



Pergamon

Anxiety Disorders
393 (2002) 1–13

JOURNAL OF
Anxiety Disorders

4 Screening for social anxiety disorder in the
 5 clinical setting: using the Liebowitz
 6 Social Anxiety Scale[☆]

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14 Received 28 June 2000; received in revised form 12 October 2000; accepted 8 May 2001

15 **Abstract**

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 18 **Objective:** We sought to determine optimal cutoff values for the Liebowitz Social
 19 Anxiety Scale (LSAS) total and subscale scores for the diagnosis of social anxiety
 20 disorder (SAD) and designation of the generalized subtype of SAD. **Method:** Three
 21 hundred and sixty-four patients from a multi-site sample who met criteria for SAD
 22 according to structured diagnostic interview, 262 of whom met criteria for the generalized
 23 subtype, and 34 control participants free of current Axis I disorders participated in this
 24 study. All participants were given the Liebowitz Social Anxiety Scale by an independent
 25 assessor. **Results:** Receiver Operating Characteristics analysis revealed that the LSAS
 26 performed well in identifying individuals who met criteria for SAD and for the general-
 27 ized subtype of SAD. Cutoffs of 30 for SAD and 60 for its generalized subtype on the
 28 LSAS total score represented the best balance of specificity and sensitivity. **Conclusions:**
 29 These findings provide support for the use of the Liebowitz Social Anxiety Scale for the
 30 identification of individuals with SAD and its generalized subtype in clinical settings.
 31 Identification of patients with SAD should increase the percentage of these patients who

[☆] A preliminary version of this paper was presented at the Annual Meeting of the Anxiety Disorders Association of America, March 1999, San Diego, CA.

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35 *Keywords:* Liebowitz Social Anxiety Scale; Social anxiety disorder; Clinical settings

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Almost two decades ago, Liebowitz, Gorman, Fyer, and Klein (1985) designated social phobia the “neglected anxiety disorder.” Indeed, at that time, social phobia was considered to occur only in circumscribed performance situations such as public speaking. In addition, it was not believed to be prevalent or significantly impairing. However, recent years have witnessed a surge of interest in the study and treatment of the condition, increasingly referred to as social anxiety disorder (SAD) (Liebowitz, Heimberg, Fresco, Travers, & Stein, 2000).

The more contemporary nomenclature reflects the shift in our understanding of the impact of SAD. SAD is one of the most prevalent mental disorders, with estimates of its lifetime prevalence of over 13% in the general population (Kessler et al., 1994). It is a chronic condition (Reich, Goldenberg, Vasile, Goisman, & Keller, 1994) and a major risk factor for other psychiatric disorders (Schneier, Johnson, Hornig, Liebowitz, & Weissman, 1992). In addition, SAD is associated with significant functional impairment (Schneier et al., 1992, 1994; Wittchen, Fuetsch, Sonntag, Mueller, & Liebowitz, 1999), reduced quality of life (Bech & Angst, 1996; Safren, Heimberg, Brown, & Holle, 1997; Wittchen et al., 1999), and increased risk of attempted suicide (Weissman et al., 1996). Recognition of the importance of SAD has led to increased study of the effectiveness of its treatment (Heimberg et al., 1998; Stein et al., 1998b), which has further stimulated awareness of the condition.

The two most recent editions of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R, DSM-IV; American Psychiatric Association, 1987, 1994) distinguish generalized (GSAD) and non-generalized (NSAD) subtypes of SAD. GSAD is characterized by fear of most social situations, whereas persons with NSAD typically exhibit less pervasive fears. GSAD has an earlier age at onset (Mannuzza et al., 1995) and is associated with significant familial aggregation while NSAD is not (Stein et al., 1998a). Furthermore, individuals with GSAD are more broadly impaired than their NSAD counterparts (Heimberg, Holt, Schneier, Spitzer, & Liebowitz, 1993; Kessler, Stein, & Berglund, 1998; Mannuzza et al., 1995). They are less educated, less likely to marry, and more likely to be unemployed. They also endorse greater depression, social anxiety, avoidance, and fear of negative evaluation. Heimberg, Stein, Hiripi, and Kessler (2000) documented a higher prevalence of GSAD, but not of NSAD, among the younger age cohorts in the National Comorbidity Survey — suggesting that the prevalence of GSAD is on the rise and that the development of effective treatments for this disorder is a significant public health issue.

