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Validation of the Social Appearance Anxiety Scale in Patients with Systemic Sclerosis: A Scleroderma Patient-centered Intervention Network Cohort Study

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Abstract

Objective: Systemic sclerosis (SSc) is an autoimmune disease that can cause disfiguring changes in appearance. This study examined the structural validity, internal consistency reliability, convergent validity, and measurement equivalence of the Social Appearance Anxiety Scale (SAAS) across SSc disease subtypes.

Methods: Patients enrolled in the Scleroderma Patient-centered Intervention Network Cohort completed the SAAS and measures of appearance-related concerns and psychological distress. Confirmatory factor analysis (CFA) was used to examine the structural validity of the SAAS. Multiple-group CFA was used to determine if SAAS scores can be compared across patients with limited and diffuse disease subtypes. Cronbach's alpha was used to examine internal consistency reliability. Correlations of SAAS scores with measures of body image dissatisfaction, fear of negative evaluation, social anxiety, and depression were used to examine convergent validity. SAAS scores were hypothesized to be positively associated with all convergent validity measures, with correlations significant and moderate to large in size.

Results: A total of 938 patients with SSc were included. CFA supported a one-factor structure (CFI: .92; SRMR: .04; RMSEA: .08), and multiple-group CFA indicated that the scalar invariance model best fit the data. Internal consistency reliability was good in the total sample (α = .96) and in disease subgroups. Overall, evidence of convergent validity was found with measures of body image dissatisfaction, fear of negative evaluation, social anxiety, and depression.

Conclusion: The SAAS can be reliably and validly used to assess fear of appearance evaluation in patients with SSc, and SAAS scores can be meaningfully compared across disease subtypes.

Significance and Innovations

- Changes in appearance are common in SSc and can result in significant body image dissatisfaction and appearance-related anxiety.
- The Social Appearance Anxiety Scale can be validly and reliably used to assess fear of appearance evaluation in patients with SSc.
- Social Appearance Anxiety Scale scores can be meaningfully compared across patients with limited and diffuse disease.

Systemic sclerosis (SSc) is a rheumatic disease characterized by thickening and fibrosis of the skin and internal organs (1). Changes in appearance are common, and can include altered facial features, digital ulcers, hypo- and hyper-pigmentation, hand contractures, and telangiectasias. These changes can have significant psychosocial impacts as they may occur in socially-relevant areas such as the hands and face (2). There is no cure for the disease, and disfiguring appearance changes can be permanent. Given these appearance changes, body image dissatisfaction (BID) and appearance-related social discomfort are important concerns for patients with SSc (2, 3).

Social appearance anxiety, or a fear of situations in which one's appearance will be evaluated, may be particularly salient in SSc due to changes in appearance that often occur in socially-relevant areas of the body. Despite high rates of appearance concerns in SSc, research in appearance-related social anxiety is limited. A small number of studies have evaluated social discomfort due to appearance changes and fear of negative evaluation (2, 4), but no studies have examined social appearance anxiety in patients with SSc. Social discomfort due to appearance changes refers to unease in social interactions because of appearance changes. Fear or negative evaluation refers to worry about being evaluated unfavorably and can include concerns about appearance, but is not specific to appearance. A measure of social appearance anxiety validated in patients with SSc is needed to support research in this area. Since appearance anxiety may be associated with disease severity, such a measure would ideally have measurement equivalence across limited and diffuse disease subgroups. Diffuse SSc is associated with more skin involvement than limited SSc, and can be used as an indicator of severity, particularly related to appearance (1).

The Social Appearance Anxiety Scale (SAAS; 5) is a self-report measure that assesses

fear of situations in which one's appearance will be evaluated. The SAAS has demonstrated strong measurement properties in various populations, including university students (5-6), females with eating disorders (7), and gay and bisexual men of color (8), but has not been validated in SSc. A unidimensional factor structure has been found in previous studies, and internal consistency reliability has been excellent (αs: .93 to .96). Convergent validity has been demonstrated via moderate to large correlations in expected directions with measures of depression, anxiety, BID, and fear of negative evaluation (5-8).

