and SAD. Thus, for clinical practice as well as research, the SPAI and the SAS-A are considered first-line assessment measures to assess adolescents' social anxiety.

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