Evidence of differentiation between subtypes has led investigators to view GSAD as a distinct category that may require a unique approach to treatment. In

77 fact, Brown, Heimberg, and Juster (1995) found that patients with GSAD began
78 treatment and ended treatment more impaired than patients with NSAD. They
79 were also less likely to meet criteria for treatment response after 12 weeks of
80 treatment. Recognition of subtype differences has also led recent investigations of
81 pharmacological treatment of SAD to limit themselves to the generalized subtype.
82 In fact, many recent pharmaceutical efficacy trials (including the paroxetine
83 registration studies for the Food and Drug Administration) have been conducted
84 solely in patients with GSAD. These findings suggest that early identification of
85 individuals with GSAD may be required in order to provide a more specific and
86 intense approach to treatment.

87 Although SAD (especially GSAD) is prevalent and associated with significant
88 impairment, it often goes unnoticed (Magee, Eaton, Wittchen, McGonagle, &
89 Kessler, 1996). Patients may be hesitant to offer information about the extent of
90 their social anxiety for fear that they may be negatively evaluated by the clinician,
91 and many providers fail to inquire about or misdiagnose SAD symptoms as
92 indicative of other disorders (Olfson et al., 2000). Lack of awareness of SAD is
93 especially acute in primary care settings (Bisserbe, Weiller, Boyer, Lepine, &
94 Lecrubier, 1996; Stein, McQuaid, Laffaye, & McCahill, 1999; Weiller, Bisserbe,
95 Boyer, Lepine, & Lecrubier, 1996).

96 To increase their ability to detect SAD and GSAD, clinicians may benefit from
97 the use of empirically validated assessment tools. While structured diagnostic
98 interviews may be especially helpful in obtaining the information necessary to
99 diagnose and subtype SAD, they are typically costly and time-intensive. Altern-
100 atively, rating scales for social anxiety may be easily administered in clinical
101 settings.

102 The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) is a commonly
103 used clinician-administered social anxiety rating scale with impressive data in
104 support of its validity (Heimberg et al., 1999). The LSAS assesses the degree of
105 anxiety or avoidance in a number of typical social and performance situations. An
106 overall total score is often used, but subscale scores for anxiety or avoidance in
107 social interaction or performance situations are also calculated. Although the
108 LSAS is a psychometrically sound measure of the degree of social anxiety
109 experienced by patients, it is difficult to know whether a particular score
110 corresponds to a diagnosis of SAD or GSAD. Thus, determination of specific
111 cutoff scores on the LSAS or its subscales that accurately identify persons with
112 SAD or GSAD would greatly enhance its clinical utility.

113 Statistical techniques such as receiver operating characteristic (ROC) analysis
114 (Kraemer, 1992; Murphy et al., 1987; Swets, Dawes, & Monahan, 2000) allow
115 researchers and clinicians to determine the ability of tests to discriminate
116 individuals with a characteristic from individuals without the characteristic.
117 ROC analysis is based on logistic regression with a continuous predictor variable
118 and a dichotomous criterion variable. Once the logistic regression equation is
119 estimated, the probability of each value of the predictor and its associated
120 sensitivity and specificity values are derived. *Sensitivity* (Sn) is defined as the