The first objective of this study was to examine the factor structure of the SAAS in a sample of patients with SSc. A unidimensional factor structure was expected. The second objective was to examine internal consistency reliability. Based on previous studies, internal consistency reliability was expected to be strong. The third objective was to examine convergent validity. We expected positive, moderate to large correlations, defined according to Cohen's (9) rules [small: $|r| < .3$; moderate: $.3 \leq |r| < .5$; large: ($|r| \geq .5$)], with measures of depression, social discomfort, dissatisfaction with appearance, fear of negative evaluation, and social anxiety. Based on previous research and theoretical hypotheses about relationships with convergent validity constructs (5-8), correlations with measures of social discomfort, fear of negative evaluation, and social anxiety were expected to be more robust than correlations with depression and dissatisfaction with appearance. Items from the SAAS were developed considering symptoms used to diagnose social anxiety disorder. Thus, the SAAS was expected to be more strongly associated with discomfort in social contexts and anxiety as compared to clinical symptoms of depression and dissatisfaction with appearance, which are distinct from social discomfort (10). The final objective was to determine if SAAS scores can be meaningfully compared across limited and diffuse subtypes.

Patients and Methods

Participants and procedures

This study was a cross-sectional analysis of patients enrolled in the Scleroderma Patient-centered Intervention Network (SPIN) Cohort who completed study questionnaires from May 2014 through August 2016. Cohort patients were enrolled at 28 centers in Canada, the United States, and the United Kingdom. To be eligible for the cohort, patients must be classified as having SSc according to 2013 ACR/EULAR classification criteria, be at least 18 years of age, have the ability to provide informed consent, and be fluent in English, French or Spanish. Exclusion criteria include not being able to respond to questionnaires via the internet. The SPIN sample is a convenience sample. Eligible patients are invited by local site personnel, and written informed consent is obtained. Cohort patients complete outcome measures via the internet upon enrollment and subsequently every three months. The SPIN Cohort study was approved by the Jewish General Hospital Research Ethics Committee and by the Institutional Reviews Boards of each participating center. Patients with diffuse or limited SSc who completed all items of the SAAS in English were included in the present study.

Measures

Demographic and Medical Variables. Demographic variables were collected via self-report and medical variables by SPIN physicians or nurse coordinators. Limited disease was defined as skin sclerosis confined to the limbs distal to the elbows and knees with or without face involvement and diffuse disease as skin sclerosis involving the limbs proximal to the elbows and knees with or without chest or trunk involvement (1).

SAAS (5). The SAAS is a 16-item measure examining fear of situations in which one's appearance will be evaluated. Response options range from 1 (not at all) to 5 (extremely). To

calculate a total score, the first item is reverse coded and then all items are summed. Total scores range from 16 to 80, with higher scores indicating greater fear.

Brief Satisfaction with Appearance Scale (Brief-SWAP; 10). The Brief-SWAP is a measure of BID. Response options range from 1 (strongly disagree) to 7 (strongly agree). Two 3-item subscale scores can be calculated that reflect dissatisfaction with appearance and social discomfort. To calculate subscale scores, 1 is initially subtracted from each item. For Dissatisfaction with Appearance scores, items are then reverse scored and summed. For Social Discomfort scores, items are summed. Subscale scores range from 0 to 18, with higher scores indicating greater BID. Internal consistency reliability was good in the present sample (Dissatisfaction with Appearance: $\alpha = .83$; Social Discomfort: $\alpha = .89$).

Brief Fear of Negative Evaluation Scale-II (BFNE-II; 11). The BFNE-II assesses the degree to which individuals worry about how they are perceived and evaluated by others. Response options items range from 1 (not at all characteristic of me) to 5 (extremely characteristic of me). Total scores are calculated by summing individual items and range from 12 to 60. Higher scores indicate greater fear of negative evaluation. Internal consistency reliability was excellent ($\alpha = .98$).

Patient Health Questionnaire-8 (PHQ-8; 12). The PHQ-8 measures depressive symptoms over the last 2 weeks. Response options range from 0 (not at all) to 3 (nearly every day). Item scores are summed to produce a total score, which range from 0 to 24 with higher scores indicating more depressive symptoms. Internal consistency reliability was good ($\alpha = .89$).