121 likelihood of having positive test results among individuals with a positive
122 diagnosis whereas *specificity* (Sp) is the likelihood of having negative test results
123 in individuals without the diagnosis (Kraemer, 1992). In the present context,
124 positive test results refer to either obtaining a diagnosis of SAD or a determination
125 of GSAD subtype. Conversely, negative test results refer to *not* obtaining a
126 diagnosis of SAD or being classified as NSAD instead of GSAD. Sn and Sp values
127 can range from 0 to 1; a value of .50 represents chance. In ROC analysis,
128 probabilities are plotted on a graph with Sn on the Y -axis and the reflection of the
129 Sp values, $1-Sp$ (which equals the rate of false positives), on the X -axis. This line
130 is called the Test ROC. Each point on the Test ROC represents a possible cutoff
131 value for the scale's prediction of the criterion variable (i.e., the test result). A
132 diagonal line, the Random ROC, is plotted from the origin at the bottom left of the
133 graph to the top right. This line represents a probability of .50 or chance that an
134 individual with a given score belongs to the criterion group.

135 The area between the Random ROC and the Test ROC is called the area under
136 the curve (AUC) and provides a summary index of a test's ability to correctly
137 classify individuals. A value of 1.0 signifies perfect classification. The Random
138 ROC has an AUC of .50. The AUC may also be used to compare curves to each
139 other and to chance using a Chi-square statistic (Hanley & McNeil, 1982). Thus,
140 when several measures are available to choose from, ROC can inform the
141 selection of the measure with greatest likelihood of correct classification.

142 Each point on the Test ROC line represents a cutoff score and its ability (as
143 determined by Sn and Sp) to predict the dichotomous criterion variable. As one
144 maximizes Sn , Sp will decrease (and vice versa). ROC analysis allows one to
145 evaluate the relative merits of choosing a cut score so that future screening or
146 assessments can be informed based on the needs of the research or clinical
147 endeavor. Often, the score that maximizes both Sn and Sp is considered the best
148 cutoff value for the scale. However, if finding everyone who is likely to be positive
149 on the criterion measure is critically important and having some false positives in
150 the sample is acceptable (as might be the case when screening for a highly
151 contagious disease), then a cut score that maximizes sensitivity is indicated.
152 Conversely, if a more conservative approach in which a homogeneous sample is
153 required and it is less important that all true positives are identified, then a cut score
154 that maximizes specificity might be used. Studies requiring the investment of
155 substantial resources in the evaluation of a single participant because assessment of
156 false positives would prove wasteful (e.g., a functional magnetic resonance imaging
157 study) represent an example where maximizing specificity might be beneficial.

158 The present study sought to determine the optimal cutoff scores for the LSAS
159 for the diagnosis of SAD and assignment of the GSAD subtype. Utilizing ROC
160 analysis, LSAS scores were compared to SAD diagnosis and GSAD classification
161 made by a consensus of clinicians based on information obtained from semi-
162 structured diagnostic interviews for DSM-III-R or DSM-IV. Cutoff scores for
163 SAD and GSAD were generated using the LSAS total score. LSAS subscale
164 scores (performance and social interaction) were also examined to determine the

165 relative strength of different types of situations in predicting diagnosis and
166 subtype.

167 1. Method

168 1.1. Participants

169 Participants, aged 18–65, were obtained from a large multi-site sample of
170 patients seeking treatment for social anxiety. One hundred and eighty-five
171 participants sought treatment at the Center for Stress and Anxiety Disorders
172 of the University at Albany, State University of New York (CSAD). One hundred
173 and fourteen participants sought treatment at the Anxiety Disorders Clinic of the
174 New York State Psychiatric Institute (NYSPI). Sixty-five participants sought
175 treatment at the Adult Anxiety Clinic of Temple University (AACT). In addition,
176 a group of individuals from the community, matched to the AACT patient sample
177 on demographic characteristics, but who met criteria for no current DSM-IV Axis
178 I disorders served as a non-anxious control group (NAC; $n = 34$). There were no
179 significant differences among these groups on demographic characteristics.

180 The 364 treatment-seeking participants received a principal diagnosis of SAD
181 according to either DSM-III-R or DSM-IV criteria. At the CSAD, diagnoses were
182 determined by either the Anxiety Disorders Interview Schedule-Revised (ADIS-R;
183 DiNardo & Barlow, 1988) or the Anxiety Disorders Interview Schedule IV: Lifetime
184 Version (ADIS-IV-L; DiNardo, Brown, & Barlow, 1994), while the ADIS-IV-L was
185 used at the AACT for both clinical and control participants. Participants at NYSPI
186 were assessed with the Schedule for Affective Disorders and Schizophrenia,
187 lifetime version modified for use with the anxiety disorders (SADS-LA; Mannuzza,
188 Fyer, Klein, & Endicott, 1986) or the Structured Clinical Interview for DSM-IV
189 (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996). All interview procedures
190 have been shown to have high rates of inter-rater agreement for the principal
191 diagnosis of SAD (Brown, DiNardo, Lehman, & Campbell, 2001; DiNardo, Moras,
192 Barlow, Rapee, & Brown, 1993; First et al., 1996; Mannuzza et al., 1989).

193 Individuals with comorbid diagnoses, with the exception of current bipolar
194 disorder or psychotic disorder as well as drug or alcohol dependence within the past
195 6 months, were included. SAD patients were classified as having GSAD if they
196 demonstrated fear in most social situations or were otherwise classified as having
197 NSAD. GSAD and NSAD patients did not differ on demographic characteristics.

198 1.2. Materials and procedure

199 The data for the present study were obtained during patients' pre-treatment
200 assessment or when community participants visited the AACT to take part in
201 various studies. All participants provided written informed consent after being
202 given a complete description of the purpose and procedure of the specific study in

203 which they took part. A clinician uninformed about the participants' performance
204 on other assessment measures administered the LSAS. The LSAS contains 13
205 social and 11 performance situations that are rated by the clinician on separate 4-
206 point (0–3) scales of fear/anxiety and avoidance. A number of subscale scores can
207 be derived from the LSAS including total fear, fear of social interactions, fear of
208 performance, total avoidance, avoidance of social interactions, avoidance of
209 performance, total performance, and total social interaction. In addition, an
210 overall total score is generated by summing both fear and avoidance ratings
211 for all items and is commonly used in the evaluation of pharmacotherapies for
212 SAD. In the present analyses, the overall total score (LSAS-T), the total
213 performance subscale score (LSAS-PER), and total social interaction subscale
214 score (LSAS-SI) were examined. Extensive support for the reliability and validity
215 of the LSAS has been reported by Heimberg et al. (1999).

216 1.3. Data analysis

217 Using ROC analysis, we examined cutoff values that corresponded to a
218 diagnosis of SAD (distinguishing patients with SAD from normal comparison
219 subjects) and GSAD (distinguishing between subtypes of persons with SAD). We
220 determined cutoff values that: (1) maximized both Sn and Sp; (2) maximized Sn
221 (without reducing Sp below chance level); and (3) maximized Sp (without
222 reducing Sn below chance level). For the LSAS-SI and LSAS-PER scale scores,
223 only the cutoff values that maximized both Sn and Sp are presented. Data were
224 analyzed using the STATA 6.0 software program (Stata Corporation, 1999).
225 Significance for the following analyses was set at .01.

226 2. Results

227 2.1. Diagnosis of SAD

228 The total sample ($N = 398$) of SAD patients ($n = 364$) and NAC partici-
229 pants ($n = 34$) was submitted to ROC analysis. The AUC for this ROC analysis
230 was .98 and was significant versus chance or the random ROC line ($P < .0001$)
231 (Fig. 1). A LSAS-T score of 30 provided the best balance between Sn and
232 Sp. The vast majority (93.28%) of patients with SAD were correctly identified,
233 and only 5.88% (1-Sp) of persons without SAD were misclassified with a
234 LSAS-T score of 30. A score of 10 (maximizing Sn) correctly classified all
235 patients with SAD but misclassified 44.12% of persons without SAD as
236 positive cases. Conversely, with a score of 63 (maximizing Sp), all persons
237 without SAD were correctly identified but 47.29% of persons with SAD were
238 overlooked.