Social Interaction Anxiety Scale-6 (SIAS-6; 13). The SIAS-6 assesses anxiety resulting from social interactions. Response options range from 0 (not at all characteristic or true of me) to 4 (extremely characteristic or true of me). Total scores are computed by summing item scores,

and range from 0 to 24. Higher scores indicate greater anxiety from social interactions. Internal consistency reliability was excellent ($\alpha = .90$).

Statistical Analysis

Descriptive statistics were calculated for the total sample. *T*-tests and analysis of variance were used to compare participants who completed the SAAS to those who did not and to compare SAAS scores across disease subtypes, sex, and age (SPSS v22). Confirmatory factor analysis (CFA) using maximum likelihood parameter estimates was used to examine the factor structure of the SAAS (Mplus v7.2). Model fit was determined considering descriptive fit indices as recommended by Bentler (14): (a) the Comparative Fit Index (CFI), (b) the Root Mean Square Error of Approximation (RMSEA), and (c) the Standardized Root Mean Residual (SRMR). For CFI, values $\geq .90$ indicate acceptable model fit. For RMSEA and SRMR, values $\leq .08$ indicate acceptable model fit. The likelihood ratio Chi-squared (χ^2) was reported for completeness, but is heavily influenced by sample size and does not demonstrate degree of model fit (15). There was significant multivariate skewness and kurtosis (*ps* < .05) in the present data, so the Satorra-Bentler scaled χ^2 (S-B χ^2) was used. A unidimensional factor structure was hypothesized to best fit the data. If a unidimensional factor structure did not fit well, modification indices would be examined to improve model fit. Once a factor structure with adequate fit was identified, multiple-group CFA was used to evaluate measurement invariance of the SAAS across limited and diffuse patients. For the multiple-group CFA, configural invariance, metric invariance, and scalar invariance models were iteratively examined. For the configural invariance model, a one-factor solution was fit to the data in two separate models, one each for the limited and diffuse SSc groups. Parameters were freely estimated. For the more restrictive metric invariance model, factor loadings were constrained to equivalence across disease subtypes. For the most restrictive

scalar invariance model, factor loadings and item intercepts were constrained to equivalence across disease subtypes. The CFI was used to statistically compare increasingly restrictive models for the multiple-group CFA. A change in CFI of ≤ .01 was indicative of no difference between models (15).

Internal consistency reliability was examined using Cronbach's coefficient alpha. Convergent validity was examined via Pearson product-moment correlations of the SAAS and measures of depression (PHQ-8), BID (Brief-SWAP), and social anxiety (BFNE-II, SIAS). Fisher's *z* was used to statistically compare correlation coefficients among convergent validity variables.

Results

Descriptive Statistics

Sample statistics are in Table 1. Of 1,012 patients who initiated baseline assessments, 47 patients were removed from the sample because they did not complete any items of the SAAS, and one patient was removed because one item was not completed. Patients who completed the SAAS were significantly ($p < .01$) older than patients who did not, however, there were no significant differences ($p > .05$) by sex, disease subtype, or modified Rodnan skin score. Patients with sine ($n = 18$), a subtype of patients who have internal organ involvement without detectable skin features, or unknown disease subtype ($n = 8$) were not included due to their limited sample sizes. Participants included in analyses ($N = 938$) were predominantly female and had a mean age of 55.6 years ($SD = 11.8$). The mean SAAS score in the total sample was 28.3 ($SD = 13.2$). SAAS scores were significantly ($p < .01$) higher among patients who were younger, female, and with diffuse disease as compared to patients who were older, male, and with limited disease, respectively.

Confirmatory Factor Analysis

Results from the CFA supported the hypothesized one-factor model in the total sample (Table 2). The one-factor model fit well based on three descriptive fit indices (CFI: .92; SRMR: .04; RMSEA: .08; S-Bχ^2 = 678.37, $p < .01$). All factor loadings were significant, and ranged from .64 to .90 with the exception of item 1 (.43).