239 The ROC analysis for the LSAS-SI subscale produced an AUC of .95 that was
240 significantly different from the random ROC line ($P < .0001$). The AUC for the

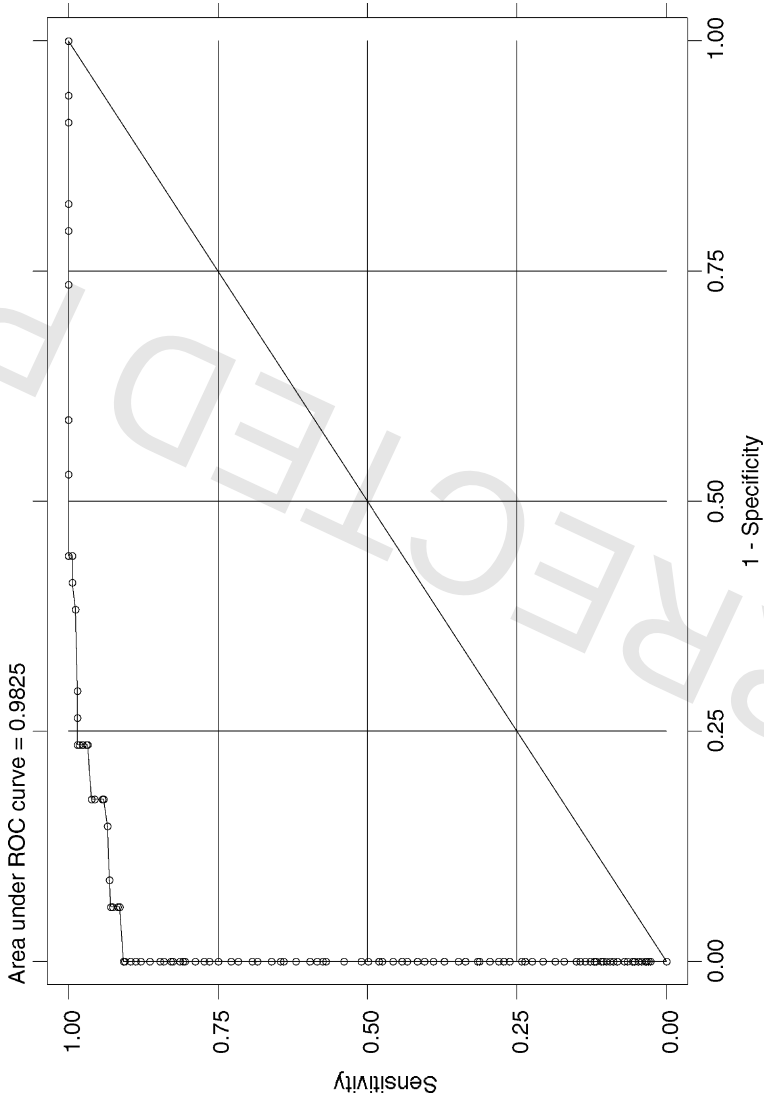


Fig. 1. Receiver operating characteristic (ROC) curve for determining social anxiety disorder (SAD) diagnosis according to LSAS-T total score (LSAS-T).

241 LSAS-SI was significantly smaller than the AUC for the LSAS-T ($\chi^2[1] = 20.75$,
242 $P < .0001$). A cutoff value of 15 on the LSAS-SI maximized both Sn (correct
243 classification of SAD, 87.89%) and Sp (correct classification as not having SAD,
244 88.24%), somewhat less accurate than the parallel score of 30 for LSAS-T.

245 ROC analysis of the LSAS-PER subscale revealed an AUC of .99 ($P < .0001$)
246 which was not significantly different from the AUC for LSAS-T. However, the
247 AUC (.99) of the LSAS-PER subscale score was significantly greater than the
248 AUC for LSAS-SI ($\chi^2[1] = 14.61$, $P < .0001$). For the LSAS-PER, a cutoff score
249 of 15 maximized both Sn (94.59%) and Sp (94.12%).¹

250 2.2. Subtype of SAD

251 For determination of subtype, NAC participants were excluded — leaving a
252 sample of the 364 participants with SAD (262 participants with the generalized
253 subtype of SAD, 102 with the non-generalized subtype). ROC analysis of LSAS-T
254 for determination of GSAD produced an AUC of .82 which was significantly
255 different than the random ROC line ($P < .001$) (Fig. 2). A score of 60 was found to
256 provide the best balance of Sn (correct classification as GSAD, 72.52%) and Sp
257 (correct classification as NSAD, 73.53%). A score of 47 maximized Sn, correctly
258 classifying 92.37% of persons with GSAD but misclassifying 44.12% of persons
259 with NSAD. Conversely, a cutoff of 73 maximized Sp, correctly classifying 88.24%
260 of persons with NSAD while misclassifying 50.38% of persons with GSAD.

261 Examination of ROC curves for GSAD determination revealed significant
262 AUC values (vs. the random ROC line) for the LSAS-SI (AUC = .84; $P < .001$)
263 and LSAS-PER subscales (AUC = .75; $P < .001$). The AUC for LSAS-SI was
264 significantly larger than the AUC for LSAS-PER ($\chi^2[1] = 14.0$, $P < .001$) but did
265 not differ significantly from the AUC for LSAS-T ($\chi^2[1] = .93$, ns). The AUC of
266 the LSAS-PER was also significantly smaller than that of the LSAS-T
267 ($\chi^2[1] = 24.26$, $P < .0001$). A cutoff value of 30 on the LSAS-SI was found
268 to have the strongest balance of Sn (73.66%) and Sp (76.70%) for GSAD. For the
269 LSAS-PER, a cutoff value of 30 was optimal for determining GSAD
270 (Sn = 66.41%, Sp = 69.90%).²

271 3. Discussion

272 The present study sought to determine optimal cutoff values for the LSAS in
273 making the diagnosis of SAD and determining GSAD subtype. In fact, the LSAS
274 performed very well for these purposes. Using the LSAS total score, scores of 30

¹ Tables of selected values of LSAS-SI and LSAS-PER scores and their associated Sp and Sn values for the identification of social anxiety disorder are available on request from Richard G. Heimberg.

² Tables of selected values of LSAS-SI and LSAS-PER scores and their associated Sp and Sn values for the identification of the generalized subtype of social anxiety disorder are available on request from Richard G. Heimberg.