Multiple-group Confirmatory Factor Analysis Models

Configural Invariance. The one-factor model fit the data well in limited (CFI: .92; SRMR: .04; RMSEA: .08; S-Bχ^2 = 427.34, $p < .01$) and diffuse (CFI: .92; SRMR: .04; RMSEA: .09; S-Bχ^2 = 410.98, $p < .01$) SSc groups. In addition, all factor loadings for items were statistically significant, and all factor loadings were .63 or higher, except item 1 (.42 and .43).

Metric Invariance. The metric invariance model fit the data well (CFI: .92; SRMR: .05; RMSEA: .08; S-Bχ^2 = 864.43, $p < .01$), indicating that factor loadings were equivalent across disease subtypes. Compared to the less restrictive configural invariance model, model fit was not compromised (ΔCFI < .01).

Scalar Invariance. The scalar invariance model fit well (CFI: .91; SRMR: .05; RMSEA: .08; S-Bχ^2 = 897.98, $p < .01$), indicating that factor loadings and item intercepts were equivalent across disease subtypes. Compared to the metric invariance model, model fit was not compromised (ΔCFI = .01).

Internal Consistency Reliability and Convergent Validity

Internal consistency reliability was excellent for the total sample (α = .96) and for limited (α = .96) and diffuse (α = .97) subtypes. As hypothesized, SAAS scores had significant, positive, large correlations with scores on the Social Discomfort subscale, BFNE-II, PHQ-8, and SIAS-6 for the total sample, and for limited and diffuse patients separately (Table 3). Correlations with

the Dissatisfaction with Appearance subscale were significant, positive, and moderate in size for the total sample, and for limited and diffuse patients separately. Correlations with the Social Discomfort subscale and the BFNE-II were significantly ($p < .05$) higher than correlations with the SIAS-6, PHQ-8, and Dissatisfaction with Appearance subscale. Correlations with the SIAS-6 and PHQ-8 were significantly higher than with the Dissatisfaction with Appearance subscale, but there were no significant differences between SIAS-6 and PHQ-8 correlation coefficients.

Discussion

The results of the present study demonstrate that the SAAS is a valid and reliable measure for use with SSc patients. CFA provided support for the scalar invariance model, indicating a unidimensional factor structure of the measure for all patients with SSc, and across diffuse and limited SSc subtypes. Item 1 had a lower factor loading than other items, but this is consistent with previous studies (4, 6-7). This is likely because of the positive phrasing of the item, as all other items are negatively worded. Internal consistency reliability was excellent. Overall, evidence of convergent validity was found. Correlations between the SAAS and measures of social discomfort, fear of negative evaluation, social anxiety, and symptoms of depression were large, whereas the correlation with a measure of dissatisfaction with appearance was moderate. Although the correlation with depressive symptoms was slightly larger than hypothesized, the most robust correlations were with social discomfort related to BID and fear of negative evaluation, followed by social anxiety, symptoms of depression, and dissatisfaction with appearance. This suggests that SAAS scores are more closely associated with social discomfort as compared to more broad clinical symptoms of psychological distress and dismay about appearance.

There are limitations to this study. The SPIN Cohort is a convenience sample receiving treatment at SPIN centers; SPIN patients may differ from those in other settings. There can be selection bias in convenience samples especially with a sensitive topic, however, this is unlikely as there was no stated focus on body image when patients enrolled in the Cohort. Missing data for the SAAS and other related measures were minimal. Patients completed self-report questionnaires online in English, potentially limiting the generalizability of study findings. Future studies may consider the use of physician-assessed constructs, such as social anxiety disorder, for convergent validity analyses. They may also consider examining relationships between the SAAS and constructs that have shown to be unrelated to the measure, such as social desirability and conscientiousness (5, 6). Since this study used cross-sectional data, we did not examine stability and sensitivity to change of SAAS scores.

In sum, these findings suggest that the SAAS can be reliably and validly used to assess fear of appearance evaluation in patients with limited and diffuse SSc, and that SAAS scores can be meaningfully compared across disease subtypes.