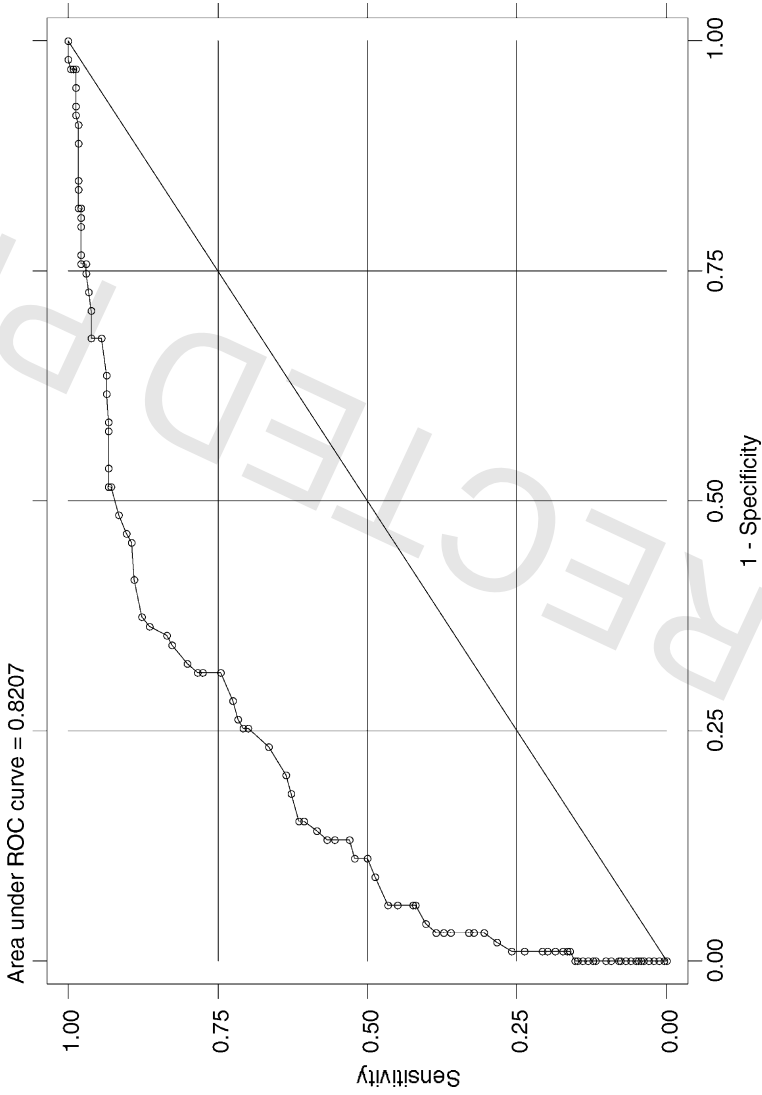


Fig. 2. Receiver operating characteristic (ROC) curve for determining generalized subtype of social anxiety disorder (GSAD) according to LSAS total score (LSAS-T).

275 for SAD and 60 for GSAD provided the best balance between sensitivity and
276 specificity.

277 Cutoff values were also presented that maximized either sensitivity or spe-
278 cificity for SAD and GSAD. These values were provided to demonstrate that the
279 appropriate cutoff score depends on one's particular purpose. Sensitivity is to be
280 emphasized when correct identification of positive cases is more important than
281 the misclassification of a greater percentage of negative cases as positive (i.e.,
282 false positives), as might be the case in some public health initiatives. Specificity
283 is to be emphasized when a truly homogeneous population for study is desired. In
284 the absence of particular objectives, however, we suggest that the cutoff points
285 that maximize both sensitivity and specificity be used, as they provide the best
286 balance between correct identification of individuals who do have SAD or GSAD
287 and misclassification of those who do not.

288 We also examined the performance of the LSAS-PER and LSAS-SI subscales.
289 LSAS-PER was superior to LSAS-SI in correct classification of SAD. However,
290 when subtype was examined, LSAS-SI was superior to LSAS-PER. LSAS-SI
291 performed as well as LSAS-T in detecting GSAD. Since the total score was as
292 good or better than the subscale scores, it will be most straightforward to utilize it
293 for both diagnosis and subtyping. However, the pattern of findings for the
294 subscales is intriguing and warrants further study. This pattern suggests that
295 anxiety and avoidance of performance situations may be most important in
296 distinguishing between individuals with and without SAD, but it is the addition
297 of fear and avoidance of social interaction situations that distinguishes patients
298 with generalized SAD from nongeneralized SAD patients.

299 Although promising, the present findings should be interpreted with some
300 caution. First, we did not provide a comparative benchmark for the LSAS. We were
301 able to show how subscales differed in their ability to predict diagnosis and
302 subtype. However, it remains for future research to determine whether the LSAS is
303 superior to other measures for this purpose. For instance, there are a number of self-
304 report measures that have been developed to index the severity of social anxiety
305 (e.g., the Social Interaction Anxiety Scale and the Social Phobia Scale by [Mattick
306 & Clarke, 1998](#); the Social Phobia and Anxiety Inventory by [Turner, Beidel,
307 Dancu, & Stanley, 1989](#)). At this point, no studies have examined the relative
308 efficacy of the LSAS and these instruments in detecting social anxiety disorder or
309 GSAD. Future investigations will need to utilize these comparison scales to
310 determine if the LSAS is the optimal measure for the diagnosis of social anxiety.

311 Second, the LSAS was quite a bit more accurate when attempting to classify
312 cases of SAD versus subtype of SAD. Indeed, the SAD cutoff score of 30 on the
313 LSAS-T correctly classified 93.3% of individuals with SAD. In contrast, the
314 GSAD cutoff score of 60 on the LSAS-T correctly classified only 72.5% of
315 individuals with GSAD. It is, however, a more difficult task to tell the difference
316 between different subtypes of disorder than between a disorder and its absence.

317 A third limitation of the present study concerns the composition of the study
318 sample. The study was conducted at a consortium of specialty anxiety clinics,

319 and the sample was composed of individuals with social anxiety disorder and
320 a smaller group of normal comparison subjects. This situation created an
321 artificially high base rate of social anxiety disorder (91%). Although sensitivity
322 and specificity are independent of base rate, the predictive value of test scores
323 varies as a function of base rate as well as sensitivity and specificity (Glaros &
324 Kline, 1988). Positive predictive value is the percentage of true positives among
325 those identified by the scale as positive. Negative predictive value is the
326 percentage of true negatives among those identified by the scale as negative.
327 If the base rate is high, positive predictive value for given values of sensitivity
328 and specificity will be higher and negative predictive value lower. Similarly, if
329 the base rate is low, negative predictive value would be inflated relative to
330 positive predictive value. Thus, when the rate of true positives is disproportionately
331 high, the likelihood of a test classifying a patient as positive may be
332 artificially inflated. In fact, with the high base rate of SAD (vs. NAC) in the
333 present study, positive predictive value was considerably higher (99.4%) than
334 negative predictive value (57.1%) in determining SAD. If the base rate of social
335 anxiety disorder in the sample were 20% rather than 91%, positive predictive
336 value would be only 79.8%, while negative predictive value would increase to
337 98.4%.

338 There was less disparity in the rates of GSAD (72% of the sample) and NSAD
339 (28%) in our sample, and this proportion appears similar to that reported in many
340 clinical settings. Thus, the positive and negative predictive values in the ROC
341 analyses of SAD subtype were 87.6 and 51.0%, respectively, for a LSAS-T score
342 of 60, suggesting that we should put more faith in a diagnosis of GSAD than of
343 NSAD. However, one must be cautious in applying cutoff values for either
344 diagnosis or subtype in settings where the base rate of social anxiety disorder
345 would be considerably lower. Future research is needed to examine the ability of
346 the LSAS to identify cases of SAD and GSAD in a mixed psychiatric sample
347 (which is comprised of individuals diagnosed with other conditions such as panic
348 disorder or depression) or an epidemiological sample.

349 These limitations notwithstanding, our findings suggest that the LSAS can be
350 used to identify cases of SAD in clinical settings. This is a vital task given the
351 history of poor detection of SAD in clinical settings. Socially anxious persons'
352 hesitancy to bring their distress to the attention of clinicians for fear of negative
353 evaluation (Olsson et al., 2000) places the responsibility for the identification of
354 individuals with social anxiety disorder, especially the generalized subtype,
355 directly on the clinician's shoulders.

356 Acknowledgments

357 This study was supported by grants from the National Institute of Mental
358 Health to Drs. Heimberg (MH44119) and Liebowitz (MH40121), and to the New
359 York State Psychiatric Institute MHCRC (PO5 MH30906).

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