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Table 1

Sociodemographic and disease variables for patients with systemic sclerosis (N = 938)

Demographic variables	
Age (years), mean (SD)	55.6 (11.8)
Education completed (years), mean (SD)	15.3 (3.2)
Female, n (%)	822 (88)
Married, n (%)	635 (68)
Medical variables	
Years since first non-Raynaud's symptom, mean (SD)	11.8 (8.9)
Disease Subtype, n (%)	
Limited SSc	533 (57)
Diffuse SSc	405 (43)
Modified Rodnan Skin Score, mean (SD)[a]	8.0 (8.7) [range = 0 - 48]
Self-report questionnaire scores	
SAAS, mean (SD)	28.3 (13.2) [range: 16 - 80]
Disease Subtype, mean (SD)	
Limited SSc	26.5 (11.9)
Diffuse SSc	30.6 (14.4)
Sex, mean (SD)	
Female	28.8 (13.4)
Male	24.7 (10.7)
Age, mean (SD)	

Less than 50 years	33.2 (15.1)
50 – Less than 65 years	28.1 (12.9)
65 years and older	22.7 (8.0)
BSWAP – Dissatisfaction with Appearance, mean (SD)	9.2 (5.2) [range: 0 - 18]
BSWAP – Social Discomfort, mean (SD)	5.3 (5.3) [range: 0 – 18]
PHQ-8, mean (SD)	6.1 (5.4) [range: 0 - 24]
SIAS-6, mean (SD)	2.4 (3.8) [range: 0 - 24]
BFNE-II, mean (SD)	24.7 (12.1) [range: 12 - 60]

Note. SSc = systemic sclerosis; SAAS = Social Appearance Anxiety Scale; BSWAP = Brief Satisfaction with Appearance Scale; PHQ-8 = Patient Health Questionnaire-8; SIAS=6 = Social Interaction Anxiety Scale; BFNE-II = Brief Fear of Negative Evaluation Scale-II. Due to missing values: [a]*n* = 730.

Table 2

Standardized factor loadings from the CFA for the total sample and the multiple-group CFA baseline models for the SAAS

SAAS Item (abbreviated)	Factor loadings		
	Limited (n = 533)	Diffuse (n = 405)	Total Sample (N = 938)
1. comfortable with the way I appear to others	.42	.42	.43
2. nervous…having picture taken	.64	.63	.64
3. tense…people are looking at me	.74	.76	.75
4. concerned people would not like me	.83	.80	.81
5. worry that others talk about flaws in my appearance	.83	.84	.84
6. concerned people find me unappealing	.89	.91	.90
7. afraid people find me unattractive	.89	.90	.90
8. worry my appearance will make life difficult	.82	.83	.83
9. concerned I have missed out on opportunities	.79	.73	.76
10. nervous when talking to people	.86	.86	.86
11. anxious when people say something about my appearance	.85	.83	.84
12. afraid I would not meet others' standards	.84	.88	.87
13. worry people will judge the way I look	.86	.90	.88
14. uncomfortable when others are noticing flaws	.87	.87	.87
15. worry a romantic partner will/would leave me	.64	.74	.71
16. concerned people think I am not good looking	.86	.87	.87

Note. For all factor loadings $p < .05$.

Table 3

Pearson product-moment correlations among the SAAS and the PHQ-8, SWAP, BFNE-II and SWAP

	SAAS Limited	SAAS Diffuse	SAAS Total
PHQ-8	.52	.53	.53
Brief-SWAP – Dissatisfaction with Appearance	.38	.43	.41
Brief-SWAP - Social Discomfort	.69	.75	.73
BFNE-II	.67	.67	.66
SIAS-6	.52	.56	.55

Note. Values are presented as *r*. All correlations were significant at $p < .05$ (two-tailed). SAAS = Social Appearance Anxiety Scale; SWAP = Satisfaction with Appearance Scale; PHQ-8 = Patient Health Questionnaire-8; SIAS=6 = Social Interaction Anxiety Scale; BFNE-II = Brief Fear of Negative Evaluation Scale-II.